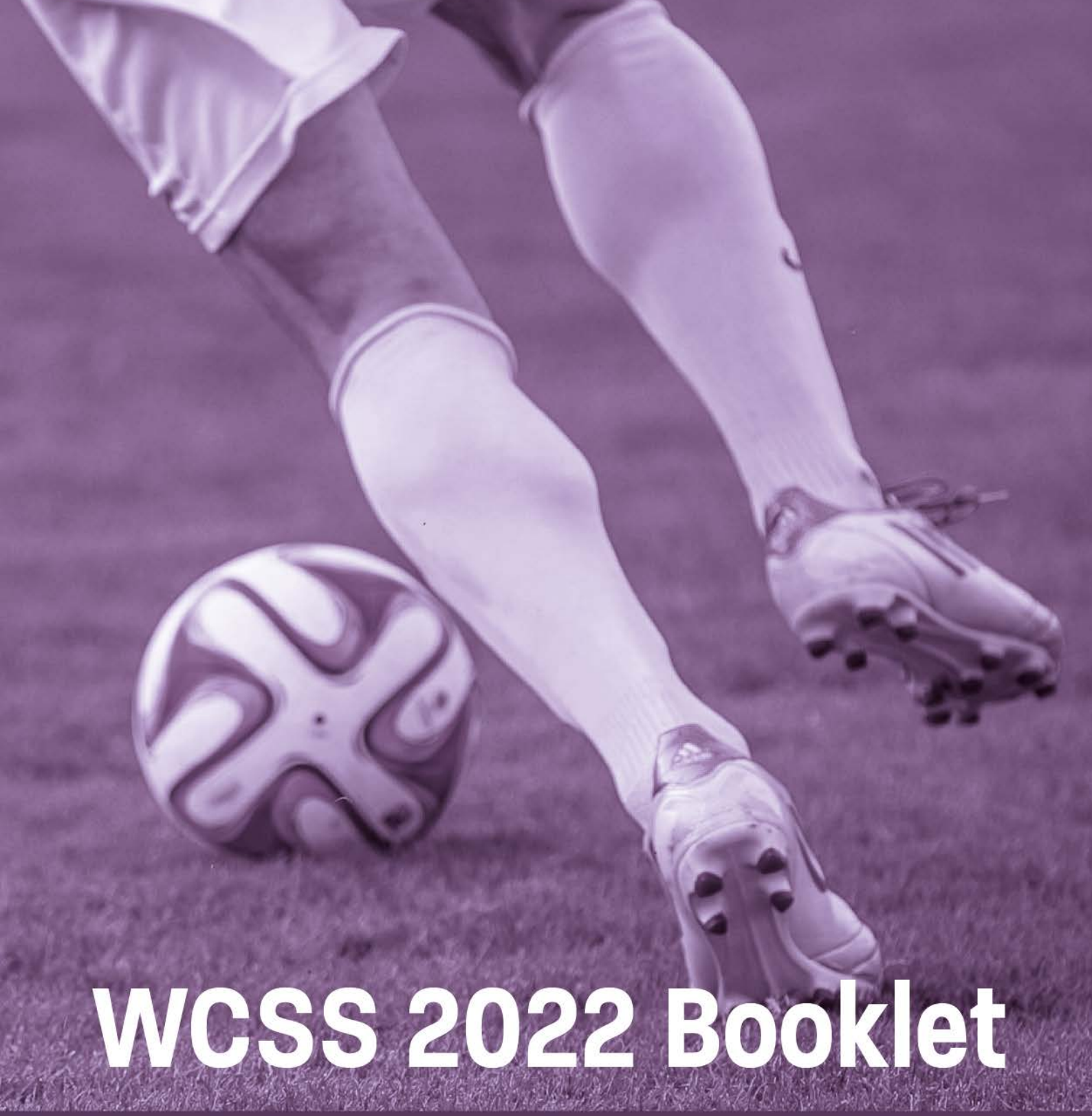


WCSS 2022 Booklet

WORLD CONGRESS ON SCIENCE AND SOCCER

15, 16 & 17 JUN, 2022

COIMBRA, PORTUGAL

1 2 9 0 UNIVERSIDADE D COIMBRA

Word Congress on Science and Soccer 2022 – Book of Abstracts

Faculty of Sport Sciences and Physical Education, University of Coimbra
15th-17th July 2022, Coimbra, Portugal

Edited by: Antônio Figueiredo, Manuel João Coelho e Silva, Terence Favero & Hugo Sarmento

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WORLD CONGRESS ON SCIENCE AND SOCCER

15, 16 & 17 JUN, 2022

COIMBRA, PORTUGAL



WELCOME

Dear Participants, welcome to the World Congress on Science and Soccer 2022.

This event will put together colleagues from all over the world merging interests of science and field application. It will be days of fruitful learnings and professional growth and an open field for collaborative partnerships, all within a fellowship ambience.

The University of Coimbra and its Faculty of Sport Science and Physical Education and the city of Coimbra, will very welcome you to share all the requisites that made us a reference site for knowledge, tradition, innovation and friendship.

The WCSS2022 will cover a large area of topics and will count on the support and expertise of some of the most recognised researchers and coaches, as well as the interaction with the technical and scientific staff from the Portuguese FA and Portuguese Professional Soccer League.

It is with great honour and pleasure that I invite you to come to our beautiful and historical city, place of a university that was recognized by Unesco as a World Heritage Site.

Antõnio Figueiredo

WCSS2022, Chair

Organizing Committee

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The World Congress on Science and Soccer 2022 will be held on Convento de São Francisco, Avenida da Guarda Inglesa, n.01A, 3040-193 Santa Clara, Coimbra, Portugal.
For transportation and access, please, scan the QR Code below, with the location on Google Maps and also the QR Code from the Moovit APP if you need to consider a bus from some city point.
Bus lines to Convento de São Francisco are the numbers 6, 13, and 31 but any other bus that reaches Beira Rio area is also valid if you would like to enjoy a short walk and cross the Santa Clara bridge and Mondego river towards the venue.

Convento de São Francisco location

SMTUC for bus lines

Pratical Workshops from June 16th morning (Football and Futsal) and June 17th morning (Women's Football) will occur at the University of Coimbra Stadium. The UC Stadium is right in front of the Convent, on the other side of the road. The entrance will be by the gates on the parking slot and you can scan the location on the QR Code below.



19:15 | Welcome Reception

The Welcome Reception venue is at Praça da Caixa de Palco do Convento São Francisco, Coimbra.



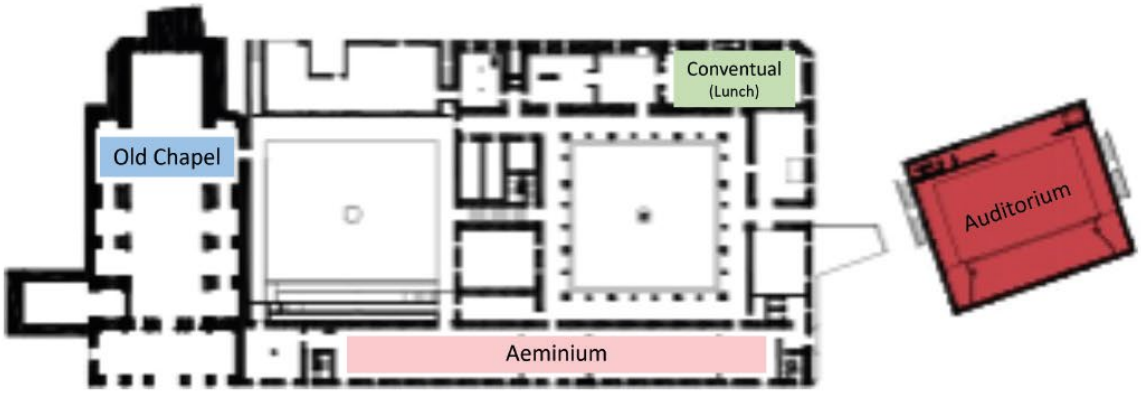
20:00 | Congress Dinner

The Gala Diner venue will be on Afonso Henriques Room (Old Chapel).



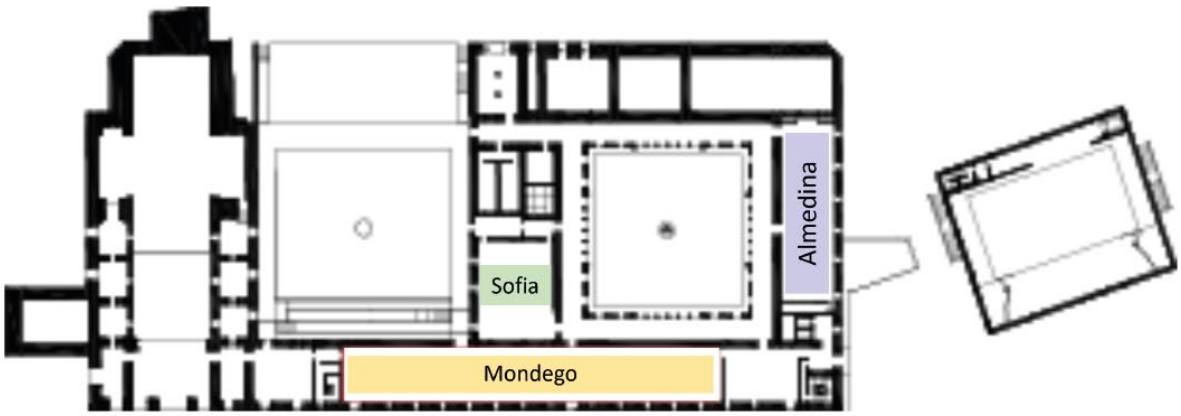
First Floor

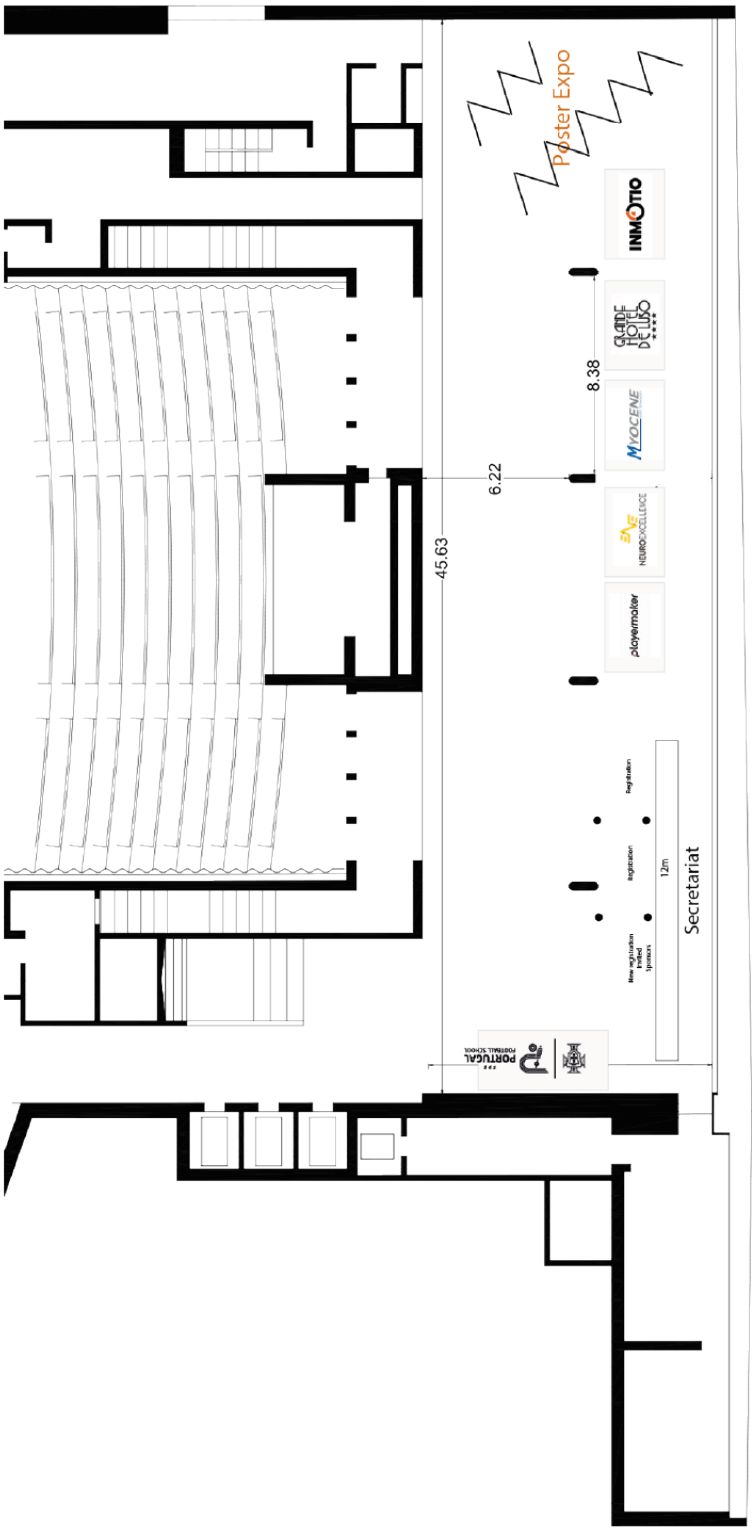
Rooms:
Aeminium
Conventual (lunch)
Old Chapel



Second Floor

Rooms:
Sofia
Mondego
Almedina




Poster Expo
INMOTIO
MYOCENE
playermaker
8.38
6.22
45.63
12m
Secretariat

Science and Soccer Congresses and Science and Football Congresses History

Science and Football Congresses

2019: Melbourne (Australia)
2015: Copenhagen (Denmark)
2011: Nagoya (Japan)
2007: Antalya (Turkey)
2003: Lisbon (Portugal)
1999: Sydney (Australia)
1995: Cardiff (Wales)
1991: Eindhoven (the Netherlands)
1987: Liverpool (England)

Science and Soccer Congresses

The Science and Soccer Congress are also held every four years (after beginning in 2008) and alternate with Science and Football. This congress shares the same aims and discipline areas as the World Congress, but are dedicated (primarily) to soccer, rather than all football codes.
2017 Rennes (France)
2014 Portland (USA)
2012 Ghent (Belgium)
2010 Port Elizabeth (South Africa)
2008 Liverpool (England)



University of Coimbra History

By signing "Scientiae Thesaurus Mirabilis", King Dinis created the oldest university of the country and one of the oldest in the world. Dated from 1290, the document originated the General Study, recognized in the same year by Pope Nicholas IV. A century after the birth of the nation, the University of Coimbra germinated. It starts operating in Lisbon but, in 1308, it is transferred to Coimbra, alternating between the two cities until 1537, when it is definitely settled in the city of river Mondego.

Initially confined to the Royal Palace, the University spread throughout the city of Coimbra, while modifying its landscape and making of it the University City. It later enlarged with the creation of a second Campus, dedicated to Engineering and Technology, and with a third Campus devoted to Health Sciences.

To study at the University of Coimbra is to pursue the intellectual history of the country in the school that graduated some of the most distinguished personalities of national culture, science and politics.

With over seven centuries, and celebrating this year its 730th anniversary, the University of Coimbra has a unique tangible and intangible heritage, keystone in the scientific culture of Europe and the World, and is a UNESCO World Heritage Site since 2013.



APP

Stay connected during the Congress!

The official WCSS2022 App is available for free download at Play Store and APP Store (Android or IOS).

You must use the access code we sent you by e-mail and your e-mail registration on the WCSS 2022 to enter.

View all congress information on your mobile (programme, abstracts, speakers, sponsors,...), browse the programme by date, time and build a personalized schedule with your own reminders. View full abstracts and more!

Scan the QR Code to start!

Enjoy the WCSS 2022 - Coimbra - Portugal



Programme

Programme

15 JUNE
Wednesday

12:00 | Registration

AUDITORIUM

14:00 | Open Ceremony
José Manuel Silva, *Mayor of Coimbra*
Amílcar Falcão, *Rector of University of Coimbra*
Fernando Gomes, *President of Portugal Football Federation*
António Figueiredo, *Chair of the WCSS 2022*

15:00 | Keynote Presentation
Chair: Duarte Araújo - Faculty of Human Kinetics
How the theory of Ecological Dynamics has shaped Research and Practice in Soccer in the new Millennium
Keith Davids | *Sheffield Hallam University*

16:00 | Discussion Panel
Chair: Germano Almeida - Portuguese Football Federation
New trends to keep merging science and practice
Pedro Dias, *Directive Board Member of Portugal Football Federation*
Jorge Braz, *Head Coach of futsal of the Portuguese National Team*
Hans Leitert, *UEFA Technical Observer*

17:00 | Coffee-Break and Poster Presentation

17:30 | Neuroexellence Talk | Exploring flywheel and bio-feedback in football neuromuscular training
"Aiming at enhancing performance & increase training availability- sharing ideas about periodization"
Andrea Azzalin

18:15 | Symposium 1 | Perception and Action in Soccer: New Insights
Chair: Duarte Araújo, FMH
The effect of physical workload on gaze behavior of soccer defenders: an in situ approach | Filipe Casanova
The impact of penalty takers' footedness on goalkeepers' performance during a penalty: A field study in soccer | Vicente Luis del Campo, *Faculty of Sports Sciences, University of Extremadura*
Spatial vision occlusion in youth football: an exploratory training intervention | Pedro Esteves, *Instituto Politécnico da Guarda*
Characterizing Eye Movement Patterns in 1v1 Situations in Elite Futsal | Bruno Travassos, *University of Beira Interior*

ALMEDINA

17:30 | Parallel Oral Sessions 1 | Futsal
Chair: Bruno Travassos
Seasonal Changes in Neuromuscular Performance in Elite Futsal Players | Konstantinos Spyrou, *Centro de Investigación Alto Rendimiento Deportes (CIARD), UCAM, Murcia, Spain*
How weekly monitoring variables influence players and teams' match performance in elite futsal | João Nuno Ribeiro, *Department of Sport Sciences, University of Beira Interior, Covilhã, Portugal; Research Centre in Sport Sciences, Health Sciences and Human Development, CIDESD, CreativeLab Research Community, Vila Real, Portugal*
The effect of different high-intensity activity properties on interchange player rotation in Futsal - An analysis by playing position | João Nuno Ribeiro, *Department of Sport Sciences, University of Beira Interior, Covilhã, Portugal*
Effects of warm-up duration on physical performance of futsal players | Nuno Silva, *Research Center in Sports Science, Health Sciences and Human Development, CIDESD, University of Maia, Maia, Portugal*
Effects of different warm-up strategies during match in futsal non-starting players: a case report | Nuno Silva, *Research Center in Sports Science, Health Sciences and Human Development, CIDESD, University of Maia, Maia, Portugal*

SOFIA

17:30 | Parallel Oral Sessions 2 | Recovery and Readiness
Chair: Liam Harper
How the climatic conditions forecast for the FIFA World Cup in Qatar 2022 will affect on the physiological and psychomotor responses of soccer players | Pawel Chmura, *Wroclaw University of Health and Sport Sciences*
The reliability and sensitivity of post-match neuromuscular measures in elite youth soccer players | Alberto Franceschi, *Sport Science and R&D Department, Juventus Football Club, Torino, Italy; School of Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom*
Physiological and immunological responses in young soccer players | Luís Rama, *University of Coimbra, Research Center for Sport and Physical Activity, Faculty of Sport Sciences and Physical Education, Coimbra, Portugal*
Relationship between internal and external training load metrics on neuromuscular performance | Kieran Collins, *TUDublin, Dublin, Ireland*
The Short-term Relation Between Load and Psychophysiological Responses in Invasion Sports: A Meta-Analysis | Jur Brauers, *Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands*
A case study comparing sleep in shared and individual rooms during a training camp in elite youth soccer players | Júlio Alejandro Henriques da Costa, *Portugal Football School, Portuguese Football Federation, FPF, Oeiras, Portugal*
Prevalence of poor sleep quality, sleepiness, and insufficient sleep duration in soccer players: A pilot study | Lúcio Cunha, *Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Maia, Maia, Portugal*

MONDEGO

17:30 | Parallel Oral Sessions 3 | Testing
Chair: Jaime Sampaio
Effects of preferred leg on the peak acceleration, deceleration, and speed on 5-0-5 change-of-direction test: a cross-sectional study conducted in adult male soccer players | Filipe Manuel Clemente, *Escola Superior Desporto e Lazer, Instituto Politécnico de Viana do Castelo, Portugal*
Using the heart rate ratio method to estimate maximal oxygen uptake in recreational male footballers | Susana Póvoas, *Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Maia, ISMAI, Maia, Portugal; Department of Sports Science and Clinical Biomechanics, SDU Sport and Health Sciences Cluster (SHSC), University of Southern Denmark, Odense, Denmark*
Using Submaximal Exercise Heart Rate for Monitoring Cardiorespiratory Fitness Changes in Youth Soccer Players | Stefan Altmann, *Karlsruhe Institute of Technology, Germany; TSG ResearchLab, Germany*
Validation of the Université de Montréal Track Test and a Set Distance 1500 m Time Trial to Assess Maximal Aerobic Speed in Soccer | Maximiliane Thron, *Department for Performance Analysis, Institute of Sports and Sports Science, Karlsruhe Institute of Technology, Karlsruhe, Germany*
Mechanical Power in Team Sports | Pietro Enrico di Prampero, *Department of Sport Science Exelio srl, Udine, Italy*
Mechanical Power in Soccer: overcome the limits of acceleration alone | Cristian Osgnach, *Department of Sport Science Exelio srl, Udine, Italy*
Reliability and Validity of a Modified Illinois Change-of-Direction Test with Ball Dribbling Speed in Young Soccer Player | Issam Makhlouf, *Sport Performance Optimization Research Laboratory, National Centre of Medicine and Science in Sport (CNMSS), Tunis, Tunisia*

19:15 | Welcome Reception

16 JUNE
Thursday

08:00 | Registration

University of Coimbra Stadium

08:30 | Practical Workshop

Football

Training the Defensive Organization and Offensive Transitions Moments. Portuguese Football Federation Youth Identity

Rui Bento and Daniel Barreira

Organized by the Technical Staff of the Portuguese Football Federation

University of Coimbra Stadium

08:30 | Practical Workshop

Futsal

The dialectical attack-defense relationship: The creation of specific training contexts

Ricardo Azevedo

Organized by the Department of Sport Performance of Portuguese Football Federation

20:00 | Congress Dinner

Afonso Henriques (Old Chapel)

AUDITORIUM

10:00 | Keynote Presentation

Chair: Antonio Tessitore - Universitã di Roma "Foro Italico"

The impact on sports medicine of deciphering the human genome and necessar genetic revolution

Yannis Pitsiladis | *University of Brighton*

11:00 | Coffee-Break | Foyer

11:30 | Parallel Oral Sessions 4 | Injuries

Chair: Fabio Serpiello

Unilateral vertical jump can highlight motor disorders related to previous injuries in soccer players | Rufin Boumpoutou, *Stade Rennais Football Club, Rennes, France*

Epidemiology of lower extremity muscle injuries in professional German football: a prospective study of seven consecutive seasons | Ida Bo Steendahl, *Institute of Sports and Preventive Medicine, Saarland University, Saarbrücken, Germany*

Can speed variables predict the odds ratio and relative risk of non-contact injuries in soccer players? A prospective study | Elena Malner Pardos, *University of San Jorge, Zaragoza, Spain*

Are Off-Field Activities an Underestimated Risk for Hamstring Injuries in Dutch Male Amateur Soccer Players? An Exploratory Analysis of Prospective Cohort Study | Jur Brauers, *Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands; 2 Department of Rehabilitation, Physical Therapy Science and Sports, Utrecht University, University Medical Center Utrecht, Brain Center, Utrecht, The Netherlands*

Incidence and characteristics of heading in youth football (soccer) | Rebecca Schnitker, *Institute of Sports Medicine, Department of Sports and Health, Paderborn University, Paderborn, Germany*

Influence of environmental temperature on injury occurrence in professional German football (soccer) | Edgar Schwarz, *Saarland University, Saarbrücken, Germany*

13:00 | Lunch | Conventual Room

14:00 | Keynote Presentation

Chair: André Seabra - Portuguese Football Federation

Let's keep players on the pitch: applied science in elite soccer

João Brito | *Portugal Football School, Portuguese Football Federation*

15:00 | Parallel Oral Sessions 8 | Match analysis II

Chair: Fabio Nakamura

Moving towards a comprehensive analysis of acceleration profiles in elite youth football | Damian Kovacevic, *Victoria University, Melbourne, Australia*

Can the coach dismissal impact on match physical demands? An across both the short and the long-term perspective | José Carlos Ponce Bordón, *University of Extremadura, Faculty of Sport Sciences, Cáceres, Spain*

Associations between running activities and odds of scoring goals during professional soccer matches | Marco Martín, *Mapei Sport Research Centre, Olgiate Olona, Italy*

A New Approach to Compare Training and Soccer Match demands | Mauro Mandorino, *Performance and Analytics Department, Parma Calcio 1913, Parma, Italy; Department of Movement, Human and Health Sciences, University of Rome "Foro Italico", Rome, Italy*

Match-play running performance in elite Spanish soccer: A comparison between the first and second leagues considering the opposition's quality | Javier Fernandez-Navarro, *Nottingham Trent University, Nottingham, UK*

Characterizing the Most Demanding Periods of High Intensity Activity in Elite Football Using a Multivariate Approach | Farzad Youseflan, *Research Center in Sports Sciences, Health Sciences and Human Development (CIDESD), Department of Sport Sciences, University of Beira Interior, Covilhã, Portugal; Portugal Football School, Portuguese Football Federation, Oeiras, Portugal*

In week-to-week forecasting of individual match actions in football, age matters, and less data is more | He Qixiang, *National Institute of Education, Nanyang Technological University, Singapore*

16:30 | Coffee-Break and Poster Presentation

17:00 | Symposium 2 (English FA) | Developing a research model to support evidence informed practices on the England Lionesses' Talent Pathway

Chair: Stacey Emmonds

Understanding the differences between training/ micro-cycle outputs of technical and possession based statistics compared to match play in women's football | Steve Barrett, *Playermaker, UK*

Locomotor and Technical Characteristics of Female Soccer players training: Exploration of differences between competition standards | Stacey Emmonds, *Leeds Beckett University, UK*

Applying Feature Selection Methods to Identify Unique Technical and Physical Performance Indicators within Women's Football | Nick Dalton-Barron, *Leeds Beckett University, UK*

The Football Association Physical Profiling and Injury Surveillance Project: The Development of a database and system English Elite Youth Female Soccer Academies | Jake Beech, *Carnegie School of Sport, Leeds Beckett University, Leeds, UK and The Football Association, Burton-Upon-Trent, UK*

The differences in anthropometric, growth, maturation, and physical qualities between injured and un-injured elite youth Female Soccer players | Jake Beech, *Carnegie School of Sport, Leeds Beckett University, Leeds UK. The Football Association, Burton-Upon-Trent, UK*

A latent variable conceptual model of the training process in female team sport athletes | Dan Weaving, *Leeds Beckett University, UK*

A multi-club analysis of the locomotor training characteristics of elite English female soccer players | Naomi Myhill, *Leeds Beckett, The FA, UK*

ALMEDINA

11:30 | Parallel Oral Sessions 5 | Match Analysis I

Chair: Nic James

Calculating a per second 'goal threat' value in football using player and ball locations | Nimai Parmar, *London Sport Institute, Faculty of Science and Technology, Middlesex University, London, UK*

Analyzing physical performance during successful open-play and counterattacks in professional football | Floris Goes, *Department of Human Movement Sciences, University of Groningen, University Medical Center Groningen, The Netherlands*

The use of player tracking data to analyze defensive play in professional soccer - A scoping review | Leander Forcher, *Institute of Sports and Sports Science (IfSS), Karlsruhe Institute of Technology (KIT)*

In-Game Formation Changes as Momentum Shift: The Influence of In-Game Changes in Tactical Formation in Professional Soccer | Leon Forcher, *Institute of Sports and Sports Science, Karlsruhe Institute of Technology, Karlsruhe, Germany*

Degeneracy in Soccer: Association Between Inter-Team Movement Variability Shows the Highly Adaptive Behaviour of Players During the Match | Daniel Carrilho, *CIPER, Faculdade de Motricidade Humana, Universidade de Lisboa, Portugal*

13:00 | Lunch | Conventual Room

15:00 | Parallel Oral Sessions 9 | Small Sided Games II

Chair: João Pedro Duarte

Small, medium and large-sided games: the effect of pitch dimensions and team size on acceleration demands in train | Sigrid Olthof, *Liverpool John Moores University, Liverpool, United Kingdom*

Exploring the effects of pitch obstacles on external load and technical performance during football large-sided games | Diogo Coutinho, *Department of Sports Sciences, Exercise and Health, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, CreativeLab Research Community; University Institute of Maia, ISMAI, Maia, Portugal*

High-speed running and sprinting in professional adult soccer players: methodological definitions, match demands and training recommendations. A systematic review | Antonio Gualtieri, *Sport Science and R&D Department, Juventus Football Club, Torino, Italy; School of Health and Sports Sciences, University of Suffolk, Ipswich, UK*

Comparison of the effects of a combined intervention of small-sided games and high-intensity interval training vs. hig of youth soccer players: a parallel study design | Mohammad Faramarzi, *Department of Exercise Physiology, Faculty of Sport Sciences, University of Isfahan, Isfahan*

Training Load Variations During Small-Sided Games in Soccer: The influence of Recovery Time | Luis Branquinho, *Higher Institute of Educational Sciences of the Douro, Penafiel, Portugal*

Design and reliability of an observational tool to evaluate the individual offensive behavior in soccer (INDISOC) | Joaquín González-Rodenas, *Centre for Sport Studies. Rey Juan Carlos University, Madrid, Spain*

16 JUNE
Thursday

08:00 | Registration

University of Coimbra Stadium

08:30 | Practical Workshop

Football

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Organized by the Technical Staff of the Portuguese Football Federation

University of Coimbra Stadium

08:30 | Practical Workshop

Futsal

The dialectical attack-defense relationship: The creation of specific training contexts
Ricardo Azevedo

Organized by the Department of Sport Performance of Portuguese Football Federation

20:00 | Congress Dinner
Afonso Henriques (Old Chapel)

ALMEDINA

16:30 | Coffee-Break and Poster Presentation

17:00 | Symposium 3 | Innovations and developments in science and soccer from an Ecological Dynamics perspective since 2000
Chair: Keith Davids

Science and Futsal - Advances from ecological dynamics | Bruno Travassos, *Universidade da Beira Interior, Department of Sport Sciences, Covilhã, Portugal; Research Center in Development, CIDESD, CreativeLab Research Community, Vila Real, Portugal; Portugal Football School, Portuguese FA*

Advances in ecological dynamics and soccer research: What does the future promise? | Duarte Araújo, *Faculdade Motricidade Humana, Lisboa, Portugal*

Practical applications of ecological dynamics in professional football ñ achievements, opportunities and challenges! | Pedro Silva, *CIFI2D - Centro de Investigação, Formação, Inovação e Intervenção em Desporto - Universidade do Porto, Portugal*

How bi-directional synergy formation informs training designs | João Ribeiro, *Faculdade de Desporto da Universidade do Porto (FADEUP) & Universidade Lusófona do Porto (ULP), Portugal*

Nonlinear Pedagogy and Soccer | Jia Yi Chow, *National Institute of Education, Nanyang Technological University, Singapore*

"We just want consistency": What do players and coaches need to know about how referees make decisions? | Ian Renshaw, *School of Exercise & Nutrition Sciences, Faculty of Health, Queensland University of Technology, Brisbane, Queenland, Australia*

A Department of Methodology can Enhance Scientist - Practitioner Integration | Martyn Rothwell, *Sheffield Hallam University, UK*

SOFIA

11:30 | Parallel Oral Sessions 6 | Youth Development / Strength & Conditioning
Chair: Antonio Tessitore

'He's Got Growth': Coaches Understanding and Management of the Growth Spurt in Male Academy Football | Megan Hill, *Leeds Beckett University, Leeds, United Kingdom*

Growth, maturation and short-term power output profile in youth soccer players | João Bruno, *University of Coimbra, FCDEF, Portugal*

Hip strength of adductors and abductors in elite youth soccer players according to age and maturity status | Maros Kalata, *Sport Research Center, Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic*

Variation within Bio-Banded Groups | Jan M. Konarski, *Poznan University of Physical Education*

Using deadlifts as post-activation performance enhancement strategy in warm-ups in football | Diogo Coutinho, *CIDESD (Centro de Investigação em Desporto, Saúde e Desenvolvimento Humano) e UTAD (Universidade de Trás-os-Montes e Alto Douro), Universidade da Maia (ISMAI), Portugal*

Investigation of the effects of eight weeks trx exercises on some motorical abilities and in football players | Alper Kartal

13:00 | Lunch | Conventual Room

15:00 | Parallel Oral Sessions 10 | Talent identification & Sports Psychology
Chair: Tomás García-Calvo

Talent and Expertise Research in Football: a review | João Roquette, *CIPER, Faculdade de Motricidade Humana, Lisboa, Portugal*

Talent Identification within Scottish Football -Understanding the physical and technical outputs for successful players | Mike King, *University of the West of Scotland*

How do scouts identify talented soccer players? | Ruud den Hartigh, *University of Groningen, Groningen, the Netherlands*

Soccer players and other athletes: Assets development, Enjoyment and Sport Attitudes | Artur Santos, *Centre of 20th Century Interdisciplinary Studies of the University of Coimbra, Coimbra, Portugal*

The role of action capabilities for decision making in football | Daniel Müller, *Vrije Universiteit Amsterdam, the Netherlands*

Why are they always older and stronger? Relative Age Effect and Talent Identification factors in youth elite soccer play | Krystian Rubajczyk, *University School of Physical Education in Wroclaw, Poland*

16:30 | Coffee-Break and Poster Presentation

17:00 | Myocene Talk | Objective measurement of muscle fatigue with Myocene: new dimension in physical training
Prof Guillaume Millet, Raphaël Ravet

MONDEGO

11:30 | Parallel Oral Sessions 7 | Small Sided Games I
Chair: Pedro Figueiredo

Area per player to replicate official match demands in U-18 elite Spanish soccer player: a replicational study | Vicente De Dios, *Performance Department, Real Club Celta de Vigo, Vigo, Spain. 2Faculty of Education and Sport Sciences, University of Vigo, Pontevedra, Spain*

Soccer-drill specificity in top-class players with reference to peak match demands | Andrea Riboli, *Department of biomedical sciences for health, Università degli Studi di Milano, Milan, Italy*

Technical demands in elite soccer: manipulating area per player during small-sided games to replicate official match demands | Andrea Riboli, *Università degli Studi di Milano, Milan, Italy*

The effects of goal manipulations on tactical and technical performance in U-17 football small-sided games | Paulo Pereira, *Department of Sports and Health, School of Health and Human Development, Évora, Portugal; Comprehensive Health Research Centre (CHRC), University of Évora, Évora, Portugal*

The effects of floaters location on tactical, physical, and technical performance during offensive ball possessions in football small-sided games | João Teixeira, *Department of Sports and Health, School of Health and Human Development, Évora University, Évora, Portugal; Comprehensive Health Research Centre (CHRC), Évora University, Évora, Portugal; Portugal Football School, Portuguese Football Federation, Oeiras, Portugal*

13:00 | Informal Session | Career planning for MSc and PhD students
Chair: Terence Favero, Aaron Coutts, Barry Drust, António Figueiredo

13:00 | Lunch | Conventual Room

15:00 | Parallel Oral Sessions 11 | Coaching
Chair: André Roca

Decision-making practices during coaching sessions in grassroots youth soccer: A mixed-methods investigation | André Roca, *Research Centre for Applied Performance Sciences, Faculty of Sport, Allied Health and Performance Science, St Mary's University, Twickenham, London, UK*

The Understanding, perceptions and practices of Neuroathletic training in German Football | Cameron Daniel Scullard, *The Institute for Sports and Preventative Medicine, Saarland University, Saarbrücken, Germany*

Developing creativity-supportive learning environments in youth football players | André Marinho, *Universidade da Maia - ISMAI, Portugal*

Effects of Didactic Model Game Action Competences and Didactical Model of Direct Instruction on indexes Performance tactical in U-12 Soccer Players | Wilder Valencia, *Universidad de Antioquia, Medellín-Colombia*

Current view and new perspectives on skill in football | Jani Sarajärvi, *University of Lisbon, Lisbon, Portugal*

Goal-Directed Behavior? Enhancing Representativeness in Soccer Training | Albert Deuker, *German Sport University Cologne, Germany*

16:30 | Coffee-Break and Poster Presentation

17:00 | Practical Workshop | Match Analysis

Observation and Analysis in Portuguese Nacional Teams - A practical example | André Reis, José Pedro, Pedro Matias, *Organized by the department of sport Performance of Portuguese Football Federation*

17 JUNE
Friday

08:00 | Registration

University of Coimbra Stadium

08:30 | Practical Workshop

Women's Football

Offensive Organization and Defensive Transition - An example of approach in the Women's National Teams

Marisa Gomes, Bernardo Carapau, Ricardo Tavares

Organized by the Technical Staff of the Portuguese Football Federation

AUDITORIUM

10:00 | Keynote Presentation
Chair: Terence Favero - University of Portland
Football is medicine: Prescribing football for global health promotion
Peter Krustrup | *University of Southern Denmark*

11:00 | Coffee-Break and Poster Presentation | Foyer

11:30 | Parallel Oral Sessions 12 | Match Analysis III
Chair: Nimai Parmar

Evaluating the use of the high press in the English Premier and K Leagues using Passes Per Defensive Action | Nic James, *London Sport Institute, Faculty of Science and Technology, Middlesex University, London, UK*

Analysing Team Dynamics to Explain Team Physical Performance in Elite Football | Farzad Youseflan, *Research Center in Sports Sciences, Health Sciences and Human Development (CIDESD), Departm Interior, Covilhã, Portugal; Portugal Football School, Portuguese Football Federation, Oeiras, Portugal*

Visualizing Performance Dynamics of Soccer Players in Personalized Networks | Niklas D. Neumann, *Department of Psychology, University of Groningen, Groningen, the Netherlands*

Do professional soccer teams run the same throughout the season? Relationship with team performance | José C. Ponce-Bordón, *University of Extremadura, Faculty of Sport Sciences, Cáceres, Spain*

Analysis of Spanish La Liga Soccer Players' Performance before Signing a New Contract | Feng Runze, *Faculty of Physical Activity and Sport Sciences, Technical University of Madrid, Madrid, Spain*

An innovative approach to the analyses of football player running profiles | Paulo Roriz, *University of Maia, Maia, Portugal*

13:00 | Lunch | Conventual Room

14:00 | Parallel Oral Sessions 17 | Perception and action
Chair: Filipe Casanova

Multiple Players Tracking in Virtual Reality: influence of soccer specific trajectories and relationship with gaze activity | Alexandre Vu, *Univ Rennes, Inria, M2S -EA 7470, F-35000 Rennes, France*

Nature Environments can Enhance Skill and Performance in Football | Henrique Brito, *CIPER (Interdisciplinary Center for the study of Human Performance), Faculdade de Motricidade Humana, Lisboa, Portugal*

Football, beyond the field of vision | Maria do Perpetuo Socorro Sarmento Pereira, *IFPA Tucurui, Brazil*

Football scenes unseen consciously but seen unconsciously: Decision-making capability is predicted by unconscious perceptual information pick-up / *David Mann, Vrije Universiteit Amsterdam, the Netherlands*

15:00 | Parallel Oral Sessions 20 | Match analysis IV
Chair: Antonio Tessitore

In-match penalty kick analysis of the German Bundesliga | Guilherme de Sousa Pinheiro, *Kinexon Sports & Media GmbH*

Illustrating a Landscape of Shooting Opportunities in Soccer | Ilias Loutfi, *Faculdade de Motricidade Humana, Portugal*

Evaluation of Off-the-Ball Actions in Soccer | Tim Swartz, *Simon Fraser University, Canada*

Will he play like we thought? Effect of player role variability on adaptation and sustainability of football performance | John Komar, *Physical Education and Sports Science, National Institute of Education, Nanyang Technological University, Singapore*

How the COVID-19 Pandemic has Changed the Game of Soccer | Daniel Link, *Technical University Munich, Germany*

16:15 | Playermaker Talk | Playing forward, square or back: which direction are we going with science and football?
Barry Drust, *University of Birmingham, UK*

17:15 | Closing Ceremony
Carlos Lopes, *Councilor of the Coimbra City Council*
Pedro Ferreira, *Dean of the Faculty of Sport Sciences*
Terence Favero, *AFC Steering Group*
António Figueiredo, *Chair of the WCSS 2022*

Announcing the WCSS 2022 Young Investigator Awards
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Best oral communication & Best poster presentation

Announcing the WCSF 2023

ALMEDINA

11:30 | Parallel Oral Sessions 13 | Sports Psychology
Chair: Tomás García-Calvo

Self-controlled feedback improves perceived competence and movement execution in soccer players | Elline Nijmeijer, *Department of Human Movement Sciences, University Medical Center Groningen, University of Groningen, The Netherlands*

The use of positive or negative feedback changes the physical and mental efforts of soccer players during trainings | Jesús Díaz-García, *Faculty of Sport Sciences, University of Extremadura, Spain*

An overview of Sports Psychiatry and its application in Football | Paulo Sousa Martins, *Hospital de Magalhães Lemos, EPE, Portugal*

In the Context of a Sports Match, the Goal to Win is Most Important, Right? Evidence for a Hierarchical Achievement Goal System | Nico W. Van Yperen, *University of Groningen, the Netherlands*

Play a play-offs phase increases the mental fatigue of semi-professional soccer players | Jesús Díaz-García, *Faculty of Sport Sciences, University of Extremadura, Spain*

Resilience in soccer: A multidisciplinary, dynamic, and personalized approach | Ruud den Hartigh, *University of Groningen, Groningen, the Netherlands*

13:00 | Lunch | Conventual Room

14:00 | Parallel Oral Sessions 18 | Refereeing
Chair: Pawel Chmura

VAR incidents affect negative sentiment of fans of the English Premier League on Twitter | Otto Kolbinger, *Technical University of Munich, Munich, Germany*

Effect of Video-Based Training on Soccer Refereesi Decision Making: A Meta-Analysis | Yeqin Zhang, *China Football College, Beijing Sport University, Beijing, China*

Virtual Reality (VR) as a training method for football referees | Tammie van Biemen, *Koninklijke Nederlandse Voetbal Bond, Zeist, the Netherlands*

14:45 | Parallel Oral Sessions 21 | Biomechanics
Chair: Luis Rama

Exploration of reactive and preplanned components of agility in elite soccer players: a new biomechanical assessmen approach | Anthony Sorel, *Univ Rennes, Inria, M2S -EA7470, F-35000 Rennes, France*

Discriminative power of an inertial sensor Bram Bastiaansen setup to quantify biomechanical load between national and regional male soccer players | Bram Bastiaansen, *Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands*

Biomechanical analysis of hamstring injury history on biomechanical deficits during a reactive functional test in professional soccer players | Anthony Sorel, *Univ Rennes, M2S -EA 7470, F-35000 Rennes, France*

Auditorium

17:15 | Closing Ceremony

Carlos Lopes, *Councilor of the Coimbra City Council*
Pedro Ferreira, *Dean of the Faculty of Sport Sciences*
Terence Favero, *AFC Steering Group*
António Figueiredo, *Chair of the WCSS 2022*

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Announcing the WCSF 2023

17 JUNE
Friday

08:00 | Registration

University of Coimbra Stadium

08:30 | Practical Workshop

Women's Football

Offensive Organization and Defensive Transition - An example of approach in the Women's National Teams

Marisa Gomes, Bernardo Carapau, Ricardo Tavares

Organized by the Technical Staff of the Portuguese Football Federation

Auditorium

17:15 | Closing Ceremony

Carlos Lopes, *Councillor of the Coimbra City Council*
Pedro Ferreira, *Dean of the Faculty of Sport Sciences*
Terence Favero, *AFC Steering Group*
António Figueiredo, *Chair of the WCSS 2022*

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SOFIA

11:30 | Parallel Oral Sessions 14 | Monitoring
Chair: Bruno Travassos

Test-Retest Reliability and Construct Validity of Hip Load Compared to Playerload During Football Specific Running, Kicking and Jumping Tasks | Erik Wilmes, *Amsterdam Movement Sciences, Department of Human Movement Sciences, Faculty of Behavioural and Amsterdam, the Netherlands*
Training Load Variables in Elite Youth Soccer: Is a Data Reduction Approach consistent across different age groups? | Darragh Connolly, *Sport Science and R&D Department, Juventus Football Club, Torino, Italy*
The dose-response relationship between training load measures and changes in force-time components during a coun soccer players | Matthew Ellis, *Newman University, UK*
Pathways for measuring perceived exertion-recovery state in under-19 young football players: an observational and prospective cohort study | Luís Branquinho, *Higher Institute of Educational Sciences of the Douro, Penafiel, Portugal*
Relationships between selected strength parameters and match-related running speed performance in young elite soccer players | Matej Varjan, *Sport Research Center, Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic*
How do young soccer players train? A 5-year analysis of elite academy players weekly training load and its distribution across a micro-cycle | Darragh Connolly, *Sport Science and R&D Department, Juventus Football Club, Torino, Italy*
COVID-19 lockdown in Italian Serie-A male football players: Was there a silver lining for players physical fitness and body-composition? Maurizio Fanchini, *AS Roma Football Club, University of Verona, Italy*

13:00 | Lunch | Conventual Room

14:00 | Parallel Oral Sessions 19 | Small Sided Games III
Chair: Filipe Clemente

Soccer players' tactical performance in small-sided games according to positional role | Wilder Geovanny Valencia Sánchez, *Universidad de Antioquia, Colombia*
Effects of modifying the number of targets on the individual offensive behavior during small-sided games in youth soccer players | Joaquín González-Rodenas, *Centre for Sport Studies, Rey Juan Carlos University, Madrid, Spain*
Effects of small-sided games on physical abilities in youth soccer players of Club Deportivo Ferrovãlvulas | Jorge Luis Salazar Martínez, *Universidad de Antioquia, Colombia*
Cardiac parasympathetic reactivation after small-sided soccer games and repeated sprints in untrained healthy adolescents | Amri Hammami, *Laboratory of physiology, faculty of medicine Sousse, Sousse, Tunisia*

15:00 | Parallel Oral Sessions 22 | Sports Sociology
Chair: Artur Santos

But where did they go? | Arthur Hochedé, *URePSSS -ULR7369 -Laboratoire Sherpas, France*
The Features and Mission of the Chinese Football Association Youth Training Outline: A Brief Introduction | Yeqin Zhang, *China Football College, Beijing Sport University, Beijing, China*
Equality is everyone's job: An exploration of the lived experiences of British South Asian people working in manageria football in England Scotland | Stefan Lawrence, *Newman University, UK*
Exploring perceptions of loneliness amongst the migrant professional footballersí community | Adele Muscat, *University of Malta, Malta*

MONDEGO

11:30 | Parallel Oral Sessions 15 | Technology and Data Science
Chair: Pedro Figueiredo

Unpacking a football team - profile and contribution of the players that allow outplaying more opponents in 2022 UEFA Champions League (UCL) season | André Oliveira, *University of Maia, Maia, Portugal, 2Sports Analytics Lab, Maia, Portugal*
Applying Machine learning algorithms to study Tactical behavior in Football | Sofia Fonseca, *CIDEFES, Lusofona University, Lisbon, Portugal*
Managerial Artificial General Intelligence (MAGI) for football: what could go wrong? | Scott McLean, *Centre for Human Factors and Sociotechnical Systems, University of the Sunshine Coast, Australia*
Coach, I don't feel it today - A Machine Learning approach for early in-game performance prediction | Matthias Kempe, *University of Groningen, the Netherlands*
Sahka - Individual Soccer Coaching Technology | Markus Bergum Hilbertsen, *UiT The Arctic University of Norway, Norway*

13:00 | Lunch | Conventual Room

14:45 | Parallel Oral Sessions 23 | Health & Nutrition
Chair: Susana Póvoas

A comparative study on the intensity of walking and recreational football for older adults | Sophie Mowle, *Coventry University, UK*
Effects of football training on health-related physical fitness measures in male adolescents | Amri Hammami, *Laboratory of physiology, faculty of medicine of Sousse, Tunisia*
Who is in control of anti-doping in soccer in Australia? | Mitchell Naughton, *Centre for Human Factors and Sociotechnical Systems, University of the Sunshine Coast, Sippy Downs, QLD, Australia*
Relationships between in-game athletic performances and fat and carbohydrates oxidation rates in young elite soccer players | Arthur Guillotel, *Stade Rennais Football Club, Rennes, France*
Nutritional support in elite German football clubs | Dolores Dravinec Reyzls, *Saarland University, Germany*

AEMINIUM

11:30 | Parallel Oral Sessions 16 | Women's Soccer I
Chair: Susana Póvoas

Measurement of energy expenditure by doubly labeled water in female professional soccer players | Marcus S. Dasa, *UiT, The Arctic University of Norway, Norway*
Is match related physical performance in womenis football position or player specific? | Andreas Kjæreng Winther, *UiT -The Arctic University of Norway, Norway*
The effect of neuromuscular training on body composition in female soccer players | Elena Mainer-Pardos, *University of San Jorge, Autov A23 km 299, 50830. Villanueva de Gállego, Zaragoza. Spain*
Warm-up strategies of elite female soccer players: practitionersí perspectives | Naomi Datson, *University of Chichester, UK*
Braiding the Beautiful Game: Characterizing Team Movement Patterns in Elite Football | Abdullah Zafar, *Department of Kinesiology, University of Waterloo, Waterloo, Canada*
Technical and spatio-temporal factors influence playing sequences in professional womenis soccer | Laura M.S. de Jong, *School of Exercise & Nutrition Sciences, Centre for Sport Research, Deakin University, Geelong, Australia*

13:00 | Lunch | Conventual Room

14:00 | Symposium 4 | Maritimo (Professional Soccer Club) Training Lab
Chair: Élvio Rúbio

Maritimo Training Lab: A Research Laboratory for Innovation and Performance in Football | Élvio Rúbio Gouveia, *University of Madeira, Portugal; LARSyS, Interactive Technologies Institute, Portugal*
Body composition and physical fitness differences between elite and non-elite football players | Cintia França, *Universidade da Madeira, Portugal*
High-performance athletes and sports injuries: a longitudinal study in a professional soccer team | Francisco Martins, *Department of Physical Education and Sport, University of Madeira, Portugal; LARSyS, Interactive Technologies Institute, Portugal*
The influence of numerical variability in small-sided games on youth football Goalkeepers' tactical-technical behavior | Honorato Sousa, *Universidade de Coimbra, Portugal*

15:00 | Symposium 5 | IPMAIA
Chair: Daniel Duarte

Are the Self-myofascial Release Instruments Effective on Performance and Recovery in Sports? | Ricardo Ferreira, *Núcleo de Investigação do Instituto Politécnico da Maia (N2I), Instituto Politécnico da Maia (IPMAI Departamento de Fisioterapia, Escola Superior de Tecnologia da Saúde de Coimbra (ESTeSC), Instituto Politécnico de Coimbra, Portugal*
Objective and subjective tests for fatigue monitoring: What is the relation? | João Pedro Roque Lourenço, *N2i, Instituto Politécnico da Maia, Portugal*
Coach-athlete relationship in international national teams competitions | João Ramos, *Núcleo de Investigação do Instituto Politécnico da Maia (N2I), Portugal*
Soccer variables and metrics for success | Rui Lima, *Núcleo de Investigação do Instituto Politécnico da Maia (N2I), Instituto Politécnico da Maia, Portugal*

Posters

The posters ID P001 to P030 should be posted on June 15th (after 12:00h) and should be withdrawn until 19:00h of the day 15th.

Discussion Scheduled for: 15/05/2022 from 17:00h to 17:30h during the Coffee-Break and Poster Presentation

Health

P001 Effectiveness of a walking football intervention on cardiorespiratory fitness in middle-aged and elderly active men
P002 Respiratory performance and occlusal strength of soccer players: an approach after training and detraining during the lockdown due to coronavirus disease 2019 (COVID-19)

Injury

P003 Headgear Does Not Prevent Sport-Related Concussion: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with 6311 Athletes and 173383 Exposure Hours
P004 The FIFA 11+ Injury Prevention Programs Reduce the Incidence of Hamstring Injury by 66% among Soccer Players: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with 2949 Players and 274032 Exposure Hours
P005 The FIFA 11+ Injury Prevention Program Reduces the Incidence of Lower Back Injury among Soccer Players: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with 7374 Players and 574061 Exposure Hours
P006 Can we reduce injury risk during the growth spurt? An iterative sequence of prevention in male academy footballers

Recovery and readiness

P007 Group findings of load and recovery in soccer are not generalizable to individual players
P008 Use of total cryotherapy in elite footballers: match preparation and recovery strategies
P009 Aetiology and Recovery of Neuromuscular function from a Professional Soccer Academy Training Week

Biomechanichs

P010 Biomechanical comparison of soccer players performance on natural and artificial playing surfaces
P011 Acceleration sprint running and maximal sprint pedaling technique in football players

Coaching

P012 The impact of video-based reflection on youth football coaches' questioning practices
P013 The technical-tactical analysis of the training process and the connection with the game (model)
P014 The importance of preparing for the defensive transition in offensive set pieces: the coaches opinion
P015 An analysis of the effectiveness of football curriculums: A Case Study on the Australian Curriculum compared to Europe
P016 The current landscape and contribution of isolated practice in European professional and academy football: A thematic analysis of professional coaches and player interviews

Testing

P017 Testing the relationships between peak acceleration, deceleration and speed and change-of-direction deficit on the 5-0-5 test: a cross-sectional study in adult male soccer players
P018 Characterization of muscular strength in soccer players according to age, competitive level, and position on the field
P019 Analysis of the determinants of repeated sprints ability in youth soccer
P020 High isokinetic testing speeds are correlated with linear sprint performance
P021 Asymmetry in diving technique is associated with goalkeeper specific training and body composition among youth goalkeepers
P022 The Relationship Between Maximal Running Velocity and Yo-Yo Intermittent Recovery Test Level 1 in Elite Male and Female Canadian University Soccer Players
P023 Asymmetry in isokinetic strength of knee muscle actions at the angle positions of 30, 45 and 60 degrees among male professional soccer players
P024 Reliability Coimbra Agility Soccer Test (CAST)
P025 Lower-limbs agonist-antagonist relationship in academy under-19 male football players
P026 Change of Direction Characteristics in Elite Youth Soccer. Not Always Straight Forwards?
P027 Wingate Anaerobic Test Reference Values for Male Cyprus League Elite Soccer Players
P028 The kinetic differences of two plyometric exercises in youth football players

Small Sided Games

P029 Small sided game as fitness assessment in young soccer players
P030 Is training intensity of 3v3 small-sided games related to aerobic performance and hemoglobin concentrations of professional soccer players?

The posters **ID P031 to P062 and the P142** should be posted on June 16th (after 09:00h) and should be withdrawn until 18:00h of the day 16th.

Discussion Scheduled for: 16/05/2022 from 16:30h to 17:00h during the Coffee-Break and Poster Presentation

Women

P031 How many scenarios greater than 75% of the most demanding passages occur in female official football matches?
P032 The influence of contextual factors on physical performance in women's football
P033 Differences in psychological factors between elite female football players in Norway
P034 Study of the efforts of each club to realise the philosophy of the Women Empowerment League —Focus on the organisation of the coaching staff
P035 Transient reductions in running intensity following periods of high intensity in women's football
P036 Evolution of the tactical peak dimensions during competition in female soccer
P037 Prevalence of supressed RMR as a marker of energy deficiency in professional female soccer players
P038 Evaluation of body composition in adult female soccer players using concurrent technologies: bioimpedance and dual-energy x-ray absorptiometry
P039 Day-off before a match-day? Effects on match physical performance in elite women's soccer
P040 Allometric modelling of left ventricular mass in female soccer players aged 12–16 years
P041 Chronological age at different moments of the career, in five major women's soccer leagues
P042 Relative and biological age in Spanish male and female elite vs. non-elite soccer academies
P043 Talent development in elite female soccer: Practice activities of professional players in the United Kingdom
P044 Measuring Team Synergic Behavior in Female Football
P045 Playing time according to chronological age in elite women's soccer
P046 In-season Microcycle Quantification of Professional Women Soccer Players – External, Internal and Wellness Measures
P047 Activity profile in female soccer players – a comparison between under-19 and senior athletes
P048 Relative age effect in European Women's elite Soccer

Youth development

P049 Inter-observer agreement in the assessment of bone developmental stages using TW2 score systems among male pubertal soccer players
P050 12-month intra-individual changes in bone health among male adolescent soccer players
P051 Talent Identification and Talent Development in Football - A Qualitative Study
P052 Sprint training adaptations in youth soccer players: the role of biological maturation
P053 Gold Score Soccer: Prognostic Validity of Different Talent Identification Models for Future Success of Young Soccer Players
P054 Body composition or biological maturation? What variables are more influenced by linear sprint performance in teenage female soccer players?
P055 How is mental factors prioritized in female elite football? An experience-based study from Norway

Sociology

P056 The training of football athletes in Brazil: the illusion of the successful footballer
P057 Football spectacle in the context of capital realisation strategies: aesthetic innovation and the construction of the "magical aura" of commodities
P142 Using wireless inertial measurement units and the fourier transform for the analysis of effective activity time in soccer

Psychology

P058 Us versus them mentality in football fans: Reward and mentalization brain networks as basis of affiliation
P059 The effects of self-talk and body posture on performance in soccer players
P060 Self-Regulation of Learning During Soccer Practices: An Ecological Dynamics Approach
P061 Developing cognitive and motor decision-making skills through tactical principles and Game Sense Approach in youth soccer

Strength & conditioning

P062 Acute, locomotor, heart rate and neuromuscular responses to added wearable resistance during soccer specific training

The posters **ID P063 to P093** should be posted on June 17th (after 09:00h) and should be withdrawn until 18:00h of the day 17th.

Discussion Scheduled for: 17/05/2022 from 11:00h to 11:30h during the Coffee-Break and Poster Presentation

Futsal

P063 A Review on Talent Identification and Development in Male Futsal
P064 Patterns of Play in Offensive Sequences that Result in Goal Scored in Portuguese Futsal
P065 Mechanical Profiles in Professional and Elite Futsal Competitions

Match Analysis

P066 Multilevel Analysis of Sociocultural and Ecological Determinants of Playing Styles in Football: An Ecological Dynamics Perspective on Cross-Cultural Research
P067 Quantifying Nonlinearity in school football
P068 The influence of playing position and contextual factors on running performance in professional portuguese soccer players
P069 Physical & Physiological Maximal Intensity Periods of Elite Youth Soccer Match Play
P070 Efficiency of the offensive process in elite football teams
P071 Detection and analysis of regular behaviour structures in effective offensive sequences in two elite portuguese teams
P072 Systematic Observation of Corner Kick Strategies in Portuguese Football Players
P073 Physical demands according to tactical match dynamics: a research project
P074 "Play what you train?": the example of set pieces in youth football
P075 An attempt to quantify the difficulty in a goalkeeper's defensive response to a cross ball
P076 Analysis of the interaction and offensive network of the Portuguese national team at the 2016 European Championship
P077 The influence of audience on the home advantage in football matches in UEFA and CONMENBOL competitions
P078 Capturing bi-directional synergy formation in elite football teams through multilevel hypernetworks
P079 Home Advantage in Professional Soccer: the Case of Real Madrid
P080 Executing penalty kicks in the Danish football top-tier – Do match-related circumstances matter?

Monitoring

P081 Match demands differences between youth soccer teams
P082 Are match physical performances correlated with weekly training load? - a pilot study with elite female soccer players
P083 Use of technological devices to quantify external and internal load in soccer players in competition: A systematic review
P084 Associations between physical performance changes and training intensity in professional soccer players
P085 The relationship between iTRIMP and aerobic fitness: A re-analysis
P086 Training loads responses in young soccer players
P087 Weekly external load in an amateur soccer: A match reference study by positions of play
P088 The effects of game timing on warmup and in-game player load in an American college men's soccer team
P089 Player global profiles for match and training sessions
P090 Differences of high-speed actions between matches and training sessions in semi-professional soccer players
P091 The weekly external load relative to game demands by positions of play: a first approach in a portuguese professional football team

Perception and action

P092 3D-MOT training improves dynamic attention and field vision in youth soccer players
P093 Speed of decision making as a key element for professional and academy soccer players' performances

MYOCENE

MYOCENE is a Belgium based company which develops and commercializes a **unique device for objective muscle fatigue measurement**.

Muscle fatigue, defined as a reduction of all physical capacities (strength, speed, power), decreases sports performance as long as the fatigue persists. Thanks to the combination of a very specific neurostimulation, the MYO-CONTRACTOR, a high precision force sensor, the MYO-SENSOR, and a dedicated algorithm, the MYO-AI, the MYOCENE device provides in only 2 minutes a precise measurement of the Powerdex® of the quadriceps, i.e. the level of fatigue and performance of the muscle.

Thanks to the MYOCENE device, coaches, trainers or physical trainers of high-level athletes are now able to optimize and individualize the training load of their athletes. A real revolution to monitor and control recovery kinetics, avoid overtraining, reduce injuries and bring athletes to the pinnacle of performance.

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Keynote Presentations

Keynote Presentation | How the theory of Ecological Dynamics has shaped Research and Practice in Soccer in the new Millennium

Presenting Author: Keith Davids
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The world class coach, Josep (Pep) Guardiola described soccer as '…the most difficult game in the world because it is open and every situation is completely different and you have to make decisions minute-by- minute.' https://www.theguardian.com/football/2016/oct/07/pep-guardiola-exclusive-interview-johan-cruyff- unique.

This insight of an elite soccer coach, based on a significant amount of 'experiential knowledge' gained as a professional player and coach at the highest levels, characterises the dynamic and transitional nature of the sport. It complements the significant amount of data and knowledge gained in empirical research on soccer from an Ecological Dynamics perspective in the new millennium.

The theory of Ecological Dynamics has characterised team sports like soccer as a complex adaptive system, open to informational flows of the performance environment. Research, from that perspective, in the new millennium has investigated how information supports movement (re)organisation in different sports to study coordination, control and learning. Early work conceptually modelled coordination and control of soccer actions (Davids et al., 2000) and soccer matches from a dynamical systems perspective (Davids, Araújo & Shuttleworth, 2005). These milestone papers highlighted the importance of the information-movement relationship in performance and practice in soccer.

This presentation overviews key highlights of Ecological Dynamics research on performance and practice designs in soccer at developmental and elite levels. This body of work has clarified the importance of specificity and generality of practice for developing skill in soccer players in the past two decades, providing practical ideas for pedagogical practice in frameworks of Nonlinear Pedagogy and the Athletic Skills Model (Rudd et al., 2021). Research within these important pedagogical frameworks has highlighted the deep integration of empirical data and experiential knowledge of elite coaches emphasising importance of representative design and skill adaptation in practice designs to provide athletes with dexterity, through conceptualising practice as a 'particular type of repetition without repetition' (Bernstein, 1967, p234). The presentation exemplifies how key ideas from Ecological Dynamics can shape the way that sports practitioners in soccer could design practice environments to enrich the capacities of players to cope with the most variable constraints of dynamic competitive environments.

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Keynote Presentation | The impact on sports medicine of deciphering the *human* genome and necessary next steps to fulfil expectations of this genetic revolution

Presenting Author: Yannis P. Pitsiladis
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Recent advances in DNA sequencing technology enable the analysis of a large number of genomes. The generation of large data combined with new and improved methods of analysis, which includes machine learning and artificial intelligence, is collectively predicted to advance precision medicine considerably to facilitate optimal tailored medical therapies based on the individuals complete clinical and risk profiles which includes their genomic information. This reality has the potential to also revolutionise sport and exercise genomics by substantially enhancing the efficacy of genetic discovery. The rapid advances in DNA sequencing technology have also introduced many new ethical and confidentiality issues such as reidentification of anonymised genotype data, data ownership, newborn screening and incidental findings. These advances and the anticipation of a true revolution in precision medicine have created a lively market for direct to consumer genetic testing (DTC-GT0 companies. Starting in the 2000s, DTC-GT has become commercially available for the purposes of tracking ancestry and providing genetic information for diet, nutrition, fitness and well-being, as well as the risk of several diseases, including T2D, CVD, and cancer. At present, the vast majority of company claims are more in line with future aspiration and promise rather than current evidence-based reality. At present, DNA sequencing technologies are able to generate data at a much faster rate than our ability to interpret and therefore appropriately exploit these data. In the field of sport and exercise medicine, dissecting the relationship between genetic factors and health-related fitness, athletic performance, trainability and susceptibility for exercise-related health risks (e.g., musculoskeletal injury) were previously attempted. However, from previous candidate gene approaches and GWAS, there are very limited outcomes with clinical utility, and therefore a paradigm shift in sports genomics is urgently needed. However, with the exception of the Athlome Project Consortium (www. athlomeconsortium.org) which was launched in 2015 for the advancement of ‘omics’ in exercise sciences and medicine, there are no significant international consortia. The Athlome Consortium aims to collectively study the genotype and phenotype data currently available on elite athletes, in adaptation to exercise training and on exercise- related musculoskeletal injuries both from individual studies and from consortia worldwide.

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Keynote Presentation | Let's keep players on the pitch: applied science in elite soccer

Presenting Author: João Brito
Affiliation: Portugal Football School, Portuguese Football Federation

It is well documented that elite soccer is getting more and more demanding, and the number of matches played every season might not decrease in the near future, both for men and women. The stakeholders should note that the whole soccer industry is developed around the very broad idea of matches played by teams and players. Though, despite the anecdotal reports and commentaries regarding the potential limits and risks associated with the increased number of matches played every season, clubs, coaches, health and performance staff and players need to be prepared and adapted to cope with this current reality. Therefore, it is sound that the stakeholders in elite soccer search for the best strategies that may contribute to keep players available for training and matches, while performing at their best.

Generally, applied science aims to put scientific knowledge into practical use. In soccer, applied sport science has long tradition and has been vital for the development of the game. A major area of applied science in soccer has been related to injury prevention. Traditionally, prevention strategies have been categorized in three dimensions (i.e., primary, secondary, and tertiary), but the concept of quaternary prevention has emerged recently. Quaternary prevention aims to protect individuals from actions that may likely cause more harm than good. In soccer, this can be conceptually integrated by trying to prevent all types of harm associated with training, monitoring, recovery, testing, diagnosis, or rehabilitation. The literature in such topics is vast in soccer, but high-quality applied science in this area is needed to support the implementation of interventions that can contribute to keep players available to train and compete on the pitch. The concept of quaternary prevention in soccer is also ethically sound because it contributes to protect players from excessive, inappropriate, or questionable interventions, training regimens and evaluations. Moreover, integrating the principles of quaternary prevention might contribute for appropriate cost-benefit analysis that assist on allocating resources for the most beneficial areas of intervention. Therefore, players, coaches, and health and performance staff may clearly benefit from including applied science and knowledge-based decision making in the active hazard control process of risk management related to keep elite soccer players available for training and competing on the pitch.

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Keynote Presentation | Football is medicine: Prescribing football for global health promotion

Presenting Author: Peter Krustrup
Affiliation: Professor of Sport and Health Sciences, University of Southern Denmark

The scientific evidence supporting the use of recreational football as a broad-spectrum prevention and treatment of lifestyle diseases has gradually increased over the last decades (Krustrup et al. 2009, 2010, 2018, Krustrup & Krustrup 2018, Milanovic et al. 2015, 2019, 2022). More than 250 peer-reviewed articles, 6 special issues and several books have been published within this research area using a variety of research methodologies ranging from exercise physiology, sports science, sports medicine, epidemiology, sports psychology, and sports sociology (Krustrup and Parnell, 2019). This research covers investigations in participant enjoyment, flow and exercise intensity of drills and small-sided football all the way to efficacy and effectiveness studies on the health, fitness, wellbeing and learning effects of short- and medium-term football training for children, youth, adults, elderly and patients. Several meta-analyses have confirmed that football is an effective combination of strength, endurance and high-intensity interval (HIIT) training with marked positive effects on cardiovascular, metabolic and musculoskeletal fitness. Thus, 3-6 months of twice- weekly 60-min football training sessions increases VO_2max by 3.5 ml/min/kg for untrained adults and lower the blood pressure by 11/7 mmHg for patients with mild-to-moderate hypertension, elevates leg, hip and lumbar spine BMD by 2-5% for untrained adults, elderly women with prediabetes, osteopenia or breast cancer, and for elderly men with prostate cancer (Milanovic et al. 2015, 2019, 2022). Additionally, school-sport concepts can be used to enhance health, fitness, well-being, cognitive function and health knowledge for girls and boys aged 6-13 yrs, including ethnic minority children with no prior sporting experience (Larsen et al. 2021, Ryom et al. 2022). In studies with 55-80-yr-old men with prostate cancer we have furthermore observed stronger bones in a 5-yr follow-up (Uth et al. 2018), and a 40% reduction in the number of hospitals admissions comparing football with standard care (Bjerre et al. 2019). This research has been used in the development and implementation of several best practice evidence-based sporting concepts for schools and sports clubs in 20 countries, such as FIT FIRST 10/20/Teen, 11 for Health, Football Fitness, Football Fitness ABC, FC Prostate, Football for the Homeless and Football for the Heart.

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Oral Presentations

CO151| The effect of physical workload on gaze behavior of soccer defenders: an in situ approach

Presenting Author: Filipe Casanova

The development of perceptual-cognitive skills enhances the ability to identify and process environmental information in order to select and execute the most appropriate actions. These skills are influenced by different interrelated constraints during in situ tasks, which are inherent to specific competitive demands such as the mental-physical workload, and the technical-tactical and perceptual-cognitive skills required This study examined the effect of physical workload on gaze behavior during defensive 2vs.1+Gk situations. Twenty-two soccer players were separated into two groups based on their defensive tactical performance on-task, creating separate high- and low- performing groups using a within-task criterion. In the task, 12 game sequences (trials) were presented under high- and low-workload conditions. The low- and high- workload conditions were defined when the players achieved at least 60% and 90% of their HRmax respectively, during performance on the Yo-Yo Intermittent Recovery Test. Visual search data were recorded using Tobii pro eye-movement registration glasses. The low-performing group increased Fixation Duration and decreased the Number of Fixation and Number of Fixation per Location between the low- to high-workload conditions. Both groups displayed different visual search strategies with regards the AOIs fixated upon. The high-performing group focused on the SpaceFrontPlayer then Ball and AnotherOpponent. The low-performing group spent more time focusing on SpaceFrontPlayer and SpacePlayers than Ball and AnotherOpponent. Findings highlight how fatigue impacts differently on perception and decision-making in high- and low-performing players, respectively.

Keywords: soccer; visual search; small sided-conditioned games; yo-yo test.

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CO154| The impact of penalty takers' footedness on goalkeepers' performance during a penalty: A field study in soccer

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The penalty kick is a dynamical system of information between a penalty taker and a goalkeeper, being characterized by unstable and stable movement patterns that both players perform in the penalty box. There is a wide literature about different variables influencing performance of penalty takers and goalkeepers in this specific situation (e.g., expertise, psychological and emotional states, perceptual training, visual and motor experiences accumulated in the task, etc.). However, there is scarce investigation about the effect of footedness of penalty takers on goalkeepers´ motor behaviour and performance when faced right- and left-footed penalty shootings. Therefore, the aim of this study was to novelty address the influence of penalty takers´ footedness on the goalkeepers' onset movement and saving performance when tried to intercept a penalty on a standard soccer field. Sixteen male experienced goalkeepers, performing at amateur categories in Spain, were recruited to save a sequence of 10 randomized penalties composed by five penalties performed by a right-footed penalty taker and five penalties from another left-footed penalty taker. A hight-speed camera and a sports radar were used to register the motor behaviour and performance of participants in the study. Results showed that goalkeepers initiated their saves later when faced the left- footed penalty taker´s shootings (27.68 ms before the kick) compared to the right-footed one (57.75 ms before the kick), but these differences were not significant ($U = 2796.50$; $p = .16$). The goalkeepers also achieved a higher percentage of saves when faced right-footed penalty shootings (26%) compared to left- footed ones (21%), but not at a significant level again. It is recommended that goalkeepers were familiar to the observation of shootings performed by right- but also left-footed penalty takers during trainings to better prepare them when trying to save penalty kicks during real matches.

Keywords: Perception; footedness; action; performance; penalty; soccer.

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CO182| Spatial vision occlusion in youth football: an exploratory training intervention

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Scientists and sport practitioners widely recognize the importance of visual information for soccer player's performance. While previous research has highlighted the usefulness of spatial vision occlusion googles to enhance the performance of typical soccer skills (e.g., passing) [1], no evidence is available in youth soccer players. The purpose of this exploratory study was to evaluate the impact of spatial vision occlusion googles on control and passing performance in youth football. A pre-post parallel group trial was undertaken. Eight youth soccer players (M= 17.30±0.44 years) were assigned to one of two groups (occlusion and practice). Intervention consisted of a rondo task (4v2) in the initial part of the training session (15 minutes x twice/week x 5-weeks). While the occlusion group had the spatial occlusion googles on, the practice group was exposed to regular practice conditions. Pre and post tests were composed by a rondo task (4v2), juggling and ball control. Four variables were selected for analysis: passing and ball reception efficacy (%), number of ball touches, quality of ball control (number of points). A 2 Group x 2 Time mixed ANOVA was conducted to analyze the effects of training intervention on all performance variables. A main effect for Time, ($p < .05$, $\eta 2p = .43$) on passing efficacy was observed. With regard to reception efficacy, we found a nearly significant Group x Time interaction ($p = .046$, $\eta 2p = .29$). No significant results were found for the remaining variables. Contrasting with previous research, this exploratory study did not disclose a clear effect for the use of occlusion googles on the performance of youth soccer players. More research is needed to clarify the usefulness for practice of spatial vision occlusion googles in youth football.

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CO201| Characterizing Eye Movement Patterns in 1v1 Situations in Elite Futsal

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Introduction: Current investigations into eye movements behaviours in team sport involve lab-based simulations or constrained scenarios involving dead ball scenarios with consequences for understanding of players' performance in sporting context. As such, we present an exploration of the visual behaviour of attackers in a live 1v1 scenario in futsal, to characterize differences in visual search strategies involved in successful take-ons.

Methodology: Portable indoor eye-tracking glasses (SMI mobile Eye-Tracking) were used to capture eye position data at 200Hz and the world scene video at 30Hz, from attacking players (n=5 athletes) in a 1v1 scenario (n=148 trials). Eye position streams were overlaid on world scene videos and fixation locations manually annotated into 12 areas of interest (AOI). The AOIs were then collapsed into two main fixation regions, to indicate whether the player was looking down at the area surrounding the ball or looking up towards the space leading to the goal. The structure of the fixation sequences was analyzed using stationary gaze entropy (SGE) and gaze transition entropy (GTE). Additionally, directed graphs were constructed from the fixation sequences and the prominence of each AOI was computed via its graph centrality.

Results and Discussion: Our results reveal that both the SGE ($d=1.21$, $p<0.01$) and the GTE ($d=0.97$, $p<0.05$) of eye movements was significantly higher during unsuccessful attempts compared to successful attempts. The higher SGE is indicative of greater spatial spread in the fixations, while the higher GTE points to less structured patterns of gaze transition between AOIs. Furthermore, graph centralities revealed that in successful attempts the prominence of fixation was significantly lower on the front space ($d=0.47$, $p=0.05$) and was significantly higher on the defender's legs ($d=0.72$, $p<0.01$), compared to unsuccessful attempts.

Conclusions: Concluding, more successful take-on attempts were characterized by the reduced spread and structured transitions, focused more about the defenders' legs than the front space is characteristic of more successful take-on attempts. Further work should probe the temporal dynamics of gaze behaviour, in relation to the attacker-defender spacing, the global positioning of players, as well as the visual coupling between the actors.

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CO102| The effect of different high-intensity activity properties on interchange player rotation in Futsal – An analysis by playing position

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This study aimed to investigate the impact of different HIA (high-intensity activities) on players' physical performance during match rotations, stratifying by playing position. The data used for this study were from 7 official matches from the Spanish futsal league, which included 19 professional players. Players were categorized into three positions: Defenders (n = 6), wingers (n = 10) and pivots (n = 3). HIA factors included the number of high-speed running activities (>18 km-h), the number of high-intensity accelerations (>3 m- s2), and the number of high-intensity decelerations (>3 m-s2). To calculate the HIA per rotation, the sum of these three variables was measured in each player. Properties of HIA (effort, duration, distance, work-rate and time-frequency) were calculated for comparison purposes. Linear mixed models were used to assess differences in mean HIA properties (dependent variables) between rotations, participants, and any interactions between the independent factors. Bonferroni post-hoc tests were used to identify differences between means in the event of a significant effect. The relationship between HIA properties across rotations were determined using Spearman Rho correlation. In general, only HIA efforts across rotations and positions demonstrate statistically significant differences. The first rotation was shown to be more intense (18 HIA) than rotations three (13 HIA), four (12 HIA), and five (12 HIA). Wingers have a higher HIA effort and time-frequency value than defenders ($p \leq 0.05$) and pivots ($p \leq 0.001$). The HIA duration and distance show no interaction with player rotation or playing position. Furthermore, there were strong correlations between different HIA properties such as rotation duration and HIA effort (r=.627**); HIA effort with HIA work-rate (r=.900**); and HIA time-frequency with HIA effort (r=-.493**). Our findings suggested that physical demands in futsal are positional dependent. HIA duration and distance can be considered as properties to characterize activities with high-intensity, while HIA effort, time-frequency and work-rate can be considered as performance properties. The first rotation tends to be more physically demanding, and the higher activity profiles (wingers and defenders) had a lesser ability to maintain HIA (effort, time-frequency, and work rate) across match rotations.

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CO131| How weekly monitoring variables influence players and teams` match performance in elite futsal

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This study aimed to investigate how weekly training load constraints the performance of players and team in official competitions. Data from one team were collected during two seasons (46 weeks). The applied monitoring system analyzed the training load (as measured by Session Perceived Exertion, sRPE), the total recovery status (TQR), the well-being score (WBs) and the variability of neuromuscular performance during each week (CMJ-cv). In addition, the performance was assessed for all the matches. A path analysis model was performed to test the associations across variables. Results revealed that the proposed model explains 31% of teams' performance. In general, the results show that previous team performance as no significance effects on the training week. A significant negative relationship was found between CMJ-cv and match performance (β= -.34; CI95%-.359 to -.070), as well as a significant negative relationship between player's match performance and the team match performance (β= -.55; CI95%-.292 to .740). Regarding indirect effects, only a negative association between CMJ-cv and team match performance via players' match performance (β= -.19; CI95% -.342 to -.049) was identified. The few variation of the weekly CMJ (CMJ-cv) seems to be a key variable to monitor and explain both players and team performance. Based on this model, and only looking at the physical variables, it was possible to explain 31% of teams' performance. Further studies should be conducted to integrate other technical, tactical and psychological variables that allow to improve the level of understanding of players' and teams' performance.

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CO159| Seasonal Changes in Neuromuscular Performance in Elite Futsal Players

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Recent evidence suggests that a more comprehensive analysis of kinetic variables during the countermovement jump (CMJ) may be needed to detect neuromuscular impairments associated with acute or residual fatigue (1, 2). This study aimed to investigate the effects of seasonal variations on vertical jump kinetic variables. Eleven elite futsal players, competing in Spain's 1st Division over the season 2019-2020 performed two CMJ on a force platform at three different time-points (every ~5 weeks from August to October): 1) before the Pre-Season; 2) immediately after the Pre-season; and 3) In-Season. A one-way repeated measure ANOVA with Post-hoc pairwise comparisons and effect sizes (ESs) were used to analyze differences amongst these assessments. Non-significant and trivial changes were observed in CMJHeight (p=0.830; ES=0.12) among the three time-points. However, significant and moderate changes amongst seasons were found in specific CMJ kinetic variables such as: modified Reactive Strength Index modified (RSImod)(p=0.011; ES=0.60), flight time:contraction time (p=0.002; ES=0.72), eccentric (Ecc) peak force (p=0.011; ES=0.65), Ecc deceleration rate of force development (p = 0.008; ES = 0.60), Ecc braking duration (p=0.019; ES=0.74), Ecc duration (p=0.040; ES=0.89), and concentric (p=0.030; ES=0.45) and landing peak force (p=0.012; ES=0.68). While there were small-moderate changes in other concentric, Ecc, and landing metrics, these were not significant. In conclusion, CMJ kinetic variables during the jump- land cycle should be incorporated analyzed alongside more standard measures (e.g., jump height) to monitor performance during the season, as changes of substantial magnitude were observed initial stages of the competitive calendar.

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CO185| Effects of warm-up duration on physical performance of futsal players

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Warm-up is a traditional pre-match routine that affects subsequent players' performance. Under this scope, manipulating the warm-up structure may play an important role to enhance acute performance.

This study aimed to investigate the effects of warm-up duration manipulation on futsal players' physical performance.

Twelve highly trained male futsal players participated in this study during the in-season period. All players performed three different warm-up protocols on consecutive days that differed on its total duration: normal (28 minutes), short (15 minutes) and very short duration (9 minutes). All protocols included the same exercises, performed in the same sequence and with equal time %. Testing included countermovement jump (CMJ), drop jump (DJ) and reactive strength index (RSI) variables and was performed in three different moments: pre-warm-up, post-warm-up and post 10' warm-up, representing a real-world pre-match scenario.

CMJ and RSI improved in all protocols at post warm-up, with greater effects observed after very short duration protocol (7.0±4.9% and 13.6±22.1%, moderate to small effect size (ES), respectively). In opposition, trivial effects were observed at post 10' warm-up in all protocols. Regarding drop jump, small effects were observed after short (3.4±7.8%, small ES) and very short (3.1±3.7%, small ES) warm-ups, in post-warm-up and unclear results in post-10´warm-up.

Warm-ups of very short duration appear to induce positive effects on futsal players' physical performance. However, these effects seem to be attenuated over time, suggesting that short-duration warm-ups should end as close as possible to the beginning of the match. Also, different responses may emerge from the same warm-up structure, which reinforces the need of selecting adequate warm-up strategies according to payers' individual profiles.

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CO188| Effects of different warm-up strategies during match in futsal non-starting players: a case report

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Futsal dynamics are highly influenced by the unlimited substitutions. Under this scope, maintaining players' readiness throughout the game is key to achieve high-intensity actions, which means that acute performance enhancement strategies may play an important role for non-starting players.

This study aimed to investigate the effects of different warm-up strategies on futsal non-starting players´ physical performance.

Five highly trained male futsal players participated in this study during the in-season period. All players performed three different post warm-up protocols on consecutive days: seated rest, dynamic stretching and plyometrics with change of direction (PLY-COD). All protocol interventions were performed following a standard warm-up and had the same total duration: 5 minutes, including 2 minutes of rest and 3 minutes of intervention. Testing was performed in two different moments: 10 minutes after standard warm-up (pre-test) and immediately after post warm-up intervention (post-test), which represents a real-world match timeline scenario for non-starting players.

Running performance (linear 5 and 10 meters and 505 test) was improved after PLY-COD (5m: -2.9±1.7%, Cohen's d with 95% of confidence intervals: -0.56 [-1.31, -0.07], moderate effect size, ES; 10m: -2.2±0.7%,

-0.73 [-1.57, -0.25], moderate ES; 505: -2.7±0.6%, -0.46 [-0.98, -0.18], small ES) while seated rest impaired

linear running performance (5m: 2.6±2.8%, 0.43 [-0.16, 1,2], small ES; 10m: 1.9±2.2%, 0.44 [-0.18, 1.2], small ES). Dynamic stretching exercises had a trivial effect in all running variables. Vertical jumping performance (countermovement jump, CMJ; drop jump, DJ; reactive strength index, RSI) decreased after dynamic stretching (CMJ: -5.5±2.9%, -0.30 [-0.69, -0.06], small ES; RSI: -10.4±9.1%, -0.31 [-0,82, 0.05],

small ES) and seated rest (RSI: -24.1±18.7%, -1.3 [-3.2, -0.03], large ES). On the other hand, PLY-COD was able to enhance vertical jumping performance in all variables (CMJ: 1.7±2.4%; DJ: 1.4±6.3%; RSI: 21.2

±29.4%).

Warm-up strategies during match may promote different effects in non-starting futsal players' readiness during the first minutes. Remaining inactive or performing dynamic stretching may be insufficient to maintain readiness of non-starting players physical performance following warm-up. However, combining plyometrics with changes of direction exercises appear to positively affect the subsequent readiness for performance as observed in the improvements in running and jumping performances.

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CO098| Prevalence of poor sleep quality, sleepiness, and insufficient sleep duration in soccer players: A pilot study

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Purpose: Sleep is recognized as the most important recovery component for athletes (1). Nevertheless, little is known about soccer players' sleep/wake behavior. Therefore, the aim of this pilot study was to investigate the prevalence of daytime sleepiness, sleep duration, sleep quality, and self-assessed sleep needs.

Methods: The study included 104 male soccer players of various age groups (average age: 17 ± 3.9; range: 11-31 years). The participants completed the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Score (ESS), and answered the question "how many hours of sleep do you need to feel rested?". For each athlete, a sleep deficit index (SDI) was calculated by subtracting their habitual sleep duration (reported in the PSQI) from their self-assessed sleep need and was considered relevant if the SDI was ≥ 1 hour(2). The habitual sleep duration was compared with sleep recommendations for each age category.

Results: Daytime excessive sleepiness was present in 27% of the players, 20% reported poor sleep quality, and 38% did not achieve the minimum recommended sleep duration (11-13 years: 78%; 14-17 years: 29%;

≥18 years: 29%). There was a moderate relationship between ESS and PSQI score (rs= 0.47, p<0.01). SDI

≥ 1 hour was present in 35% of the athletes (adult athletes ≥18 years: 41%; young athletes, 11-13 and 14

-17 years: 28%).

Conclusions: The results showed that more than one-third of the athletes in our sample have poor sleep quality, associated with high levels of daytime sleepiness. A large proportion of the athletes between 11-13 years did not meet the minimum recommended sleep duration of 9 hours, and 41% of adult athletes obtained substantially less sleep than their self-assessed sleep need. Non-invasive and free tools, such as the PSQI and ESS, may be helpful identifying athletes who require sleep education and/or interventions to improve sleep, recovery and well-being.

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CO132| The reliability and sensitivity of post-match neuromuscular measures in elite youth soccer players

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Introduction: A suitable measure for monitoring post-match response should be valid, reliable and sensitive [1]. Isometric and dynamic tests are frequently utilized to indirectly assess neuromuscular fatigue following matches [2]. Therefore, a detailed analysis of ground reaction forces may offer insights for detecting neuromuscular fatigue [3]. This study aimed to quantify the reliability and sensitivity of a range of neuromuscular measures recorded during the isometric posterior chain (IPC) lower-limb muscle test and a countermovement jump (CMJ) test.

Methods: Eighteen Italian Serie A academy soccer players performed three IPC repetitions per limb and five CMJ trials in 4 testing sessions. Reliability was evaluated between two testing sessions, performed seven days apart, using typical error (TE), coefficient of variation (CV) and intraclass correlation coefficient (ICC). Sensitivity (i.e., responsiveness) was assessed on two additional test days performed before and after a soccer match using Hedges' g effect size (g) and comparisons to typical variation. A total of 20 neuromuscular measures were examined.

Results: IPC and CMJ neuromuscular measures demonstrated moderate to excellent levels of relative reliability (ICCs ranged from 0.85 to 0.99). Absolute reliability (CVs) ranged from 1.5 to 8.8%. A wide range of neuromuscular measures showed significant alterations at post-match ($p < 0.05$; g: small to moderate). IPC peak torque, CMJ eccentric peak force (EccPF) and CMJ force at zero velocity (F@0V) recorded post- match changes greater than their typical variations, demonstrating superior sensitivity in detecting neuromuscular changes compared to jump height and CMJ concentric phase measures.

Discussion: IPC peak torque and CMJ eccentric phase forces (EccPF, F@0V) were found to be both reliable and sensitive to match-induced fatigue in elite youth soccer players. IPC peak torque and CMJ eccentric phase forces could be applied for monitoring youth soccer players' post-match neuromuscular status.

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CO156| How the climatic conditions forecast for the FIFA World Cup in Qatar 2022 will affect on the physiological and psychomotor responses of soccer players

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This year, for the first time in history, the FIFA World Cup in Qatar 2022 will be moved to November and December in order to make the climatic conditions more bearable and less thermally troublesome for players (Konefał et al., 2021). This study aimed to assess the capacity for repeated maximal effort (RME) of soccer players in the thermo-natural conditions (NC) and in simulated conditions for the 2022 FIFA World Cup in Qatar (QSC). Twenty-four semi-professional soccer players participated in the study. The exercise test consisted of ten 6-second maximal efforts on a cycloergometer. A 90-second passive rest interval was used. The test was performed in a Weiss Technik WK-26 climate chamber under two different conditions: 1) thermo-neutral (NC - 20.5°C; 58.7% humidity); 2)simulated for the 2022 World Cup in Qatar (QSC - 28.5 ± 1.92°C; 58.7 ± 8.64% humidity) - (Chodor et al., 2021). Power-related, physiological, psychomotor, blood, and electrolytes variables were recorded. Results showed that, (1) players achieved higher peak power, needed less time to peak power, had higher values of fatigue slope in QSC than in NC (in each repetition of research protocol); (2) comparing to the 1st repetition, subsequent repetitions were observed many significant changes among physiological, blood-related, and electrolyte variables, but their direction was similar in both simulated conditions; (3) an 8°C of temperature difference between the climatic conditions did not significantly affect the physical and physiological responses of the soccer players in RME. Results can be used in the design of training programs to increase players' physiological adaptations by simulating soccer-specific conditions of play in terms of anaerobic capacity, in particular repetitive maximal effort. These findings will be useful during the upcoming event and in locations where high ambient temperatures are customary.

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CO163| A case study comparing sleep in shared and individual rooms during a training camp in elite youth soccer players

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In recent years, the growing interest in understanding how athletes sleep has boosted the number of scientific studies on the topic1. In fact, athletes and coaches have ranked sleep as the most important recovery strategy1. However, athletes often spend nights in unfamiliar environments during training camps that may disrupt sleep2. Therefore, the purpose of this study was to analyse the impact of sleeping in shared vs. individual bedrooms on objective and subjective sleep, and on cardiac autonomic activity in elite youth soccer players during an official training camp. Thirteen elite male youth soccer players (aged: 17.9 ±

0.4 years; mean ± SD) participated in the study. Sleep indices were examined using wrist actigraphy and a 7-point Likert scale. Heart rate (HR) monitors were used to examine cardiac autonomic activity during slow- wave sleep (SWS)-derived episodes throughout two training camps (training camp with players sleeping in individual bedrooms [TCIR] vs. training camp with players sleeping in shared bedrooms with separate beds [TCSR]). Workload was characterized using global positioning system (GPS) units and the session rating of perceived exertion (s-RPE). Players slept significantly longer during TCIR than TCSR (+ 1:28 [1:18–1:42] min, $P < 0.001$). Sleep efficiency was significantly higher during TCIR than TCSR (+ 12 [10–15] %; $P < 0.001$), while sleep latency was significantly shorter during TCIR than TCSR (-3 [-15 – -4] min; $P < 0.001$). Subjective sleep quality was significantly lower during TCIR than TCSR (-2 [-3– -2] arbitrary units; $P < 0.001$). No significant differences were found for SWS-derived cardiac autonomic activity, neither for training and match workloads between training camps. Overall, this study suggests that sleeping in an individual bedroom compared to shared bedroom may improve objective and subjective sleep in elite male youth soccer players during training camps.
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CO190| The Short-term Relation Between Load and Psychophysiological Responses in Invasion Sports: A Meta-Analysis

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Background:

Understanding the short-term relation between training or match load and the psychobiological responses is important to enhance athlete's resilience to future training stimuli (Den Hartigh et al., 2022; Kellmann & Kölling, 2019). Especially in team sports, where training includes unstandardized group exercises. Currently, the direction and strength of the relation between load and psychobiological responses remains unclear.

Method:

We estimated 11 meta-analysis models, according to PRISMA-guidelines, to identify whether there is a short-term relation between load and the psychobiological responses wellbeing, recovery, and heart rate indicators in team sport athletes. In addition, we applied a meta-regression model to explore the influence of several moderators on the relations between load and fatigue and muscle soreness.

Results:

In total, 45 articles and 937 participants were included in the meta-analysis, which showed significant short- term relations between load and overall wellbeing (r = -0.36 [95%CI: -0.48 – -0.22]), sleep (r = -0.21 [95% CI: -0.32 – -0.09]), fatigue (r = -0.28 [95%CI: -0.43 – -0.12]), muscle soreness (r = -0.28 [95%CI: -0.42 –

-0.14]), stress (r = -0.13 [95%CI: -0.24 – -0.01]), and recovery (r = -0.28 [95%CI: -0.45 – -0.09).

Discussion:

The overall quality of evidence for the relations between load and the different psychobiological responses is relatively low. Furthermore, the psychometric properties of questionnaires regularly used in studies in this meta-analysis may be considered as doubtful. The significant relations between load and overall wellbeing, sleep, fatigue, muscle soreness, and recovery suggest that these responses provide useful insights in athletes' readiness to train.

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CO223| Physiological and immunological responses in young soccer players

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The main aim of this study was to investigate some immune and hormonal responses during a regular in season training week and explore their association with training load and the incidence of upper respiratory symptoms (URS) in three groups of young soccer players.

During a regular training week, three groups of Portuguese national level young soccer players were monitored; 14 under-15, 15 under-17, and 18 under-19.

Athletes were followed during one regular in season week in the same period of the year (February/March). Before training, all athletes had to answer a symptom questionnaire (WURSS-21) and a pre-saliva sample was collected. In each training session 30 minutes after, they had to classify the training intensity throw, Foster´s scale (Cr10: 0-10) and a post-saliva sample was also collected. The duration of the training sessions was controlled (minutes).

Friedman test, Cohen´s d effect size and Spearman Rho correlation were calculated using the software SPSS V28.

The three teams displayed a decrease of post training salivary testosterone values along the week, showing lower post training values at the end of the week. In U-15 and U-17 teams' salivary cortisol (S-C) post training values showed no changes. Nerveless, in U-19 there exists am increasing of the S-C values in the first two days. Meanwhile, the last 3 days we could note a decrease in S-C level after training. Free testosterone: cortisol ratio (S-T:C) displayed higher values post training than pre training in U-15 and U-17 teams and also after third until fifth days in U-19. S-IgA and Sr-IgA had no alterations across the week in the three teams.

We can conclude that a regular training week could affect hormonal parameters in young soccer players, mainly in older groups that had an additional training day and a harder training load. Despite S-IgA and Sr- IgA did not showed important changes after training sessions, it was observed that some immune parameters like Sr-IgA could facilitate the detection of athletes who have increased probabilities to got an URS. Athletes with more than 3 symptoms of URS had the tendency of lowest concentrations of Sr-IgA in the three categories of age.

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CO232| Relationship between internal and external training load metrics on neuromuscular performance

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Measuring neuromuscular performance (NMP) in soccer is of interest to practitioners due to its negative effect on performance. Reductions in NMP can be seen 48 hours post-match and thus aiding practitioners to alter periodization schemes to include recovery modalities. The aim of the current study was to examine the potential relationship between internal and external training load metrics and NMP during multiple training windows prior to matches. Thirty-five male professional soccer players from a single squad in North America participated in the study during the 2021 season. Players performed a countermovement jump (CMJ) as a predictor of neuromuscular fatigue. Tests were conducted the day prior to a game (Match Day

-1). Players were familiarized with the CMJ test prior to the onset of the study. Internal and external training load was measured at every training session and games. The effect of a seven, fourteen and twenty-eight day accumulated load were analysed against changes in CMJ measures. Data was analysed using a multiple regression where changes in mRSI, jump height and time to take off were the dependent variables. Statistical significance was set at $p<0.05$ with 90% confidence intervals. A relationship was found between total distance and accelerations with NMP in a 7-day training window. High-speed running, training load and total distance had a relationship with a decrease in NMP over a 14-day training window while increases in sprint distance resulted in lower NMP across a 28-day training window. Highlighting that changes across internal and external training load measures can have an impact on NMP across several different training periods. The current study has displayed a relationship with high intensity, mechanical training load and neuromuscular performance. While a relationship was observed, further research is needed in the area of measuring NMP in team sports and in particular in its effect on match physical performance and outcomes.

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CO095| Using the heart rate ratio method to estimate maximal oxygen uptake in recreational male footballers

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Cardiorespiratory fitness (VO2max) is associated with cardiovascular and metabolic health in the general population. Direct VO2max assessment requires skilled personnel, specific expensive devices and individual testing in certified laboratories, which limits its use in the general population. The heart rate (HR) ratio method (HRratio) is a valid, easy, and accessible method for estimating VO2max in well-trained subjects. The purpose of this study was to determine the validity of the HRratio in estimating VO2max in recreational football players in the untrained and trained states. Sixty-six participants (age 39.3±5.8 years) were tested pre-training, and twenty-eight after 12 weeks, for VO2max assessment, running on a treadmill alternating speed (1 km.h-1) and inclination (1%) increments every 30s until exhaustion. A multiple approach was used to directly determine maximal HR (HRmax), which was also estimated with selected equations. Resting HR (HRrest) was measured in supine position, after 15 min of rest. The HRratio method considers the product of HRmax/HRrest ratio by a theoretical proportionality factor (15 ml.kg-1.min-1, TPF) to estimate VO2max. This population specific proportionality factor (SPF) was 14.6±2.6 ml.kg-1.min-1. In the untrained state (n=66), participants' actual VO2max (41.3±6.2 ml.kg-1.min-1) was moderately lower (~2 ml.kg-1.min-1) than the estimated VO2max using the TPF. A non-significant difference (0.7 ml.kg-1.min-1) was found when VO2max was estimated using the SPF. When using HRmax equations and the TPF, a small nonsignificant difference (~1.5 ml.kg-1.min-1) was found between actual and estimated VO2max. In the trained state (n=28), the estimated VO2max values were not significantly different from the actual VO2max (44.2±5.2 ml.kg-1.min-1), with large effect sizes when considering TPF and estimated HRmax. This study results provide evidence that the HRratio can be used for estimating VO2max in male adult/middle-aged recreational football players.

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CO103| Effects of preferred leg on the peak acceleration, deceleration, and speed on 5-0-5 change- of-direction test: a cross-sectional study conducted in adult male soccer players

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Purpose: The aim of this study was to compare peak acceleration, deceleration and speed between preferred and non-preferred legs during the 5-0-5 change-of-direction test in adult male soccer players. Methods: The cross-sectional study design included twenty elite male soccer players (21.6 ± 2.0 years; 73.2

± 6.1 kilograms; 174.8 ± 4.5 centimeters). The players were assessed in the 5-0-5 change-of-direction test during a single day between 3 p.m and 6 p.m. The assessments occurred on synthetic turf and were preceded by a 48-hour period of rest. Before the assessment players reported an average of 8 ("well recovered/somewhat energetic") on the Total Quality Recovery scale. After indicating their preferred and non-preferred legs, players performed three trials on each leg, interspaced by 5 minutes between sets and 3 minutes between repetitions. Peak acceleration, peak deceleration and peek speed was recorded for each trial using a Polar Team Pro (Polar Electro, Kempele, Finland) device sampling at 10 Hz housed in a specialized pocked on the players upper backs. The best peak acceleration, deceleration, and speed for preferred and non-preferred legs was used for analysis. Coefficient of variations (CVs) were calculated for reliability, with paired sample t-tests and Cohen's D effect sizes calculated to compare for differences between conditions. Results: CVs for peak acceleration were 3.6 ± 2.4% for preferred and 3.2 ± 1.7% for non-preferred leg, –4.2 ± 3.7% and –4.3 ± 3.2% for peak deceleration, 2.3 ± 1.3 and 2.0 ± 1.1% for peak speed. Comparisons revealed a significantly greater peak acceleration (+0.22 m/s2; t=5.131; p<0.001; d=0.581) and deceleration (+0.17 m/s2; t=–3.266; p=0.004; d=–0.586) for the non-preferred leg. While there were no significant differences found between legs for peak speed (t=1.142; p=0.268; d=0.298). Conclusions: Braking with the preferred or non-preferred leg during the 5-0-5 change-of-direction test appears to have an effect on peak acceleration and deceleration. It is therefore recommended, that when utilizing this test, standardization is needed in the leg chosen for braking and comparisons only made between preferred or non-preferred legs.

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CO65| Using Submaximal Exercise Heart Rate for Monitoring Cardiorespiratory Fitness Changes in Youth Soccer Players

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Testing cardiorespiratory fitness plays an integral role in the overall monitoring process of soccer players. This study aimed to assess the value of monitoring fitness in elite youth soccer players (U15 to U19 age groups) by analyzing the concomitant changes in heart rate at submaximal intensity (HR12km/h) and the velocity at a lactate concentration of 4 mmol/l (v4mmol/l).

Players were tested by means of an incremental treadmill test on two occasions during the summer pre- season in two consecutive seasons. Based on data from a total of 170 test comparisons from the U15 (n = 48 test comparisons), U16 (n = 40 test comparisons), U17 (n = 46 test comparisons), and U19 (n = 36 test comparisons) age groups, the agreement between substantial changes in HR12km/h and v4mmol/l was analyzed using the threshold combination of HR12km/h = 4.5% and v4mmol/l = 6.0%.

Results revealed 2% full mismatches, 36% partial agreements, and 62% full agreements for the whole sample in terms of fitness change interpretation between both variables. The respective values for the U15 to U19 age groups ranged between 0–5% full mismatches, 28–44% partial agreements, and 56–68% full agreements with no meaningful differences between age groups.

In conclusion, our findings confirm the practical value of using HR12km/h to monitor fitness changes in elite youth soccer players when lactate sampling during incremental tests is not possible. To further interpret the agreements or mismatches between changes in HR12km/h and v4mmol/l, future research could benefit from investigating influencing factors of these two variables.

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CO66| Reliability and Validity of a Modified Illinois Change-of-Direction Test with Ball Dribbling Speed in Young Soccer Players

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The purpose of this study was to assess test-retest reliability, discriminative and criterion-related validity of the modified Illinois change-of-direction (CoD) test with ball dribbling-speed (ICODT-BALL) in young soccer players of different biological maturity and playing levels. Sixty-five young male soccer players (11.4±1.2 years) participated in this study. The participants were classified according to their biological maturity (pre- and circum-peak height velocity [PHV]) and playing-level (elite and amateur players). During the test-retest time period of two weeks, the following tests were performed during week one and as retest during week two: ICODT-BALL, ICODT, 4×9-m shuttle-run, countermovement-jump, triple-hop-test, maximum-voluntary isometric-contraction of back-extensors, Stork, Y-Balance, 10 and 30-m sprints. The ICODT-BALL showed excellent relative ($r=0.995$, $p<0.001$; ICC=0.993) and absolute (SEM<5%; SEM<SWCs(0.2, 0.6, 1.2)) reliability. The circum-PHV (22.8±1.7-s) and elite (22.5±0.9-s) players showed better ICODT-BALL performance than their pre-PHV (24.2±2.5-s) and amateur (25.1±2.8-s) counterparts ($p=0.028$ and $p<0.001$, respectively). The ICODT-BALL showed "very good" (AUC=0.81) discriminant validity when comparing the elite and amateur players, and "moderate" (AUC=0.67) discriminant validity when compared to pre-PHV and circum-PHV boys. ICODT-BALL demonstrated "large" positive associations with the ICODT ($r=0.65$; 41.8% shared-variance) and sprint tests ($r\geq0.52$; 27.3 to 34.8% shared-variance). In addition, results showed "moderate" negative associations between ICODT-BALL and strength, and power measures, as well as a "small" negative relationship with balance tests. In conclusion, the ICODT-BALL is a valid and reliable test to evaluate the ability to quickly CoD while ball dribbling in young soccer players. Therefore, practitioners can use the ICODT-BALL as a tool for talent identification.

Key words: sensitivity; football-specific testing; youth; biological maturity; playing level.

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CO114| Mechanical Power in Soccer: overcome the limits of acceleration alone

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Training load monitoring based on tracking systems has become a standard practice in soccer, as well as in different team sports. In this context, there is a multitude of parameters and indexes aiming at describing the physical performance of the players in detail. Some of these are based purely on the displacement of the player on the ground (i.e. distance, speed, acceleration) and are directly measured by video or GNSS systems. Other parameters are based on the estimate of energy expenditure or mechanical work performance in a specific time period that are still calculated from the time course of the speed.

As concerns the mechanical approach, the most common performance indicators are the amount of work completed at high speed (e.g. number of sprints, distance covered above 7 $m \cdot s^{-1}$, etc…) and the relevant speed changes (e.g. number of accelerations and decelerations).

However, since these last are selected on the bases of a predefined threshold (e.g. acc>2.5 $m \cdot s^{-2}$ for a duration greater than 0.5 s), the following aspects of this analysis deserve crucial attention: (1) the same criterion cannot be applied to all players regardless of their individual sprint capacities and (2) the acceleration alone cannot be considered regardless of the speed. In addition, as shown in a preceding communication, the instantaneous maximal acceleration decreases linearly with the speed, the corresponding profile defining the individual sprint capacities. We will show that this profile can be obtained from a sufficient number of matches or training sessions (ASP in-situ) [1]. Furthermore, the ASP in-situ can be utilized to assess the overall mechanical work intensity as well as the number of events performed above a given fraction of it.

An entire season of a professional soccer team (Italian Serie B, 44 official matches) was analysed providing a total of 326 individual ASP in-situ (playing time>45 min). The following results for V_0 and A_0 were obtained: V_0 = 9.22±0.47 $m \cdot s^{-1}$, A_0 = 6.41±0.32 $m \cdot s^{-2}$ (avg ± SD), thus allowing us to calculate individual absolute and relative (referred to the ASP in-situ) work intensities for each match.

[1] JB Morin et al. 2021 doi:10.1016/j.jbiomech.2021.110524.

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CO118| Mechanical Power in Team Sports

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The running speed is a correct index of the corresponding mechanical power only when the speed itself is constant. Consider for instance the 100m dash, in which case the speed increases rapidly in the first instants to attain a maximum after about 5 - 6 seconds. Hence, the forward acceleration, as well as the external mechanical cost of running per unit distance and body mass (Wext-const), is very high initially and decreases progressively in the central and final phases of the run. The overall external mechanical power (Pext-tot, $W \cdot kg^{-1}$) that a sprinter must develop throughout a 100m dash, is the product of Wext-const ($J \cdot kg^{-1} \cdot m^{-1}$) and the velocity (v, $m \cdot s^{-1}$) plus the product of the acceleration (acc, $m \cdot s^{-2}$) and v itself:

$$Pext\text{-}tot = Wext\text{-}const \cdot v + acc \cdot v \qquad (1)$$

Cavagna and Kaneko [1] showed that, during constant velocity running at sea level (between 2.8 and 8.3 $m \cdot s^{-1}$) on a series of force platforms, Wext-const ($J \cdot kg^{-1} \cdot m^{-1}$) is described by:

$$Wext\text{-}const = 0.66 \cdot v^{-1} + 1.19. \qquad (2)$$

Equations 1 and 2, together with knowledge of the time course of velocity and acceleration during the first 7 seconds of a 100m dash for Usain Bolt and for a medium level sprinter [2] allowed us to estimate, for any given velocity Pext-tot ($W \cdot kg^{-1}$), as well as its two components (equation 1). During a 100m dash, the difference between Pext-tot and the external power for running at constant speed: i) is very large when the speed is low, ii) it decreases progressively with increasing speed, and iii) it vanishes when the maximal speed is attained. It necessarily follows that, in exercises characterised by frequent accelerated running phases the speed alone cannot be considered an appropriate index of the corresponding mechanical power.

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CO200| Validation of the Université de Montréal Track Test and a Set Distance 1500 m Time Trial to Assess Maximal Aerobic Speed in Soccer

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Introduction. Maximum aerobic speed (MAS) is increasingly used in soccer to determine aerobic endurance performance. It represents the minimal speed at reaching maximal oxygen uptake and is usually examined during an incremental treadmill test. Moreover, numerous different field tests are used for MAS estimation. However, literature on the validity of field test procedures seems to be contradictory. Therefore, this work aims to investigate the convergent validity of two commonly used field tests, namely the Université de Montreal Track Test (UMTT) and a set distance 1500-m time trial for estimating MAS in soccer players. Methods. Thirteen male soccer players at a higher amateur level completed three different test procedures on three different days. MAS was determined by an incremental treadmill test with spirometry as the speed at the beginning of the oxygen uptake plateau. Furthermore, the UMTT (VUMTT = speed of the last stage) and a 1500-m time trial (V1500m = average speed) were performed. MAS, VUMTT, and V1500m were compared using an ANOVA. In addition, limits-of-agreement analyses were performed; Pearson's r and the ICC were determined for correlation analysis. Results. VUMTT and V1500m significantly overestimated MAS by 1.61 km/h and 1.68 km/h, respectively (ES = 2.03; $p < 0.01$ and ES = 1.77; $p < 0.01$, respectively), with large to very large correlations ($0.65 \leq r \leq 0.79$; $p \leq 0.02$; $0.51 \leq ICC \leq 0.72$; $p \leq 0.03$). Additionally, the limits of agreement between MAS and VUMTT (0.05-3.17 km/h) and MAS and V1500m (-0.18-3.55 km/h) were relatively large. Discussion. The overestimation of MAS from VUMTT and V1500m indicates that UMTT and a 1500-m time trial seem questionable for estimating MAS for soccer players at the same level as the investigated sample. Large to very large correlations indicate the possibility of using regression equations to estimate MAS. The results of the present work contribute to the clarification of MAS acquisition using field tests in soccer.

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CO113| Unilateral vertical jump can highlight motor disorders related to previous injuries in soccer players

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Objective:

The aim of this study was to explore the motor performance of professional soccer players with previous lower limb injury during a unilateral vertical jump.

Methods:

35 “injured” players, who reported, during the last 12 months, an osteoarticular injury of the lower limb “OA” (Nb: 25 ; age: 25.1 ± 4.55 years; weight: 77.1 ± 8.07 Kg) or an injury of the musculotendinous apparatus extensor of the knee "MT" (Nb: 11 ; age: 22.3 ± 2.9 years; weight: 79 ± 9.63 Kg) and 44 “healthy” players (age: 21.2 ± 3.38 years; weight: 78.1 ± 11.3 Kg), participated in a protocol comprising 3 unipodal stop jumps of the dominant lower limb (SJD) then 3 for non-dominant limb (SJND). The jumps were carried out on a force plate connected to a digital device making it possible to analyze the maximum jump height (Hmax in meter) and the average peaks of vertical reaction force from takeoff (PF dec in N/Kg) and landing (PF att in N/Kg). Non-parametric tests (Kruskal-Wallis and Mann-Whitney) were performed to compare injured vs. healthy players.

Results:

OA, but not MT, develop lower Hmax for SJD (0.304 ± 0.05 vs. 0.334 ± 0.04 m, p=0.02) and for SJND (0.302 ± 0.06 vs. 0.343 ± 0.04 m, p=0.03) compared to healthy players. On takeoff, OA exhibit lower PF dec for SJD (27.1 ± 3.10 N/Kg vs. 29.4± 2.42 N/Kg, p<0.01) and for SJND (26.9 ± 3.09 vs. 29.8 ± 2.53 N/Kg,

p<0.001) compared to healthy players. However, PF dec does not differ between the MT and healthy players for SJD (p=0.69) and for SJND (p=0.88). On landing, OA exhibit lower PF att for SJD (45 ± 8.55 vs.

50.1 ± 7 N/Kg, p=0.01) and for SJND (46 ± 7.96 vs. 50.8 ± 7.69N/Kg, p=0.015) compared to healthy players. However, MT players develop a higher PF att (60.1 ± 9.66 vs. 50.8 ± 7.69N/Kg), p<0.01) than healthy players. No significant difference for SJND were reported in PF att between MT and healthy players (p=0.33).

Conclusion:

The unilateral vertical stop jump can highlight lower limb motor performance disorders related to previous injuries of various typologies (As a decrease of maximum jump height or/and a decrease of vertical propulsion and landing forces in players with previous osteoarticular injury). Other studies should be carried out to confirm the potential of this tool in the diagnosis and the management of the risk of injury or reinjury in professional soccer players.

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CO127| Epidemiology of lower extremity muscle injuries in professional German football: a prospective study of seven consecutive seasons

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Introduction

Lower extremity muscle injuries (LEMIs) are a substantial problem in professional football (1) and continued epidemiological research on the matter is needed. This study aimed to describe the epidemiology of LEMIs and to analyse changes in injury incidence rates (IRs) over time within one of the top leagues.

Method

Injuries in the 1st German male football league were recorded prospectively through 7 seasons (2014/15

-2020/21). Injury diagnoses and time-loss data were primarily sourced from the publicly available “Kicker Sportmagazin”, and confirmed through other relevant news outlets, social media platforms, and web pages. The data was analysed descriptively, including IRs, incidence rate ratios (IRR), and burdens. Time trends of IRs were analysed with linear regressions in R studio.

Results

A total of 2,929 LEMIs (44% of all injuries) were recorded, causing 26% of all injury related time-loss. The overall IR for LEMIs was 2.4/1000 hours of exposure (95% CI 2.3-2.5) and the average time-loss was 12 +/- 17 days. The IR was 10.6/1000 match hours (10.0-11.3) and 1.6/1000 training hours (1.5-1.7). The match injury risk is 6.7-fold higher compared to a training injury (IRR: 6.7 95% CI 6.2-7.2, $p<0.001$). The most affected areas by LEMIs were the thigh (51%), hip/groin (20%), and the lower leg (14%). The most reported injury types were unspecified muscular problems (49%, injury burden: 7.1 days of absence/1000 hours of exposure), followed by muscle tears (28%, 18.4) and contusions (12%, 1.5). No significant changes were found over the 7 seasons for IRs of all LEMIs ($R2=0.26$, $b=-0.07$, $p=0.14$), match injuries ($R2=-0.13$, $b=-0.02$, $p=0.63$), or training injuries ($R2= 0.21$, $b=-0.03$, $p=0.17$).

Conclusion

The unspecified muscular problem has a low injury burden, which indicates the difficulties for media-based research to obtain accurate diagnoses for the least severe injuries. Thigh injuries were the most reported injury location, which is in line with previous research (1). Overall, this study can conclude that players in the first German football league have a considerable risk of sustaining LEMIs, although IRs did not significantly change from 2014/15 to 2020/21.

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CO158| Can speed variables predict the odds ratio and relative risk of non-contact injuries in soccer players? A prospective study

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INTRODUCTION: Training load is a modifiable risk factor for successive injury in soccer [1]. A systematic review observed the relationship between some sprint GPS variables and non-contact injuries in soccer players [2]. Therefore, an inappropriate sprint workload during the season can increase injury risk and reduce performance. PURPOSE: To analyse the association between the total distance (TD), high-speed distance (HSD), sprint distance (SD) and repeated sprint (RS) with non-contact injuries in elite soccer players during a season and to observe the injury risk associated between high- (HL) vs. low-load (LL) level for each of sprint variables. METHODS: 21 male players from professional soccer team participated in the study. External load monitoring was performed by GPS at each training and match session over the whole season. All noncontact injuries (that is, occurring without contact with foreign material or athletes) were recorded. Non-parametric Mann–Whitney U tests were used to compare the median of the load levels of the sprint variables. In order to detect statistically significant inter-group differences between the means of injuries at the HL and LL levels of the mentioned variables. To estimate the risk of having a HL level compared to a LL level, respectively, of each variable, odds ratio (OR) and relative risk (RR) were calculated. RESULTS: Mean injuries were significantly higher in the high load weeks compared to the low load weeks for all sprint variables. The OR and RR of producing some injury without contact was significantly higher in the weeks of high load compared to the weeks of low load in all sprint variables. In addition, significant RR were found for all variables except for RS. CONCLUSIONS: The weeks of high-load levels increase the risk of sustaining non-contact injury within elite soccer players. TD, HSD, and SPD variables could potentially track training and may allow exercise prescription to reduce non-contact injuries.

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CO189| Are Off-Field Activities an Underestimated Risk for Hamstring Injuries in Dutch Male Amateur Soccer Players? An Exploratory Analysis of a Prospective Cohort Study

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Background:

Amateur soccer players generally deal with an occupation or study besides their soccer career. It is thought that these off-field activities play an important role in the development of hamstring injuries through higher stress levels and poor recovery (Brink et al., 2010; Kenttä & Hassmén, 1998).

Purpose:

The purpose of this study was to explore what extent male amateur soccer players participate in off-field activities and whether these off-field activities are associated with the development of hamstring injuries.

Methods:

Amateur soccer players (n = 399) from first-class selection teams (n = 32) filled out a baseline screening questionnaire concerning off-field activities (i.e., work and study type and hours, traveling time, perceived sleep, perceived energy costs, and time spent on other activities) and their history of hamstring injury as a part of a cluster-randomized controlled trial. Throughout one competition, the players reported weekly their hamstring injuries, which were verified by medical/technical staff. Multivariable Firth corrected logistic regression models were used to explore associations between off-field activities and hamstring injuries.

Results:

Sixty-five hamstring injuries were recorded. Previous injury was significantly associated with hamstring injuries (OR ranging from 1.94 [95% CI 1.45–2.61] to 2.02 [95% CI 1.49–2.73]), but off-field activities were not.

Conclusion:

Although amateur soccer players spent a relatively large amount of time on off-field activities, we did not find off-field activities measured at baseline to be associated with hamstring injuries in the subsequent competitive soccer season. In contrast, previous hamstring injury was found to be strongly associated with (recurrent) hamstring injuries.

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CO213| Incidence and characteristics of heading in youth football (soccer)

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OBJECTIVE Concerns about short- and long-term consequences of repetitive heading contributed to heading restrictions in youth football in some countries. A realistic assessment of the header burden in young players may facilitate effective modifications of heading recommendations and restrictions. This prospective longitudinal study aims to describe heading exposure in children's and youth' football over two seasons using standardized video analysis of each practice and game during the observation period.

METHODS All matches and training sessions of a male Under-11 (n=29), Under-15 (n=28), Under-19 (n=38) and a female Under-17 (n=39) team were videotaped during the seasons 2019/20 and 2020/21. All teams played at the highest league possible for that age. Heading frequencies and characteristics (situation of header, flight distance, location of impact) were analysed. Individual heading exposure is presented as average incidence rates (IR) per 1000 match/training hours with 95% confidence intervals (CI).

RESULTS 275 matches and 673 training sessions were observed (total match and training exposure of 13,507 hours resulting in 22,921 headers). Heading IR per player in matches [CI] in Under-11 was 1256 [884-1627], in Under-15 1608 [1195-2022], in Under-17 1050 [802-1298], and in Under-19 1966 [1625

-2307]. No player headed >4 times per match hour on average. In training sessions, IR per player was 739 [586-894] for Under-11, 2206 [1636-2775] for Under-15, 1661 [1381-1942] for Under-17, and 1419 [1190

-1648] for Under-19. Under-11 had significantly lower training IR compared to older groups (Kruskal-Wallis, p<.01). Five players of the Under-15 were heading the ball 5-8 times per training on average accounting for 34% of all practice headers in that team. Most headers were performed without heading duels (match: 58%, training: 91%). Flight distance was predominantly 5-20m (54%) in games and <5m (65%) in training. While head impact location most frequently was at frontal areas, one-third of all headers in Under-11 in matches hit the temporal, parietal, and occipital part of the head.

CONCLUSION Heading incidence is low in the youngest age group, whereas (predominantly 5) Under-15 males show very high heading exposures in training. Recommendations for heading the ball in practice should account for individual as well as age related differences.

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CO246| Influence of environmental temperature on injury occurrence in professional German football (soccer)

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Introduction. The influence of environmental conditions on injury in elite soccer is an important consideration to possibly guide policies although study results remain equivocal(1,2). This study analysed the association of dry-bulb temperature (Td) and wet bulb globe temperature (WBGT) with match injury rate in a professional football league. Methods. Data from seven seasons (2142 matches; 2014-21) of Bundesliga, Germany's highest professional league, was analysed. Injury occurrence was collated from media-sources following an established procedure(3). Environmental data was obtained from Meteostat.net and categorized into quintiles, excluding the second and fourth one to arrive at larger contrasts, resulting in three categories: cold (Td<4.7°C; WBGT17.5°C; WBGT>20.4°C). A one-way ANOVA was conducted to compare overall injury occurrence and occurrence of specific injury types (contact/non-contact/muscle-tendon/joint-ligament/knee-ligaments/acl-pcl/ankle-ligaments) between quintiles. Results. Average Td; WGBT was 11.0°C±7.2; 13.7°C±7.7 (range: -11.2 - 34.4; range: -14.4 - 35.2°C). A total of 1779 injuries was recorded at an average of 25.17±29.49 injuries/1000h (CI: 23.92-26.42). No significant differences in the number of injuries/1000h existed between the 3 quintiles for Td (p=0.68; cold: 24.30±27.8, temperate: 24.80±30.5, warm: 24.85±29.1) or WBGT (p=0.24; cold: 23.77±27.4, temperate: 24.31±29.8, warm: 24.91

±30.3). Further, no significant differences existed between environmental quintiles for any subclassification of injury (p>0.05). Discussion. The current results did not demonstrate a negative influence of either cold or hot environmental conditions on injury-occurrence in elite German soccer. It is possible that higher temperatures must be reached in a larger number of matches to elicit a relevant effect.

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(3)*Krutsch W, Memmel C, Alt V, Krutsch V, Tröß T, aus der Fünten K, Meyer T. 2022. Archives of Orthopaedic and Trauma Surgery. 142:455-463.*

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CO100| Analyzing physical performance during successful open-play and counterattacks in professional football

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Introduction: Physical performance is often studied irrespective of tactical behavior and has seemingly little relationship with match outcome. One could argue this is not because of the lack of a relationship between physical and overall performance, but because performance is typically aggregated over larger timespans and multiple tactical contexts. The aim of this work is therefore to analyze physical performance during attacking play in professional football, by comparing open play and counterattacks and successful and non- successful attacks.

Methods: Tracking and event data were collected for 310 professional matches. Attacking sequences (n on- ball actions > 2) starting from elaborate play outside the final third, were selected from the data and labelled as open-play or counterattacks (attacks starting on the own half, resulting in a final third penetration within 10 seconds). Attack outcome was subsequently defined as successful when an attack resulted in a cross, shot or score-box penetration. Next, matching sequence time-series were extracted from the position data, and the physical performance intensity (%), defined as distance at speeds > 4.16 m.s-1 / total distance * 100, was computed. Intensity was aggregated over the entire attacking sequence. Finally, a statistical comparison between conditions was made using Kruskal-Wallis H tests.

Results: 40.888 attacking sequences were identified of which 33.990 were open play attacks (11.8% successful) and 6.898 counterattacks (17.3% successful). Results showed significantly higher intensity in open play vs. counterattacks and in successful vs. non-successful attacks, with a mean intensity of 15.1% ± 15.1% in successful counterattacks and 9.4% ± 15.0% in non-successful open-play attacks.

Discussion: The results indicate physical performance should be analyzed respective of a teams preferred attack style and can be related to match performance if one accounts for tactical context. Limitations of the current analysis are the fact that player role, score-line and total minutes on the field were not yet accounted for, while these could be confounding factors. Another key point to investigate would be the interaction between offensive and defensive external load during the tactical contexts analyzed here. Accounting for these factors in future research could further attenuate the results.

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CO164| The use of player tracking data to analyze defensive play in professional soccer - A scoping review

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The analysis of tracking data in tactical game analysis is a topic of rising interest, as more detailed insights into performance structure in soccer can be obtained compared to traditional (e.g., notational) analyses. Compared to the variety and detailed analyses of offensive play, the number of studies analyzing the defensive play is low. However, in recent years, an increasing number of studies investigating defensive play have been published, so it seems useful to provide an overview of the current state of research in this area. Therefore, this study aims to identify the approaches that have been used to analyze the defensive play in professional soccer using player tracking data and to reveal the findings on successful defensive play.

A systematic literature search of electronic databases (PubMed (n=604), Web of Science (n=593), and SPORTDiscuss (n=872)) was conducted according to the PRISMA extension for Scoping Reviews (PRISMA-ScR). Studies that were included used tracking data of professional adult male soccer and analyzed defensive play. The result is a total of 23 studies that were analyzed in detail using the standardized quality assessment checklist for systematic reviews in sports science. The synthesis of results was carried out descriptively by organizing the results into different levels of tactical play (individual level, group level, team level).

All included studies were of good methodological quality. The approaches to investigate defensive play using tracking data are highly heterogeneous (e.g. analysis of defensive pressure, analysis of synchronization, behavioral analyses, ball recoveries). Successful defensive play is characterized by high pressure at the individual level, by high inter-team and intra-team synchronization and balanced defense at the group level, and by a compact coordinated organization at the team level.

By summarizing the state of research on defensive play in soccer using sophisticated analysis approaches that showcase the possibilities of tracking data, this study provides an important foundation for future research in this area.

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CO167| In-Game Formation Changes as Momentum Shift: The Influence of In-Game Changes in Tactical Formation in Professional Soccer

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Tactical formation has been shown to influence match performance of professional soccer players. The aims of this study were to examine the effects of in-game changes in tactical formation and to analyze coach-specific differences.

We investigated three consecutive seasons of a top team in the German Bundesliga which were managed by three different coaches, respectively. For every season, the formation changes that occurred during games [in-game] were recorded. The match performance was measured on a team level using the key performance variables goals, chances, and last plane entries (≙successful attacking sequence) for the own and for the opposing team.

In the ten minutes after the formation change, the team achieved more goals/chances/last plane entries than the ten minutes before the formation change (ES range: 0.00≤ES≤0.95). Similarly, the team conceded fewer opposing goals/chances/last plane entries in the ten minutes after the formation change (0.00≤ES≤1.29). Furthermore, the results indicate that the success of the respective formation change was dependent on the responsible coach. Depending on the season the size of the impacts were diverse (season 1: 0.00≤ES≤1.29; season 2: 0.00≤ES≤0.60; season 3: 0.04≤ES≤0.57)

Over all three seasons, the in-game formation changes had a positive effect on the match performance of the analyzed team, highlighting their importance in professional soccer. Depending on the season, in-game formation changes had varying impacts on the match performance, indicating coach-specific differences. The provided information can support coaches in understanding the effects of their in-game decisions and, in turn, choosing the optimal decision to influence the game dynamic in a positive way.

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CO180| Degeneracy in Soccer: Association Between Inter-Team Movement Variability Shows the Highly Adaptive Behaviour of Players During the Match

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Degeneracy can be understood as different structures performing the same function, as well as the same structure performing different functions. In this study, we tested degeneracy in the context of a soccer match by comparing the variability of team structures (i.e., team collective movement), emerging from the displacement of players, during the ongoing competition for space between both teams. We used positional (x, y) data from a soccer match of the 2018 FIFA World Cup, including players on the pitch (n=22) and the ball (n=1). The match was separated into sequences (n=106) of more or equal to 4 seconds (i.e., 20 frames). Single-player movement variability was measured by applying sample entropy to the time series of each player-goalposts angle in each sequence. Team structure variability was computed by summing the movement variability of all players in each team. Team space influence was measured by adding each player's 'degree of influence' on the pitch, measured by computing a probability density function of a bivariate normal distribution, considering the player's speed vector magnitude and angle, and distance to the ball. Team space influence was normalized by a grading function where spaces near the goal had greater importance. Pearson correlations were used to measure the association of i) both teams' structure variability, and ii) the difference between the variability of both teams and the difference between space influence of both teams. Sample entropy mean results for each team showed the existence of team structure variability in both teams (1.26±0.57 and 1.29±0.56). Correlation results showed a high correlation between both teams' structure variability ($r(105) = 0.84$, $p < 0.01$), and no correlation between the difference between the variability of both teams and the difference between space influence of both teams ($r(105) = 0.01$, $p = 0.87$). The high correlation between both teams' movement variability showed the players' highly adaptive behaviour. These results confirmed the applicability of the degeneracy concept to study the complex dynamics of a soccer match by showing that the existence of variability in team structures might be a means to maintain space influence and adapt to the other team's movement.

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CO218| Calculating a per second 'goal threat' value in football using player and ball locations

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Calculating a per second 'goal threat' value in football using player and ball locations Ole André Nordahl1, Nic James2 & Nimai Parmar2
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Dynamical systems theory (McGarry et al., 2002) views games like football as a system which fluctuates between stable (no advantage for either team) and unstable states (an advantage present). An action within the system, called a perturbation, can signify a change of system state and give a team a distinct advantage over their opponent (James et al., 2012). These situations are typically found in goal scoring related events. System instability in football was thus calculated using the xy coordinates of players and the ball, weighted in relation to proximity to the goal to provide a 'goal threat' value every second (scaled from 0 to 100). Video recordings and synchronised Amisco 2D representations of goals (n=64) scored in Swansea City AFC English Premier League 2012/2013 matches (n=20) were analysed using Dartfish v10 Pro software. Each goal was analysed from when the play was judged to be relatively stable, or the start of possession, until the goal had been scored. Maximum goal threat values for each video clip ranged from 13.4 to 99.0 suggesting that goals in the EPL may not necessarily be preceded by high goal threat values. Subjectively determined perturbations typically occurred up to 7 seconds from when the goal threat value increased by at least 40%. This novel method provides a useful, quantifiable and simple measure of instability that may aid the understanding of the complex dynamic nature of football, particularly the identification of perturbations. An evolving goal threat value would be a useful measure to increase audience engagement and measure defensive effectiveness.

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CO110| Variation within Bio-Banded Groups

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Introduction: Bio-banding is a relatively recent effort to address maturity-associated variation among youth athletes. Percentage of predicted adult height at the time of observation is the commonly used maturity indicator to define specific maturity bands. Youth within a specific chronological age range are placed in bands based on percentage of predicted adult height, e.g., 80%-90%, 90%-95%, for specific competitions and training.

Objective: The purpose of the study was to address in chronological age, skeletal age, body size and functional capacities among soccer players 11-15 years in commonly used bands with bands defined relative to observations in several longitudinal studies.

Methods: Subjects were 82 youth soccer players 11-15yrs (11.0 - 15.87yrs) from a club in Western Poland. Observations included: chronological age (CA), Fels skeletal age (SA), height, weight, and five functional tests (5m and 20 m sprints, vertical jump, agility, grip strength). Adult height was predicted with the equations of Khamis and Roche which require age, height and weight of the player and midparent height of his biological parents. Current height of each player was expressed as a percentage of his predicted adult height. Players were divided into four commonly used bands: <85%, 85%<90%, 90%95%, and four bands based on longitudinal studies: percentage of adult height at (1) take-Off (TO) of the growth spurt, 78.0%

<84.0%; (2) interval between TO and peak height velocity (PHV), 84.0%<88.0%; (3) interval of PHV, 88.0%

93.0%.

Results: Differences in means were small and not significant between the general bands and those based on longitudinal studies, but variation in maturity status and body size was reduced in the bands defining the interval between TO and PHV and the interval of PHV. Functional capacities also did not differ significantly between the respective bands, although mean performances of players in the interval of PHV tended to be somewhat lower compared to the players in the 90%<95% band except for agility.

Conclusions: Although differences between commonly used bands and those based on longitudinal studies are not statistically significant, variation in the interval between TO and PHV and the interval of PHV is reduced.

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CO126| Using deadlifts as post-activation performance enhancement strategy in warm-ups in football

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Post-activation performance enhancement activities may be relevant warm-up strategies aiming to improve subsequent physical performance. The purpose of the current study was to investigate the effects of adding barbell deadlift or hex-bar deadlift exercises to current warm-up routines, on running and jumping performances in football players. Ten highly trained male football players (age: 29.0 ± 6.4 years-old; stature:

176.0 ± 6.2 cm; body mass: 78.7 ± 10.4 kg) from 1st, 2nd and 3rd portuguese divisions participated in the study during in-season period. All players performed three protocols in the same week: a standard warm-up that included players' regular routines, and two other protocols with the addition of barbell or hex-bar deadlift, after the end of the warm-up (3 sets of 3 reps, progressing set by set from 60% to 85%RM). All protocols had the same time interval between pre-test (immediately after the warm-up) and pos-test (15 min after the warm-up). Vertical jumping (countermovement jump, CMJ; Abalakov lump, AJ) and running performances (505 test) were impaired 15 min after the standard warm-up (CMJ: -6.7±4.2%; AJ: -8.1±8.4%; and 505 time: 1.4±2.5%). For warm-up with the addition of barbell deadlift, vertical jump increased by 4.3

±5.6% (1.8 cm [0.2, 3.5]; small effect size, ES) and 505 time decreased by -5.9±3.6% (-0.16 s [-0.23, -0.09]; with large ES). The warm-up with hex-bar deadlift led to trivial changes for CMJ and AJ, but 505 time decrease by -2.7±2.6% (-0.08 s [-0.13, -0.02]; moderate ES). The deadlift exercise can be added to warm- up routines to maintain or even enhance acute physical performance. However, coaches and practitioners should be aware that acute performance enhancements are dependent on individual athletic profiles.

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CO170| 'He's Got Growth': Coaches Understanding and Management of the Growth Spurt in Male Academy Football

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The majority of studies investigating maturation in football have focused upon the impact of maturity status or timing upon athletic performance. There is comparatively little research investigating the impact of the adolescent growth spurt, and the few research articles that have, focused upon injury incidence and burden rather than performance. Considering the limited understanding and knowledge of this phenomenon there was a need to explore the impact of maturation and the growth spurt in greater and broader detail. The aim of this study was to explore and better understand how the adolescent growth spurt impacts male youth football players within professional football academies. This longitudinal mixed methods study aimed to understand youth football coaches' perceptions, experiences, and management of male adolescent football players. Over one year, in three phases, player's maturity status, growth velocities, and match performance were measured and recorded and interviews with coaches occurred in parallel. The qualitative and quantitative data were then combined to generate a deeper contextualised understanding. This study revealed that academy football coaches describe adolescent growth as a 'condition'; players are 'diagnosed' with growth through perceived signs and symptoms which coaches recognise and aim to manage and treat. Adolescent growth was also seen to impact coaches' perceptions of performance and potential and therefore had implications for selection and release decisions. This study highlights the importance of continuous monitoring of growth and maturation and the need for further education around adolescent changes for academy staff and talent identification decision makers.

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CO172| Hip strength of adductors and abductors in elite youth soccer players according to age and maturity status

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Background: Insufficient strength of hip adductors (HAD) and hip abductors (HAB) and an imbalanced HAD: HAB ratio have been reported as injury-related risk factors. However, there is a lack of information how age and maturation affect hip strength and HAD:HAB ratio.

Purpose: The aim of this study was to determine the strength of the HAD and HAB and the HAD:HAB ratio in youth elite soccer players across different age categories and maturity status.

Methods: Youth elite soccer players (n=69) across ages U12-U15 were recruited. Peak muscle torque relative to body mass (PTR; N/kg) and adjusted allometrically (PTS; N/kgb) of HAD and HAB for left and right legs during 3 s isometric muscle contraction at an angle of 60° between tibia and femur were measured with Groinbar (Vald Performance, Australia). Somatic maturity status using non-invasive determined peak height velocity (PHV) and maturity offset (difference between chronological age and PHV) classified players into two groups: pre-PHV (> -1 year) and circa-PHV (-1 to + 1 year). Associations between variables using Pearson's correlation coefficient were determined. Function ratio values between body mass and hip strength for age category (b=0.50-0.81) and maturity status (b=0.49-0.82) by log-linear scaling were calculated.

Results: Significantly higher body mass in circa-PHV (n=29) compared to pre-PHV group (n=40) was found (51.6±8.8 kg vs. 40.2±5.1 kg, p<0.001). Significantly higher values for PTR in HAD for both legs in U12 compared to U14 and U15 were found (p0.05). Significantly higher values for PTR in HAD for both legs and HAD:HAB ratio for right leg in pre-PHV compared to the circa-PHV group were found (5.60±1.01 vs. 4.99

±0.86 N/kg; 5.74±1.07 vs. 5.05±0.86 N/kg; 1.17±0.16 vs 1.06±0.15, p0.05). Significant negative correlations (r =-0.346 to -0.367, p<0.01) for maturity offset and HAD for both legs were found.

Conclusion: Despite pre-PHV players producing significantly higher PTR HAD strength compared to the circa-PHV group, when appropriately scaled allometrically, creating a 'size free variable', no significant differences in PTS for HAD strength were found between maturity groups.

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CO174| Investigation of the effects of eight weeks trx exercises on some motorical abilities and in football players

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The aim of this study investigation of the effect of eight weeks trx exercises on some motoric abilities in football players. 51 volunteer football players participated in this study 25 in the test group and 26 in the control group. Body weight and height measurements, body fat percentage, sit and reach test, vertical jump test, handgrip test, 20 meter speed test, isokinetic balance test were applied to both groups 8 weeks before the start of the exercise program. The training period was implemented in the Aydın Adnan Menderes University Sports Hall for eight weeks during the pre-season preparation period. Experimental and Control group

football players applied the same football training program. While the control group continued their routine football training, the experimental group was given TRX exercise for 1 hour, 2 days in 8 weeks, in addition to routine football training. At the end of eight weeks, post-test measurements were made. As a result of the research, it was seen that there was a statistically significant

difference according to the results of the dependent sample t test performed according to the vertical jump, flexibility, balance, right hand claw strength, left hand claw strength test results of the experimental and control groups, while there was a statistically significant difference only in the experimental group in the 20- meter sprint run. ($p<0.05$). As a result of the independent sample t-test performed according to the pre-test results of the experimental and control groups, it is seen that there is a statistically significant difference in the variables of 20 meters sprint running, right hand claw strength movement and left hand claw strength movements ($p<0.05$). As a result of the independent sample t-test performed according to the post-test results of the experimental and control groups, it is seen that there is a statistically significant difference in the variables of vertical jump, 20-meter sprint run, flexibility, right hand claw force movements and left hand claw strength movements ($p<0.05$).

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CO228| Growth, maturation and short-term power output profile in youth soccer players

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Background: This study was aimed to examine the contribution of growth, maturation and estimates of body composition to inter-individual variance in maximal short-term effort assessed by the Wingate test (WAnT). Methods: The sample was composed of 89 young soccer players, aged 13.07-14.97 years who were grouped as goalkeepers (n=8), defenders (n=33), midfielders (n=20) and forwards (n=28). Anthropometry included stature, body mass, and whole-body composition derived from air displacement plethysmography. Lower limb volume was estimated from circumferences and lengths (Pearson & Jones) and expressed in liters (L). Somatic maturation was given by the % of predicted maturity stature - %PMS (Khamis & Roche, 1994) - expressed as z-score using sex-and age-specific US means and SDs. Finally, WAnT outputs (WAnT-peak, WAnT-mean) were expressed in watt, watt.kg-1 and watt.L-1. Results: Chronological age was correlated to WAnT-peak (r=0.558) and WAnT-mean (r=0.519). Z-score %PMS presented larger correlation coefficients: WAnT-peak (r=0.677), WAnT-mean (r=0.703). Discussion: The young soccer players, on average, tended to be slightly advanced in terms of somatic maturation and as expected taller and heavier than the general population. Goalkeepers accumulated more training experience but attained poorer jumping performance. In parallel, the defenders were taller and also larger on body mass and thigh volume. Midfielders attained the better scores in both WAnT outputs.

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CO106| Area per player to replicate official match demands in U-18 elite Spanish soccer player: a replicational study

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The current study aimed to determine the ApP in small-sided games (SSGs) to replicate the relative (m·min

-1) total (TD), high-speed running (HSRD, 18-21 km·h-1), very high-speed running (VHSRD, 21-24 km·h-1), sprint (>21-24 km·h-1) and acceleration plus deceleration (Acc+Dec, > or <3 m·s2) distances determined during official matches in elite youth soccer players. Thirty-five U18 elite Spanish soccer players were monitored using 10Hz global-positioning systems in both training and matches across one season. A total of 733 individual observations for different SSGs formats (n=24) and official matches (n=28) were collected. The correlations with ApP were moderate for TD (r = 0.485; P = 0.019), large for HSRD (r = 0.616; P = 0.002), and very large for VHSRD (r = 0.842; P < 0.001) and sprint (r = 0.855; P < 0.001), while Acc+Dec was not correlated with ApP (r = -0.080; P = 0.716). The magnitude of the ApP differences (P VHSRD > HSRD = Acc+Dec = TD (effect-size: 0.20 to 3.30). The ApP to replicate official match locomotor demands was ~127 m2·player for TD, ~151 m2·player for HSRD, ~214 m2·player for VHSRD, ~270 m2·player for sprint and ~145 m2·player for Acc+Dec. The current findings may help coaches and sport scientists to manage training loads using SSGs in a specific ApP across the weekly routine. Previous results in U18 elite Italian soccer players [1] showed a similar ApP to replicate TD, HSRD and Acc+Dec (~137, ~149 and

~130 m2·player, respectively), while a quite lower ApP to replicate VHSRD and sprint (~157 and ~190 m2·player, respectively) was found. Despite such differences between Spanish and Italian U18 soccer players, the present results further highlighted that ApP higher than ~200/250 m2·player are required to replicate official match demands for high-speed to sprint activities in elite youth soccer players.

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CO88| Soccer-drill specificity in top-class players with reference to peak match demands

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To compare the locomotor demands of a wide range of soccer-specific or running drills with the official match peak demands determined across different time-windows of the same duration. Forty top-class soccer players competing in European championship and international UEFA competitions were monitored across two competitive seasons. Total distance (TD), high-speed running (HSR), very high-speed running (VHSR), sprint and acceleration+deceleration (Acc+Dec) distances were measured during training and official matches. A total of 9372 individual observations were classified as technical-tactical drills, small- sided games (SSGs), super-SSGs (i.e. relative pitch area >340 m2·player), SSGs with rules modifications (SSGmodified), individual positional drills or running drills. The relative (i.e. meters per minute) TD, HSR, VHSR, sprint and Acc+Dec were compared with the peak demands determined during official matches across different time-windows of the same duration. Results highlighted a lower (P0.05) or slightly higher (P<0.05; ES: 1.17 to 4.61) TD, HSR and VHSR than official match peak demands, while some differences with a lower (P<0.05; ES: -0.07 to -4.84) sprint and Acc+Dec were still found. These results highlight that locomotor load during soccer-specific ball-drills were lower than peak performance demands, particularly for VHSR and sprint. Since training intensity is a key-factor for high-performance development, these results could assist practitioners for drills prescriptions to prepare top-class players for the official match peak demands.

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CO123| Technical demands in elite soccer: manipulating area per player during small-sided games to replicate official match demands

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The current study investigated the optimal ApP to replicate both the technical and locomotor match demands using SSGs in elite soccer players. Twenty soccer players competing in major European and UEFA competitions were monitored during different SSGs formats (n=24) and official matches (n=28). The relative number of technical activities (number·min-1) were counted. The relative (m·min-1) total (TD), high- speed running (HSRD), very high-speed running (VHSRD), sprint and acceleration plus deceleration (Acc

+Dec) distances were collected. Technical demands showed inverse moderate correlation (r=-0.529) with ApP. For the locomotor demands, the correlations (P<0.001) with ApP were positively large for TD (r=0.560), HSRD (r=0.633) and VHSRD (r=0.640), very large for sprint (r=0.710) and inversely moderate for Acc+Dec (r=-0.457). Inverse moderate to large correlations (P<0.05) between the number of technical activities and locomotor demand were found for TD (r=-0.397), HSR (r=-0.530), VHSR (r=-0.600) and sprint (r=-0.577). The ApP to replicate the technical demands (~243 m2·player) was quite similar to the ApP required to replicate HSRD (~201 m2·player), VHSRD (~222 m2·player) and sprint (~288 m2·player), while higher (P<0.001) ApP than TD (ES:1.91/3.11) and Acc+Dec (ES:2.66/4.06) was found. For locomotor demands, higher (P<0.05) ApP for HSRD, VHSRD and sprint than TD and Acc+Dec (ES:1.34/4.80) were reported. Sprint required higher (P<0.001) ApP than each other locomotor metric (ES:2.39/4.80). The technical demands of official matches are replicated with ApP similar to high-speed activities. These findings may help to replicate, overload and underload both technical and locomotor demands using SSGs in elite soccer.

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CO145| The effects of floaters location on tactical, physical, and technical performance during offensive ball possessions in football small-sided games

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Due to its match-derived specificity, small-sided games (SSG) are popular in football training. During these games, player and team behaviour depend on different interacting constraints, which afford different tactical, physical, and technical performance outcomes. Floaters are frequently used during SSG, and their location in the pitch may promote different behaviours. This study aimed to explore the effects of outfield floaters' location on tactical, physical, and technical performance during ball possessions (BP) in SSG. Sixteen U-17 players played three different SSG: four GK+5vs5+GK (NOR); four GK+5vs5+GK + 4 side-line floaters (LAT); and four GK+5vs5+GK + 4 end-line floaters (END). SSG of 6 min were performed in a 44mx34m pitch with seven-a-side goals. Positional data were collected with GPS units and games were filmed. Results revealed that BP last for 7.6±5.2s in NOR (n=154), 8.0±5.0 in END (n=144) and 10.3±6.02s in LAT (n=117). The duration of BP was significantly higher ($p<0.05$), with moderate effect size (ES), for LAT compared with both NOR (Cohen's d with 95% of confidence intervals: 0.56 [0.32; 0.80]) and END (0.42 [0.17; 0.66]). The NOR exhibited a significantly lower team length per width ratio ($p=0.02$) with small ES (-0.33 [-0.57; - 0.09]) comparing with LAT. This ratio presented a significantly higher coefficient of variation in LAT and small ES compared with both NOR ($p<0.001$, 0.45 [0.20; 0.69]) and END ($p=0.028$,

0.33 [0.08; 0.57]). Significant differences were also observed in several physical variables comparing LAT with NOR and END, namely total distance (NOR: $p<0.001$, large ES, 0.97 [0.42; 1.49]; END: $p=0.004$, moderate ES, 0.73 [0.23; 1.22]) and pace (NOR: $p<0.001$, large ES, 1.21 [0.62; 1.78]; END: $p=0.002$, large ES, 0.82 [0.30; 1.32]). END showed a spatial exploration index significantly higher compared with NOR ($p=0.002$, moderate ES, 0.78 [0.27; 1.28]). Regarding technical behaviours, NOR displayed significantly lower differences in passing distance (END: $p=0.03$, small ES, -0.24 [-0.42; -0.06]; LAT: p0.05). In conclusion, during SSG, floaters impacted the behaviour dynamics and performance to create finishing opportunities but did not affect its frequency and accuracy.

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CO207| The effects of goal manipulations on tactical and technical performance in U-17 football small-sided games

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Small-sided games (SSG) have been commonly used in football practice aiming to develop tactical and technical behaviours. During SSG, the manipulation of constraints promotes the emergence of adaptative behaviours maintaining the representativeness of the game dynamics. Therefore, constraining the goals format in SSG may influence the variability of finishing opportunities created. This study aims to capture the effects of goal manipulation on tactical and technical performances in SSG. Twenty U-17 players from two Portuguese clubs performed randomly a total of eighteen SSG (Gk+4vs4+Gk), with three different goal formats: i) seven-a-side goal (RG); ii) goal marked with sticks (SG); iii) goal marked with cones (CG). All formats maintain RG official length measure. The SSG were played in a 40x30m (length x width) pitch with six minutes duration, interspersed with a three minutes recovery period, during six training sessions. Positional data were collected with GPS units and games were video recorded. Results revealed no significant differences ($p>0.05$) considering finishing frequency and accuracy. Nevertheless, team finishing distance to goal was significantly higher ($p=0.027$), with small effect size (ES), in RG compared to CG (Cohen's d with 95% of confidence intervals: 0.43 [0.10; 0.75]). The finishing angle to the goal (FA) had an opposite small ES for SG (0.26 [-0.07; 0.58]) and CG (-0.23 [-0.55; 0.09]) compared to RG. Accordingly, the FA was significantly higher ($p=0.015$) for CG (small ES, 0.48 [0.15; 0.82]) compared to SG. Regarding tactical variables, RG showed a significant higher team area ($p=0.007$) with small ES (0.325 [0.12; 0.53]) compared to CG. Also, RG team area presented a narrow shape with significant higher length ($p=0.044$) comparing to CG, with small ES (0.23 [0.05; 0,47]). In conclusion, despite goals format, during SSG, did not affect the finishing frequency and accuracy, player and team explored different adaptative behaviours to create finishing opportunities.

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CO099| Can the coach dismissal impact on match physical demands? An across both the short and the long-term perspective

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Abstract: Research has been shown that coaching change may provide an essential stimulus to improve team performance. Also, coach replacement could imply changes in teams' physical performance. Guerrero-Calderón et al. (2021) reported that players developed significant higher physical responses with the dismissal coach compared to new coach in training; however, although no significant results were found, a trend of higher physical responses were shown with the new coach in match. Therefore, this study analyzed the relationship between coach dismissal and match physical demands over the season in two different stages: across the short term and across the long term. The sample included the team match observations of all the matches played over four consecutive seasons (from 2015/16 to 2018/19) in the first (Liga Santander; n = 2,950) and second (Liga Smartbank; n = 3,045) Spanish soccer leagues. Match physical demands data were obtained using an optical tracking system called ChyronHego® (TRACAB, New York, US). Total distance (TD); distance covered between 21-24 km·h-1 (HIRD), distance covered at more than 24 km·h-1 (VHIRD), the number of sprints between 21-24 km·h-1 (Sp21), and the number of sprints at speeds above 24 km·h-1 (Sp24) were analyzed. All within-season coaching dismissals were considered with at least four matches played with each coach (i.e., before and after coach dismissal) and the prior and post coach dismissal stage. Linear Mixed Models (LMM) were applied to analyze the differences in match physical demands (i.e., distances covered and the number of efforts) with respect to the coach dismissals. Results showed that across the short term, only TD was significantly greater during four next matches under the new coach ($p < .01$), while across long terms, TD, HIRD, VHIRD, Sp21 and Sp24 were significantly greater during post coach dismissal stage ($p < .001$) than the prior coach dismissal stage. Thus, there is a positive relationship between coach dismissal and match physical demands across the short and long term.

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CO134| Moving towards a comprehensive analysis of acceleration profiles in elite youth football

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In football, having greater acceleration ability may decide the most important moments within matches. Up to now, commonly used acceleration variables have typically been investigated in isolation, with each variable suffering from unique limitations. Subsequently, any findings may provide a limited representation of what specific acceleration demands had actually occurred. Without gaining a comprehensive understanding of acceleration demands in football, it appears difficult to identify how to best monitor and maximise the long-term development of acceleration ability in footballers, all whilst doing so in a safe, sport- specific manner. This perspective study aims to discuss the benefits of adopting a comprehensive analysis of the acceleration demands during competitive matches for football players, by simultaneously analysing high-intensity accelerations, repeated high acceleration ability (RHAA), and average acceleration. We discuss examples of the calculation and application of comprehensive acceleration profiles at a team level throughout the course of an entire elite youth football season, as well as on an individual level. The results of this perspective study illustrate that each acceleration variable fluctuates differently throughout the course of an entire elite youth football season. If such fluctuations are (to some extent) independent – i.e. while one variable rises, the other/s may rise or fall disproportionately – then each variable may provide unique information to coaches and conditioning staff that the others cannot. Moving towards a comprehensive analysis of acceleration profiles addresses this, as it can provide a more robust, informative understanding of the unique acceleration demands of competitive match-play, which not only appears important from a training load/injury prevention perspective, but also equips coaches and conditioning staff with the specific information necessary to develop and prescribe individualised, acceleration-emphasised training protocols that are replicable to the demands of match-play.

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CO147| Associations between running activities and odds of scoring goals during professional soccer matches

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Introduction: Higher total match physical activity has not been associated with increased chances of winning (Andrzejewski, 2018; Chmura, 2018). However, to better understand these relationships, discrete analysis of activity profiles in different time intervals with consideration of the opponents is required. We aimed to assess the associations between reference teams' physical activities or the difference with the opponents and goals scored in professional soccer. Methods: Physical activities (total distance, TD; distance >20 km/h, VHS collected using a semi-automatic video tracking system) and goals scored during official matches of the Italian Serie A by 4 teams (two Best and two Worst Teams according to the ranking) and by their opponents considering 5-min and 15-min intervals were collected. Mixed models were employed to estimate odds ratio (OR±95% CI) of scoring goals when reference teams performed higher or lower levels of running activities, as well as higher or lower levels compared to the opponents. Results: Considering the activities performed by reference teams, TD or VHS were not associated with goal scoring odds in 5-min ($p>0.595$) and 15-min ($p>0.901$) intervals. Best and Worst Teams odds of scoring goals increased when TD was higher than the opponents in 5-min (30.8±5.8% and 9.4±2.5%, $p<0.001$, d=large) and 15-min intervals (54.7±12.0% and 23.1±6.3%, $p<0.001$, d=large). Performing higher compared to lower TD than the opponents increased the OR of scoring goals for Best and Worst Teams in 5-min (19.8±5.2 and 16.1±7.3) and 15-min (11.5±3.3 and 11.5±4.9) intervals. Best and Worst Teams odds of scoring goals increased when VHS was higher than the opponents in 5-min (13.0±3.0% and 5.9±1.8%, $p<0.025$, d=moderate) while in 15- min intervals increased only for Best Teams (34.8±8.5%, $p=0.020$, d=small). Performing higher than lower VHS than the opponents increased the OR of scoring goals for Best and Worst Teams in 5-min (3.7±0.9 and 2.5±0.6) and for Best teams in 15-min (3.3±1.1) intervals. Conclusion: Superior physical activity over short discrete match intervals was associated with the odds of scoring goals during professional soccer matches. The odds of scoring were higher when considering the relative differences in running activities between the teams, rather than absolute levels of activity.

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CO161| In week-to-week forecasting of individual match actions in football, age matters, and less data is more

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Accurately forecasting week-to-week performance is crucial in team strategy selection. The current study explored underlying mechanisms of short-term performance prediction – specifically the relationship between prediction accuracy and amount of data in training datasets. We also compared the predictability of key match actions widely examined in research and practice. Lastly, we examined if players across different age categories differed on the predictability of key match actions. Three match action frequency prediction models were computed based on the Exponential Moving Weighted Average (EMWA) method, using data from 3, 5 and 7 preceding matchdays respectively (EMWA3, EMWA5, EMWA7). Data from 4607 players in the top five leagues in Europe from the 2014/15 to 2019/20 season was collected. For each match, model accuracy was evaluated as the Root Mean Square Error (RMSE) between predicted frequency and actual frequency of each match action (e.g., RMSE between predicted and actual frequency of shots taken). The models were then compared using a paired-samples t-test for each player-match instance and for each match action. Similarly, predictability of key match actions were evaluated by comparing prediction accuracy generated by the best performing EMWA model. Prediction accuracy of key match actions were compared across players in three age categories (based on their age when the 2014/15 season began: development (≤22 years), prime (23-27 years) and veteran (≥28 years). Our results revealed the EMWA3 as the best performing prediction model across every match action. Secondly, prediction accuracies of key match actions differed significantly. In offense, crossing and dribbling were most accurately predicted, while clearance and interception frequency were most accurately predicted in defense. Significant differences in prediction accuracy between age categories were found, specifically in forecasting clearances and aerial duels (development > veterans), dribbles (veterans > development), interceptions (development > prime, veteran) performed in each match. Our results suggest that in predicting short-term football performance, prediction accuracy is enhanced by modeling with fewer, but more recent datapoints. Predictability of match actions also differed depending on the type of match action and the age of the individual. These results have important implications in opposition analysis and team selection in professional football.

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CO233| Characterizing the Most Demanding Periods of High Intensity Activity in Elite Football Using a Multivariate Approach

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Introduction: Current methods of identifying the most demanding periods (MDP) of high-intensity activity (HIA) using univariate analysis are reductionist and limited as they negate the complexity of activity and locomotor movements involved in elite football. We present a robust multivariate analysis approach towards identifying and characterizing the MDP by considering combined and specific maximal kinematic and mechanical demands during elite football competition.

Objectives: Identify and characterize the MDP of HIA based on peak kinematic (high-intensity running (15-19.7km/h), high-speed running (19.8-25.1km/h), and sprint (≥25km/h)), peak mechanical (high-intensity acceleration ≥3m/s2 and deceleration (≤ -3m/s2)) and combined peak kinematic and mechanical variables in elite football.

Methodology: Global positioning system (GPS) technology microsensor data were obtained from elite Swedish First Division teams across 56 matches (n=332 observations). Three novel metrics are presented to define the MDP of HIA using a 5-minute rolling average approach, based on peak kinematic (PEAKVel), peak mechanical (PEAKMec), and combined peak kinematic and peak mechanical demands (PEAK). Using linear mixed models, we examined the magnitude of such variables during the 5-minute Peak, Post, and Mean periods, as well as their respective frequency and distribution throughout the match and each half. Such metrics were also investigated according to central (central defenders, central midfielders, and forwards) and external (external defenders and external midfielders) tactical positions.

Results and Discussion: Our results reveal that the MDP of HIA are manifested and can be distinguished based on peak kinematic, mechanical, and their combined demands. Furthermore, such peak activities occur at distinct periods within each half and exhibit distinct locomotor profiles. Finally, we observed distinct MDP of HIA profiles for central and external tactical positions based on the metrics investigated.

Conclusions: Characterization of the MDP based on kinematic and mechanical demands can be used by practitioners to design bespoke and position-specific training protocols with the aim of improving specific locomotor performance while mitigating risk to injury. In addition, the results of the study can be used to develop training exercises that reproduce the MDP under standardized conditions to assess players' individual physiological response and the development of acute fatigue.

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CO237| A New Approach to Compare Training and Soccer Match demands

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In soccer, the adoption of small- or large-sided games has become very popular to replicate the soccer- specific demands. To quantify them the use of GPS is widespread. However, the many available metrics often make analysis and comparison between training and match complex. Therefore, this study aims to present a new approach providing a similarity score of the training sessions in relation to match demands.

Thirty-two male elite professional players were recruited for this study, and classified according to their playing position: defenders, wide players, midfielders, and forwards. Twenty workload parameters (WIMU Pro device), including kinematic, mechanical, and metabolic variables, were used to analyze 1439 small- sided games. The latter were classified according to the area per player (ApP) [1]: small- (SSGs, ApP 188 m2).

For each player, the match vector (resulting from player's match external load average), was identified as the individual benchmark. Then, all players match vectors were compared to their own training vectors (resulting from training drills), adopting the Euclidean distance (ED) analysis. Different ED analyses were provided: ED for kinematic variables (EDkin), ED for mechanical variables (EDmec), ED for metabolic variables (EDmet).

The Kruskal-Wallis test was employed to estimate differences in ED scores between SSGs and LSGs, and within SSGs and LSGs groups to assess differences between different playing positions.

The SSGs showed a significant ($p < 0.05$) higher similarity score for EDkin. Differently, LSGs exhibited a significant ($p < 0.01$) higher similarity score for EDmec. Within the SSGs group, defenders showed the highest similarity score ($p < 0.01$) for EDkin and EDmet. Midfielders presented the highest similarity score (p

< 0.01) for EDmec. In the LSGs group, midfielders revealed the highest similarity score ($p < 0.01$) for EDkin and defenders for EDmet.

According to previous studies [1], our results suggest that different types of drills (SSGs, LSGs) could elicit match effort in a different way. This aspect leads to different physical responses to training also in relation to the players' playing role.

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CO240| Match-play running performance in elite Spanish soccer: A comparison between the first and second leagues considering the opposition's quality

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Introduction: Different competitive standards (Bradley et al., 2013) and quality of opposition (Rampinini et al., 2007) influence the match running demands in soccer. However, there is scarce information on the influence of both aspects on running demands in specific domestic leagues. Therefore, the aim of this study was to analyse the differences in match-play running demands between the First (L1) and Second (L2) Spanish soccer leagues while considering the quality of opposition.

Methods: All matches played for four consecutive seasons (2015-2016, 2016-2017, 2017-2018 and 2018

-2019) from L1 (n = 1520) and L2 (n = 1848) were collected to analyse the teams' running performance. A multi-camera match analysis tracking system was used to gather the running performance variables, and match balance was considered to determine the opposition's quality. Linear Mixed Models were undertaken to analyse the differences between leagues while controlling for the opposition's quality.

Results: Teams from L1 playing against a higher quality opponent significantly covered more total distance, total distance without possession and total distance >21 km/h without possession in comparison with L2 (p21km/h with possession (p21km/h in comparison with L2 ($p<0.001$), independent of the opposition's quality.

Discussion: The results suggest that the best teams tend to have greater ball possession and cause the low-quality teams to run more in the defensive phase. Due to the higher distance covered at high intensity running, teams from L1 apparently had a more effective running performance and players with better physical condition than L2 teams. Practitioners could take these results into account to improve match preparation and develop better training programmes.

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CO128| Design and reliability of an observational tool to evaluate the individual offensive behavior in soccer (INDISOC)

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Evaluating the individual tactical performance is crucial to design the appropriate learning process in youth soccer players. Despite the variety and quality of the existing tools (González-Villora et al., 2015), their design is primarily oriented to the analysis of tactical situations occurred in modified versions of soccer, such as small-sided games, what may limit their application to analyze the real competition.

The aim of this study was to design and check the reliability of an observational tool to analyse the INDIvidual offensive behavior in competitive 11-a-side SOCcer (INDISOC).

A total of eight experts in soccer coaching and analysis participated in the design of the tool by means of meetings and exploratory observations. This process involved design and re-design steps of the INDISOC tool to its final version which includes 12 dimensions related to the spatial, technical, and tactical constraints of individual behavior in soccer. The unit of analysis was the individual ball possession (IBP), described by Link and Hoernig (2017) as the time that begins the moment a player can perform an action with the ball, and it ends the moment IBP for another player begins. In the INDISOC tool the IBP is evaluated considering three temporal moments: 1) receiving the ball, 2) processing the ball and 3) culminating the individual action.

Inter-observer and intra-observer analyses were carried out and kappa (K) coefficient was calculated to test the observation tool reliability. The K values indicated optimal inter (0.76-0.98) and intra-observer (0.79-1) reliability levels, suggesting that the INDISOC observational tool could be an appropriate tool for evaluating the individual offensive behavior in competitive soccer.

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CO133| High-speed running and sprinting in professional adult soccer players: methodological definitions, match demands and training recommendations. A systematic review

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High-speed and sprint running match demands have progressively increased in the last years, thus becoming one of the hallmarks of modern professional soccer.

The aims of this review were to: summarize the evidence on absolute and relative velocity thresholds used to classify high-speed running and sprinting in adult soccer players, describe high-speed and sprint running distance match demands, and provide practical applications for training high-speed and sprint running in professional adult soccer players.

To date, there is no consensus on the absolute thresholds defining high-speed and sprint running in adult soccer players. Until international standards are defined, it is reasonable to set absolute thresholds considering the range of values found in the literature collected in this review. On the other hand, relative velocity thresholds could be considered for specific training sessions whose goal is to reach near to maximal velocity exposure and verify individual players training loads.

During official matches, high-speed and sprint running distances ranged from 911 to 1063 m and 223 to 307 m, respectively, in professional female soccer players, while ranges from 618 to 1001 m and 153 to 295 m, respectively, in professional male soccer players (note that lower absolute thresholds were used for female players compared to male players). Moreover, maximal intensity periods recorded during matches should also be considered: indeed, the most intense phases can be 2 and 4 times more demanding than the mean values for high-speed running and sprinting, respectively. In addition, high between-player, between-game and between-role variability for these external load demands were reported during official matches.

During training, sided-games designed in formats using relative areas per player greater than 225 m2 appear to be adequate for achieving high-speed running and sprinting exposure, although large between- subject variability may be expected. The combination of sided-games, running exercises and soccer circuit- based drills is advisable to ensure adequate high-speed and sprint running exposure both at a team and individual level. Monitoring high-speed running and sprint distances during every single session can allow practitioners to assess the efficacy of the training process and best prepare players for the most demanding phases of the match.

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CO141| Training Load Variations During Small-Sided Games in Soccer: The Influence of Recovery Time

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Small-Sided Games have been proposed as a useful tool for training technical, tactical and physical skills that are essential for success in soccer. Due to the variety of behaviors required during reduced games, exercises without proper control can promote fatigue in soccer players. Therefore, the correct manipulation of the small-sided games duration as well as the recovery periods between repetitions must be ensured by coaches, since the ability to maintain a high exercise intensity in several exercise repetitions depends on the recovery from the previous exercise. This study aimed to identify the effects of different recovery times on training load responses during small-sided games. The study included 20 professional male semi-professional soccer players, who participated in a continuous (1 x 18 min) and fractional (3 x 6 min) small- sided game format (5 vs. 5) with different recovery times (30s, 60s, 90s and 120s). The results showed that there was a tendency for significant changes in internal load (i.e., heart rate) and external load (i.e., total distance, maximum speed and speed at different intensities) responses as a consequence of manipulation of recovery times. Furthermore, the results seem to indicate that short recovery periods (i.e., 30s) may be sufficient to guarantee higher training load responses, compared to the use of continuous formats and other fractional formats with different recovery times and the same exercise duration (i.e., 18m). Thus, the study allows to conclude that different recovery times induce different training load responses. Coaches can use this information to manipulate the training load imposed by the exercise according to the specific objectives proposed for the training session and the period of the season (i.e., pre-season, competitive period, detraining period). These findings provide new evidence on the relationship between exercise and recovery duration for small-sided games in soccer, that can help researchers, coaches, and athletes improve training efficiency and optimize performance.

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CO214| Small, medium and large-sided games: the effect of pitch dimensions and team size on acceleration demands in training

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Small-sided games (SSGs) are used to induce simultaneous physical, technical, and tactical stimuli in soccer practice. Coaches predominantly use small pitch dimensions and team sizes to create an overload in quick actions, which can be captured as acceleration frequencies. Although larger pitch sizes result in a closer representation of match demands in physical and tactical performance[1,2], it remains unclear how players' acceleration profiles respond to different SSG manipulations. Therefore, the aim is to investigate the effect of playing SSGs with varying pitch dimensions and team sizes on acceleration frequencies.

Twenty-three male soccer players of one under-18 academy team were monitored during training across one season. Sixteen SSGs were included in the study, which were categorised on team size (small: 5vs5, medium: 6vs6 to 8vs8 and large: 9vs9 to 11vs11) and relative pitch area (small: <75m^2·player, medium: 75-175m^2·player and large: >175m^2·player). Accelerometery data were obtained with Catapult S5 (Melbourne, Australia) and analysed on total and high acceleration and deceleration frequencies. Differences in game demands were statistically evaluated for the type of SSG (MANOVA).

Pitch dimensions and team size had significant effects on acceleration and deceleration frequencies. All acceleration variables were greater on small and medium than large pitch dimensions, and in small and medium than large team sizes ($p<.001$). Furthermore, there was a significant interaction effect of pitch dimension and team size: a large team size and a large or medium pitch dimension resulted in less accelerations and decelerations than other types of SSGs ($p<.05$).

Manipulating pitch dimensions and team size in SSGs significantly affected acceleration profiles. More accelerations and decelerations took place in SSGs with less players on smaller pitch dimensions, and also at higher intensities. This created an overload in acceleration frequencies compared to larger pitch dimensions and team sizes, but contrasts to previous findings on physical and tactical performance[1,2]. Designing SSGs is important for effective training outcomes, and monitoring the accelerations – in addition to physical and tactical performance – aids in optimal training programmes.

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CO227| Comparison of the effects of a combined intervention of small-sided games and high- intensity interval training vs. high-intensity interval training on physical fitness of youth soccer players: a parallel study design

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The aim of this study was to compare the effects of an 8-week training intervention using a small-sided games (SSG) combined with long high-intensity interval training (LHIIT) vs. using only long HIIT on the physical fitness of youth soccer players. Between and within-group changes will be analyzed based on the main objective.Thirty-six soccer players (Mean age 14±1.1 years; Weight 48.6±7.53 kg) participated in this study. The SSG+LHIIT group completed a 8-week period intervention with two sessions using different SSG formats while combining with LHIIT consisting of intermittent 3mins runs at 65-87%VIFT speed separated by 3mins passive recovery. The singly LHIIT protocol consist of 2x3 mins work with 3 mins of passive recovery in-between, two sessions weekly lasting 24mins. The final velocity at 30-15IFT (VIFT), 30m Sprint, change of direction, 10m Acceleration, and heart rate of participants were measured before and after exercise interventions using validated tests.

The HIIT and HIIT + SSG showed no significant differences in 10m acceleration (HIIT: 6.3 vs. HIIT+SSG: 7.4%), 30m sprint (HIIT: 3.4 vs. HIIT+SSG: 4.2%), and body fat percentage (HIIT: 11.6 vs. HIIT+SSG: 7.3%) (P>0.05). On the other hand, HIIT+SSG combined exercises induced more improvements in the maximal oxygen consumption than the HIIT group (HIIT: 6.7vs.HIIT+SSG: 9.1%; p=0.003), and in the change of direction, significant improvement was observed in HIIT + SSG than HIIT group (HIIT: 4.2vs. HIIT + SSG: 6%; p=0.002). It seems that the HIIT+SSG exercises were more effective in developing aerobic performance and change of direction due to their nature in soccer players, but in 30m sprint and 10m acceleration, the effectiveness of both training methods was the same.

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CO230| Exploring the effects of pitch obstacles on external load and technical performance during football large-sided games

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Players' performance results from their ability to interact with surrounding information to unfold goal-directed movement behaviours. In this respect, different task constraints emphasize distinct information, and consequently, leading the players towards different functional actions. For example, coaches may add wall barriers (training mannequins) in specific zones of the pitch to induce subtle changes in the space exploration, with consequences on the players' external load and technical actions. Thus, this study aimed to explore the effects of adding wall barriers during a football Gk+9vs9+Gk large-sided game (LSG). Twenty semi-professional players performed 3 LSG consisting of: 1) Control condition (CTR), performed without any obstacle; 2) central wall barrier (MID), in which a 6m length wall barrier was placed 20m in front of each target; and 3) side-line wall barrier (SIDE), in which four 3m wall barriers were placed at each half, 4m from each side-line. The LSG were performed on a 50x40m natural turf pitch and consisted of 6-min interspersed by 2-min of passive recovery. Players external load were captured with GPS data, while video analysis was used to code players' actions. The results shown that players covered a small higher total distance during the MID than the CTR (Cohen's d with 95% of confidence intervals: 0.30 [0.09; 0.51]), while also small higher distance while running (0.52 [0.07; .96]). In addition, the SIDE also induced small higher distance covered while running than the CTR (0.56 [0.18; .94]). These differences may result from the additional space that the players must cover to provide mobility when in possession or press without the ball when playing with obstacles. From the technical performance, both the MID and SIDE showed a small lower number of unsuccessful passes compared to the CTR (-0.33 [-0.84; .18; and -0.28 [-0.49; -0.01]). These results suggest that adding obstacles may limit the available space for the defenders to intercept passes, possibly contributing to the lower number of failed passes when using obstacles. Thus, coaches may add obstacles to provide more variable scenarios while slightly increase the external load and refine players' technical actions.

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CO211| How do scouts identify talented soccer players?

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The identification of talented soccer players is very challenging. It is often the responsibility of scouts or coaches, who need to make selection decisions: Which players have the greatest potential to excel in the future [1]? The aim of the current study was to examine how scouts make these decisions. Through an online self-report questionnaire, 125 Dutch soccer scouts were asked about (1) the age at which they can predict players' future performance, (2) the attributes they consider most relevant, and (3) the extent to which they predict performance in a structured manner. The most important results were, first, that scouts of young players (under-12) did not believe they could reliably predict future performance at such young ages. Second, scouts mostly take general technical attributes into account when selecting players. Third, scouts reported that they assess attributes of players in a structured manner. Yet, they ultimately based their final assessments of players by intuitively integrating scores on different performance attributes. These outcomes provide clues to improve the reliability and validity of the talent identification process. More specifically, talent identification in soccer may advance by incorporating methodological principles from selection psychology. This field is concerned with how to best select candidates for different achievement domains, yet has hardly been considered in the sports domain [2,3].

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CO215| Why are they always older and stronger? Relative Age Effect and Talent Identification factors in youth elite soccer players

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Assessment of the player's motor potential for soccer is multidimensional. Typical testing set dedicated to youth players take into account the anthropometric, linear or curve sprinting characteristics, jumping and agility testing and ability to rapidly change of direction. Nevertheless, interpretation of the obtained data is disturbed by the phenomenon of relative age effect (RAE) and different maturity status in youth soccer players. There is a lack of studies that investigated the relationship between anthropometric profile, body composition, results of motor tests, and different methods to maturity-based banding for the Talent Identification (TI) process in soccer. The aims of the study were: a) examination of anthropometrical and motor performance with traditional age-grouping by chronological age (CA) and Midway Point methods (MP) proposed by Helsen and colleagues (2021), and b) identify the birth-date distribution in elite polish youth soccer payers. Two hundred thirty-six (236) elite youth soccer players aged 12-14 selected by Polish Football Association to National Development Camp (NDC) completed a physical performance battery with anthropometric and body composition analysis. Players biological maturity status was assessed with the age at peak height velocity (APHV) method. All data were compared to growth charts and distribution of birth dates for the Polish Population. Assessment of the normality of the variable distributions was performed using the Kolmogorov-Smirnov test with Lilliefors correction. Homogeneity of variance was checked, and no violations were found. The $\chi 2$ test was used to determine the differences between the observed and expected frequencies of a birth-date quartile. The effect size was defined by calculating Cramér's V. Differences in body height and match statistics were analyzed with ANOVA and Tukey`s post hoc test. The calculations used a confidence interval of $p < 0.05$. An independent t-test was conducted to determine the differences in anthropometric characteristics and performance tests results between grouping methods and the first and fourth birth quarter. Before data set rellocation RAE was identify in each sub- group (U13, $\chi 2 = 13{,}5$, $p = 0{,}0023$, $V = 0{,}3$; $\chi 2 = 14{,}34$, $p = 0{,}0025$, $V = 0{,}29$; U15 $\chi 2 = 17{,}65$, $p < 0{,}001$, $V = 0{,}33$).

Analysis shows quaterly signifitaly difference for U13 grup for body mass ($p < 0{,}05$), body height ($p < 0{,}01$), total body water ($p < 0{,}01$),

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CO220| Talent and Expertise Research in Football: a review

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In an ongoing work, we developed un umbrella review about the development of expertise for all sports (Roquette et al, in preparation). A total of 44 reviews were selected (30 SRs and 14 SRMSs), and the descriptive findings revealed that 20% of these articles focused specifically on football. The present communication reviews the specific results of the existing systematic reviews on football.

The football-specific reviews about predictors of talent identification (TI) in football showed that there is questionable validity in predicting future performance in youth players and confirm the risks and complexity of the long-term prediction-process. Also, the use of high inference measures such as athletes' potential or skill levels at younger ages as the mains criterions for players's selection.

The majority of studies on the development of football expertise used retrospective approaches and compared the impact of sport specific and non-specific practice between elite and less-elite players.

Given the non-linear nature of expertise and expert performance development in sport in general and in football in particular, the literature indicates that a player's potential ultimately reflects the complex interaction between the performer, task and environmental constraints that are unique to football context game (Davids et al., 2017).

Concerning the debate about the impact of different types of practice in developing football expertise the results pointed to an excessive youth sport specialization. In conclusion, it is suggested a balance between main-sport practice with non-organised sport play and diversified experience with other-sports practice during childhood and youth, as conditions for long-term sustainability.

Key-words: expertise, expert performance, talent identification and development, football.
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CO245| Talent Identification within Scottish Football - Understanding the physical and technical outputs for successful players

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Objectives: To understand the differences in physical and technical outputs of successful and unsuccessful youth soccer players during a Talent Identification programme.

Methods: 90 youth Scottish players (Age-11.7±0.3mean±SD; Height-149.7±7.0; Weight-38.6±4.8; Maturity Offset (Fransen Calculation)- -3.5±1.9), were invited to attend a national talent ID Day following regional trials. Players participated in a 10v10 (including goalkeepers) tournament, consisting of 10min games (Data samples=1308). Games were officiated and played to official rules for U12's players as outlined by the Scottish Football Association. All players were monitored using foot-mounted inertial measurements units, to measure the relative physical (Distance, High speed running [>4m/s], acceleration and deceleration efforts [±2m/s/s), technical (touches, releases, high-speed releases[>15m/s]) and individual possession statistics (total time on the ball, time on the ball per possession) per 10min match. Successful players, where those who were selected by national coaching staff to enter the national team programme after the event.

Results: Preliminary findings found that successful players (Age-11.7±0.3; Maturity Offset- -3.5±2.0) had higher values compared to unsuccessful players (Age-11.7±0.3; Maturity Offset- -3.4±1.8) for all physical metrics (Successful vs. unsuccessful; Distance- 777.1±336.1m vs. 740.7±316.3m , p= 0.055; High speeds- 61.9±44.7m vs. 47.6±37.7m , p=0.003; Acceleration efforts- 2.2±2.1 vs. 1.6±1.6 , p=0.005; Deceleration efforts- 2.6±2.4 vs.2.1±2.0 , p=0.03), technical metrics (Touches- 23.0±20.9 vs. 22.0±27.9 , p= 0.34; High Speed Releases- 3.9±3.1 vs. 2.8±3.0, p=0.000) and all individual possession statistics (Total time on the ball- 7.7±7.0 vs. 6.8±8.3, p=0.14; Time on the ball per possession- 1.1±0.8s vs. 0.9±0.7s, p=0.07). Only Releases (7.7±9.4 vs. 8.4±14.0, p=0.29) had higher values for unsuccessful players.

Discussion: Technical and physical metrics had higher outputs for successful players during a national team talent ID selection process. Player position and maturity calculations within talent ID selection processes require further exploration.

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CO109| Soccer players and other athletes: Assets development, Enjoyment and Sport Attitudes

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Soccer has a major role in global society, namely, at economic and educational level. In Portugal is the most practiced sport. Soccer is a non-formal context for education, namely social and personal assets, among pro-social behaviours. We intend to analyse the effects of age group, sex, and type of sport on youth development assets (DA), sources of enjoyment (SE) and attitudes (SA) in sport.

It was applied the following questionnaires, in the Portuguese translated and validated version: Development Assets Profile (DAP), Sources of Enjoyment in Youth Sport Questionnaire, Sport Attitudes Questionnaire. Participated in the study 331 youth from a specific municipality (Vila Nova de Poiares), with Mage=14,3±2.0 (Male-183, Female-148; 107 soccer players, 141 non-practitioners, 83 other sports). The age groups where define in the following way - under 13, under 15 and under 18. An MANOVA was performed and Bonferroni post-hoc.

We verified that age group, sex and type of sport influences several DA, SE and SA. The composed relation between sex and age, age and type of sport, age, sex and type of sport provide influences, namely in the sport attitudes (commitment, convention, cheat and sportsmanship). The U13 also present higher DA and SE than under 18 group, and the same happens between U15 and U18. Is normal the decrease of development assets with the increasing of age. However, is important that in early ages those assets are provide or developed, so that the youth can turn in a successful adult.

The non-practitioners mentioned less unsportsmanlike and cheat behaviours than their practitioners' colleagues. This led us to questioning what happens in the athletes' contexts to subvert the ethical principles of sport. The cheat and unsportsmanlike attitudes could be used for the benefit of the athlete group, for his own community? If so, how this bad values conflicts with the good group values? Interestingly, the non-practitioners also revealed lower Convention behaviours compared to other participants, with low intention to greet other persons. And, lower Effort Expenditure, Commitment, Self- reference Competencies and Positive Parental Involvement. So, the findings reinforce the relevance to practice sport as a mean to foster youth positive development.

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CO110| The role of action capabilities for decision making in football

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In football, interpersonal coupling between the attacker and defender has been directly linked to success in decision making (Vilar, 2013) For instance, Laakso (2017) demonstrated that if an attacker increases the interpersonal distance in relation to their direct opponent, then the situation is more likely to end with a successful dribbling action (Correa, 2016) or shot on target (Vilar, 2013). However, it is still unclear how attackers manage to increase the interpersonal distance from their opponent and how this might be measured using match data. A potential explanation proposed by Clemente et al. (2013) is that the action capabilities of the attacking player (when compared to the capabilities of the defender) might shape the interpersonal distance. The purpose of this study is to ascertain to what extent the ball-carriers' action capabilities influence their decision making through changes in the interpersonal distance with their direct defender. We predicted that the interpersonal distance would be greater when the ball-carrier has greater action capabilities when compared to that of their direct opponent, and that this would in turn lead to more successful dribbling actions and forward passes. In order to measure the action capabilities of players, we extracted the acceleration-speed profiles of the players from in-situ data, using the algorithm validated by Morin et al. (2021). In particular, we compared the action capabilities of the ball-carrier to those of their direct opponent. Using positional data from open-source match data, we identified situations where players dribbled with the ball in the build-up phase. A ratio that compared the maximal acceleration and maximal speed of the ball-carrier and that of their direct opponent served as the measure of relative action capabilities. The extent to which the relative action capabilities were associated with the interpersonal distance between the players made it possible to examine the relative importance of action capabilities on decision making in football. With this novel way of measuring players' action capabilities in relation to their opponent, it becomes possible to predict how players increase their interpersonal distance and their likelihood of successful decisions.

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CO120| The Understanding, perceptions and practices of Neuroathletic training in German Football

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The concept of Neuroathletic training (NAT) has become increasingly popular within youth and senior German football over the last decade. One of its goals is to enhance sensorimotor integration for the purpose of optimized movement efficiency. However, the complexity of the nervous system's ability to influence bodily functions leads to a variable understanding of NAT's core components and goals. The aim of this study was to determine the understanding, perceptions and practices among athletic trainers within German football structures. This descriptive cross sectional survey, comprising of multiple choice and Likert scale questions, was conducted among 47 active trainers from clubs in the top 4 senior leagues and youth academies of these clubs. More than half (55%) of respondents had received prior NAT education. Chi-square tests comparing agreements of NAT components revealed balance and proprioception (89.4%, $p \leq 0.001$, visual system (87.2%, $p \leq 0.002$), PNS (72.3%, $p \leq 0.001$) and ANS (61.7%) to be the most significant. The common goals associated with NAT were movement efficiency (76.6%, $p \leq 0.001$), individual performance enhancement (72.3%, $p \leq 0.002$), injury prevention (72.3%, $p \leq 0.002$) and rehabilitation efficacy (66%, $p \leq 0.029$). The domains believed to be most positively affected by NAT were vision (74.5%), balance (61.7%) and proprioception (61.7%). Half of NAT-educated trainers (13/26) were actively implementing NAT as part of their training regime, but there is still a perceived high demand (89%) for NAT education among all trainers. The results indicate a strong focus towards the realm of football injuries and the resolution thereof, further supported by the perception that concussion rehabilitation is most affected by NAT after vision and balance training. The perceived goals and components highlight NAT's popularity and importance to athletic trainers despite the lack of scientific evidence in a practical football setting. Future research should focus on the effect of common NAT approaches within a football-related context.

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CO130| Developing creativity-supportive learning environments in youth football players

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Nowadays football requires more than ever adaptive and creative players, however, training environments and methodologies aren't aligned with the cognitive and behavioral development of creativity (1). This study protocol aims to characterize the intervention of a creativity-supportive training environment in young football players.

The program will be implemented for 3 months, will participate in the intervention a total of 42 under-11 football players clustered in control (n=21) and experimental (n=21) groups. The assumptions and approaches of the program will be underpinned on Creativity Development Framework (1). Therefore, this innovative program encompasses three constructivist teaching models through player-centered pedagogical approaches, particularly the Teaching Games for Understanding, Student Design Games, and Sport Education Model. In addition, the program stands out by highlighting two main disruptive approaches, variability and street football which are aligned with the principles of non-linear pedagogy (2). In this vein, street football consists in designing training tasks that allow spontaneous practice by the players (e.g., playing barefoot in a small pitch with different material). In turn, variability will be induced through different types of pitch formats, targets, and balls, manipulation of constraints, and perturbations in the training environment. To evaluate the effects of the intervention, the creative development process of the players will be assessed through small sided-games using GPS and notational analysis (3).

Is expected that the implementation of such environments contributes to developing more creative and adaptive football players. Moreover, will simultaneously help coaches to improve their practices by providing new tools to promote learning of the specific football skills and develop creativity ecologically and sustainably.

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CO138| Decision-making practices during coaching sessions in grassroots youth soccer: A mixed- methods investigation

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Introduction

Decision making ability in players during match-play is mostly acquired through practice activities with the same underlying structure as competition (e.g., [1]). However, researchers have not fully investigated how coaches design practice sessions at the participation level of the sport (i.e., "grassroots") or of why they used a particular activity at a specific time point. The aim of this study was to investigate the practice activities used by youth soccer coaches working at participation level in the UK and gain insight into their intentions.

Methods

Altogether, 12 male soccer coaches participated working with players aged 9-11 years within 10 clubs at the participation level of soccer in London, UK. A total of 35 practice sessions were observed in situ. Sessions were analysed for the proportion of time spent in activities containing 'non-active decision- making' (e.g., unopposed technical skills practices, fitness training) and 'active decision-making' (e.g., small-sided games, skills practice with opposition). An interview with the coaches about the session purpose took place after each systematic observation.

Results

Coaches had players spend similar amounts of time in activities with active decision-making (M = 41%) and non-active decision-making (M = 42%) with the remainder spent transitioning between activities (M = 17%). There was more non-active decision-making activity during the first half of the session (M = 64%) when compared to active decision-making activity (M = 16%). However, there was more active decision-making activity in the second half (M = 66%) when compared to non-active (M = 20%). Therefore, the session progressed in a traditional manner from predominately non-active decision-making activity early on to mostly active decision-making activity later. Interviews revealed that the coaches believe players require frequent isolated (unopposed) 'non-active decision-making' practices to acquire technique initially in the session and during the season.

Conclusion

Our findings show that coaches had players spend nearly half of session time in non-active decision-making activities that are deemed less relevant to improving soccer match performance. Findings highlight a potential gap between science and practice in the coaching of young participation level soccer players.

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CO155| Effects of Didactic Model Game Action Competences and Didactical Model of Direct Instruction on indexes Performance tactical in U-12 Soccer Players

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The Didactical Model of Direct Instruction (DMDI) is the most used in competitive environments for teaching and coaching in soccer, however this model promotes mainly the learning of technical skills but is not so effective for the development of tactical abilities. The Didactic Model Game Action Competences (DMGAC) was designed for the learning of tactical-technical skills in sport context and, as the game-centered approaches are, it is based on constructivism. Purpose: To analyze the learning effects of the DMGAC compared to the DMDI on tactical performance indexes with children soccer players. Method: Randomized Control Trial in parallel. The participants were 37 players (age = 10.71 ± 0.73) from a competitive soccer club in the city of Medellín (Colombia). These were randomly assigned to the experimental (DMGAC; n = 18) and control (DMDI; n = 19) groups. The experimental group implemented DMGAC with five didactic strategies (i.e., small side games, psychokinetic games, 1 on 1 situations, self-directed learning of technical skills, and global game or representation). The control group used DMDI with three didactic strategies (i.e., technical skills, simulated game situations, and global game). The children participated in two sessions/week for a total of 16 sessions. The learning contents were the fundamental principles of soccer. The System of Tactical Evaluation in Football (Sistema de avaliação táctica no Futebol, FUT-SAT) was used to evaluate the tactical performance indexes before (pretest) and after (posttest) the teaching process. A total of 3674 tactical actions were analyzed. Results: The experimental group (DMGAC) had statistically significant differences compared to the control group (DMDI) in the indexes of penetration ($p = 0.009$), offensive coverage ($p = 0.026$), mobility ($p < 0.001$) and significant trend in index offensive unit ($p = 0.088$); and there were differences in the offensive tactical performance index ($p = 0.001$), defensive tactical performance index ($p = 0.006$) and a Game Tactical Performance Index (GTPI) ($p = 0.002$). The DMGAC has shown to be superior to the MDID in GTPI after 1440 minutes of intervention. Conclusions: The players who participated in a teaching program through the DMGAC attained higher tactical performance indexes, than those who participated in a teaching program through the DMDI.

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CO184| Current view and new perspectives on skill in football

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The concept of skill is a central element in football, and it has been studied from many different perspectives. Theoretical bases and concepts used in these studies and the considered skills vary notably. A global view on scientific skill-related football interventions helps to comprehend and identify gaps in current knowledge and to continue the discussion on skill in football.

A recent football skill-related scoping review (Sarajärvi et al., submitted) demonstrated that (a) examined articles were either based on two theoretical backgrounds (self-organisation approaches and information processing, 43.2% and 17.6%, respectively) or they did not have any theoretical grounding (39.2%), (b) different key concepts (>60) have been used in the skill-related studies, c) majority of football skill-related research was conducted in Europe (79.7%) with samples focused on male participants (89.2%).

The example of header football skill (Sarajärvi et al., 2020) will be used to present and discuss the relevance of ecological dynamics framework for the skill-related research in football.

Sarajärvi, J., Freitas, R., Elovaara, M., & Volossovitch, A. Skill-Related Studies from Youth to High-Performance Football: A Scoping Review. Manuscript submitted for publication.
Sarajärvi, J., Volossovitch, A., & Almeida, C. H. (2020). Analysis of headers in high-performance football: Evidence from the English Premier League. International Journal of Performance Analysis in Sport, 20(2), 189–205. https://doi.org/10.1080/24748668.2020.1736409

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CO231| Goal-Directed Behavior? Enhancing Representativeness In Soccer Training

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As complex systems with cooperative characteristics, soccer teams attempt to satisfy continuously interacting constraints of the learning environment (Duarte et al., 2012). To maximize the learning of their players, coaches should design representative practice tasks to afford their teams seeking goal-directed functional behaviors that transfer to the actual soccer game (Pinder et al., 2011). Therefore, the present study investigates how different practice tasks in soccer represent the kinematic properties of the 11 vs. 11 game. 22 male soccer players participated in one formal game condition (FG11VS11) and four practice task conditions: 6 vs. 6 (GO6VS6) and 7 vs. 5 (GO7VS5) on goal and two possession game conditions, 6 vs. 6 (PSS 6VS6) and 7 vs. 5 (PSS7VS5), which aimed players to maintain possession as long as possible. The teams performed 60 trials in a crossover study design. Players' positional data were computed using a global positioning system and processed to calculate measures of inter-team distance, trail duration, dyadic distance, and distance to the nearest opponent. The major findings indicate that concerning the interpersonal spatio-temporal relation, the applied possession games differed significantly from the formal game, while the on-goal conditions showed representativeness. Consequently, when simulating the interpersonal properties of soccer, the direction of play is crucial to facilitate kinematic representativeness. Possession game designs in soccer may fail to reflect relevant information sources of the formal soccer game. Future studies should extend the kinematic comparison between the formal game and practice tasks in soccer to facilitate the skill transfer into the performance environment.

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CO104| The Football Association Physical Profiling and Injury Surveillance Project: The Development of a database and system to support evidence-based practice in English Elite Youth Female Soccer Academies

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The collection, analysis and reporting of injury data and physical qualities is key for practitioners to inform evidenced-based injury prevention and athletic development strategies. However, despite women's soccer experiencing an increase in professionalism and participation numbers, practitioners working in elite youth female soccer face several challenges to support this process (paucity of research available on injury and physical qualities in elite youth female soccer, limited time/ resources, limited access to specialist testing equipment and medical note systems, establishing comparative data etc.). To address these challenges and the gap currently present in research concerning youth female soccer (and youth female sport as a whole), the English Football association (FA) employed a nationwide injury surveillance and physical profiling project over the last two soccer seasons (2020/21 and current). Fourteen elite girls' soccer academies (Regional Talent Clubs, [RTC's]) currently participate in the project. The project aims to:

1. *Establish a large nationwide injury and physical qualities database in elite youth female soccer players aged 8-16 years.*
2. *Develop and provide RTC's with high-impact, low-cost data collection systems and tools to support evidenced based-practice.*
3. *Investigate the interaction between growth & maturation, injury, and physical qualities in elite youth female soccer players.*

Injury and exposure data from each participating RTC is captured prospectively during a season(s) using tailored online capture sheets. Alongside injury surveillance, the FA service participating RTC's with a standardised physical testing battery at specified windows throughout the season (pre- mid- and end-of- season). Data cleaning, analysis and storage is managed by the FA. Currently, injury and physical testing data is available for 1269 elite youth female soccer players. Each participating RTC receives their own bespoke online injury and physical qualities dashboard including visualisations and interactive elements that allow for longitudinal data monitoring and direct comparisons to the national dataset. These tools support injury prevention and player development practices of RTC's with no fees and minimal practitioner burden as data collection methods sit inside standard club practices and schedules.

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CO107| A multi-club analysis of the locomotor training characteristics of elite English female soccer players

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Objective: To quantify the differences in locomotor characteristics of training between standards of competition and micro-cycle training days (e.g., match day minus-1 [MD-1]) in elite female soccer players. Methods: Foot-mounted inertial measurement unit (Playermaker) data were collected from 293 players from three Women's Super League (WSL; n = 76) and eight Women's Championship (WC; n = 217) teams in England over a 28-week period. Data were analysed using partial least squares correlation analysis followed by linear mixed effects models. Results: WSL players performed more high-speed running (HSR;

>5.29m·s-1), sprint distance (SD; >6.26m·s-1), acceleration (ACC; >3m·s-2) and deceleration (DEC; <-3m·s

-2) distance during training than WC players. The largest difference in HSR and HSR per minute occurred on MD-4, WSL players performed higher locomotor activities compared to WC (354.7 vs. 190.29 m and 2.8 vs. 1.7 m·min-1). On MD-2 WSL players also covered more SD (44.66 vs. 12.42 m), SD per minute (0.38 vs. 0.11 m·min-1) and HSR per minute (1.67 vs. 0.93 m·min-1). Locomotor activity was highest for both WSL and WC on MD-4. Both WSL and WC teams reduced HSR and SD from MD-4 to MD-2 but not ACC and DEC distance. Conclusion: HSR and SD volume and intensity is tapered in WSL and WC players, however there is no clear taper of ACC or DEC. MD-4 is a key training day discriminating between competition standards. As such, WC teams could increase the volume and intensity of HSR on MD-4 to mimic locomotor activities of those at a higher standard.

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CO112| The differences in anthropometric, growth, maturation, and physical qualities between injured and un-injured elite youth female soccer players

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Background: To date, the associations of player anthropometrics, growth, maturation, and physical qualities with injury have not been examined at a girls' soccer academy level in England.

Aim: To identify differences in anthropometric, growth, maturation, and physical qualities between youth female soccer players who were injured or not-injured during the same season.

Methods: Injury surveillance data, anthropometric and physical quality data were collected on 295 players from 7 elite girls' soccer academies during the first half of the 2021-22 season (August-February). Player anthropometrics (standing height and body-mass) and physical qualities (strength, power, speed, change of direction, fitness) were assessed during pre-season and mid-season. Player maturation status was assessed using estimated percentage of adult stature attainment (Khamis-Roche method) and estimated years from peak height velocity (YPHV; Mirwald maturity-offset). Monthly growth rates, including height, leg- length and body-mass were calculated (difference between pre- and mid-season divided by duration in months). Medical practitioners at each club recorded time-loss injuries during the study period. For the analysis, age groups were split into two categories: younger (U10-U12, n=114, age=10.9±0.8y) and older (U14-U16, n=181, age=14±1.2y). Linear mixed models were used to determine differences for players age, anthropometrics, maturation status, player growth rates, and physical qualities collected during pre-season between injured and un-injured players.

Results: Eleven injuries were registered by 8 players in the younger category and 28 injuries were registered by 24 players in the older category. In the younger category, injured players were significantly taller (150cm, 95%CIs: 143-156 vs 144cm, 95%CIs: 140-148, p=0.049), heavier (43.7kg, 95%CIs: 37-50.4 vs 36.9kg, 95%CIs: 32.4-41.4, p=0.016), stronger (78.5kg, 95%CIs: 66.3-90.6, vs 67.3kg 95%CIs: 61.2
-73.4, p=0.040) and more advanced in YPHV (-0.65YPHV, 95%CIs: -1.23--0.06, vs -1.26YPHV, 95%CIs: -1.66--0.86, p=0.011) compared to un-injured players. Un-injured players had significantly greater height growth rates (0.44cm/month, 95%CIs: 0.30-0.59 vs 0.21cm/month, 95%CIs: 0.02-0.40, p=0.002) versus injured players. No significant differences were observed in the older category.

Conclusion: Increased injury risk in younger players may be due to greater body-size affording greater biomechanical loads and increasing the potential for more severe contact situations. Other factors outside of physical characteristics may influence injury rates in older players.

CO120| Locomotor and Technical Characteristics of Female Soccer players training: Exploration of differences between competition standards

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Objectives: To (i) quantify the differences in locomotor and technical characteristics between different drill categories in female soccer and (ii) explore the training drill distributions between different standards of competition. Methods: Drill duration, technical (ball touches, ball releases) and locomotor data (total distance, high speed running distance [>5.29 m·s-1]) were collected using foot mounted inertial measurement units from 458 female soccer players from three Women's Super League (WSL; n = 76 players), eight Women's Championship (WC; n = 217) and eight WSL Academy (WSLA; n = 165) teams over a 28-week period during the 2020-2021 season. The data was analysed using general linear mixed effects. Results: Across all levels of competition, the largest proportion of time was spent in TEC (WSL = 38%, WC = 28%, WSLA = 29%) and SSGe (WSL = 20%, WC = 31%, WSLA = 30%) drills. WSL completed

more TEC and TAC training whilst WC and WSLA players completed more SSGe and POS based drills. Technical drills elicited the highest number of ball touches and releases (Touches [n]: 87 [51-135]; releases [n]: 30 [17-47]) and the highest locomotor activity (total distance [m]; 2983 [1747-4252]; high speed running distance [m]: 40 [11-97]). Positions specific drills elicited the lowest number of ball touches and releases (Touches [n]: 39 [23-64]; releases [n]: 7 [0-15]) and the lowest locomotor activity (total distance [m]: 1056 [706-1688]; high speed running distance [m]: 4 [0-28]). However, when the technical and locomotor demand of each drill were made relative to time, there were limited differences between drills, suggesting drill duration was the main moderating factor. Conclusion: The results of this study provide a novel understanding of the technical and locomotor demands of different drill categories in female soccer training. These results can be used by coaches and practitioners to inform training session design.

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CO121| Understanding the differences between training/ micro-cycle outputs of technical and possession based statistics compared to match play in women's football

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Objectives: To understand the difference between training/microcycle exposure of technical and possession based statistics in comparison to match play in female football players. Methods: 165 female soccer players from eight WSL Academy teams participated in the study, with 5,502 individual data points collected during the 2020/2021 season. Technical actions (touches, releases, high speed releases [>15m/s], and possession statistics[total time on the ball and time on the ball per possession) were monitored using foot- mounted inertial measurement units (Playermaker), within all training and match activities. Results: Differences within technical actions were observed for the total training week in comparison to match play for touches (543±289%), releases (132±60%), high speed releases(-80±-80%), total possessions (-5±-17%) and the time on the ball per possession (-98±-59). Discussion: Female academy football players have a higher volume of technical actions during a micro-cycle in comparison to match play (touches and releases). However, match play was shown to have increased technical actions in comparison to a total micro cycle for high speed releases, number of possessions and an increased time in possession of the ball. Practitioners and coaches should look at monitoring the specific drills on training days to ensure players are exposed to match type activities for high speed releases and possession based statistics.

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CO206| Applying Feature Selection Methods to Identify Unique Technical and Physical Performance Indicators within Women's Football

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AS PART OF THE FA SYMPOSIUM

The advent of wearable technology, such as foot-mounted inertial measurement units (IMU), means that sports practitioners are presented with a vast and complex array of features to use at their disposal. These typically include features related to technical (e.g., number of touches, releases, high-intensity releases) and physical (e.g., displacement, turning angles, gait parameters) performance constructs (Coutts, 2014). Despite the advantages of having more available information to inform stakeholders' decision-making processes, this also means practitioners may be faced with data overload (Weaving et al., 2019). Also, increasing the number of features inherently increases the potential to encounter multicollinearity, meaning several features may vary together and thus represent similar information. Feature selection is a technique commonly used in many fields, such as medicine (Remeseiro & Bolon-Canedo, 2019), to reduce dimensionality and noise in complex datasets. Secondly, feature selection techniques allow for the visualisation of high dimensional datasets in a 2- or 3-dimensional reduced space, whilst still retaining much of the original information. However, the application of feature selection in a female sporting context has been seldom explored.

In this presentation, we will outline the process of using domain specific knowledge alongside feature selection methods to identify unique technical and physical performance indicators within women's football. Such information may be used by sports practitioners to reduce dataset sizes, meaning they can focus on only a few important and unique features, which can inform their decision-making processes.

Data is currently being collected from 293 players across 3 leagues (Women's Super League, Championship, and Super League Academies) for training and match-play, using foot-mounted IMUs (Playermaker, UK). The data will be processed and analysed at the end of season 2021/2022 season, which concludes in May 2022. As such the results and conclusions are pending.

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CO219| A latent variable conceptual model of the training process in female team sport athletes

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Practitioners prescribe training to team sport athletes to elicit training effects that contribute to improved performance. Controlling this training process is a key goal of applied sport science support yet is theoretically complex due to concurrent multi-modal training and the mediating effects of a variety of individual athlete characteristics (e.g., aerobic capacity). This leads to varied responses between players making the control of this process difficult.

Consequently, it is important conceptual frameworks are available that suggest construct labels and definitions and their potential causal associations before they can be operationally defined and measured. While conceptual frameworks are available (Impellizzeri et al., 2005; Jeffries et al., 2020), none have focused specifically on female team sport athletes. This focus is important because training responses are likely mediated by female specific factors, including menstrual cycle phase and status (e.g. length, irregularities/dysfunction) and contraceptive use (Schaumberg et al., 2017). However, the global paths between female specific mediators and training prescription and response have yet to be conceptually and collectively proposed.

Secondly, the constructs of the training process (and their operational definitions) are inherently multidimensional in nature. For example, the dimension of internal responses to training includes physiological (e.g., VO2 and lactate responses) and neuromuscular (e.g., tendons, ligament responses) subdimensions. This creates a latent variable structure to data, requiring suitable analysis techniques such as partial least squares. It is also challenging for the practitioner to visualise such high dimensional data to decision makers. However, such models are relatively unexplored within sport science. Therefore, the aim of this presentation is to introduce a female specific conceptual model of the training process within a latent variable mediation framework and how these can concurrently assist practitioners to visualise higher dimensional data more simply.

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CO177| Advances in ecological dynamics and soccer research: What does the future promise?

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Advances in ecological dynamics and soccer research: What does the future promise?

Sport sciences have been influencing soccer for more than 50 years. Such influence has been mainly characterized by a disciplinary approach, where each sport science (e.g., physiology, biomechanics, psychology) offers its applications. The paper that Davids, Araújo and Shuttleworth (2005) wrote was different. It offered a scientific path for how physics, biology and psychology could be superimposed in a transdisciplinary approach called ecological dynamics. For this to happen, the ecology where sport behavior occurs should be considered as much as the performer's skills, and consequently the methods should go beyond discrete metrics to dynamically capture the ongoing sport behavior.

That 2005 paper was influential at three levels, which continue to operate changes today: performance, learning and development. At the level of performance, the understanding of how cognizant bodies deal with the unique circumstances of a match, needs to consider that agency is at the level of the player- environment system, instead as solely located in the brain or mind. Therefore, an ecological dynamics approach to neurosciences and psychology is auspicious. Second, at the level of learning, science is focused on how performance changes over time. Therefore, performance analyses need to go beyond the predominant accumulation of frequencies approach towards capturing match dynamics that inform about what to learn to perform better in the future. At the moment probabilistic approaches, centered on predictions, not on explanations, are becoming prominent. Ecological dynamics can accommodate contributes such as that of artificial intelligence which is a theoretic-free, inductive, probabilistic method. Finally, the development of expertise in soccer tends to be based on the selection of talented athletes. This view neglects the environment and how players and contexts co-adapt to each other, creating an ecology of change, that is not predictable from the initial organismic measures. An ecological dynamics approach stresses how social-cultural constraints create a 'form of life' where healthy and successful performance is promoted, leveraging on the diversity of its inhabitants.

Davids,K. etal.(2005). Applications of dynamical system theory to Football. In T.Reilly, J.Cabri, & D.Araújo (Eds.), Science & Football V (pp.556-569). Routledge.

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CO187| Science and Futsal – Advances from ecological dynamics

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Like Soccer, the futsal match is a complex adaptive system in which performance of players and teams emerges from interactions among individual, task and environment constraints. Understanding how performance emerges in futsal is to understand how players with different capabilities (physiological, tactical, technical) interact under task (game rules, different game systems) and environmental (home- away, winning -osing teams) constraints to facilitate emergence of functional, dyadic and collective spatiotemporal patterns of relations between teammates and with opponents.

Since 2005, grounded on key ideas of ecological dynamics, research has used positional data to identify relevant informational variables (inter-player distances, angles, spaces covered or orientation and alignment with the goal or the ball). This information sustains individual (passing, dribbling, and shooting) and collective (attacking patterns of play, attacking behaviour, defensive behaviour) tactical behaviours. From that knowledge, research has helped us to identify the most prevalent information variables that change with manipulations of practice tasks to support the acute adaptations of Futsal players' and teams' tactical behaviours. Evidence suggests that such skill adaptations are not only dependent on practice task manipulations, but also on players' ages and individual capacities.

Some recent attempts have sought to understand how the situational and contextual aspects of competitive performance constraints impact players' and teams' tactical and physical performance behaviours.

In this communication we aimed to retrospectively analyse the contribution of ecological dynamics to better understand and characterize performance in Futsal. We seek to understand how to improve coaches' practice as designers of representative practice tasks, ensuring the links between information and action, as they emerge in competition, for adaptive individual and collective performance solutions.

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CO195| A Department of Methodology can Enhance Scientist-Practitioner Integration

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In the current sporting landscape, it is not uncommon for professional soccer teams and organisations to employ multidisciplinary sport science support teams. In these teams and organizations, a head of performance may manage several sub-discipline specialists with the aim of enhancing player and team performance. Despite the best intentions of multidisciplinary sport science support teams, difficulties associated with integrating sub-disciplines specialists, and coaching practitioners, to enhance performance preparation have become apparent (Sporer & Windt, 2018).

Academic interest in how to facilitate scientist-practitioner integration is growing, however, a crucial and often overlooked factor is the use of a theoretical framework to guide integrated, and effective, practice designs. It has been suggested that the problem of integration is embedded in the traditional reductionist method of applied sport science, leading to individual specialists quantifying progress in isolated terms (Rothwell et al., 2020). Resulting in silo working, and decontextualized learning environments, that can hinder athlete preparation and performance.

To address this challenge, ecological dynamics is a theoretical framework that can inform common principles and language to guide the integration of sport science sub-disciplines, and coaching practitioners, in a Department of Methodology. The aim of a Department of Methodology would be for group members to work within a unified conceptual framework to (1) coordinate activity through shared principles and language, (2) communicate coherent ideas, and (3) collaboratively design practice landscapes rich in information (i.e., visual, acoustic, proprioceptive, and haptic) to guide the emergence of highly skilled behaviours for player performance.

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CO127| How bi-directional synergy formation informs training designs

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The last 20 years have witnessed a growing body of research attempting to conceptualize sports teams as dynamic, complex adaptive systems. Notably, a seminal paper from Davids et al. (2005) highlighted the conceptual modelling of football teams as dynamical systems, exhibiting self-organization under constraints, pattern-forming dynamics, and synergy formation, among others. Self-organization seem to be paramount in explaining how collective-system behaviours emerge from players' local interactions with specific informational constraints. Interestingly, such bi-directional tendency of synergy formation (Ribeiro et al., 2019) has been completely neglected by the sports science community over the years. Careful attention should be paid by coaches when designing training programs that shape the self-organizing tendencies of players and teams at a global-to-local scale by imposing, for example, a rigid tactical/strategical plan with associated tactical principles of play. A major concern is that coaches need to promote and manage such global-to-local self-organizing tendencies in teams in a soft and adaptable manner by allowing players to explore adaptive and innovative performance solutions, emerging at a local-to-global scale, coherent with the accomplishment of intended tactical principles of play circumscribed in a game model, instead of faithfully reproducing a set of pre-determined behaviours. Indeed, a manifold of performance solutions can be used by players to perform a given principle of play, which is aligned with the biological principle of degeneracy reflecting the ability of elements that are structurally different to perform the same output (Edelman & Gally, 2001). This presentation discusses how bi-directional synergy formation informs training designs to enhance individual and team performance.

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CO128| Practical applications of ecological dynamics in professional football – achievements, opportunities and challenges!

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The last 20 years have seen a growing body of research focusing on an ecological dynamics approach to study skill acquisition, coordination, and control of action in sports. This theoretical approach took off at the beginning of the millennium after prominent ideas from notable human movement scientists (e.g., Turvey, Newell, and colleagues) were brought to the field of sports sciences. This contribution re-directed research towards the study of movement coordination and its acquisition, rather than focus on cognitive motor control mechanisms and processes. Most initial studies drew inspiration from Bernstein's ideas and Gibson's ecological theory of perception to explain individual movement coordination under the influence of informational constraints. Simultaneously, in 2005, Davids et al. raised awareness of the interpersonal level of analysis of coordination tendencies inherent to team sports, considered as dynamical systems. This analysis triggered a series of studies aiming to explain how collective team behaviors emerge under constraints during practice and competition. For example, it was advocated that intra-team synchronization is governed by locally created information, which specifies shared affordances responsible for synergy formation between team members (Silva et al., 2015). But despite the development of such an innovative theoretical model for team sports, its application has yet to make a meaningful impact in current football practices. This presentation discusses how ideas from an ecological dynamics approach can help shape specific tactical coordination patterns while improving coach-player relationships (through increasing player buy-in). Also highlighted is the need for a more in-depth understanding about the influence of interacting constraints on team behavior and why the principles of representative design should be applied in practice to provide more effective training tasks. Finally, the use of a systems approach to football training is highlighted to help unveil a different dimension of fatigue. These ideas open up new perspectives for shaping and monitoring team performance in football.

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CO212| Nonlinear Pedagogy and Soccer

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The theory of Ecological Dynamics has helped academics and practitioners to better understand how human movement is coordinated and developed. Over the years, Ecological Dynamics has also been applied to examine and understand game play dynamics in invasion games such as in soccer. Players within and between teams interact as they engage in game play. These interactions are key to describe and explain how different game play behaviours emerge in soccer. Importantly, skills and adaptive movement behaviours of players are pivotal in supporting key aspects of the game and accordingly, Ecological Dynamics can provide a sound foundation to help academics and practitioners explore innovative pedagogical practices to support skill development. Over the last two decades, a Constraints-led Approach and emanating from that, Nonlinear Pedagogy have provided critical ideas on how practitioners can design and enact practices underpinned by concepts from Ecological Dynamics. Key design principles that can support how learners/players acquire and adapt skills are proposed in Nonlinear Pedagogy. These design principles such as creating a representative learning environment, skillful manipulations of constraints, an emphasis on task simplification to strengthen perception-action coupling, understanding the impact of informational constraints and infusion of practice variability can account for the nonlinearity that are inherent in skill adaption. The inclusion of the above design principles help to accentuate the focus of Nonlinear Pedagogy to encourage exploration and the acquisition of individualized movement solutions that are especially relevant in the game of soccer. Undoubtedly, the continuous innovation in the science of pedagogy will have implications on the evolution of coach education in soccer.

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CO251| "We just want consistency": What do players and coaches need to know about how referees make decisions?

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The role of the referee has generally been viewed as enforcing the laws of the game with expertise measured by accuracy in identifying fouls (and their location), with commensurate calls by players, coaches and the media for uniform consistency across referees and game situations. Indeed, much of training of referees is geared toward this universal goal. The assumption of such a viewpoint is that decisions are 'independent' of each other during the match (i.e., that a penalty is as likely to be given in the first minute as in the first minute or the ninetieth). However, recent work from an ecological dynamics perspective drawing on the 'missing voice' of the referees themselves has found that referees view consistent decision-making as emergent. Thus, decision-making consistency could be understood as 'dynamical transactions' within a complex system (i.e., competitive football game), with varying decision-making responses by the referee to 'similar incidents' reflecting expert maintenance of key decision-making priorities, rather than inconsistency. Specifically, the findings emphasise that players and the referee negotiate game-specific understandings of what constitutes a foul and fair play on a game-by-game basis. Consequently, decisions are not simply reactions to moments, but rather represent a complex web of co-dependent interactive behaviours between players and the referee that define the functional synergy of the game. These findings have important implications for coaches and players as information perceived by the players, such as referee's decisions, constrains their actions, whilst in turn, actions from players related to those refereeing decisions, generate new information impacting on the decision-making behaviours of the referee. Referee decision-making operates as an adaptive and exploratory activity to accommodate varying skill levels, desired game styles, or re-structure game coordination states. For example, officials in this study emphasised how they needed to be flexible and adjust foul determinations depending on the style of football they wish to play or the standard (level) of football being played. These co-adaptive inter-actions from both teams and the referee mean that rather than expecting uniformity in decision making in every game, players and coaches need to understand that the games trajectory shapes decision making.

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CO143| Visualizing Performance Dynamics of Soccer Players in Personalized Networks

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Research on soccer performance and its related factors has mostly been conducted 1) at one or a few points in time, 2) on a group level, and 3) as a causal-chain of monodimensional predictor and outcome variables. This approach has not yet led to a clear set of variables that can explain soccer performance, and omitted the fact that performance factors can interact in individual-specific, complex ways. In accordance with recent developments we argue that soccer performance should be approached as 1) dynamic, 2) individual-specific, and 3) emerging from (mutual) interactions between multidimensional factors (Den Hartigh et al., 2016; Glazier, 2017; Neumann et al., 2021; Unnithan et al., 2012). The purpose of this research is to present a novel analytical method, that is, time-varying vector-autoregressive (TV-VAR) modeling, that may capture the interactions and changes between the performance-related factors of individual soccer players (Bringmann et al., 2018). Therefore, we measured important psychological (e.g., confidence, motivation) and physiological (e.g., load, recovery) factors of youth male players from a professional soccer club on a daily basis across one season. We assessed the temporal dynamics (i.e., autoregressive and cross-lagged effects) of those factors and visualized the findings in changing network graphs. Results show that the performance-related factors are influencing themselves and other factors with sometimes changing effects over time. For instance, the findings of one player revealed that self-confidence was a central element in the network as it influenced many other factors, including the performance of the player. For a second player, a different network structure was found with multiple factors influencing each other, such as the recovery, self-confidence, mood, and performance. The findings confirm the assumption that the performance networks are highly individual-specific. Hence, TV-VAR models offer a tool to capture the dynamics, individual-specificity, and multidimensional interaction of soccer performance. In that sense, the models may allow researchers and practitioners to know which knob to turn for which player and to detect when relations between factors change, which may be indicative of a change to a higher or lower level in performance (Hill et al., 2020; Scheffer et al., 2018).

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CO199| Do professional soccer teams run the same throughout the season? Relationship with team performance

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Abstract: In relation to the evolution of movement profiles within a season, it has been shown that a professional soccer team recorded the lowest TD during the preparation phase, whereas the greatest TD was achieved in mid-season (Smpokos et al., 2018). Also, final ranking has been highly related with match movement profiles. Therefore, it would be interesting to analyze whether the teams with different final performance have different match movement profiles across the season. This this study aimed to analyze how the match movement profiles evolve within season; and across seasons (into four different phases). Moreover, it analyzed how running distance variables could be related to the coaches' perceptions of team performance. Games from four consecutives Spanish LaLiga seasons (n = 1,520) were recorded using an optical tracking system (i.e., ChyronHego). Total distance (TD), distance covered between 21-24 km·h-1 (HIRD), and > 24 km·h-1 (VHIRD) were analyzed, as well as the number of efforts between 21-24 km·h-1 (Sp21) and > 24 km·h-1 (Sp24). Seasons were divided into four phases (P): P1 (matches 1-10), P2 (11-19), P3 (20-29), and P4 (30-38). The performance of each team was evaluated by twenty professional soccer coaches. Linear Mixed Models (LMM) were calculated to compare the match movement profiles in the four phases considered. Team performance was included as covariate. Results revealed that soccer players covered significantly greater distances and completed a higher number of sprints in P2 and P3. Also, team performance evaluated by soccer coaches was positively related to TD, HIRD, VHIRD and Sp21 in P1. A negative relationship was observed between team performance and distance covered at speeds below 21 km·h-1 in P2 and P3. Team performance was negatively related to TD, HIRD, and Sp21 in P4. As conclusion, it seems that the players of the best teams have the best physical performance at the beginning of the season with respect to the rest of the phases.

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CO217| Evaluating the use of the high press in the English Premier and K Leagues using Passes Per Defensive Action

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The “high press” is a collective team action which aims to reduce the time and space of the opponents when they have possession of the ball in their defensive areas. The antithesis of this is the “low block” where a team tries to fill their own defensive area to make the opponent’s attack difficult. To measure these effectively player and ball movements need to be tracked and a complex algorithm developed. However, Trainor (2014) developed a proxy measure, passes per defensive action (PPDA) using only action data. This metric has gained popularity to the extent that it is now widely available and regularly discussed on football television shows. PPDA values for all matches in the EPL (2017/18) and K league (2018) seasons were accessed through Opta Sportsdata (www.optasports.com). Teams who tended to press high i.e. with lowest median PPDA over the whole season, tended to finish highest in the league although the effect size was large for the EPL but small for the K league. PPDA had a small effect on match outcome in the EPL and K leagues with EPL teams tending to perform better when they had lower PPDA values than the opposition with the opposite being true for the K league. An analysis of individual match PPDA values revealed clear tactical decisions by some teams not to undertake a high press e.g. low against top ranked teams. Other factors likely to determine pressing behaviour include evolving score line (Jones, James and Mellalieu, 2004) as teams may increase their pressing intensity immediately after conceding a goal.

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CO234| Analysing Team Dynamics to Explain Team Physical Performance in Elite Football

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Introduction: In football, team dynamics is critical for exploring game possibilities for performance. As such, the analysis of spatial-temporal relations seems to be a useful manner to understand variations in players' performance over the match. Thus, based on the analysis of teams' spatial-temporal dynamics, this study aimed to identify and characterize variations in players' physical performance over competitive matches.

Objectives: Investigate relations between teams' dynamics and physical performance in elite football competition and investigate fluctuations in team performance within matches considering match outcome.

Methodology: ChyronHego Tracab multiple-camera systems were used to collect tracking data for 698 competitive matches (n=1165 performances) from 16 elite Danish First Division teams across three seasons. A radial basis function of the coordinates of 10 outfield players generated a dense field divergence. Divergence field (DF) analysis metrics amplitude (AMP) and gradient (GAIN), which determined the magnitude and the force of team displacement, respectively, were computed for player and team movements. Players' performances were measure as total high-speed running (HSR; ≥19.8-25.2km/h) and sprint (≥25.2km/h) distances.

Results and Discussion: Pearson coefficient correlation analysis revealed positive significant ($P \leq 0.01$) associations ($r=0.3$-0.5) between AMP and GAIN, as well as total high-speed running and sprint distances. Both AMP and GAIN decreased throughout the match, with significant ($P \leq 0.01$) differences observed between the first and final 15-minute intervals (15'-INT). Successful match outcome (win) performances demonstrated significantly ($P \leq 0.01$) greater AMP across 15'-INT within a match when compared to unsuccessful performances (draw or loss). Such observations were also observed in the final standings of teams across all seasons. Finally, the 5-minute (5'-) period immediately following the 5'-peak AMP was significantly ($P \leq 0.01$) lower when compared to the 5'-peak and 5'-mean periods.

Conclusions: The dynamics of team movement was described by the DF metrics, which is related to team physical performance metrics. Defined DF metrics can also discriminate successful and unsuccessful team performance within and between match performances. Results of the study can be applied by practitioners in designing tactical and physical training protocols. Relationships between match events, physical performance, and team movement dynamics in football should be further examined.

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CO238| Analysis of Spanish La Liga Soccer Players' Performance before Signing a New Contract

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Introduction:

Research in sports management shows that players may perform better in order to obtain a higher-paying contract just before signing a new one (Della Torre et al., 2018). Yet there is little published data on players' performance within this context. Therefore, this study seeks to analyze the performance of soccer players before signing a new contract in terms of playing position, nationality, player's role and age.

Method:

The sample was comprised of n=101 players (n=30 defenders, n=33 midfielders, and n=38 forwards) from Spanish La Liga during the seasons 2020-2021-2022. The K-means cluster analysis was used to divide players' role (important and less important) according to the variable minutes played per match and player's market value. Two-step cluster analysis was used to classify the sample into different groups by players' role, playing position, age and nationality. Finally, paired samples T-test was used to test the differences between player's performances during the two years of analysis.

Result:

The main results showed significantly better performances before signing a new contract for national less important forwards (decreased number of bad control), national important defenders (increased number of defense), and defenders less than 26-year-old (increased number of defense and minutes played). In addition, performance was significantly lower for national important forwards (decreased number of being fouled, defense, dribble, minutes played, and dispossessed per game), foreign important midfielders (decreased number of shooting), foreign less important forwards (decreased passing accuracy and increased number of bad control), national important defenders (decreased passing accuracy), midfielders more than 30-year-old (decreased number of key passes) and forwards more than 30-year-old (decreased number of being fouled, minutes played, key passes, and crosses).

Conclusion:

The current data highlight the importance of the period for players just before signing a new contract. These results may be of interest to stakeholders in elite soccer to make decisions considering this factor.

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CO244| An innovative approach to the analyses of football player running profiles

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Background. In football, monitoring player performance indicators is a very useful and common methodology to maximize individual and team outcomes. For example, current player speed analysis allows for the estimation of running peak speeds, durations, distances, among other characteristics. In addition, it permits the classification of different types of runs, such as medium speed runs (MSR-14.4-19.8kmh), high speed running (HSR-19.9-25.2km/h) and sprinting (Sprint-25.2km/h). Nonetheless, commercial software platforms have a very limited capability of examining speed profiles and to the best of our knowledge, do not provide any adequate solutions for analyzing acceleration characteristics.

Aim. Investigate speed and acceleration profiles, of different types of runs, during a football match.

Methods. This small study focused on 8 adult field players that completed 90 mins of a top Portuguese league football match. Participants wore a GPS unit (Catapult, Melbourne, AU) on their back during the entire match, allowing for the extraction of speed and acceleration profile characteristics for MSR, HSR and Sprint runs. A linear mixed-effects model was used to perform comparisons between the different runs for all parameters, with significance set at $p<0.05$.

Results. Sprint runs occurred significantly less often (Sprint: 7.0±3.6%, HSR: 27.8±7.4% and MSR: 65.2±5.2% of all runs), attained greater peak speed (Sprint: 27.2±0.7km/h, HSR: 22.2±0.3km/h and MSR: 16.9±0.2km/h, $p<0.05$) and significantly greater peak deceleration (Sprint: -2.87±0.40 m/s2, HSR: -2.23

±0.22m/s2 and MSR: -1.78±0.13m/s2). In addition, Sprint runs showed larger peak acceleration than MSR (Sprint: 1.86±0.35m/s2 and MSR: 1.32±0.13m/s2, $p<0.05$). Peak speed occurred later during Sprint runs (Sprint: 59.6±3.8%, HSR: 51.1±4.9% and MSR: 48.6±2.9% of the total run time, p0.05) between the different runs. Overall, these occurred around 27.0±4.3% (acceleration) and 82.5±3.6% of the total run time (deceleration).

Conclusions. This novel approach to speed and acceleration profile analysis can allow for a deeper understanding of football's performance demands. Furthermore, it can help guide the training programs to better prepare players and teams for competition and potentially reduce the risk of injuries.

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CO137| Self-controlled feedback improves perceived competence and movement execution in soccer players

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Although effort is put forward regarding prevention programs, the rate of ACL injuries in soccer is still high. Autonomy is possibly a key component to improve movement execution and therefore decreasing injury risk. A previous study of our group showed that a self-controlled feedback (SC) group showed better Cutting Movement Assessment scores (CMAS) in retention, compared to a yoked (YK) group. The question remains how to explain these effects while similar sidestep cutting (SSC) execution was found during training. In the current study, the psychological questionnaires belonging to that study were analyzed.

Two groups (SC and YK) of each 11 amateur soccer players (22.9±1.7 years, 185.5±7.2 cm, 79.3±9.2 kg) performed 20 SSC movements during training. The yoked counterparts received feedback after the same trial on which their partner in the SC group had requested feedback. Spearman's rho correlations between retention CMAS scores and psychological statements were calculated. The following statements were rated on a Likert scale from 1 (totally disagree) to 7 (totally agree); 'I want to improve my score' (motivation), 'How much confidence do you have to execute the movement as well as the expert' (confidence) and 'I think I am pretty good at this exercise' (perceived competence).

The groups showed similar scores for all statements ($p>.05$). For the SC group, retention score was negatively correlated with perceived competence ($\rho=-0.748, p=.008$). Thus, this group estimated their performance realistic, i.e. higher perceived competence was related to better movement execution (lower score). Involvement in the timing of feedback may have led to realistic estimates. For the YK group, perceived competence was positively correlated with retention score ($\rho=0.631, p=.037$) and confidence ($\rho=0.893, p<.001$). So, this group estimated their performance worse, i.e. higher perceived competence was correlated with worse movement execution but high confidence. This may have hindered learning as subjects who thought they were good and did not need to change much were apparently not at the perceived level.

To conclude, realistic estimates of competence during training may have enhanced the learning process. Self-controlled feedback is advised to be implemented in soccer training programs to improve movement execution and enhance perceived competence.

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CO144| An overview of Sports Psychiatry and its application in Football

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Sports Psychiatry is an growing field that specializes in assessing and treating mental health disorders in elite athletes. Also, it studies the use of physical activity in preventing and treating mental health symptoms. The role of a Sports Psychiatrist in a sports organization is to integrate the Sports Medicine team and liaison with Sports Psychologists.

Although physical activity can decrease mental health symptoms in the general population, elite athletes are not immune to them. Contrary to misconceptions in popular opinion, this population has equal prevalence of depression and anxiety disorders and even higher for eating disorders. Potential stressors unique to elite athletes such as competitions, injuries and career changes (e.g. retirement) partially explain this. Mental health symptoms can significantly decrease sports performance but also other life aspects of the athlete.

The aim of this presentation is to overview common mental disorders (e.g. depression, anxiety, eating disorders, addiction, attention deficit hyperactivity disorder) in elite athletes, as well as those specific to this population, namely prevalence, etiology and diagnosis specifics that differ from the general population. Treatment adjustments and prevention, keeping sports performance in mind, will also be discussed.

Finally, a focus on recent studies on football athletes and the increased risk for mental health disorders, such as sports-related concussion, will be made.

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CO157| In the Context of a Sports Match, the Goal to Win is Most Important, Right? Evidence for a Hierarchical Achievement Goal System

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In the Context of a Sports Match, the Goal to Win is Most Important, Right? Evidence for a Hierarchical Achievement Goal System

When evaluating one's own or others' performances, there is a strong tendency to rely on social comparison information. Remarkably, however, the extant achievement goal research suggests that the prevalence of other-based goals (also referred to as ego goals or performance goals) is very low, also in sport contexts such as soccer (e.g., Elliot & Hulleman, 2017; Van Yperen, 2021). In the present research, we argue and demonstrate that in the context of a sports match: (1) most athletes' overarching achievement goal is an other-based approach goal (i.e., the goal to win), and (2) athletes with an overarching other- based approach goal also rely on self-based criteria (referring to one's personal performance trajectory) and task-based criteria (referring to the absolute demands of the task). Survey data was collected among 647 competitive team athletes (including elite athletes), ranging in age from 16 to 56 years. As expected, for most athletes (51.6%), to win matches was their overarching achievement goal, and pursuing self-based and task-based approach goals added to their competence satisfaction. These findings suggest that athletes with a strong desire to win acknowledge that they need to focus on what needs to be done to ultimately attain the outcome they desire: Coming out victorious. Making their goal systems visible and explicit likely helps them to effectively self-regulate, to monitor their hierarchically structured goal pursuit, and to enhance their competence satisfaction.

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CO181| The use of positive or negative feedback changes the physical and mental efforts of soccer players during trainings

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Because a significative increase in the mental fatigue can impair the soccer performance (Gantois et al., 2020; Smith et al., 2016), experts have recommended coaches to investigate how they can manipulate the mental fatigue of their players using ecological strategies (Smith et al., 2018). Specifically, experts have recommended to avoid the use of mentally fatiguing tasks nearly competitions and to train in mentally fatiguing conditions to develop resistance to mental fatigue (Smith et al., 2018). The present study aimed to investigate how different types of feedback can change the mental fatigue perceived by players during trainings. A total of 45 semiprofessional soccer players performed two trainings sessions with the same tasks but using positive feedback in one session and negative feedback in the other session. The results showed that the use of negative feedback may significantly reduce the physical efforts performed by players during trainings in comparison with the use of positive feedback: ($p = .003$ for medium heart rate, $p < .001$ for peak heart rate and $p = .016$ for total distance covered). On the contrary, the mental fatigue was significantly higher ($p = .004$) by the use of negative feedback in comparison with the session where a positive feedback was used. These results can be used by coaches to choose the more adequate feedback for their sessions according to their objectives.

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CO183| Play a play-offs phase increases the mental fatigue of semi-professional soccer players

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Mental fatigue in soccer can be caused by the prolonged cognitive and tactical efforts that players must perform to achieve performance (Smith et al., 2018). Indeed, the performance of soccer players may be impaired by the presence of excessive levels of mental fatigue (Gantois et al., 2020; Smith et al., 2016). Then, experts recommended to investigate what variables can influence the mental fatigue of soccer players. This study aimed to know how the mental fatigue perceived by soccer players changed from regular season to play-offs phase. Voluntarily, 53 male semi-professional soccer players recorded their mental load and mental fatigue perceived after four trainings/weeks of 5-regular season weeks and five 5- play-offs weeks. Results showed that during the play-offs phase the soccer players perceived the trainings significantly as more mentally fatiguing ($p = .037$). However, players did not report significant changes in the mental efforts of the trainings between these two phases ($p > .037$). It suggests that play the play-offs phase may cause an increase in the feelings of mental fatigue perceived by soccer players without changes in the mental efforts that coaches design for their trainings. Because the mental fatigue can impair the soccer performance, coaches should counterattack this phenomenon during trainings of play-offs.

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CO209| Resilience in soccer: A multidisciplinary, dynamic, and personalized approach

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Soccer players are regularly exposed to various stressors, such as losing matches and high training loads. In order to maintain optimal performance, it is important that players quickly recover from such stressors, both psychologically and physically. In other words, players need to demonstrate resilience by quickly bouncing back from the stressors [1]. Recent work suggests that resilience processes are dynamic and athlete-specific, which warrants a focus on psychological and physiological processes over time, within individual players [2]. Accordingly, soccer clubs need an infrastructure that allows the measurement, integration, and analysis of the stressors players encounter, as well as the resulting psychological and physical changes [1].

In this talk, I will present a multidisciplinary, dynamic, and personalized approach to measure and improve resilience in the soccer field. Our research project involves a close collaboration between psychologists, human movement scientists, data scientists, and professional soccer clubs (see project-ris.nl/english). We have developed an infrastructure to measure the stressors and states of soccer players through wearable sensors on the pitch and a tailor-made web application. I will demonstrate insights on warning signals of resilience losses in individual players: How can we detect when athletes are losing the ability to bounce back from stressors? Furthermore, I will illustrate how our analytic algorithms are translated into visualizations for practitioners on the resilience of individual soccer players.

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CO096| Test-Retest Reliability and Construct Validity of Hip Load Compared to Playerload During Football Specific Running, Kicking and Jumping Tasks

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Purpose – This study aimed to evaluate the test-retest reliability and construct validity of the recently developed Hip Load (HL) metric during football-specific short distance shuttle runs. In addition, the test- retest reliability and construct validity of HL was compared to that of Playerload.

Methods – Eleven amateur football players conducted two identical experimental sessions. Each session included three different shuttle runs that all were performed at two pace-controlled running intensities of 9 km/h and 14 km/h. The shuttle runs consisted of only running, running combined with kicks, and running combined with jumps. Cumulative Playerload and HL of the kicking leg (HL kick) and HL of the non-kicking leg (HL non-kick) were calculated for the different shuttle runs. Test-retest reliability was determined by comparing the cumulative load metrics from the first experimental session with the cumulative load metrics obtained during the second experimental session using intraclass correlations (ICC), coefficients of variation and Bland Altman analyses. To be able to compare the different load metrics, the cumulative load values were normalized to the respective values obtained during a 54m straight run at 9km/h. Sensitivity of each normalized load metric to running intensity, kicks, and jumps was assessed using separate linear mixed models.

Results – ICCs were high for the HL kick (0.91) and HL non-kick (0.96), and moderate for the for the Playerload (0.87). Coefficients of variation were 13.7% for the HL kick, 9.1% for the HL non-kick, and 6.4% for the Playerload. The effects (95% Confidence Intervals) of intensity and kicks were larger on the normalized HL kick (running intensity: 0.95 – 1.50, kicks: 0.36 – 1.59) and HL non-kick (running intensity:

0.96 – 1.53, kicks: 0.06 – 1.34) than on the normalized Playerload (running intensity: 0.12 – 0.25, kicks: 0.22 – 0.53).

Conclusions – HL is more sensitive to differences in running speed than Playerload and can quantify additional hip-specific load of kicks and jumps. In addition, good test-retest reliability was shown for the HL kick, HL non-kick, and Playerload.

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CO144| Training Load Variables in Elite Youth Soccer: Is a Data Reduction Approach consistent across different age groups?

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Introduction: Data reduction techniques have become increasingly prevalent in team sports for the identification of variables that provide important insights relating to the quantity and nature of training performed by each individual player [1]. This study aimed to reduce the number of variables assessed in a player monitoring program and verify the consistency of variables retained across different age groups of an elite soccer academy.

Methods: A Principal Component Analysis (PCA) with Varimax rotation was conducted to reduce the dimensionality of training and match data recorded by 145 players from U15 to U19 squads. The variables assessed included GPS metrics, heart rate measures and players sRPE values (n = 82). Factors were extracted when Eigen values were greater than 1.

Results: Seven PCs were extracted for each age group, describing 67.6–68.7% of variability. Inconsistencies were observed in the number of variables retained (range: 24 – 28) and their loadings between the different age groups. However, general themes did emerge across the four age groups, identifying components relating to training volume and high-speed running, high acceleration load, and high intensity heart rate.

Discussion: The differences in metrics retained and strength of their contributions indicate that a separate PCA would be required for each age group and are likely group dependent. These inconsistencies show that a PCA approach may not be practical for use in an applied environment as outcomes cannot be generalized across the different age groups of an elite youth academy. Nonetheless, the identification of general themes that emerge from the data reduction analysis support the use of different constructs of load (i.e., internal and external load) to effectively capture the greatest degree of variance. Therefore, it is recommended that practitioners create a conceptual framework, comprising different constructs of load, from which to base the selection of variables considered within the clubs' monitoring system.

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CO145| How do young soccer players train? A 5-year analysis of elite academy players weekly training load and its distribution across a micro-cycle

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Introduction: The quantification of athletes' training load and their individual responses to that load is common practice in many elite level football clubs and their youth academies [1]. The aim of this study was to quantify the session rating of perceived exertion (sRPE), duration and training load accrued by youth soccer players across a training week and its distribution within a micro-cycle.

Methods: Data was collected from 230 elite youth players in four age groups (U15, U16, U17 and U19) across 5 competitive seasons. In-season training weeks were assessed to evaluate the distribution of load across the different training days of a micro-cycle (n = 456 player observations). Mixed models were utilized to detect variation between age groups and starters compared to non-starters, with season as a fixed covariate effect. Estimated marginal means, 95% confidence intervals (CI) and effect sizes (d) were calculated for each training day of the micro-cycle.

Results: Main findings highlight a significant effect of age and playing status on training intensity, duration, and players' internal load. Weekly training load increased progressively from the U15 to U17, with significant differences between each age group ($p < 0.03$). Low variation of weekly training load was observed across different phases of the season, with pre-season exhibiting the greatest variance (3.6– 6.2%). Significant differences were observed in the periodisation of MD-4 and MD-3 (days before the next Match Day) for U15 and U19. All age-groups recorded a reduction in sRPE-training load in the 2 days prior to a competitive fixture. Matches were the most demanding day of the weekly micro-cycle and recorded moderate to large differences between the four age groups.

Discussion: Differences in the training load are more attributable to changes in training duration rather than sRPE, indicating that this appears to be one of the key moderators in manipulating load within a weekly micro-cycle. When interpreting training load data, the assessment of each individual players variations in load is recommended.

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CO148| COVID-19 lockdown in Italian Serie-A male football players: Was there a silver lining for players physical fitness and body-composition?

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Introduction

Off-season in football is a period where team training and matches cease for a period of recovery following the competitive season. It is not uncommon that players return for the start of the next season in worse physical fitness and body composition (1, 2). During March 2020, the Italian government enforced a strict 7- week lockdown restriction in response to the COVID-19 pandemic where players were confined to their homes. Off-season and lockdown shared a similar duration (~6-8 weeks) but it was widely expected within the sporting world that there would be a greater detrimental effect on physical characteristics compared to a typical off-season. The aim of the present study was to compare physical characteristics following the enforced lockdown with previous off-season' values in professional footballers.

Methods

Nineteen male players (age 28 ± 4 yrs, height 185 ± 7 cm, body mass 83 ± 7 kg) from an Italian Serie A team were tested following the COVID-19 lockdown (15 March - 3 May 2020) and values compared to previous off-season. Body composition was assessed with dual-energy X-ray absorptiometry and physical characteristics using Yo-Yo Intermittent Recovery level 1 (YYIRTL1), countermovement jump (CMJ), hamstring eccentric and adductor isometric strength. Player training load was monitored with session rate of perceived exertion (S-RPE) method pre and during home-based high intensity cross-training. Percentage changes were examined with 90% confidence interval (90%CI).

Results

Session-RPE and RPE were higher during lockdown compared to pre-lockdown i.e. normal football training (18.9%, 90% CI 7.3-32.0 and 25.9%, 90% CI 17.1-35.3, respectively). Changes post-lockdown showed, compared to previous off-season, higher YYIRTL1 (18.6%, 90% CI 24.9-11.8) CMJ height (7.2%, 90% CI 10.9-3.3), peak power (4.8%, 90% CI 7.7-1.8) and relative to body mass peak power (2.9%, 90% CI 5.6 -0.04). No significant changes in other parameters were observed.

Conclusion

The results of the present case study supports the adoption of high intensity cross-training. Lockdown was considered a window opportunity to train targeted physical characteristics and was successful in at least maintaining physical capacities, with some even improving compared to a normal off-season.

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CO198| The dose-response relationship between training load measures and changes in force-time components during a countermovement jump in professional academy soccer players

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To manage fatigue in soccer, practitioners monitor training sessions and its consequence on performance. A method frequently used to assess performance is the countermovement jump (CMJ). However, the efficacy of CMJ to detect fatigue from soccer matches and training remains uncertain when utilising jump height (JH) data from the flight-time method. A more accurate method that remains to be explored longitudinally is to utilise the force-time data and the consequent CMJ strategy. Moreover, practitioners may wish to alter training if players present signs of fatigue (e.g. decreased JH), but there is paucity in research investigating the relationship between training load (TL) and change in CMJ performance. Therefore, the present study aims of the study are two-fold. The first is to establish whether the force-time components rather than the JH will change over a longitudinal period (6 weeks pre-season). The second is to identify whether dose-response relationships exist between TL measures and JH and/or force-time components (e. g. jump strategy) longitudinally. Twelve elite professional male youth soccer players (17±1 year, 71.2±5.6 kg, 178±5.8 cm) were recruited. Daily changes in CMJ (n=244) were assessed against baseline scores established before pre-season training, along with internal (heart-rate and perceived exertion) and external (global positioning system and accelerometer data) training load. A series of Bayesian random intercept models were fitted with different response distributions to determine probability of change above/below 0 and greater than the coefficient of variation (CV) established at baseline. Jumps were categorised into match-day minus (MD-) categories where the higher number indicated more time from a match. JH was lowest on MD-3 (28cm) and highest on MD-4 (34.6cm), with the chances of change from baseline CV highly uncertain (41% and 61% respectively). The probability for force-time components (particularly the braking phase) to reduce was more likely on MD-3 (21%-99%), which provided less uncertainty than JH. Explained variance, calculated using Bayes R2, ranged from 22% to 57% between training load measures and CMJ parameters. In conclusion, force-time components were more likely to change than JH. Given the uncertain relationships, practitioners should also be cautious when manipulating training load measures to influence CMJ performance.

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CO202| Pathways for measuring perceived exertion-recovery state in under-19 young football players: an observational and prospective cohort study

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Measuring perceived exertion-recovery state allows to better understand the in-between training sessions' recovery quality and players' readiness in youth football. Thus, the aim of this study was to analyze the association between perceived exertion and recovery status in under-19 youth football players. Twenty under-19 sub-elite young football players (17.29 ± 0.55 years) were monitored over a 6-week period during the first month of the 2019-2020 competitive season. Perceived exertion-recovery state was monitored using the rating of perceived exertion (RPE) scale, session RPE (sRPE) and total quality recovery (TQR). Pearson's parametric correlation was computed. RPE, sRPE and TQR was expressed in arbitrary units (A. U.). Statistical significance was set for $p < 0.05$ associated with 95% confidence intervals (95% CI). Descriptive statistics for perceived exertion and recovery status was analysed. On average, perceived exertion was a somewhat hard intensity (RPE = 12.45 ± 2.50 A.U.; sRPE = 2497.99 ± 224.69 au) and a good recovery status (TQR = 15.21 ± 2.16). Negative and moderate correlation between perceived exertion and recovery status was observed (r = -0.312, 95% CI:-0.362 to -0.262, $p < 0.05$). Current study provides new insights about the associations between perceived exertion and recovery status in youth football training. Although perceived exertion-recovery state showed a negative association, while young football players seem to have a lower perceived exertion due to the age-related interdependence. Futures investigation should consider other age groups and include sleep and well-being variables using multivariate models.

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CO221| Relationships between selected strength parameters and match-related running speed performance in young elite soccer players

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Background: The pace of the game in soccer is increasing over time. It is theorized that muscle strength (MS) positively influence level of physical performance and reduce risk of musculoskeletal injuries. However, evidence of how MS impact player´s affected match-related running performance (MRP) success is lacking.

Purpose: To determine influence of the selected MS parameters on MRP in elite young soccer players. Methods: Players from first division of Czech Republic (n = 34, age: 18.24±1.26 years) were measured. The peak muscle torque of knee extensors (PTKE) and flexors (PTKF) of both legs, were measured by isokinetic dynamometer (Cybex NORM®, Humac, USA) at three angular velocities (60, 180, 300°·s-1). Vertical jump performance (VJP) was evaluated by force platforms (KISTLER AG, Winterhur, Switzerland) with countermovement jump with free arms (CMJFA) and drop jump (DJ). Outcome variables of the VJP were assessed: jump height (JH), vertical ground reaction force (VGRF), absolute force impulse (FIA), relative force impulse (FIR). MRP was expressed as a covered distance in high-speed running (HSR, >19.8 km·h-1), sprint running (SR, >25.2 km·h-1) and were collected in 30 official matches via GPS technology (Playertek, Catapult, Australia). Pearson correlation coefficient and linear regression was used to data processing among variables.

Results: A significant correlations ($p<0.05$) were found between MRP (HSR = 1000.39±279.37 m, SR = 246.65±106.13 m) and PT in highest angular speed for both PTKE300 and PTKF300 (HSR vs. PTKE300: r = 0.64, SR vs. PTKE300: r = 0.55, HSR vs. PTKF300: r = 0.62, SR vs. PTKF300: r = 0.63). Significant correlations ($p<0.05$) were found between HSR, SR and JH respectively FIR for both types of jumps. No statistical significance between HSR, SR and VGRF respectively FIA has been found. Linear regression analysis showed two main significant predictors for HSR (PTKF300, SIR_DJ, R-squared=0.67) and similar for SR (PTKF300, JH_CMJFA, R-squared=0.65).

Conclusion: The current findings indicate that PTKE and PTKF in the highest angular velocity together with JH and FIR for both type of jumps, were the most related parameters to MRP. The strongest predictors PTKF300, FIR_DJ and JH_CMJFA to running performance were also identified in youth elite soccer players.

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CO149| Sahka - Individual Soccer Coaching Technology

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Soccer as a team sport has been infused with technologies supporting performance development. We have contributed to this digital transformation over a decade developing novel multimedia systems [1] with elits users including national soccer teams, top-flight soccer teams for both men and women, and youth academies. Data on monitored athletes coupled with analysis software can provide actionable insights impacting, for instance, training methodologies, game strategy, and team selection.

To our surprise, performance optimization of individual athletes has not realized the full potential of such technologies. Hence, we have meticulously investigated the requirements needed for a software system that supports individual athlete performance development. Coach feedback received includes a plethora of problems, from which performance indicators matter for the specific athlete to the time-consuming process individual coaching is. Ideally, such feedback should be given during each micro cycle period, which is a daunting task given a squad of 25-28 players.

We strive for a holistic, 24/7 athlete development process. Our Sáhka system collects and stores multimedia data relevant for analysis and use in one-on-one coaching sessions. This includes qualitative time-series of daily logged sRPE, mood, wellness, sleep, injuries, and similar. Quantitative data from, for example, wearable positional systems used during drills and games, DXA scanners, sprint tracks in the lab, jump boards, and manually entered data by physical coaches in the weight gym are collected and stored in our system. Also, relevant video input are selectively stored by either the athlete or the coaching staff. Nutritional information is relevant, and we support non-invasive meal data collection through cellular phone cameras for quick and real-time capturing of the meals consumed.

A coach is presented with a visual dashboard for the specific player where the most relevant performance indicators and associated data for the feedback session are visualized. Information overload problems are addressed by artificial intelligence software that extracts information out of all the data. Such software continuously works on daily data input and might alert for intervention decisions to be taken.

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CO152| Coach, I don´t feel it today - A Machine Learning approach for early in-game performance prediction

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Knowing the physical performance level of a player and if he will perform to his standards throughout the game is essential for coaches. A coach can adapt game tactics or prepare substitutions of underperforming players based on this knowledge. In this study, we used player tracking data to predict players' physical performance and identify underperforming players. Tracking data of individual players, except for goalkeepers, from 302 elite soccer matches were used to the predict physical performance of an individual player. The players' physical performance is expressed via variables distance covered, distance in a speed zone (e.g., Low intensity Running or High Intensity Running), and energy expenditure in power category. Each variable was individually normalized for 5 minutes bins throughout the match. Individualized parameters were used to build machine learning models (Decision Tree and Random Forrest) predicting if a player would reach 100%, 95%, or 90% of their average physical match performance. Trained models were compared to a Naïve Bayes baseline model to prove for insignificant, by chance, results.

Random Forrest model achieved the most precise prediction results in general for all tree variables. The best prediction scores were observed for Random Forrest models based on energy expenditure with AUC scores between 0.96 and 0.99. This combination of Random Forest and energy expenditure in the power category also resulted in precise prediction of performing and underperforming players after 15 min in a match, with values of 0.91, 0.88, and 0.92 precision for the thresholds 100%, 95%, and 90%, respectively. To conclude, it is possible to predict the physical performance of individual players in an early phase of the match (after 15 minutes of play). These findings offer opportunities to support coaches in making more informed decisions on their tactical approach and player substitutions in elite soccer.

Dijkhuis, T.B.; Kempe, M.; Lemmink, K.A.P.M. Early Prediction of Physical Performance in Elite Soccer Matches—A Machine Learning Approach to Support Substitutions. Entropy 2021, 23, 952. https://doi.org/10.3390/e23080952

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CO173| Managerial Artificial General Intelligence (MAGI) for football: what could go wrong?

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Advanced technologies now threaten to surpass human intelligence. This watershed will radically impact the ways we currently play, view, and even understand sport. Artificial intelligence (AI) is progressing rapidly, and it remains a matter of time until the impact on sport is fully realised. AI is currently used in sport to assist humans with performance monitoring, supporter and media engagement, and injury prediction, amongst other things. Artificial General Intelligence (AGI) represents the next step in AI in which human intelligence will be exceeded in all its aspects. AGI will have the ability to achieve complex goals in a wide range of complex environments. Whilst AGI does not currently exist, it is expected to arrive sometime this century. Here, we take an envisioned world view to explore the introduction of AGI in sport and consider specifically what could happen when the first AGI football manager is introduced. Our thought exercise indicates that an AGI football manager may transform football, perhaps even beyond recognition. For example, an AGI football manager would be capable of synthesising every recorded match and training session, player performance profile and health record, every book, blog, magazine piece, and peer- reviewed article on football, available on the internet. This would enable it to devise playing tactics and training methods never conceived and would have a solution to every tactical challenge it faces. Whilst the benefits are tantalising and point to significant performance enhancements, we also identified various risks. If the AGI inexorably pursues its goal of winning football matches, it may care little about player health and well-being, and may employ tactics that leave football monotonous and uninteresting, unintentionally destroying the game itself. Further, should there be one club only employing an AGI manager, the competitive advantage would be extreme and not in the spirit of the game. It is critical that work is undertaken now to ensure that advanced AI and eventually AGI render positive effects in the sporting arena, and that unintended consequences of their introduction are controlled. Now is the time to discuss who is in control of regulating these game-changing innovations in sport.

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CO153| Unpacking a football team – profile and contribution of the players that allow outplaying more opponents in 2022 UEFA Champions League (UCL) season

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In team sports context is everything. Players actions and decision making are based upon complex interactions and complex metrics that provide context to players behaviour (player action and decision making) and reflect their environment hence should be regarded as such. In recent years there has been a consensus about the awareness of providing contextualized and meaningful variables that are keen on delivering high context value. Yet, despite the awareness for such analysis most staff teams and clubs continue to overlook this trend and focus on classic KPIs that provide little to zero context in players actions and team behaviour. Measuring the number of opponents that are outplayed by a pass (NOOs)[1] with some contextualization will provide meaningful information, thus elevating the chance for team success, disrupting movements and key actions. All passes performed by the same team in 2022 UCL matches (2751 passes in 8 matches against 4 different opponents) were manually analysed counting outplaying opponents[1]. The inter-observer reliability was confirmed with Cronbach's alpha = 0.981. The average of the number of opponents that were surpassed was divided using the TwoStep Clusters Analysis with Log- likelihood as distance measure. Results showed three poor clusters: Cluster #1: x=-0.47±1.1 (x= average number of opponents outplayed ± standard deviation); Cluster #2: x=1.06±2.3; Cluster #3: x=1.38±2.3. As a reference maximum individual result, it was observed that a player was able to successfully receive 14 passes that outplayed an average of 3.63 opponents. Despite considerable inter-player variability, it is possible to develop a performance profile regarding the opportunity that each player gives to his team to make penetrating passes. This methodology provides an opportunity to support decision-making regarding tactical behaviours, considering the different contexts.

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CO154| Applying Machine learning algorithms to study Tactical behavior in Football

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Introduction

As suggested by other authors, it is reasonable to hypothesized that some characteristics of the tactical behavior in team sports are printed in the spatial organization of the players in the field. Thus, not surprisingly, spatial metrics derived from positional data have been considered to this end. These metrics have been, for example, applied to compare the spatial organization of teams in different phases of the game (attack vs defense) or in different contexts (SSG). Although these approaches have shown interesting results, it has not been study how these measures can be used to automatically identify specific moments or phases during a game. Machine learning algorithms can be used to do this, conditional on the right choice of variables to feed these methods and optimize this classification. In this study we applied and measure the accuracy of different machine learning algorithms to classify different phases of an amateur indoor SSG, using variables associated with the spatial organization of the players in the field.

Methods

We considered 4 amateur indoor SSG trials (GK+4v4+GK) played in a 33m×18m field during 10 minutes each. The trials were recorded on video and the trajectories of all players were collected (3.74 ± 0.45 Hz per transmitter/player). Experienced observers have classified sequences into the categories: attack, defense, transition and ball dispute. Positional data was used to compute the following spatial metrics: distance between centroids, bounding rectangle areas, convex-hull areas and Voronoi areas. A 200 time 10-folds cross validation approach was adopted to find the mean (± SD) accuracy of each spatial metrics (solely and combined) in classifying sequences' categories, using four different machine learning classification algorithms (LDA, QDA, MDA and k-NN).

Results and Conclusion

Having achieved a mean accuracy of 99%, it was possible to identify the combination of variables that most effectively capture the broad characteristics of the players' spatial organization during the game and to conclude that this methodology may be applied in different classification contexts to automatically identify specific game moments.

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CO105| Technical and spatio-temporal factors influence playing sequences in professional women's soccer

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Women's soccer is growing in professionalism, but women's specific research has not kept up. Very few studies have investigated tactical performance or playing sequences in elite level women's soccer. The aim of this study was to analyse both technical, spatial, and temporal aspects of playing sequences in matches , in order to understand their association with success. Playing sequences extracted from all matches played in the American National Women's Football League (NWSL) 2016-2018 seasons, were used for analysis (n = 94 339). Variables that represent the spatio-temporal and technical characteristics of playing sequences were constructed. Sequences were classified as having a positive, neutral and negative outcome at the end of the sequence based on possession loss (negative); retaining possession but a pause in play occurs (neutral); and a shot on goal, assist or penalty box entry (positive). Sequence outcome (i.e. success) was modelled using multinominal regression and decision tree models based on their spatio-temporal and/or technical characteristics. Distance to goal was modelled with the same variables using linear regression. Finally, a random sample of playing sequences (n = 5000) were analysed for the existence of recurring playing patterns, using k-means cluster analysis. It was found that distance to goal (within 30m) and the end angle to goal (<60 degrees) are the most important predictors of a successful outcome of the playing sequence. Other than variables that indicate field locations, crosses, misses, throw ins, path length and the number of ball transfers were the best indicators of distance to goal. Finally, three playing patterns were detected. One with short sequences on the defending half, one with sequences of long duration and path length, and one with short sequences close to goal. The latter had the highest rate of successful sequence outcomes. The results imply that to be successful in elite women's soccer, teams should aim to get close to the goal, directly in front of it and avoid dispossessions.

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CO117| Measurement of energy expenditure by doubly labeled water in female professional soccer players

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Female soccer players on an elite level run the risk of imbalances between energy expenditure (EE) and energy intake (EI) in connection with seasonal and match play demands. With limited research existing, more information about EE, EI and associated training and match intensity is required. This cross-sectional study examined EE and EI, over a 14-day in-season period on professional female-soccer players in the highest elite division in Norway.

The data collection runs between October 2021 – May 2022, which have been completed by one of three teams (n=17). Daily EE is quantified using the doubly labeled water method and EI is assessed using a validated diet recall method. Match and training intensity is measured with a global positioning system estimating distance meters/min, total distance, EE, max speed and intensity distribution. The alpha level was set to < .02 to account for familywise error.

The physiological activity data showed a significantly higher level on match vs training days (p's .05). Carbohydrate intake was significantly higher on match (4.4 ± 2 g/kg) compared to rest days (3.1 ± 1 g/kg; $p < .02$) but not training days (4.4 ± 2 g/kg; $p = .06$). Daily protein and fat intake did not significantly differ between training, match, and rest days, with weighted mean intake of (1.4 ± 0.4 g/kg; $p = .59$ and 1.1 ± 0.4 g/kg; $p = .43$) respectively.

These findings indicate that female professional soccer players display modest levels of EE, as well as notable underreporting of EI. Nevertheless, carbohydrate intake should be increased to comply with in- season recommendations. Fat and protein intake was in line with recommendations. Further, female soccer players do not display overall nutritional periodization although carbohydrate intake was significantly elevate

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CO119| Is match related physical performance in women's football position or player specific?

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Introduction

Studies in men's football have shown that male players adapt their physical performance when switching playing positions [1,2]. Whether the same pattern emerges in women´s football is not known.

Methods

Data from 102 official matches of 2020 and 2021 of the Norwegian Toppserien were analysed. We further split the data into two parts, with one part containing players having played in at least two different positions in four full matches (2+2). Players not fulfilling this criterion were used to estimate normative data. For each dataset, linear mixed modelling was carried out to estimate differences in total distance, high-speed distance (>16-20 km/h), sprint distance (>20 km/h, acceleration distance (>2.26 ms-2), and deceleration distance (> -2.26 ms-2) between central defenders, wide defenders, central midfielders, wide midfielders, and forwards. The positional differences for the players having played in two different positions was then then examined in relation to the normative data using Pearson's product moment correlation.

Results

Large to very large correlations (r = 0.63–0.88, r2 = 40–94%) were found between the positional difference in physical performance of the players and the associated positional difference in the normative data.

Conclusion

A change in playing position has a strong influence on the physical match performance in women´s football.

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CO140| Braiding the Beautiful Game: Characterizing Team Movement Patterns in Elite Football

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Introduction: The analysis of movement patterns in football typically considers only entire team movement, such as centroid analysis, or individual player trajectories. As such, how individual players interact via their movement trajectories to generate coordinated movements across the team requires investigation. The aim of this study was to model team movement using algebraic braids to analyze both tactical and physical performance, at the group and individual levels.

Methodology: Female university football players (n=17) were monitored during five competitive matches at an international tournament using combined 10-Hz global positioning system (GPS) and Heart Rate recordings (Polar Team Pro System, Polar Electro Oy, Finland). Player trajectories were considered as strands in space-time, and were braided by the overlapping movement of players, thereby representing group movement as an algebraic braid. Recurring movement patterns were identified using braid groups (BG) and analyzed by field location. Additionally, movement pattern complexity was computed by braid entropy (BE) and correlated with physical metrics using Pearson correlation coefficients.

Results and Discussion: Disparities in BE between defensive and attacking players increased with time ($r = 0.34$, $p < 0.05$), as BE values were higher in the second half of the match ($p < 0.05$). Significant differences were observed in BG occurrences ($p < 0.05$) across the left, right and central channels in the attacking third of the pitch. Furthermore, braid patterns correlated with key physical metrics of distance covered ($r = 0.83$, $p < 0.05$), high intensity running ($r = 0.74$, $p < 0.05$) and sprinting ($r = 0.91$, $p < 0.05$).

Conclusions: The analysis of braid entropy and braid groups allows for the characterization of movement patterns employed by a team during different phases of play and at different field locations. The overall increase in entropy over time may indicate the effect of fatigue on team movement coordination between offensive and defensive units. The analysis of braid interactions between players can uncover coherence in team structure and tactics. Practitioners in football can use this information in implementing tactical and physical training protocols. Relationships between match events, physical performance, and team movement dynamics in football should be further examined.

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CO153| The effect of neuromuscular training on body composition in female soccer players

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INTRODUCTION: Neuromuscular training (NT) is amongst the most frequently used strategies to reduce injury risk [1] and improve performance in female soccer players [2]. Despite the effects of these training protocols on performance, it is not well stablished to date their effect in body composition in this population. PURPOSE: To evaluate the effects of a NT program on body composition in female soccer players.

METHODS: 40 female soccer players from Spanish team (age: 23.9±4.2 years; height: 164.3±5.5 cm; body mass (BM): 60.4±5.5 kg) were assigned to an experimental (EG; n = 18) or a control group (CG; n = 22). Participants in the EG received NT program (12 weeks, 3 times per week, 25 min per session). The NT program included lower limb strength, agility, stability, dynamic mobility and core exercises. The players were tested on the following variables: BM, height and six skinfolds (abdominal, supraspinale, subscapular, triceps, front thigh and medial calf). Paired t-test was conducted to detect significant differences between the pre and post-tests in both groups.

RESULTS: EG made significantly greater improvement than CG did on BM (GE pre 61.6±4.43kg vs post 61.2±4.38kg. $p<0.01$; GC pre 59.4±6.22kg vs post 59.4±6.21kg), six skinfold sum (GE pre 65.1±11.6mm vs post 61.7±11.4mm. $p<0.00$; GC pre 71.2±17.1mm vs post 71.6±16.9mm) and percent body fat (GE pre 15.4 ±2.68% vs post 14.7±2.67%. $p<0.00$; GC pre 17.1±3.58% vs post 17.2±3.53%).

CONCLUSIONS: Twelve weeks NT could improve BM, six skinfold sum and percent body fat in female soccer players. The results indicate that NT can be useful to coaches, especially in competition season where less time is available to training.

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CO191| Warm-up strategies of elite female soccer players: practitioners' perspectives

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Warm-up activity is routinely performed prior to soccer match-play, with the aim of holistically preparing players and reducing risk of injury. Research in male soccer has highlighted disparities between the available evidence base and the strategies adopted by practitioners working with professional teams. To date this has not been considered in female soccer and therefore the aim of this study was to identify warm- up strategies and the associated underpinning scientific reasonings currently employed in elite women's soccer.

Physical performance practitioners from the English Women's Super League (WSL) and Championship participated in this study during the 2021/22 season. Twenty-four physical performance practitioners (WSL: n = 12; Championship: n = 12) were asked to complete an online questionnaire comprising 22 questions in the form of rank order, categorical and free text design. The survey was completed by 20 respondents, representing an 83% completion rate.

Most practitioners (70%) stated that players completed 13 ± 7 min of preparatory activities prior to commencing the pitch-based warm-up. The duration of the pitch-based warm-up was 34 ± 6 min (range: 25 -48 min) with 90% of practitioners administering a warm-up >30 min. Of the practitioners surveyed, 33% stated that on occasion they altered the duration and/or intensity of the warm-up for reasons including environmental conditions, long travel time or in response to player monitoring data. Warm-up activity was generally designed and delivered by physical performance staff and technical coaches, with medical practitioners contributing to the design in 25% of cases. Respondents reported the warm-up concluded 13 ± 2 min prior to match kick-off. Re-warm-up activity was completed prior to the start of both the first and second half by 85% of practitioners, but a lack of time and space in away team dressing rooms were stated as significant barriers to the delivery of a re-warm-up strategy.

The findings describe the current warm-up strategies implemented in elite female soccer and highlight similarities both within the current sample and those previously identified in male soccer. The impact of alternative approaches to warm-up activities, which better reflect the contemporary evidence base, are yet to be considered in female soccer.

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CO097| Multiple Players Tracking in Virtual Reality: influence of soccer specific trajectories and relationship with gaze activity

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The perceptual-cognitive ability to track multiple moving objects and its contribution to team sports performance has traditionally been studied in the laboratory under non-sports specific conditions. It is thus questionable whether the measured visual tracking performance (Ehmann & al., 2021) and the underlying gaze activity (Harris & al., 2020) reflected the actual ability of team sports players to track teammates and opponents on a real field. Using a Virtual Reality-based visual tracking task, the ability of participants to track multiple moving virtual players as they would do on a soccer field was observed to pursue two objectives. i) See the influence of different scenario types (soccer-specific trajectories versus pseudo- random trajectories) on the visual tracking performance of soccer (n=15) compared to non-soccer players (n=16). ii) Observe the influence of spatial features of the simulated situations on gaze activity between soccer players and non-soccer players. i) The linear mixed model regression revealed a significant main effect of the group but no interaction effect between group and the type of trajectories, suggesting that the visual tracking ability of soccer players did not benefit from their specific knowledge when they faced scenarios with real game trajectories. ii) Virtual players' spatial dispersion and crowding affected the participants' gaze activity and their visual tracking performance. Furthermore, the gaze activity of soccer players differed in some aspects from the gaze activity of non-soccer players. Assumptions are formulated as to the implication of these results in the difference in visual tracking performance between soccer players and non-soccer players. Overall, using soccer-specific trajectories might not be enough to replicate the representativeness of the field conditions in the study of visual tracking performance. Multitasking constraints should be considered along with motor-cognitive dual-tasks in future research to develop the representativeness of visual exploration conditions.

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CO178| Nature Environments can Enhance Skill and Performance in Football

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Throughout the years, footballers have delighted fans with their skill, competence, and mastery of the game. Many virtuous players have developed their skill by playing with improvised goals, ball and shoes, playing in makeshift grounds with irregular surfaces limited by undefined pitch lines, and playing under variable rules adapted to ever-changing, unexpected events by playing street soccer (environmental and task constraints). Furthermore, the makeshift grounds where street soccer is played may include trees, roots, bushes, and other natural features which are often harnessed to design the playing field (e.g. the tree is a goal post). We recently conducted a meta-analysis that may contribute to the explanation of the benefits of such interaction with nature (Brito et al., 2022). The results showed that during nature-based exercise, perceived exertion and stress are lower ($d = 0.52$ and $d = 0.36$, respectively), while mood, energy, and attention are higher than when doing the same activity indoors ($d = 0.51$, $d = 0.42$ and $d = 0.68$, respectively). These benefits then contribute to better task performance in nature in comparison to indoors ($d = 0.32$). We explained these results from an ecological dynamics perspective, which we discuss in the present communication in the context of soccer. We argue that training settings with nature features may enhance perceptual and motor variability around task goal achievement. Therefore, instead of players becoming automatic or adapted to practice task constraints, they become cognitively embedded and adaptive to deal with changing task constraints, as it happens in matches, towards task goal achievement. Coaches may explore the features from nature in practice design.

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CO194| Football, beyond the field of vision

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The sports world has its own language to show its practice spaces, positioning on the court and rehearsed plays. Existing representations, for example, on a soccer field (large area, midfield, corner, etc.) support the logic of its execution. Thus, much of what is learned about sports is based on the visual aspect of the location of these spaces, elements and people in the sports space. This research carried out a study on the use of tactile drawings of sports spaces, positioning and plays of Field Football / Futsal, in sports training for people with visual impairments. And, tactile drawings of the sports areas, types of positioning and soccer/futsal plays were built on the computer using the free software Inkscape®. In making the drawings, well-differentiated textures were used to emphasize different parts of the spaces (lines and areas) associated with positioning and rehearsed moves, which facilitated tactile exploration by the visually impaired. The print was made on microcapsulated paper (swell paper) size A3, Zy-tex2® maraca, containing visual inscriptions (for sighted people) and in Braille (for people who only read Braille), where, first, the design was printed on the microcapsulated paper in a laser printer and then the paper was subjected to heating in a thermal fuser (heating machine), brand Teca Fuser® and with the heating, only the black parts on the paper "puff", turning into relief with a uniform height. The use of tactile drawings facilitated the understanding of visually impaired people in soccer/futsal sports spaces, better relating to their positioning in these spaces and the performance of rehearsed plays, thus becoming an important tool for their sports training.

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CO205| Football scenes unseen consciously but seen unconsciously: Decision-making capability is predicted by unconscious perceptual information pick-up

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Accurate decision-making under severe time constraints is vital in football, but what characterises excellent decision-makers from others? And can we identify the skilled decision-makers of the future? Dual-process theory predicts that decision making is driven by both explicit and implicit processes, yet the specific role of implicit perceptual processing for decision making remains largely unclear. Here we show a strong association between decision making and implicit perceptual skill in skilled footballers. In Experiment 1, thirty skilled football players performed a football decision-making test and a backward-masking task to assess the association between decision-making performance and implicit perceptual skill, that is, the ability to rapidly identify an unmarked player in a football scene despite not being consciously aware of that information. In Experiment 2, participants performed a subliminal priming task to assess the influence of unconscious prime information on decision making. Results revealed a striking association between the decision-making capability of football players and their ability to implicitly identify an unmarked player, despite reporting no conscious perception of picking-up any information (Experiment 1). Furthermore, better decision-makers were strongly influenced by both implicit and explicit prime information for decision- making, with better decision makers being those who more deeply process the pattern information presented to them about where an unmarked player was in the scene (Experiment 2). These results suggest that superior decision-makers have developed not only football-specific explicit but also football- specific implicit perceptual skill to facilitate rapid decision-making under severe time constraints. In particular, skilled decision-makers are better able to very rapidly pick-up the position of unmarked players - despite not being consciously aware of their ability to do so - and use that information to facilitate their decision making. The results have important implications for our understanding of skilled decision-making in football, and may offer promise as a means of identifying skilled decision-makers in football.

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CO176| VAR incidents affect negative sentiment of fans of the English Premier League on Twitter

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With the IFAB rating the performed live trials as a success, the Video Assistant Referee (hereinafter VAR) was permanently introduced in 2018. Like the scientific community, the IFAB focused its evaluation on the technical procedure and the VAR's impact on decision accuracy. The impact on important stakeholders, in our case fans, was neglected, which represents a common shortcoming of evaluative research regarding technological officiating aids. Therefore, the aim of this study was to investigate the impact of the VAR on the sentiment of fans during matches of the English Premier League.

To do so, we developed two automated text classifiers to analyze the content of 643,251 tweets from 129 games of this league. The tree-based classifiers were trained with an adapted variation of a gradient boosting approach to rate a tweet's sentiment and to identify if a tweet is related to the VAR. As for each tweet the time-stamp was extracted as well, we could not just compare the average sentiment of tweets related to the VAR to other tweets, but also track how VAR incidents impacted the average sentiment over time.

We found that 9.1% of all tweets during the observed matches were related to the VAR and that those tweets showed a significantly lower sentiment level (-0.64 vs. 0.08; $t = 45.5$, $p < .001$). Looking on the sentiment over time during the investigated matches, we could show that there is on average a stable pattern of neutral sentiment. Contrary to this, as soon as there is a VAR incident, there is a significant drop of the average sentiment of 0.26 ($t = 10.7$, $p < .001$) that persists for twenty minutes.

Overall, these results provide evidence that the VAR leads to predominately negative sentiment expressions by fans tweeting about matches of the English Premier League. We identified loss aversion and general dissatisfaction with the VAR as possible contributors to this effect. To conclude, our study underlines the importance of evaluating the impact of the introduction of technological officiating aids on stakeholders' sentiment.

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CO176| Effect of Video-Based Training on Soccer Referees' Decision Making: A Meta-Analysis

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Background: Referees' contributions to soccer are undeniably important: they enforce the game's laws and penalize those who break the rules. Any mistake in their decisions could impact the match result, which is why referees are expected to make the most accurate decisions. During the last decade, an innovative training method, video-based training, has been developed and utilized to improve soccer referees' decisions. Several studies demonstrated that the accuracy of referees' decisions could benefit from the training tool. However, the overall effectiveness of this kind of off-field training in soccer referees' decisions is still unknown. This study aimed to systematically evaluate previous research investigating the effect of video-based decision-making training in soccer referees. Methods: The meta-analysis was guided by the PRISMA statement. A search within four electronic databases (APA PsycINFO, PubMed, SPORTDiscus, and Web of Science) was performed. Peer-reviewed research was considered eligible if it met all of the following criteria: (a) the participants were all healthy soccer referees, with an average age of more than 18 years; (b) the experiment group received video-based training; (c) the control group did not attend this kind of training; (d) the outcome was the accuracy of decision-making task; (e) study design was limited to the randomized controlled trial. A random-effects model was performed to pool Hedge's g with 95% confidence intervals. Results: Overall, four studies with 105 participants were found to meet the inclusion criteria. Results demonstrated the large-sized improvement of the video-based training on soccer referees' decision making ($g = 1.236$, 95% CI [0.355, 2.116], $p = .006$). Conclusion: The study illustrates that video-based perceptual-cognitive training is an effective method to improve the decision-making accuracy of soccer referees. Although the reported large positive effect of the video-based training may be influenced by the small-study effects and low power of small sample sizes, the promising tool can be used as a complementing training for referees when off the field.

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CO236| Virtual Reality (VR) as a training method for football referees

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Physical and cognitive training is essential in sports, not only for the athletes involved but also for the officials enforcing the laws of the game. Whereas simulated game-situations are inextricably linked to the practice activities of athletes, the opportunity for referees is far more limited. In particular, a realistic game simulation would require at least 22 players. As a result, football referees are often forced to do video training, though there are considerable doubts about how representative such training might be of the real on-field situation. Therefore we have explored the opportunity to use Virtual Reality (VR) as a training tool for football referees. Sub-elite referees (N=10) who were participants in the talent trajectory of the Royal Dutch Football Association participated in an experiment whereby they “officiated” 11-versus-11 match situations in three different conditions: (1) on-field (in-situ match), (2) VR and (3) video. We examined their decision-making behaviour, as well as their eye-movements (visual search behaviour), head movements and ratings of enjoyment and representativeness. The results reveal behaviour while adjudicating VR matches to be more like it is for on-field matches than it is for video footage of matches. The results provide some support for the use of virtual reality as a training tool for referees. Furthermore, the findings and feedback from referees highlight both the potential and limitations of VR as a potential training tool for football referees.

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CO150| Effects of small-sided games on physical abilities in youth soccer players of Club Deportivo Ferroválvulas

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Objectives: to determine the effects of small-sided-games (SSG) on maximal oxygen uptake, repeat sprint ability and agility after 18 training sessions compared to a control group in soccer players of Ferroválvulas Club.

Methods: the participants were the players of the first category A of the Ferroválvulas club where 12 players per group were needed. The experimental group received an intervention based on SSG from the formats two vs two to six vs six with a duration between 20 minutes and 40 minutes per unit, during nine weeks of intervention; while the control group performed high intensity interval training. Maximal oxygen uptake was measured with a indirectal test by 20 m shuttle-runs, the repeat sprint ability was measured with the repeat sprint test and the agility with the Illinois test, in both test photocells were used.

Results: the SSG-based training were not statistically significantly on maximal oxygen uptake compared with the control group ($p > 0.05$). However, the experimental group increased their performance by 5% and the control group by 10% compared to the pretest. Additionally, an ES of 0.4 was obtained, which establishes it as a moderate magnitude of change. In the repeated sprint ability were differences statistically significantly in all variables of repeated sprints ability in the experimental group, best sprint ($p < 0.02$; IC95%: -0.18; -0.01; ES: 0.26); average time in the eight sprints ($p < 0.005$; IC95%: -0.33; -0.06; ES: 0.6); total time in the eight sprints ($p < 0.003$; IC95%: -2.17; -0.52; ES: 1.76); and in the decrement percent was tendency to the significance ($p < 0.07$; IC95%: -3.07;0.15; ES: 1) compared with a control group that performed high intensity interval training. In the agility was not statistically significantly compared with the control group ($p > 0.05$).

Conclusions: the SSG-based training compared with high intensity interval training were not found differences statistically significantly on improvements on maximal oxygen uptake and agility. However, were differences in the repeated sprints ability in the SSG-based training group.

Keywords: small-sided games; conditioned games; modified games; youth players; The oxygen uptake max.

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CO162| Cardiac parasympathetic reactivation after small-sided soccer games and repeated sprints in untrained healthy adolescents

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Introduction. Recently, recreational soccer is becoming a popular alternative for those seeking to improve their physical and metabolic fitness (Krustrup et al. 2010). Currently, the comparison of acute parasympathetic reactivation responses to small-sided soccer games (SSG) and repeated sprints training (RST) in untrained adolescents has yet to be evaluated. The purpose of this study was to compare the acute parasympathetic reactivation after SSG and RST sessions.

Methods. Eight post-pubertal untrained adolescents (age 15.8 ± 0.6 years, body mass 59.1 ± 3.7 kg, height 1.7 ± 0.1 m) performed a RST, SSG and a control session in a counterbalanced order. Heart rate variability (HRV) indices in time and frequency domain, heart rate recovery and rating of perceived exertion (RPE) were evaluated.

Results. RPE was significantly lower after SSGs compared with RST ($P = 0.02$, ES = 1.1). There was a significant decrease in mean R-R intervals after RST (difference: -19.6%, $P < 0.01$, ES = 1.7) and after SSG (-19.2%, $P < 0.01$, ES = 2.3). A significant decrease was also noted in SDNN after RST (-26.6%, $P = 0.02$, ES = 1.8) and SSG (-37.8%, $P = 0.01$, ES = 1.1). For RMSSD, a significant decrease was observed only after SSG (48%, $P = 0.01$, ES = 1.3). No significant change in all HRV indices after the control condition. Conclusion. SSG and RST elicited high and similar heart rates responses. A low parasympathetic reactivation during early recovery was noted after both RST and SSG. These results were important especially for clinician looking to prescribe repeated sprint or small-sided game for sedentary subjects.

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CO168| Effects of modifying the number of targets on the individual offensive behavior during small-sided games in youth soccer players

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Recent studies observed that changing the type of finishing in small sided soccer games can modulate the information that players use to explore possibilities for action over the game (Travassos et al., 2014; Praça et al., 2021).

The aim of this study was to explore the effects of modifying the number of targets on the individual offensive behavior and performance during SSGs in youth soccer players.

A total of 20 youth elite players (age: 13.86± 0.62 years) performed a 5v5 + 1 floater (excluding goalkeepers) under two different formats (finishing at one regular goal and goalkeeper (RG) versus finishing at three mini-goals without goalkeeper (3MG). The sample comprised 1056 individual possessions for which six technical tactical indicators were evaluated by means of observational methodology.

Descriptive and comparative analyses revealed that 3MG games created a tactical context where players of all playing positions received the ball more frequently in advanced field zones, under less defensive pressure, and performed fewer dribbles than during the RG games. Also, regression logistic analyses showed that players had lower odds of performing passes to progress versus to possess (OR= 0.577; 95% CI: 0.427-0.779; $p<0.05$), as well as registered higher odds to achieve a positive outcome in their actions (OR=2.143; 95% CI: 1.488-3.086; $p<0.05$) during the 3MG format.

This study shows how modifying the number of targets can constrain the individual behaviors and technical- tactical performance during SSGs in youth soccer players.

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CO179| Soccer players' tactical performance in small-sided games according to positional role

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To develop players' tactical performance from each positional role in training session, coaches design some small sided-games (SSG) with game scenarios similar in competitive settings (1). The aim of study was to compare players' tactical performance in SSG between positional roles. We evaluated 54 male Colombian academy players (Me= 16; IQR=3 years), divided in three categories of positional role: Defenders (n=18), Midfielders (n=18), Forwards (n=18), who compete at regional level from 3 soccer clubs. We used the System of Tactical Assessment in Soccer – FUT-SAT (2) to assess players' tactical performance in small- sided games in an area of 36 meters length by 27 wide during 4 minutes. The coaching staff selected the teams according to players 'positional role (defender, midfielder, forward). All teams had the same arrangement "goalkeeper +3 vs. 3+ goalkeeper" (GK+3 vs. 3+GK) and each one played one game totalling nine games. In data analysis, we used descriptive analysis (mean and standard deviation) for tactical performance of core tactical principles. To identify the differences between players' tactical performance according to positional roles we used Anova one-way, Kruskall-Walis and Mann-Whitney. The level of significance was set $p<0.05$. Only in core tactical principle defensive coverage, midfielders displayed significantly higher values than defenders ($p=0.025$; $z = -1.891$; $U = 104.5$). According to our results, players from each positional role displayed similar performance in core tactical principles. Although they were divided according to positional role, they did not have specific function and were not organised into a tactical system. The only difference found could be explained for the characteristics of midfielders in moving to center of play at the correct moment regardless of arrangement. The experimental approach was not able to demonstrate significance difference on most tactical performance of core tactical principles between players from different positional roles.

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CO146| Body composition and physical fitness differences between elite and non-elite football players

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Worldwide, sports agents and coaches have paid attention to players' body composition and fitness assessment by its close relationship to game performance. This study aimed to compare professional male football players' body composition and physical fitness performance between elites and non-elites. The sample was composed by 22 elite (age: 25.9 ± 4.3 years, height: 181.4 ± 6.4 cm, body mass: 78.1 ± 6.9 kg) and 18 non-elite (age: 24.4 ± 2.7years, height: 177.9 ± 6.6cm, body mass: 76.0 ± 8.1 kg) football players. The InBody 770 (InBodyUSA, Cerritos, CA) was used to measure the body mass, body fat percentage (BF

%), fat-free mass, and total body water. The physical fitness tests included static strength (handgrip), lower- body explosive strength (countermovement jump - CMJ, and squat jump – SJ), velocity (5, 10, and 35 m), agility (t-test), and aerobic capacity (yo-yo intermittent recovery test). The independent samples t-test was conducted to assess differences between groups, and Pearson's correlations were used to investigate the relationships between body composition and physical fitness. Non-significant differences were seen between elites and non-elites in body composition measures. Nonetheless, elite players presented significant better scores in the handgrip ($t = 3.767$, $p \leq 0.01$, $d = 1.30$), lower-body strength tests (CMJ: $t = 5.487$, $p \leq 0.01$, $d = 1.78$; SJ: $t = 4.525$, $p \leq 0.01$, $d = 3.24$), and overall running speed performances. Body mass was related to better performances in handgrip ($r = 0.52$, $p \leq 0.01$), but with lower performances running speed at 10 m ($r = 0.42$, $p \leq 0.01$) and 35 m ($r = 0.37$, $p \leq 0.05$). BF% was negatively correlated to lower-body strength tests but positively correlated with 35 m linear sprint. This study underlines that the main discriminators between elite and non-elite football players were muscular strength and running speed. Both capacities represent crucial parts of the game, directly contributing to the success of tactical-technical skills. This study supports that football players, particularly non-elite, should undergo strength and running speed training to approach the physical characteristics of the elite.

Keywords: elite, body fat, fat-free mass, speed, strength

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CO208| High-performance athletes and sports injuries: a longitudinal study in a professional soccer team

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Professional soccer is characterized by its physical demands, making the exposure of players to high injury risks a growing problem. It is crucial to study the factors that are associated with the occurrence of injuries to optimize team performances. The objectives of this study were: (a) to determine the prevalence of muscular-skeletal injuries (MSI) in a professional soccer team over a season; (2) to identify predictors that may indicate MSI, and (3) to analyze differences in body composition and strength between injured and non-injured players. The sample was composed of 31 males soccer professionals who were followed throughout the 2020/2021 sports season of the 1st Portuguese Soccer League. The InBody 770 (InBodyUSA, Cerritos, CA) was used to measure the body mass, body fat percentage (BF%), fat-free mass, and total body water (TBW). Lower-body explosive strength (countermovement jump - CMJ, and squat jump

SJ) was assessed by Optojump Next. All the injuries throughout the season were registered, and 2 groups were built according to the injury status (i.e., injured and non-injured).

The prevalence of MSI was 29% across the season. Logistic regression identified CMJ as the strongest predictor of reporting a skeletal injury (OR=1.4; p= .031; (95%CI 1.03-1.83). In BF% [Wilks' Lambda =.42, F (7, 23) = 4.61, p = .002, r = .58] and TBW [Wilks' Lambda = .54, F (7, 23) = 2.80, p = .029, r = .46] there was a substantial main effect for the assessments performed and the injury status, suggesting that the way BF% and TBW range throughout the season is different between injured and no-injured players. Concerning CMJ, there was a significant substantial main effect for the assessments conducted throughout the season, suggesting that there was a change in CMJ across the season in both, injured and non-injured players.

Lower-body explosive strength, BF%, and TBW are important variables that should be monitored regularly throughout the season because gives important information to predict MSI.

Keywords: Sports injuries, Professional Soccer, Counter Movement Jump, Body Fat.

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CO216| Marítimo Training Lab: A Research Laboratory for Innovation and Performance in Football

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Professional soccer players are the greatest asset of the soccer business since commercial transaction is one of the main sources of income for clubs. However, soccer players' business transactions can be heavily affected by physical injuries.

Marítimo Training LAB (MTL) is a research laboratory focused on the assessment and monitoring of indicators that directly impact soccer players' performance. Specifically, the main objectives of this laboratory are: (1) to monitor the physiological response to training and competition load to early detect unbalanced patterns that substantially increased the risk of injury; (2) to investigate and develop technological solutions for post-injury rehabilitation, making the process more dynamic and motivating; and (3) to investigate the factors related to the physiological response and tactical-technical behaviours in specific training exercises. The main MTL roles are to perform the assessments throughout the season (i.e., physical fitness, external and internal training load), provide selected/individualized information, develop research on training exercises, develop virtual reality (VR) rehabilitation scenarios, and promote training courses and workshops.

In the assessment and monitoring of the physiological response in training and competition, several measures are taken daily (Locomotor intensity – GPS; Perceived exertion rating and wellness – scales), weekly (Body composition - Body 770; Adduction and abduction strength- Smart Groin Trainer; CMJ and SJ - Opto jump; Infrared thermography) and at beginning/middle/end of the season (Neuromuscular testing using advanced dynamometer technology; Metabolic testing - K5; Balance - Biodex Balance System, Speed-running - Witty Photoelectric Cells).

In the post-injury rehabilitation area, it has been validated 5 standard muscular skeletal exercises using VR (Weight transfer - balance; Military step-endurance, Side lunges-strength, Progressive step marching - endurance, and Tandem walk-balance). These exercises will be used as complementary situations in the rehab process.

In the soccer training exercises research, it has been studied the relationship between different small-sided games and official matches on players' locomotor intensity to validate training situational constraints with impact on the physiological response and tactical-technical performance.

MTL works as an independent assistant structure of the coaching team and the clinical department that provides individual information to optimize professional football players' readiness for competition.

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CO222| The influence of numerical variability in small-sided games on youth football Goalkeepers' tactical-technical behavior

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The goalkeeper's (GK's) role is essential in football during the defensive process, but also it is increasing in the offense. The behaviors required to perform are increasingly challenging and require a greater demand and better preparation at all levels. The GK's training is mostly concentrated on limited parameters, on responses to the performance of their isolated function, such as specific type of movements and technical requirements.

Empirically, the specific requirements of the GK position indicate that the training tends to be largely dedicated to the technical component and predictable technical work, usually organized in groups (3–4 elements), in small and specifically spaces, separately from the other players, except for finishing workout exercises and small-sided games (SSG's).

With SSG's, GK's could deal with a constant repetition of tactical-technical actions without repeating them. By exposing them to certain task conditions, SSG's will make them develop their awareness of specific behaviors, unlike the predominant analytical situations to train skills in isolation.

This study aimed to investigate changes in the tactical-technical behavior of football GK's across 5 SSG's formats with temporary numerical variability. The sample involved 4 male under-17 GK's from the same team, aged 16.1±0.52 years. Three sessions were held on 3 different days. On each day, the 10-minute SSG exercise was repeated twice. The numerical ratio of players changed every 2 minutes without interrupting the practice. The exercise always started with a situation of 3vs.3+GK, going randomly through 4vs.3+GK, 5vs.3+GK, 3vs.4+GK, and 3vs.5+GK.

This study confirms changes in the tactical-technical behaviors of the GK's across temporary numerical variability in SSG's. In the defensive phase, the formats in equality and numerical superiority induced a decrease in defensive actions as compared with formats in numerical inferiority. In the offensive phase, the format in numerical equality exhibited a higher number of offensive tasks when compared with both formats in superiority. This information can help coaches who don't have an element in the staff destined for the exclusive training of GKs, so that they can adapt their exercises to integrate them in the general training.

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CO139| How the COVID-19 Pandemic has Changed the Game of Soccer

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This study explores the influence of corona-specific training and playing conditions - especially empty stadiums - on match performance, contact behavior and home advantage in the Bundesliga (BL) and Bundesliga 2 (BL2). We define contact in this context as a distance between players closer than 2 meters, which is in line with the recommendation of most national health authorities to minimize the risk of coronavirus infection (MacIntyre & Wang 2020). We analyzed the 2017/18, 2018/19 and 2019/20 seasons and compared matches in rounds 26-34 before shutdown with “ghost” matches after restart. Results show increased running activity for high intensity distance: (+6.1%) and total distance covered (+4.3%). In BL2 in particular there were also changes in tactical aspects of the game (time in last third: -6.3%, pressure on pass receiver: -8.6%, success of attacking duels: -7.9%, share of long passes completed: +15.6%, outplayed opponents per pass: -14.7%). Contact time to other players (<2 m distance) was 15:35 mins per mach. After restart, contact was reduced, especially when the ball was not in the last third (-11.2%). Away wins increased by +44.2% in BL and the home-away difference in yellow cards changed in favor of the away team (+31.2%) in BL2. We conclude that empty stadiums influenced the game of soccer. We found no indications that physical fitness had significantly diminished during ghost games. In contrast, increased running activity despite warmer conditions may suggest that players had advantages due to less fatigue. Conditions during the COVID-19 pandemic have meant players reducing contacts to teammates and opponents during game interruptions as well as when the ball was in play and it was not necessary to prevent dangerous situations. This might be based on tactical demands or conscious or unconscious self-protection. The absence of crowds has erased home advantage in the Bundesliga, reduced Home Advantage in Bundesliga 2 regarding performance level and increased the neutrality of refereeing decisions when giving yellow cards. These findings help competition owners, coaches and players to counteract unwanted developments and to improve training and competition.

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CO171| Evaluation of Off-the-Ball Actions in Soccer

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Whereas there is no shortage of statistics that have been proposed and reported for invasion sports, almost all of the widely reported statistics are based on actions involving the ball.
In this paper, we develop automatic methods that analyze the activities of players that are ``off-the-ball'' in football (soccer).
Specifically, a metric is introduced which measures defensive anticipation in soccer. When a defender moves in the optimal direction quickly, the defender denies the offensive team both time and space, and this contributes to winning. The essence of the approach is that we determine where a player ought to move, and argue that if they move quickly, this is better than moving slowly.
The analysis is facilitated through the availability of player tracking data which records the position of players at frequent and regular intervals throughout matches.
We have used data corresponding to 237 matches from the 2019 season of the Chinese Super League. After data management, we have roughly 30 million instances of spatio-temporal frames.
The methodological approach is based on the adaptation of machine learning techniques.
Although the investigation concerns soccer, the general approach is applicable to all invasion sports where player tracking data are available.
A metric is calculated for players, where it is demonstrated that the metric is reliable, and correlates with related measures of aggression. The metric also conforms to common sense where it is expected and observed that there is a reduction in defensive anticipation as players tire.

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CO193| Will he play like we thought? Effect of player role variability on adaptation and sustainability of football performance

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The aim of this study was to examine if individual variability in player roles performed by football players was associated with their future performance either in a new team, or in the same team. Taking an ecological dynamics perspective, three features of player role variability were examined – player role flexibility (range of player roles performed), reactivity (degree to which player roles performed are adapted to opposition behaviour), and proactivity (degree to which player roles performed are unwavering, independent of opposition behaviour). Player roles were derived through a Gaussian-Mixture Model (GMM) clustering analysis, using match action data from 4067 players in the top five leagues in Europe from the 2014/15 to 2019/20 season. Similarly, opposition behaviour (i.e., team playing styles) were also derived using GMM clustering. The coefficient of unalikeability was used to determine player role flexibility, reactivity and proactivity of each individual player. Players were examined in three season blocks, whereby players were analyzed if they played at least 1080 minutes in each of the first two seasons. Player role variability was then computed for the first two seasons. Next, depending on whether the player transferred to a new team or remained in the same team in the third season, adaptability or sustainability of productivity was computed for the third season. The relationship between player role variability with adaptability and sustainability was assessed using a stepwise backward linear regression. For players that transferred teams, greater player role reactivity was associated with greater adaptability of offensive productivity, and greater player role flexibility was associated with greater adaptability of defensive productivity. For players that did not transfer teams, greater player role flexibility and proactivity was associated with greater sustainability of defensive productivity. Our results indicate that these three aspects of variability in player roles may be a viable indicator of future performance that football scouts and coaches should consider examining to facilitate decision-making processes in recruitment. Particularly, the enhanced productivity in defense and offense associated with greater player role flexibility propose that players encouraged (or called upon) to perform a variety of roles may facilitate development and future performance.

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CO210| Illustrating a Landscape of Shooting Opportunities in Soccer

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The purpose of the present study was to create a model, which illustrates a landscape of opportunities for shooting at goal in a competitive soccer match. For that purpose, a single soccer match was used, analyzing a sample of 75 attacking phases (n= 75) occurring in the last 30 meters of the field. Supported by players' relative positioning using bi-dimensional x and y coordinates of each player and the ball recorded at 25 fps, the potential shooting trajectories were modeled. These data were then used to create heatmaps that illustrated the shooting opportunities that were available in the first and second half in different field areas, accordingly with the level of threat. Moreover, a novelty of this study was the estimation of the time that these shooting opportunities were available. The obtained heatmaps revealed that the shooting opportunities did not display a homogenous distribution over the field. But, most of the shooting opportunities were created far from the goal, which highlights the defensive squad's commitment to keep a low level of threat close to their own goal. Additionally, it was possible to identify significant differences between the frequency and the position of the shooting opportunities available for each team. This customizable model has shown a sensibility for shooting opportunities and can be used in real-time video analysis for individual and collective performance analysis.

Keywords: soccer, shooting, opportunity, heatmaps; time and space, co-positioning; attacking patterns

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CO242| In-match penalty kick analysis of the German Bundesliga

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Penalty kicks are decisive moments in elite football. This study aimed i) to investigate the relationship between observable behaviors with the penalty taker strategy; and ii) identify the prevalence of the penalty taker strategy in the successful penalty kicks. The dataset consists of 221 penalty kicks from the German Bundesliga (2019 to 2021). A video-based performance analysis of in-match penalty kicks was performed using the OSPAF (Pinheiro et al., 2021). The videos were recorded from TV broadcasters and analyzed post-event. The procedures were in strict accordance with the Declaration of Helsinki. A descriptive analysis of the data was performed, presenting results in mean and standard deviation. The Shapiro Wilk test was performed to verify data normality. Logistic regression (enter method) analyses were performed. Kappa levels of the OSPAF were 0.90 and 0.86 - intra and inter reliability. The p level considered $p < .001$. All data were analyzed using JASP software (Team, 2020; JASP Version 0.14). The following behavior: run up speed fast, run up fluency continuous, run up approach frontal, number of steps more than 5, kicking technique instep kick, perceived ball speed as powerful shot, non-kicking foot orientation different from the final direction of the ball, gaze behavior at the ball, no deception, were related to the goalkeeper independent strategy ($\chi 2$ (157) = 189.502, 86.5% correct classifications, $p < .001$). The model correctly classified 96.1% of cases. In successful penalty kicks (i.e., goal) the independent goalkeeper strategy was more adopted (59.9%). The differentiation between penalty kick patterns provides scientific and practical insights as it enables researchers to identify patterns in professional leagues, and football practitioners to have an in-depth qualitative analysis, so they can inform coaching, training, and scouting. Future studies can use OSPAF applying technological methods to analyze its variables, such as ball pattern analysis (e.g., innovative ball tracking system) and body biomechanical pattern analysis with larger samples (e.g. OpenPose).

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CO111| Discriminative power of an inertial sensor Bram Bastiaansen setup to quantify biomechanical load between national and regional male soccer players

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Background: Monitoring training load could improve player performance. However, current monitoring systems do not monitor lower extremity biomechanical load. In this explorative study, we assess the discriminative validity of a new inertial sensor setup (Bastiaansen et al., 2020) to quantify biomechanical load between national and regional soccer players during soccer specific field tests.

Methods: National (n = 11) and regional (n = 15) soccer players performed countermovement jumps, instep soccer kicks, and 30m linear sprints. Participants had inertial sensors attached to the lower extremities. Cumulative joint angular accelerations were used to quantify lower extremity biomechanical load indicators Hip and Knee Load. Between group differences in jump, kick, and sprint performance were compared using MANOVA tests with Cohen's D effect sizes. Furthermore, Hip and Knee Load were compared between the two groups.

Results: National players outperformed regional players on knee extension kicking velocity (1766 ± 262 deg/s vs. 1576 ± 200 deg/s, ES = 0.83, p = 0.046), and sprint time (4.3 ± 0.2s vs. 4.5 ± 0.2s, ES = 1.03, p = 0.03), but not significantly on counter movement jump height (0.41 ± 0.04m vs. 0.38 ± 0.04 m, ES = 0.94, p=0.06). Hip Load did not significantly differ between groups, but differences for Knee Load were observed during kicking (10.8 ± 1.8 A.U. vs. 8.75 ± 2.4 A.U., ES= 0.97, p=0.02) and sprinting (90.0 ± 20.5 A.U. vs.
74.1 ± 14.1 A.U., ES= 0.93, p=0.03).

Conclusion: Although between group performance differences were found, discriminative validity of Hip and Knee Load could not be fully confirmed. The performance differences might indicate that national players achieved better performance using an alternative movement technique (Bartlett, Wheat, & Robins, 2007).

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CO243| Biomechanical analysis of hamstring injury history on biomechanical deficits during a reactive functional test in professional soccer players

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Hamstring strain injuries are the most common non-contact injuries in football with a complex aetiology, previous injuries being considered as one of the strongest predictors of reinjury [1,2]. Although the specific mechanism remains unclear and the evidence largely observational and correlational, an array of factors such as decreased muscle strength, decreased flexibility, fatigue and posture are commonly cited in the aetiology of HSI [3].

This study aimed to estimate hip extensor muscle stretching capacity as a function of previous hamstring injury (HSI) during a bespoke test permitting unrestricted full-body movement, evaluated using a musculoskeletal modelling approach.

Twenty-seven professional footballers (with and without HSI) performed a reactive functional test involving a knee and plantar extension with a flexed trunk. Joint kinematics served as input data of a musculoskeletal model [4], and joint angles and hip extensor muscle lengths were calculated.

Small reductions in pelvis, hip and knee joints range of motion were observed in players with HSI, associated with a lesser ability to actively stretch muscles of the posterior muscle chain. Additionally, a shorter time-to-peak length was found in players with HSI during the functional test. Persistent biomechanical deficits were observed in athletes with HSI even after undergoing rehabilitation and returning to a full competition and training schedule.

These findings contribute to assist medical practitioners, sport physicians and physiotherapists to design efficient programs for diagnosis and management of HSI injury.

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CO247| Exploration of reactive and preplanned components of agility in elite soccer players: a new biomechanical assessment approach

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Introduction

Soccer is a sport where players must deal with uncertain and rapidly changing environments. Agility to quick changes in opponent, teammates, and ball movements is thus a key factor of performance. This component of agility, called reactive as opposed to preplanned, is usually assessed through change-of- direction-speed tests, but none of them provide standardized conditions allowing to compare both components. In this study we introduce a new evaluation method that provides insight into the relationship between these two components.

Material and methods

The test consisted in sprinting toward 1 of 4 targets located at each corner of a 6m square, starting by a jump on the spot from the square center. The target to be reached was displayed on a front screen according to 2 conditions : either before the jump, allowing the player to plan his action, or 0.2s after takeoff, forcing him to react to an uncertain situation. Three repetitions per target location and condition were randomly performed and recorded with an optoelectronic motion capture system, allowing to compute the player center of gravity trajectory during the full trial.

46 elite soccer players from the French Ligue 1 Championship (men, 76±9kg) were divided into 3 groups according to their time to target in the reactive condition. The analysis consisted in comparing the degradation of their performances between the reactive and the pre-planned condition according to the group to which they were assigned.

Results and discussion

The time to reach target was significantly increased from 0.810±0.131s to 0.955±0.143s (+18%) for group #1 (most reactive), from 0.807±0.089s to 1.070±0.127s (+33%) for #2, and from 0.895±0.123s to 1.220

±0.174s (+36%) for #3 (least reactive). Although all players were negatively impacted by the reactive condition, greater degradation was observed in the two less reactive groups, especially for backward turns, for which a significant increase in curvilinear distance was also observed. In addition, the degradation appears strongly from the initiation of the movement then fades after the 1st meter, suggesting that differences in motor strategies should be studied further.

Finally, in practice, once identified as limiting in a player, reactive agility could be trained

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CO101| Exploring perceptions of loneliness amongst the migrant professional footballers' community

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Loneliness is a growing phenomenon, and a complex, multidimensional and subjective feeling; its prevalence has been seen across a wide range of populations (Tzouvara et al., 2015). This study sought to investigate whether professional footballers who have migrated for sports reasons experience loneliness and to what extent. A qualitative approach was employed to gather in-depth findings. Five players from the small island of Malta who migrated within Europe itself and another five players who moved from Asia and South America to Europe (Malta) participated in this study through semi-structured interviews. The participants' average age was 26.7 years. The findings from this study clearly indicate that during their migratory transition, the participants experienced loneliness. This was mainly attributed to being away from one's family and friends. The participants perceived loneliness and associated it with a high level of unpleasant feelings, such as dissatisfaction, unhappiness, boredom, and depression. This study highlighted that preparation for the migratory transition may have been lacking among the participants, and acculturation, language and climate challenges were very much encountered by the participants similar to that reported by Muscat et al., (2020). The findings indicate that as a consequence of loneliness, the participants could be affected mentally and physically and underperformed as a result. However, participants referred to using mental skills and the use of technological platforms as means for communicating and coping with loneliness. The findings indicate that the urge for physical contact with their family and friends remained absolute. Further research on support structures present in clubs and associations worldwide and how clubs can specifically integrate their migrant athletes within the community are recommended.

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CO160| But where did they go?

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Football is one of the most popular sports in the world, whether in terms of show practices or sports practices themselves. It is therefore not surprising that those exercised by professional footballers are of interest to scientific disciplines relating, for example, to physiology or even biomechanics or sociology. One figure even illustrates a clear enthusiasm in this regard: the number of scientific publications devoted to football would have been multiplied by 55 over the past 20 years. However, this growth is not necessarily accompanied by taking into account these scientific productions, in particular with regard to workers working, for example, in the staffs of professional teams. Why is this so? Our research deals with this enigma by qualifying it and trying to explain it. Let's take an example to clarify our point: studies by Opar et al. (2012) and Bahr et al. (2005) thus show that despite verified and justified evidence of the use of the Nordic hamstring exercise (as a means of preventing hamstrings), only 16.7% of the clubs questioned use it totally or partially.

Based on several observations of this type, we decided to question the circulation of scientific knowledge devoted to football from scientific journals to field practitioners working in French clubs. The objective of our work is in a certain way to improve the use of scientific knowledge by the technical staff of professional football clubs (coaches, physical trainers, etc.), to possibly produce popularization capable of not modifying the results. original scientists. To do this, we first developed a base of scientific knowledge stabilized from numerous articles published in variously recognized journals. We then intend to carry out field surveys in clubs, with technicians (questionnaires in training centers in France, ethnographic observations in clubs, conducting semi-structured and comprehensive interviews with coaches or physical trainers, therefore).

This communication will allow us to come back to our first results allowing us to identify the factors which facilitate, and limit or even prevent, the circulation and the putting into practice of some scientific knowledge that is nevertheless useful (for physical preparation, injury prevention, etc.) .

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CO224| The Features and Mission of the Chinese Football Association Youth Training Outline: A Brief Introduction

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The Chinese Football Association (CFA) has overhauled youth player development due to the Chinese national football team's repeated lack of success in previous years. There is no doubt that greater emphasis should be put on youth development. This study aimed to analyze and interpret the philosophy of the newly released CFA Youth Training Outline. First, the outline clarifies the vision and goals of Chinese youth development (i.e., player development vision, coach development vision, Chinese national team's game concept, and Chinese soccer youth development goals). Second, the outline illustrates the philosophy of Chinese soccer youth development, which contains four parts: player development philosophy (i.e., "Five- Ring Model," which emphasizes the comprehensive development of players' technical, tactical, physical, mental, and social skills), competition philosophy, training philosophy, and instructional philosophy. Third, the outline emphasizes the role of the external environment in the development of athletes and calls on all sectors of society to create a favorable environment for the development of players. Fourth, the outline divides four stages of young player development (i.e., Enlightenment Stage U5, Basic Stage U6-U12, Development Stage U13-U16, and Transition Stage of Improvement U17-U21). And on that basis, the outline emphasizes players' physical and psychological development characteristics at different stages and the abilities they should have. Furthermore, it also provides constructive suggestions on the coach's guidance focus, the athletes' academic learning, and the matches' format. In addition, the outline emphasizes the skills that young players should focus on improving, including 1v1, movement without the ball, first touch, and pressing. Altogether, the outline sets clear goals for Chinese football and conveys scientific training and guiding ideas to youth training practitioners.

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CO226| Equality is everyone's job: An exploration of the lived experiences of British South Asian people working in managerial, leadership and governance positions across football in England Scotland

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The football industry is worth billions of pounds to the UK economy. It is also has a multi-ethnic media audience and playing roster. This popularity however has not translated naturally into proportional representation of Black British and/ or British South Asian people in most vestiges of English football. Scholars, charities and national governing bodies across Europe, through research and consultation, have suggested that if better representation is to be achieved, the football governance workforce needs to better reflect the communities participating in and across the game. Despite this recognition very little attention and empirical investigation has been attributed to managerial, administration and governance cultures in English football. Thus, there is limited documentation or research on how existing social norms and cultural codes of football workplaces are accessed and experienced by marginalized groups. The research project extends previous work by: (a) documenting the lived experience of BSA people working at managerial, administration and governance levels of English football; (b) identifying 'best practice' at managerial, administration and governance levels of the game that has led to career progression for BA people and/or opportunities for career progression; (c) highlighting the constraints and barriers affecting the employment and progression of BA people in English football; and (D) informing the inclusion and diversity agenda across all levels of English football, specifically policies and strategies on diversifying the workforce and organizational culture. In so doing, the research highlights the importance of embedding equality, diversity and inclusion targets across all levels of the football industry to improve both football and commercial performance in the pro game.

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CO188| Relationships between in-game athletic performances and fat and carbohydrates oxidation rates in young elite soccer players

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Soccer is characterized by combining high-intensity activities, such as sprinting, accelerating, jumping, and changing direction, with low-intensity phases (stopping, walking). Optimizing energy substrates for skeletal muscle needs in each activity phase seems to be crucial to obtain maximal physical performance. Objective The aim of the study was to characterize the relationship between in-game athletic performance indicators and metabolic variables determined during incremental and submaximal tests in elite soccer players. Thirty young elite soccer players from Stade Rennais FC (18.8±0.7 years) completed an incremental ergocyle test to determine maximal power output (Pmax), VO2max and ventilatory thresholds. At least 48 hours later, they performed a submaximal exercise in a morning fasted state including 10 min at VT1 and 10 min at 90% of VT2. Rates of fat and carbohydrates oxidation were determined using indirect calorimetry and stoichiometric equations. Metabolic efficiency (ME) was also calculated as the ratio between mechanical power produced to energy that the body deploys to meet this mechanical demand. In-game athletic performances were assessed during 18 season games using GPS technology. Total distance (Dist), distance travelled over 15km/h (D15), 20km/h (D20), 25km/h (D25), number of accelerations and decelerations (AccDec) and number of sprints (S) were calculated. Pearson correlation test was used to identify correlations. We report significant positive linear relationships between total distance and SV1 ($r=0.66$, $R^2=0.43$, $p=0.014$), SV2 ($r=0.61$, $R^2=0.38$, $p=0.026$) and PMA (0.57, $R^2=0.32$, $p=0.044$). Significant negative linear relationships are also observed between D25 and VT2CHO ($r = -0.57$, $R^2=0.32$, $p = 0.043$), S and VT2CHO ($r = -0.62$, $R^2=0.39$, $p = 0.024$), D25 and ME ($r = -0.64$, $R^2=0.40$, $p = 0.02$) and S and ME ($r = -0.64$, $R^2=0.41$, $p = 0.02$). The total distance covered during a soccer game depends both on maximal power output and fundamental endurance. The negative linear relationships we found between in-game very high intensity activities and carbohydrate oxidation rate suggest that a glycolytic profile would limit the capacity to repeat high intensity activities during a soccer game. All these findings highlight the potential interest to monitor metabolic profile to optimize physical performance and nutrition strategies.

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CO189| Nutritional support in elite German football clubs

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Recently, the valuable role of nutrition has been recognized by UEFA. German football clubs, organized in a national league system and with the Bundesliga on top are one of the most competitive leagues on the European level, where clubs regularly participate in 1-2 matches per week. The role of nutrition and the provision of nutritional support in professional male and female German football leagues is currently unknown. Therefore, teams of Bundesliga (n=16), 2. Bundesliga (n=11), 3. Liga (n=18) and Frauen Bundesliga (n=7) have been investigated by an online survey. In the first part, trainers, medical and support staff members (n=52, 76%) of elite German football clubs' first teams and their academies have been asked about the existing nutritional support and to rank the influence and importance of nutrition support for their clubs. The second part of the survey (n=16 out of the 52 clubs) investigated the frequency, and the way nutrition support is provided. The survey found that nutrition support is provided on both individual and group level mostly for the first male team (92%, n=48) and academy teams (90%, n=47), mainly by nutritionists or dietitians (25%, n=13) and athletic trainers (23%, n=12). The influence of nutrition on football performance in clubs is considered to be "high" (8,1±1,6 of 10,0), the importance of nutrition consulting "very important" (4,1±0,9 of 5,0), and introduction of the nutrition services to the players is considered to have a "beneficial" effect on their match performance (4,1±0,7 of 5,0). Most of the clubs (56%) provide sports foods and supplements daily. However, clubs are facing challenges when implementing nutritional support as professional players are often led by trends (e.g., gluten-free) and uneducated persons around them. They are quite resistant to advice, and the results of dietary interventions are not directly measurable. The support is limited by time and financial resources, and clubs are currently seeking more football-specific nutrition guidelines and materials. Continuous implementation of nutrition support results in noticeable benefits for players' health and performance, especially in younger teams who "grew up" with the topic. More support should be provided by experienced professionals, especially for female teams.

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CO135| A comparative study on the intensity of walking and recreational football for older adults

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Walking football and recreational football are growing in popularity across older adults and are known to elicit health benefits (Krustrup and Krustrup, 2018). Despite being popular in older adult populations, walking football may not elicit the intensities required to improve fitness (Arnold, Bruce-Low, and Summat, 2015). Recreational football is played at higher intensities and is promoted as an effective activity to improve fitness in older adult (Madsen, Krustrup and Larsen, 2021). To understand the effectiveness of walking and recreational football, the activity profile of the players should be compared. Therefore, this study examined training intensity for older adult football, comparing walking and recreational football in two formats: 4v4 and 7v7 (77.5m2 per player). A healthy group of 18 males and 2 females (age 67.2 ± 5.8 years, height 1.70m ± 0.1, mass 83.1 kg ± 17.6) participated. Each session consisted of a standardised warm-up followed by 6 games of 3 minutes, with 2 minutes rest in-between each game. Volume and intensity were measured using 10Hz GPS devices (Playertek). After each game, rating of perceived exertion (RPE) was assessed. During 9 sessions across 12 weeks, recordings of total distance, sprint distance, work to rest ratio, PlayerLoad and RPE were taken during walking and recreational games. Repeated measures ANOVAS (2 (WF vs RF) X 2 (4v4 vs 7v7) found no statistical differences in any of the GPS variables during either format or team size. RPE was higher in recreational compared with walking football (14 vs. 13 AU, P >0.05). However, there were no differences in RPE for team size. This suggests that older adults perceive recreational football as harder, while objective data suggest otherwise. As the two formats elicit a similar training intensity, recreational and walking football can be considered effective for older adults to play.

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CO169| Effects of football training on health-related physical fitness measures in male adolescents

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The objectives of this study were to (1) compare the health-related physical fitness of untrained adolescent boys to adolescent soccer players and (2) evaluate the health-related effects of a short-period of soccer training in the untrained group.

Methods: Forty-one adolescent boys (untrained, n = 24: age = 15.9 ± 0.6 years; trained, n = 17: age = 15.7 ± 0.7 years) were recruited. For Purpose 1, the players (n = 17) and the untrained (n = 24) boys were tested for speed, jumping power, postural balance, flexibility, and aerobic capacity. After baseline testing, Purposes 2 was addressed by randomly assigning the untrained boys to either a soccer-training group (small-sided games, 2 sessions per week for 8 weeks) or to a control group, followed by identical retesting. Results: At baseline, physical fitness was higher ($p < 0.001$) in trained players than in untrained for aerobic fitness, sprinting, jumping power, and postural balance. Small-sided games using 6 v 6 or 4 v 4 elicited similar heart rate (HR) (mean: ~ 85% peak heart rate, HRpeak), rate of perceived exertion, and enjoyment responses. Over 8 weeks, the between-group analysis revealed that soccer training had a large beneficial effect on postural balance (45%) when compared with control group with unclear effects on other fitness parameters.

Conclusion: Adolescent soccer players had markedly higher physical fitness compared with untrained adolescents. Small-sided soccer games practiced by untrained adolescents elicited high exercise intensity. While 8 weeks of twice-weekly soccer training sessions induced significant improvement in postural balance, the short duration of the study was not sufficient to result in between-group differences in sprint and jump performance or aerobic fitness.

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CO186| Who is in control of anti-doping in soccer in Australia?

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Background. Despite advances in doping detection methods, stringent testing protocols, deterrents and severe punishments for detected athletes, doping remains a persistent issue throughout sport and football. A recent WADA review of progress into combating doping concluded that doping in sport is complex and influenced by wider human, environmental, and political factors. Given this complexity, a 'complex systems approach' to understanding the systemic issues is required. Whilst this approach is gaining recognition in sports research and practice, it has not yet been applied to the problem of doping in sport. The aim of this study was to apply one complex systems analysis approach, the Systems Theoretical Accident Model and Processes (STAMP) method, to understand the systemic controls and feedback mechanisms of anti-doping in football in Australia.

Method. Applying the STAMP methods involves the development of a control structure model which identifies, across hierarchical levels, the actors (people and organisations) who share the responsibility for performance of the system, the control mechanisms that are used to constrain system behaviour, and the feedback mechanisms which inform actors as to the effectiveness of controls. A STAMP control structure model was developed by the research team and validated by 11 subject matter experts with experience in anti-doping in Australia and internationally.

Results. The developed STAMP model demonstrates the complexity of the anti-doping system in football in Australia. The model identified 108 actors, 104 controls, and 69 feedback mechanisms. Actors ranged from an international context (e.g. WADA), Australian parliament and legislature (e.g. Cabinet Ministers), Government agencies and industry associations (e.g. Sport Integrity Australia), Operational delivery and management (e.g. pharmacies), Local management and supervision (e.g. coaches), the Operating environment (e.g. teammates), through to the players and doping control process. Multiple risks were identified where controls have potential to fail, and where feedback is inadequate.

Conclusions. Analysis of the model identified areas where current controls could be strengthened, where there is a need for new controls and feedback mechanisms to better prevent doping in football. The study demonstrates the utility of the STAMP method for identifying potential risks that require attention to support the anti-doping system within football.

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CO229| Objective and subjective tests for fatigue monitoring: What is the relation?

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Understanding fatigue is still a challenge, as it can encompass different bio-psycho-social processes. Thus, fatigue can be evaluated objectively and subjectively. However, the present literature is still scarce to comprehend how they are related. So, this study's objective was to know the relations between objective (Squat Jump (SJ) and Countermovement Jump (CMJ)), and the subjective (Rating of Perceived Exertion (RPE) and Hooper Index (HI)) fatigue variables. The objective metrics (contact time, flight time, height, power, pace, reactive strength index (RSI) and elasticity index) were measured on match day-2 and the subjective metrics on match day-2 (HI) and day-3 (RPE). Frequencies, means and standard deviations were gathered. Additionally, Spearman's correlation and simple/multiple linear regressions were performed. After the inclusion and exclusion criteria, it could be retrieved 360 data entries, from 32 athletes, with an overall age of 25.86 (±3.15), a BMI of 23.8 (±1.46) and 8.28 (±3.13) years of senior experience. The majority were midfielders (n=13), followed by defenders (n=10), forwards (n=6) and goalkeepers (n=3). Overall, they showed a HI of 13.90 (±2.27) and a RPE of 4.86 (±1.73). Additionally, the CMJ metrics were: contact time 4.06 (±1.42); flight time 0.55 (±0.04); height 37.75 (±4.55); power 15.34 (±1.34); pace 0.26 (±0.16); and RSI 0.10 (±0.0). The SJ metrics were: contact time 5.12 (±1.62); flight time 0.53 (±0.03); height 35.77 (±4.22); power 14.37 (±1.14); pace 0.20 (±0.11); and RSI 0.07 (±0.02). It was found statically significant ($p<0.05$) negligible correlations (0.113 – 0.172) between the objective metrics contact time, flight time, heigh, pace, power and elasticity index, and the evaluated subjective metrics. Moreover, two weak statistically significant models ($p<0.05$) between the dependent objective variables (contact time, height, and elasticity index), and the HI ($R2=3.7\%$) and RPE ($R2=1.6\%$) were found. Additionally, nine weak statistically significant models ($p<0.05$) between the dependent subjective variables (HI and RPE) and contact time ($R2=1.8 – 2.7\%$), flight time ($R2=1.1 – 1.9\%$), heigh ($R2=1.2 – 2.3\%$), power ($R2=1.4\%$), pace ($R2=1.2 – 2.1\%$) and elasticity index ($R2=1.6\%$) were found. In conclusion, although there were found relations between the objective and subjective variables, they were too weak to predispose significant changes.

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CO235| Soccer variables and metrics for success

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Success in sports will always be the focus of any team. The process to fulfill it must be judicious. Although this theme has already been studied be several authors, in the Portuguese context these are still scarce. The study´s objective was to analyze the profile of the lateral defenders of a Portuguese Football Federation league 3 team, in the 2021/2022 season. The sample consisted of 5 senior athletes with the following characteristics: 28.2±0.75 years of age; BMI 22.62±1.13 kg/m2; 16±4.69 years of experience. The instrument used was the GPS Gpexe LT (Version 2.2.8), obtaining the metrics of total distance, high intensity distance, sprint distance, number of accelerations and decelerations. These metrics were analyzed in 24 games in the variables goal/no goal, 1st half/2nd half, home/away, fast attack/positional attack/counter-attack. Frequencies, means and standard deviations were analyzed for the descriptive analysis. The metrics statistical analysis was also carried out using the non-parametric Kruskal-Wallis and U of Mann-Whitney tests, assuming a $p<0.05$. The results obtained in the 53 shots where superior within the positional attack (n=31), with only 6 resulting in a goal. The means of all actions analyzed were 71.5 ±22.5m total distance, 9.1±10.8m distance in high intensity, 5.1±12.3m distance in sprint, 0.36±0.5 acceleration and 0.6±0.7 deceleration. Individualizing the attack methods, the counterattack seems to be the game attacking method where the greatest high intensity distances (14.2±14.4m) and sprint distances (9.8±14.1m) are present. The 1st half showed superior total distances at all intensities (75.3±22.6m total, 10.8±11.9m high intensity, and 8.6±16.3m sprint). Regarding the shots attempts, the distance metrics that did not achieved a goal (72.9±22.7m total, 9.5±11.3m high intensity, and 5.6±13.1m sprint) are all higher than those that ended in a goal. However, regarding the play site, statistically significant differences were found in the accelerations ($p=0.025$) and decelerations ($p=0.024$), with home games having an average of 0.52±0.6 accelerations and 0.79±0.7 decelerations. According to the results of this sample, it can be concluded that the most significant physical metrics found are accelerations/decelerations, with the most important variable being the play site, for achieving success in soccer.

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CO239| Coach-athlete relationship in international national teams competitions

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The coach-athlete relationship has been investigated in various sports (Jowett, 2017). However, little is known about the characteristics of the coach-athlete relationship in international national team competitions. In this sense, the purpose of the present study was to explore the competencies and strategies of the coach-athlete relationship in international competitions. National coaches of several individual and team sports participated in this study. A semi-structured interview was conducted, and data analysis was performed using thematic analysis (Braun, Clarke, & Weate, 2016) in order to extract the main competencies and strategies in the coach-athlete relationship from the coach point of view. The results referred to some classic characteristics of the coach-athlete relationship, such as proximity and commitment. Specifically, the need to manage different personalities for relationship adjustment with athletes was highlighted, and also how the achievement of athletes' expectations affects the quality of commitment and maintenance of the quality of the coach-athlete relationship. Following the coach-athlete relationship, we perceive the emergence of variables associated with participation in the respective competitions, such as the motivational aspects, the management of expectations and the interpersonal relationship of the athletes in group context. All these relational aspects seem to happen aligned with the competitive strategies, such as the planning and the structuring of the training. These results seem to align the performance of the national coaches in the relationship with their athletes in international competitions, also extending knowledge to research on this topic.

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CO250| Are the Self-myofascial Release Instruments Effective on Performance and Recovery in Sports?

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Currently, the use of self-myofascial release (SMR) instruments is not uncommon in our society, especially in sports. The most common SMR instruments are foam rollers, roller massagers, and balls. These are affordable, time-efficient, simple to use, and easy to access. Regardless of the instrument used, the main objectives are to enhance performance and recovery. Nevertheless, many studies point out that there is still a lack of robust scientific evidence documenting the exact mechanisms that explain their true effects, therefore some authors affirm that the reported benefits are anecdotal in nature. Although some systematic reviews explored their benefits, adverse effects, and mechanisms, to our knowledge, there is no available umbrella review on the effectiveness of SMR instruments on performance and recovery. Therefore, this overview aims to summarize, from systematic reviews, the effectiveness of SMR instruments on performance and recovery. Following the PRISMA principles, 15 systematic reviews were found on the electronic databases according to our P (healthy active individuals) I (SMR using instruments) C (other treatment, placebo, sham, or no treatment) O (performance and recovery) S (systematic reviews) search strategy. However, after methodical analysis (R-AMSTAR), only 7 systematic reviews had sufficient quality to be included. So, based on these systematic reviews, it was found that SMR using instruments is beneficial to enhance short-term flexibility-related and recovery-related outcomes. Inconstant data was reported in muscular-related outcomes. Nevertheless, beyond pain during SMR, no major adverse effects were found. Furthermore, different effects between time, pressure, and other instruments characteristics were found. So, SMR using instruments can be a safe intervention used in sports to enhance performance and recovery from previous trainings/competitions or between matches.

Keywords: self-myofascial release instruments; performance; recover

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Poster Presentations

P001| Effectiveness of a walking football intervention on cardiorespiratory fitness in middle- aged and elderly active men

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INTRODUCTION: Walking Football (WF) has been shown to induce health benefits in untrained older men (1), but its effects on active population are unknown. Therefore, this study aimed to analyse the influence of a twice per week 3-month WF training intervention on cardiorespiratory fitness in active men aged over 50 years.

METHODS: 16 men (60.83 ± 7.52 years old) participated. Before and after the WF intervention a Bruce cardiopulmonary exercise testing (CPET) (2) with continuous gas exchange monitorization was performed. Rate of Perceived Exertion (RPE) immediately after the test was recorded (Borg CR10 Scale) and one minute Heart Rate Recovery (HRR and HRR%) noted. Blood pressure (BP) and lactate levels were measured pre-test and 1- and 5-minutes post-test. Participants' physical activity (PA) level (IPAQ - International Physical Activity Questionnaire) and sedentary behaviour (MOST - Measure of Older Adults' Sedentary Time) were recorded. Paired t-tests and Spearman's correlation were used to assess pre-post intervention differences and to compare percentage changes.

RESULTS: After the intervention systolic BP post-5' (-6.28%, p=0.013), lactate post-1' (-18.06%, p=0.013) and post-5' values (-11.03%, p=0.033) significantly decreased. A 50% increase was observed in HRR (p=0.004) and HRR% (p=0.002). Although not statistically significant, RPE was reduced by 15.48%. PA pattern changed, as participation in intense PA increased (p=0.008) and time spent on moderate intensity PA decreased (p=0.001). Sedentary time per week was also reduced by 10.32% (p=0.042). Indeed, significant correlations between percentage changes of sedentary time and test duration (r=-0.492, p=0.044), lactate post-1' (r=0.675, p=0.008) and HRR (r=-0.492, p=0.044) were found.

DISCUSSION: After 3 months of WF, cardiorespiratory fitness remained stable and exercise recovery capacity improved. These results highlight the importance of not only engaging in PA but also reducing sedentary time, since the latter was correlated with many of the observed improvements.

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P002| Respiratory performance and occlusal strength of soccer players: an approach after training and detraining during the lockdown due to coronavirus disease 2019 (COVID -19)

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Background. The aim of the study was evaluate the strength of the respiratory muscles, bite force, and occlusal force distribution of professional soccer players after training and detraining resulting from the lockdown that occurred during the coronavirus disease 2019 pandemic. Material and methods. Twelve male soccer players (age, 19-34 years) were subjected to respiratory muscle strength analysis by examining the maximal inspiratory and expiratory pressures, maximum molar bite force (right and left sides), and occlusal force distribution of the first permanent molars. Comparisons of variables after training and detraining were analyzed using the paired-sample t-test ($p < 0.05$), and the correlation between respiratory variables was measured using the Pearson test ($p < 0.05$). Results. There were no significant differences in the bite force and occlusal force distributions after training and detraining. The correlation results showed moderate positivity between the maximal inspiratory and expiratory pressures during the training period. Conclusions. The results suggest that when soccer players strengthen the inspiratory muscles, they also strengthen the expiratory muscles and that detraining does not impact the athlete's organic function, especially the respiratory muscle function and the forces of the occlusal contact of the first permanent molars.

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P003| Headgear Does Not Prevent Sport-Related Concussion: A Systematic Review and Meta- Analysis of Randomized Controlled Trials with 6311 Athletes and 173383 Exposure Hours

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Background: Sport-Related Concussion (SRC) is caused by a strong impact to the head that leads to neurological symptoms. Within the sporting community it is a widely held belief that Headgear (HG) protects against SRC leading some Australian football, soccer, and rugby clubs to mandate its use.

Objectives: The aim of this study was to evaluate the effectiveness of HG in reducing the incidence of SRC among athletes.

Methods: A systematic search for relevant studies published from 1985-2022 using the following databases: Cochrane Library, MEDLINE, AMED, PubMed, Web of Science, and PEDro was conducted. The keywords used in the search strategy were 'Headgear', 'Sport-Related Concussion', 'head injury', 'athlete', and variations of these search terms. Included studies had to be randomized controlled trials using Headgear for athletes with the primary outcome being SRC rate. There were no restrictions of age or playing level. The random-effects model by the RevMan Meta-Analysis software (version 5) was used in analysing the extracted data.

Results: The pooled results of 6311 athletes and 173383 exposure hours showed 0% SRC reduction per 1000 hours of exposure compared to the control group with an injury risk ratio [IRR] of 1.03 (95% confidence interval [CI] 0.82–1.30) P=0.79.

Conclusion: This meta-analysis demonstrates that HG does not prevent SRC among athletes and therefore the findings from this meta-analysis does not support the use of HG to prevent SRC in soccer or rugby.

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P004| The FIFA 11+ Injury Prevention Programs Reduce the Incidence of Hamstring Injury by 66% among Soccer Players: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with 2949 Players and 274032 Exposure Hours

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Background: Hamstring injury is among the most common non-contact injuries in sports. In soccer, which is the most popular sport worldwide, hamstring injuries represent between 15 and 50 % of all muscle injuries. Sports injury prevention programs have been showing promising results in reducing the risk of hamstring injury.

Objectives: The purpose of systematic review and meta-analysis was to investigate the effectiveness of the FIFA 11+ Injury Prevention Program on reducing the incidence hamstring injury among soccer players.

Methods: A systematic search for relevant studies published from 1985-2022 using the following databases: Cochrane Library, MEDLINE, AMED, PubMed, Web of Science, and PEDro was conducted. The keywords used in the search strategy were 'neuromuscular training', 'injury prevention programs', 'FIFA 11+', 'hamstring injury', 'soccer, and variations of these search terms. Included studies had to be randomized controlled trials using FIFA 11+ Injury Prevention Program for soccer players with the primary outcome being hamstring injury rate. There were no restrictions of age or playing level. The random-effects model was used in analyzing the extracted data by the RevMan Meta-Analysis software version 5.

Results: The pooled results of 2949 players and 274032 exposure hours showed 66% hamstring injury reduction per 1000 hours of exposure compared to the control group with an injury risk ratio [RR] of 0.34 (95% confidence interval [CI] 0.21–0.55) $P < 0.0001$.

Conclusions: This systematic review and meta-analysis demonstrates that the FIFA 11+ Injury Prevention Program reduces the incidence of hamstring injury by 66% among soccer players.

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P005| The FIFA 11+ Injury Prevention Program Reduces the Incidence of Lower Back Injury among Soccer Players: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with 7374 Players and 574061 Exposure Hours

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Background: The lower back injury is a common among soccer players. Sports injury prevention programs have been showing promising results in reducing the risk of lower back injury.

Objectives: The purpose of systematic review and meta-analysis was to investigate the effectiveness of the FIFA 11+ Injury Prevention Program on reducing the incidence lower back injury among soccer players.

Methods: A systematic search for relevant studies published from 1985-2022 using the following databases: Cochrane Library, MEDLINE, AMED, PubMed, Web of Science, and PEDro was conducted. The keywords used in the search strategy were 'neuromuscular training', 'injury prevention programs', 'FIFA 11+', 'lower back injury', 'soccer, and variations of these search terms. Included studies had to be randomized controlled trials using FIFA 11+ Injury Prevention Program for soccer players with the primary outcome being lower back rate. There were no restrictions of age or playing level. The random-effects model was used in analyzing the extracted data by the RevMan Meta-Analysis software version 5.

Results: The pooled results of 7374 players and 574061 exposure hours showed 63% lower back injury reduction per 1000 hours of exposure compared to the control group with an injury risk ratio [IRR] of 0.37 (95% confidence interval [CI] 0.21–0.66) P=0.0008.

Conclusions: This systematic review and meta-analysis demonstrates that the FIFA 11+ Injury Prevention Program reduces the incidence of lower back injury by 63% among soccer players.

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P006| Can we reduce injury risk during the growth spurt? An iterative sequence of prevention in male academy footballers

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The adolescent growth spurt is associated with an increased risk of injury in young athletes and to date, no studies have offered solutions to mitigate this risk. An iterative sequence of prevention was used to identify at-risk players based upon growth rate in stature, lower-limb growth rate and maturation status, using thresholds of >7.2 cm/year, >3.6 cm/year and 88% to 92.8% of predicted adult stature, respectively. During the 2019-20 season, players with two or more risk factors were included in an intervention strategy aimed at reducing the likelihood and burden of injury. The intervention included modification of training load, football- specific technical skills, balance, coordination and landing drills, and an individualised strength program.

The main finding of the intervention was that for the players with the highest risk (three risk factors) there was a significant reduction in the incidence (Odds Ratio (OR) = 0.14 (5.2 per 1,000 h → 0.8 per 1,000 h, P=0.05) and burden OR= 0.08 (216 per 1,000 h → 17 per 1,000 h, P=0.02) of injury between the 2018-19 and 2019-20 seasons. Players with zero, one or two risk factor(s) show no significant difference between season for injury incidence or injury burden. This novel study suggests that it may be possible to mitigate injury incidence and burden during the adolescent growth spurt. Other football clubs and sports could use the iterative sequence of prevention to identify areas for improvement and devise appropriate strategies. Further research is, however, required to test this strategy in other populations and more controlled settings.

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P007| Group findings of load and recovery in soccer are not generalizable to individual players

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The process of load and recovery is a key concept to optimize soccer performance and well-being. To date, studies are typically conducted at the group level, which can pose limits on applying research findings to individual athletes (Davids et al., 2003; Glazier & Mehdizadeh, 2019; Hill et al., 2020). Indeed, researchers in psychology have demonstrated that group-level statistics are often not generalizable to processes at the individual level, which is called the "ergodicity problem" (Fisher et al., 2018; Mangalam & Kelty-Stephen, 2021; Molenaar & Campbell, 2009). The aim of the present research was to investigate this ergodicity problem in the study of load and recovery in soccer. We collected internal training load (RPE*training duration) and recovery (TQR) data on a daily basis across two seasons among 82 youth male players of a professional soccer club. Next, we calculated the univariate distributions and bivariate correlations on both the group and the individual level. Group- and individual-level analysis resulted in different statistical outcomes, particularly with regard to load. Standard deviations of individuals were up to 7.63 times larger than standard deviations of the group. In addition, at either level, we observed different correlations between load and recovery. The results thus suggest that the process of load and recovery in athletes is nonergodic. Implications of these results are that recommendations for training programs of individual athletes may be suboptimal, or even erroneous, when guided by group-level outcomes. We therefore propose that researchers consider shifting their focus to the individual level when studying load and recovery in the soccer field.

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P008| Use of total cryotherapy in elite footballers: match preparation and recovery strategies

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To date, in sport, there are several post-exercise recovery strategies including: active work (es. biking, running), manual therapy (es. massage), stretching, anti-inflammatory drugs and cryotherapy.

Cryotherapy is one of the most recent systems to recover and in particular the “whole - body cryotherapy” (total body cryotherapy) is in use especially with high level athletes.

Specifically, the method consists of a short exposure (max 2 or 3 minutes) to extremely low temperatures (from -100 to -190 ° C) in cryochambers.

In addition to total cryotherapy (WBC) there is also partial cryotherapy (PBC) which consists of treatments in which at least the head is not included in the cabin / room.

The purpose of the study was to report the different strategies for using total body cryotherapy in elite athletes. The methods of use in high-level footballers (Serie A) have been described. In addition to post- training use, cryotherapy can be considered an analgesic means, for post-injury recovery and as preparation for the competition.

Body parameters were measured pre and post treatment and pre / post competition (24h) with different times and temperatures by associating them with other data such as creatine kinase (CK)

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P009| Aetiology and Recovery of Neuromuscular function from a Professional Soccer Academy Training Week

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Aim: We aimed to profile the aetiology and recovery time-course of neuromuscular function in response to a mixed-content, standard training week in professional academy soccer players. We concurrently examined physical performance, cognitive function, and perceptual measures of mood and wellness states to identify a range of simple tests applied practitioners could use in the field as surrogate measures of neuromuscular function.

Methods: Sixteen professional academy soccer players completed a strenuous training day (pitch and strength sessions). Pre-, post-, and 24, 48, and 72 h post-strenuous day, participants completed a range of neuromuscular, physical, perceptual, mood, and cognitive function tests. Maximal voluntary contraction force (MVC) and twitch responses to electrical stimulation (femoral nerve) during isometric knee-extensor contractions and at rest were measured to assess central nervous system (voluntary activation, VA) and muscle contractile (potentiated twitch force, Qtw,pot) function. Fatigue and perceptions of wellness and mood states were assessed via visual analogue and Likert scales. Cognitive function was assessed via the Stroop task. Countermovement jump, reactive strength index, and bilateral isometric adductor contraction (adductor squeeze) were assessed to profile the recovery of physical function.

Results: Strenuous training elicited decrements in MVC force post-session (−11%, P = 0.001) that remained unresolved at 72 h (−6%, P = 0.03). Voluntary activation (motor nerve stimulation) was reduced immediately post-training only (−4%, P = 0.03). No change in muscle contractile function (Qtw,pot) was observed post- training, though was reduced at 24 h (−13%, P = 0.01), and had not fully recovered 72 h after (−9%, P = 0.03).

Perceptions of wellness were impaired post-training, and recovered by 24 h (sleepiness, energy) and 48 h (fatigue, muscle soreness, readiness to train). Countermovement jump performance declined at 24 h and RSI decrements persisted at 48 h. No changes were evident in adductor squeeze, mood, or cognitive function.

Conclusion: Elite youth soccer training elicits substantial decrements in neuromuscular function, which are still present 72 h post. Though central processes contribute to post-exercise neuromuscular alterations, the magnitude and prolonged presence of impairments in contractile function indicates it is the restitution of muscular function (peripheral mechanisms) that explains recovery from strenuous training.

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P010| Biomechanical comparison of soccer players performance on natural and artificial playing surfaces

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Background: There has been controversy around of what is the best playing surface in football, since the development of the artificial surface. There is a considerable number of studies that focus on the incidence of injuries, however, there are few studies that analyze differences in performance (López & Mendoza, 2020). The aim of this study was to analyze the kinematics of jumping, sprint running and changing direction of soccer players on natural (NS) and artificial surfaces (AS). Methods: A descriptive study with a sample of six soccer players was conducted. The participants performed three drop jump tests, 10 m sprint and change of direction 5-0-5, on both playing surfaces, on randomized order. Two cameras at 240 fps were used for kinematic analysis, together with photoelectric cells, optojump and pressure insoles. Results: In the drop jump, the height of the jump, the contact time and the reactive force index were slightly better on the artificial surface (34.01 vs 31.18 p=0.301, 0,495 vs 0.47 p=0.115, 0.62 vs 0.71 p= 0.457, AS vs NS). For the change of direction test the time to fulfill the distance, the contact time of the last support and the length of the last stride at the time of change of direction were slightly lower on the natural surface (2.32 vs 2.38 p=0.406, 0.432 vs 0.458 p=0.091, 0.95 vs 0.99 p=0.505, NS vs AS). When analyzing the 10 m sprint, the time to fulfill the distance, the contact time of the supports, the stride length and the hip drop, it was verified that a slightly better performance was achieved on the artificial surface (1.63 vs 1.61 p=0.519, 0.30 vs 0.29 p=0.366, 2.35 vs 2.26 p=0.027, 7.1 vs 6.8 p 0.559, NS vs AS). Conclusion: The playing surface is a variable that has to be taken into account in the performance of the sprint, COD and jump.

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P011| Acceleration sprint running and maximal sprint pedaling technique in football players

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The sprint running performance is one of the most important factors in football. In particular, the acceleration phase, where greater force and force application technique is needed, is key for football. This is the reason why football players demand reaching at higher speed in shorter time.

Pedaling exercises are often used to assess and improve a football player's force production ability. Although pedaling technique could change the effects of pedaling training to improve sprint running performance, pedaling technique has not been paid much attention during pedaling exercises such as the timing and direction of force application.

This study aimed to clarify the relationship between acceleration performance in sprint running and pedaling technique during maximal sprint pedaling in football players.

Fifteen male football players (mean age=19.83±0.75 yrs, height=174.67±2.50 cm, weight=68.67±1.97 kg) performed 30m sprint running from static position, and 6 seconds maximal sprint pedaling on a cycle ergometer (Wattbike Pro). We assessed sprint time and thigh angular velocity during sprint running, while pedaling technique and power output of sprint pedaling. We focused on 2 steps of sprint running and 3 downstrokes of sprint pedaling.

Additionally, participants were divided in two groups based on 0-5m sprint running performance, we compared each measurements between groups.

As a result, the force production in the initial part of the downstroke and the upstroke of sprint pedaling was related to thigh angular velocity during sprint running ($r = .815$, $p < .05$).

Also, players with superior 0-5m sprint running performance had a quick switching movement of the limbs (swing leg retraction and recovery) with higher thigh angular velocities in sprint running of acceleration phase ($p < .05$). Additionally, they performed greater force production in the initial part of the downstroke and the upstroke during sprint pedaling ($p < .05$).

Furthermore, we would present as a case study the effect of pedaling exercises prior to football session during the in-season on sprint pedaling technique and sprint running performance in acceleration phase.

We would suggest for football players that pedaling exercises focusing on pedaling technique could be utilized to improve sprint running performance in acceleration phase.

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P012| The impact of video-based reflection on youth football coaches' questioning practices

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Introduction

In-training divergent questions have been encouraged to facilitate players' higher-order thinking. However, formal Coach Development Programmes (CDPs) often have limited impact on coaches' use of questioning (Stodter & Cushion, 2019). Only coach developers, facilitating reflection have increased coaches' understanding about their perceived most effective application of questioning (Raya-Castellano et al., 2021). Therefore, this mixed-method study examined the effectiveness of specific work-based CDP tasks on coaches' knowledge and adoption of question types.

Method

Two Spanish coaches (Manuel: U15; Joaquín: U14), working at a youth-elite academy, consented to participate. Manuel completed a 6-day task involving experimentation with questioning techniques during practice and between playing bouts; whereas Joaquín also engaged in 6 video-based reflective sessions guided by a coach developer. Changes in knowledge and behaviour were monitored through 4 pre- and 4 post-systematic observations and 1 pre- and 1 post-interview.

Results and discussion

Joaquín increased mean convergent questioning frequency during practice (pre: 0.75; post: 7.00), and divergent questioning in-between practices (pre: 0.25; post:10.75) or when the coach stopped (pre: 0.25; post: 2.25). Conversely, Manuel decreased convergent questioning during practice (pre: 3.75; post: 3.00), and divergent questioning in-between practices (pre: 1.75; post: 1.00) or when the coach stopped (pre: 0.25; post: 0.00). Whilst both coaches developed their knowledge about appropriate situations to utilise different question types, only Joaquín demonstrated changes in actual behaviour.

Conclusion

Results emphasise the value of video-based reflection for increasing knowledge availability and initially stimulating adoption of coach behaviour. Moreover, the study provides practical considerations underpinning the circumstances surrounding an effective application of question types during training sessions.

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P013| The technical-tactical analysis of the training process and the connection with the game (model)

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It is a general understanding that game performance is adquired due to training. Nevertheless, the data collection is fundamentally focused on the evaluation of the game, so we have much more data about the game than on its preparation. This work explored an observation system with the objective of evaluating the extent to which the tactical content occurred in the training exercise and what is its relationship with the game. Was analysed one complet microcycle (all training sessions and game) of a portuguese premier league team. In a technical meeting, the contents of each exercise were defined and later analyzed through the observation system. The number of times the expected behavior occurred in each exercise (content) was evaluated. The number of situations in which the behavior occurred well and poorly was collected, evaluating the level of effectiveness of the exercise, but also the performance of the athletes. In exercises, in which the content was the reaction to the loss of the ball, 3 reactions were coded according to the indicators established in the game model and 12 without the defined success criteria. It was possible to count the contents most and least executed in the microcycle: Finishing Zones – 37 actions / Crossing Defense – 0 actions. Moreover, the relationship between the training microcycle and the game was analyzed. Short Output, in training 16 positives and 18 negatives actions and in the game there were no positive actions and 2 negative actions were recorded; Combinations on the Wing: training 1 negative action / game 5 positive and 17 negative actions.

The data collected allowed us to analyze methodological information, namely the identity of the training exercises with the game model. 64% of the exercises had no identity, corresponding to 51% of the useful time. The competitive exercises, possession of the ball and general preparation exercises were the most performed and occupied the largest volume of training. This work was a first approach to the evaluation of the applicability of training contents, thus evaluating its effectiveness. It allowed us to explore what is effectively do in training/game and their relationship.

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P014| The importance of preparing for the defensive transition in offensive set pieces: the coaches opinion

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The evolution of the football game has led to a deepening of detail in a game preparation, and connection between moments of play is now seen as something indispensable in the dynamics of a team. As such, the connection between the offensive set pieces and the defensive transition proves to be a important question in actuall football. The objective of this work focuses on the study of the importance of preparing the defensive transition in offensive set pieces, addressing several variables that influence this preparation, from the way the team is structured positionally, to the offensive balance adopted. Through the qualitative method, and using interviews, eight professional football coaches (N=8) were interviewed, who had at least already performed functions in professional competitions in Portugal. According to the results obtained, it was verified that the game modeling has a fundamental role for the operationalization of the desired game, presenting a close connection with the way it is trained, by being the moment where it is improved. Also the set pieces were pointed out by the coaches as highly decisive for the final result of a match. Equally referenced as important, was the preparation of the defensive transition, being even considered by the coaches as a whistleblower of the quality of the teams. In the balancing strategies of the offensive set pieces, the coaches revealed as fundamental the creation of different lines of coverage. It was also highlighted the placement of players on the opponent's area and on the midfield. There were also those who highlighted the connection between the positional game of offensive organization to the positional game in the set pieces. It is concluded that given the pertinence of the work reinforced by the opinion of the coaches, the study proves to be important for a better training of the moment of offensive set pieces, as well as it may help a better modeling and systematization of the ideas of each coach for this particular moment of play.

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P015| An analysis of the effectiveness of football curriculums: A Case Study on the Australian Curriculum compared to Europe

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Football Australia produced the National Football Curriculum (NFC) in 2009 and an edited version in 2013. The document outlines a playing philosophy that all Australian players should follow (FFA, 2013). The NFC describes key technical and tactical foundations to the game that builds the coaching model and player development in Australia. While the NFC provides a structure and direction to potentially produce players for the National Team that could compete amongst the world's best (FFA, 2013), results over the past 13 years of the Australian National Team has not reflected this. The project will provide an in-depth understanding of the role that the NFC has played in youth development and talent identification (TID) and answer questions surrounding its perception amongst its stakeholders. Study One is a systematic review over two parts (A and B), which comprise of a thematic analysis between the NFC and supporting federation documents searching for congruences and contradictions in each of them. Parallel to this, a systematic review will be conducted using academic peer-reviewed journals on the development, implementation and review of educational curriculum used in schools as a comparative tool. Study Two involves a series of semi-structured interviews whereby the input of technical directors and coaches in Australia (n = 9) to understand the processes that occurred during the development of the NFC in Australia. In addition to the Australian population, technical directors and coaches from selected European clubs (n = 9) will also be interviewed in relation to curriculum development and implementation in their perspective federations to reveal any differences that contributed to their national team success. Finally, Study Three will investigate how these participants practically implement their respective curricula. A better understanding of how research informs decision-making during the developmental and review process of the curriculum will also be investigated as well as how the strategies presented in the curriculum are implemented on a practical level.

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P016| The current landscape and contribution of isolated practice in European professional and academy football: A thematic analysis of professional coaches and player interviews

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Isolated practices (IP) are defined as isolating the skill in a 'drill' format which progresses from basic to complex motor skill patterns, focusing on learning the 'correct' technique (Pill 2013). Coach education and academic research suggests that IP has no long-lasting benefit for athletes (McLean, Read et al. 2019), but it is still used in the practice of successful elite European soccer academies (Bate 2020). This study sought to understand the use and structure of IP in professional soccer academies and coaches' views on IP in skill development. A thematic analysis of media interviews of professional soccer coaches working in of elite soccer academies was carried out to do this.

Five key IP themes were identified; ball mastery activities, current use of IP, skills learned using IP, criticism of IP, IP's links to 1v1 and 2v2 games. Analysis of the data found coaches use IP in different forms with many current professional footballers having used IP in their development e.g. Cristiano Ronaldo, Harry Kane, Kevin De Bruyne. Ball mastery sessions (practicing a specific set of skills) are widely used in professional football academies and as homework for young players. There was an overwhelming opinion that IP is used to prepare players for 1v1 and 2v2 situations.

Some of the most successful players in the world are currently and have use IP to develop their skills. This may have implications for recommendations for coaches on skill development. In addition, IP in soccer may need a new definition to that of Pill (2013), to incorporate ball mastery sessions and the variation of session design, rather than 'drill-like practices'.

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P017| Testing the relationships between peak acceleration, deceleration and speed and change- of-direction deficit on the 5-0-5 test: a cross-sectional study in adult male soccer players

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Purpose: The aim of this study was to test the relationships between peak acceleration, deceleration, and speed, and change-of-direction deficit (CODD) for the 5-0-5 change of direction test. Methods: Twenty elite male soccer players (21.6 ± 2.0 years; 73.2 ± 6.1 kilograms; 174.8 ± 4.5 centimeters) voluntarily participated in this cross-sectional study. Players were assessed during a single day, between 3 p.m and 6 p.m., with 48 hours rest preceding the assessments. On a synthetic turf, players performed three trials braking on their preferred and non-preferred legs, with by 3 minutes interspaced between sets and 5 minutes between trials. The change-of-direction time was measured using a single-beamed photocells (Smartspeed; Fusion Sports, Sumner, Australia) positioned 60 cm from the floor. Polar Team Pro (Polar Electro, Kempele, Finland) devices sampling at 10 Hz housed in a specialized pocked on the players upper backs was used to record peak acceleration, deceleration, and speed. The CODD was calculated based on the difference of the 10-m COD time subtracted by the 10-m linear sprint time (acceleration phase of 5-0-5 test). The best CODD (independent of leg) was obtained for further data analysis. Pearson product- moment correlation was used to test the relationship between the best CODD and the variables of peak acceleration, deceleration and speed. Results: There were no significant correlations were found between CODD and peak accelerations (r=–0.014, [–0.193;0.166]), peak decelerations (r=–0.052, [–0.229;0.128]) or peak speed (r=0.118, [–0.063;0.291]). There were also no significant correlations for the non-preferred leg, between CODD and peak accelerations (r=0.045, [–0.212;0.295]), peak decelerations (r=–0.059, [– 0.308;0.198]), or peak speed (r=0.106, [–0.153;0.349]), or for the preferred leg (while braking) between CODD and peak accelerations (r=–0.014, [–0.266;0.241]), peak decelerations (r=–0.111, [–0.354;0.148]), and peak speed [r=0.150, [–0.109;0.388]). Conclusions: The results revealed that CODD is independent of leg preference and the kinematic measures of a 5-0-5 change of direction test. This may be useful when looking to isolate the COD ability of players, as testing on both legs appear not to be needed.

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P018| Characterization of muscular strength in soccer players according to age, competitive level, and position on the field

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Currently, physical demands in soccer have received much more attention due to the high impact on the players' performance. Although aerobic metabolism dominates the energy supply during a soccer game, high-speed intensity actions, such as jumping, accelerating/decelerating and kicking, represent the most decisive actions during match-play (Bangsbo et al., 2006).

This study aimed to characterize strength indicators in soccer players, considering differences associated to age, competitive level, and position on the field. The sample comprises 83 soccer players from one club, distributed by team A (n=22; age= 25.9±4.2 years; height= 181.91±6.3 cm; body mass= 78.12± 6.9 kg), team B (n=17; age= 22.3±1.8 years, height= 180.9±9.5 cm, body mass= 78.5±11.6 kg), team U-23 (n=19; age= 20.6±1.5 years, height= 177.94±6 cm, body mass= 72.9±9.2 kg) and a U-19 soccer team (n= 25; age= 17.8±0.7 years, height= 176.8±6.4 cm, body mass= 70.6±6 kg).

The muscular fitness measures analyzed were: (1) dynamometry (Jamar Plus+); (2) Countermovement (CMJ) and Squat-jump (SJ) (Optojump), and (3) knee extension/flexion on the isokinetic dynamometer (Biodex System 4 Pro Dynamometer).

Statistical analysis included the t-test, Friedman test, and the Wilcoxon test. All the assumptions were verified, and all calculations were performed using IBM SPSS Statistics 26.

It was found that, in knee extension/flexion, the youngest players had a higher peak torque score in comparison to the oldest in all angular speeds (ps<.005). In hand dynamometry and SJ, team A presented higher results that U-23 and U-19 (ps<.05). Regarding CMJ the highest scores seen were observed in team A (ps<.001).

Regarding the isokinetic evaluation, it was found that for all speeds, team A presented highest average power scores in comparison to U-23 and U-19 teams (ps<.05). It was also verified that the attackers had a higher score than the midfielders in the extension of the right knee at 60º/s (p<.05), only.

The periodization of strength training should be a priority, particularly in younger players, since explosive strength/power seems to be a physical performance indicator that distinguishes the highest-level players.

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P019| Analysis of the determinants of repeated sprints ability in youth soccer

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The main purposes of this study were: (1) To compare the values of repeated sprinting ability, aerobic capacity, and vertical impulsion between different age groups (U17 and U19); (2) To explain the variations of repeated sprinting ability (peak power and fatigue index) from the variables of aerobic capacity and vertical impulsion.

The participants were thirty young male soccer players (16.84±1.05 years old, 175.00±4.90 cm and 65.25

±7.45 kg), (sixteen U17 and fourteen U19 playing in the same football club). The evaluation occurred during the pre-season and included the following tests: (1) Squat jump and Countermovement jump, (2) RAST and (3) Yo-Yo intermittent recovery test level 1.

Significant differences were found between both age groups in Pmed ($p=0.008$), PP ($p=0.002$), IF ($p<0.001$), YYIR1 ($p<0.001$) and VO2max ($p<0.001$). In general, there was a moderate negative relationship between IF and YYIR1 ($r=-0.783$, $p< 0.001$) and VO2max ($r=-0.783$, $p< 0.001$), a moderate positive relationship between PP and CMJ ($r=0.550$, $p=0.002$) and a moderate positive relationship between PP and SJ ($r=0.362$, $p=0.049$). In the U17 team, there was a moderate positive relationship between Pmed and SJ ($r=0.554$, $p=0.026$), Pmed and CMJ ($r=0.595$, $p=0.015$), Pmed and YYIR1 ($r=0.552$, $p=0.027$) and Pmed and VO2max ($r=0.552$, $p=0.027$).

U19 players, on average, showed significantly higher values of power in repeated sprints, while U17 players showed significantly higher values of aerobic capacity. Furthermore, aerobic capacity is related to IF, meanwhile lower limb power is related to PP. Thus, a complementary training of both mentioned physical capacities possibly demonstrates improvements in RSA.

Keywords: lower limbs power; aerobic capacity; anaerobic power; fatigue index; young footballers

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P020| High isokinetic testing speeds are correlated with linear sprint performance

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The purpose of this study was to analyze the relationship between linear sprint performance and strength capacity in soccer players. A total of 33 Portuguese professional soccer players performed isokinetic strength tests at an angular speed of 60° s-1 and 180° s-1, and 10, 20 and 30 m sprints. Ther data were analyzed using IBM® SPSS® Statistics V.25. Pearson's correlation (r) was used to determine the relationships between variables. Concentric knee extensor peak torque at 180° s-1 was strongly correlated with 10 m ($r = -0.726$, $p = 0.011$), 20 m ($r = -0.657$, $p = 0.028$), and 30 m ($r = -0.823$, $p = 0.002$) linear sprint times and concentric knee flexion peak torque at the same angular speed was correlated with 10 m ($r = -0.712$, $p = 0.014$). No significant correlations were observed for isokinetic tests at speeds of 60° s-1 and sprint times. In conclusion, peak torque at higher velocities correlates significantly with linear sprint performance, however, this did not apply to the lower isokinetic speeds. For practitioners and coaches attempting to improve linear sprint performance, assessments of high-velocity isokinetic strength should be performed.

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P021| Asymmetry in diving technique is associated with goalkeeper specific training and body composition among youth goalkeepers

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The effect of asymmetry on physical performance has aroused growing interest, especially when we observe complex technical skills such as goalkeeping skills. The aim of this study was to examine the relationship between asymmetry in the diving technique and anthropometric, physiological and maturation characteristics. For this purpose, a sample of 29 goalkeepers from the age-categories U-13 (n=7; 11.78 ±0.52 years; 155.1±10.7 cm; 49.4±8.2 kg), U-15 (n=8; 13.95±0.80 years; 169.7±7.6 cm; 56.9±7.8 kg), U-17 (n=8; 15.90±0.70 years; 174.5±6.4 cm; 67.9±13.1 kg), and U-19 (n=6; 18.37±0.69 years; 181.2±3.5 cm; 74.9±4.8 kg) was analysed. Anthropometric characteristics and somatic maturation were also examined. The sample performed a testing battery including the assessment of acceleration, vertical jump, and horizontal jump. Asymmetries for the total sample were calculated for the diving technique using the Lateral-Shuffle Keeper Test (LS-Keeper) and the Sprint-Keeper Test (S-keeper), according to the Asymmetry Index: AI%=(((D-ND))/D)×100 and the Asymmetry Threshold: AT%=média AI%+(0.2×dp). The AI% results were, as follows: S-keeper = 1.38±3.38 (0.16 a 2.51), and LS-keeper = 0.16±1.98 (-0.54 a 0.84).The Pearson bivariate correlation showed no association between the diving technique and chronological age, age at peak height velocity, maturity offset, predicted mature height, football experience, weekly football training, goalkeeping experience, height, sitting height, body mass, and fat-free mass (weak and very weak correlations between variables). However, there was a significant relationship between the amount of specific training (r = -0.431; CI 95% = -0.739 to -0.059) and body composition (r = 582; CI 95% = 0.229 a 0.801), with LS-Keeper Test and S-Keeper Test, respectively. In addition, individual values of the asymmetry index derived from both tests allowed the calculation of asymmetry thresholds, showing higher values for the S-Keeper Test (2.05%) when compared to the LS-Keeper Test (0.54%). Thus, it seems that specific training and body composition will be important variables in reducing potential harmful asymmetries and optimizing the technical performance of goalkeepers. These indicators should be taken into account in the design of exercises to be applied in the specific training of young goalkeepers.

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P022| The Relationship Between Maximal Running Velocity and Yo-Yo Intermittent Recovery Test Level 1 in Elite Male and Female Canadian University Soccer Players

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BACKGROUND: The Yo-Yo Intermittent Recovery Test Level 1 (YYIRTL1) is a strong predictor of physical performance in soccer, with robust correlations reported between distances covered in YYIRTL1, and distances covered at high-intensity in match play, by both male and female players (Krustrup et al., 2006). Performance on the YYIRTL1 is contingent upon aerobic and anaerobic factors, including maximal anaerobic running velocity (Ueda et al., 2011). No research presently exists examining the direct relationship between maximal velocity and YYIRTL1 in soccer players. The purpose of this study was to investigate the correlation between YYIRTL1 and maximal velocity, and whether differences exist between males and females. Findings of this study may inform the implementation of velocity-based training programs, as well as player recruitment strategies.

METHODS: Forty-six Canadian university soccer players (19 females, 27 males) aged 19 ± 1.10 years, completed three 30-metre sprints, with maximal sprint velocity recorded using a 1080 Sprint device (Lindingo, Sweden), followed by the YYIRTL1. Correlations between YYIRTL1 and sprint velocity in male, female and pooled cohorts were assessed using Pearson's correlations.

RESULTS: Strong overall correlations were observed between velocity and YYIRTL1 (r=0.63) in the pooled cohort. No correlation was observed in males (r=0.03) while females showed a weak correlation (r=0.24). Correlations were significantly different from the pooled data (Z-observed = -2.840) for males, and approached significance (Z-observed = -1.701) for females.

CONCLUSION: Running velocity over a 30-metre sprint is strongly correlated to YYIRTL1 performance in a pooled sample of Canadian college soccer players, however, these correlations disappear when data are analyzed by sex. Further research is needed to better understand the sex-based differences between running velocity and YYIRTL1.

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P023| Asymmetry in isokinetic strength of knee muscle actions at the angle positions of 30, 45 and 60 degrees among male professional soccer players

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Soccer is supposed to be an asymmetric motor activity. This study examined intra-individual differences between dominant (D) and non-dominant (ND) lower limbs in isokinetic strength of knee muscle actions at different angle positions. The sample was composed of adult male professional soccer players (n=31, aged 26.5 years. Isokinetic strength was assessed using a dynamometer to evaluate torque values at the angle- specific torque at 300, 450 and 600 of concentric (cc) and eccentric (ecc) contractions of the knee extensors (KE) and knee flexors (KF). Torque values were highest at 600 for KEcc (D: 236±38 N.m; ND: 193±53 N.m) and KEecc (D: 277±69 N.m; ND: 235±73 N.m) and at 300 for KFcc (D: 137±20 N.m; ND: 119±21 N.m) and KFecc (D: 170±34 N.m; ND: 143±32 N.m). Significant bilateral differences were evident for all actions, contraction and angles: KEcc (300: $F=6.876$, $p<0.01$; 450: $F=6.448$, $p<0.01$; 600: $F=6.604$, $p<0.01$), KEecc (300: $F=4.584$, $p<0.01$; 450: $F=6.203$, $p<0.01$; 600: $F=6.351$, $p<0.01$), KFcc (300: $F=7.456$, $p<0.01$; 450: $F=7.430$, $p<0.01$; 600: $F=8.175$, $p<0.01$), KFecc (300: $F=8.413$, $p<0.01$; 450: $F=8.479$, $p<0.01$; 600: $F=5.903$, $p<0.01$). Mean differences expressed as percentage of the dominant torque values at all angle positions exceeded the critical values of 10%. The study claims for systematic assessment of soccer players on isokinetic strength throughout the range of motion of knee extension and flexion and implementation strength conditioning programs.

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P024| Reliability Coimbra Agility Soccer Test (CAST)

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Agility is the capacity of the whole body to rapidly change direction and speed in response to a stimulus (Sheppard & Young, 2006). Twenty-one university soccer players (chronological age: 19.3 ± 1.4 years; body mass: 69.6 ± 8.2kg; stature: 173.5 ± 6.5cm and federated training experience: 9.7 ± 3.6 years) were recruited to evaluate the Coimbra Agility Soccer Test (CAST) to assess soccer agility. The CAST requires players to complete six times random courses as quickly as possible. The CAST requires players to control and dribble the markers (four different colors: green, yellow, blue, and red). Soccer players completed three trials, each separated by one week. The first trial was accounted for familiarization; the second and the third trial were considered for analysis. The proposed agility test measurements appeared to be highly reliable (intra-class correlation, ICC = 0.967; 95% confidence interval; 95%CI: 0.920 to 0.987). Technical error of measurement (TEM) and associated percentage of the coefficient of variation (%CV) were as follows: %CV= 7.54; TEM = 0.54s. Performances on both trials were repeatable in university players. In conclusion, the CAST is a reliable protocol to assess agility in soccer players.

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P025| Lower-limbs agonist-antagonist relationship in academy under-19 male football players

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In football, there are movements in different descriptive plans, and it is necessary to evaluate the musculature and strength production by taking into account more than one of these plans in order to obtain a better understanding of the contribution and role of each muscle group during the performance of a technical gesture. This study aims to assess the knee flexion and extension strength and the hip abduction and adduction strength throughout valid instruments. The sample consisted of 23 male under-19 football players (age: 17.7 ± 0.2 years; height: 173.0 ± 1.1 cm; body mass: 66.1 ± 1.3 kg). Body composition was measured using a multiple bioelectrical impedance analyzer (InBody770), and the dynamometry was performed by an isokinetic dynamometer (Biodex System 3) for knee flexion and extension, and by an isometric dynamometer (Smart Groin Trainer), for hip adduction and abduction. There were statistically significant differences in the peak torques between the dominant (D) and non-dominant (ND) members in the flexion function ($Z = -4.198$, $p < 0.01$) and in the extension function ($Z = -4.197$, $p < 0.01$) of the knee in concentric muscular action, and the flexion ($Z = -4.198$, $p < 0.01$) and in the extension ($Z = -4.198$, $p < 0.01$) of the knee in eccentric muscular action. No statistically significant differences were obtained in the conventional ratio ($Z = -0.456$, $p = 0.648$) nor the functional ratio ($Z = -0.335$, $p = 0.738$) between N and ND members. There were no statistically significant differences between adductors and abductors at the moment of strength for absolute values (N) ($Z = -0.796$, $p = 0.426$) or with the values relativized by total body mass (N/kg) ($Z = -0.738$, $p = 0.460$). Regardless of the muscle groups' strength values, there must be a balance between the agonist-antagonist muscles to reduce the injury risk.

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P027| Wingate Anaerobic Test Reference Values for Male Cyprus League Elite Soccer Players

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Purpose: Power is considered to be one of the key performance components in soccer. The current study aimed to develop reference values for the Wingate Anaerobic Test (WAnT) for peak power (PP), mean power (MP), and fatigue index (FI) in Cyprus league elite male soccer players. Methods: One hundred-three (N=103) soccer players (age 26.1 ± 5.4 y, mass 76.5 ± 8.9 kg, height 179.3 ± 7.4 cm) participating in Cyprus First (Elite) Division Soccer Championship (n=13 Goalkeepers, n=31 Defenders, n=31 Midfielders, n=28 Forwards), performed a 30-s WAnT against a resistance of 0.075 kp·kg-1 body mass (BM). Athletes were grouped based on their tactical field position as follows: Goalkeepers – GK (n=13); Defenders – DF (n=31); Midfielders - MF (n=31); Forwards – FW (n=28). Comparisons between groups were made using ANOVA and Scheffe's Post Hoc test. Results: Absolute mean (± SD) values for PP and MP were 822.3 ± 122.2 and 601.3 ± 89.7 W, respectively, whereas values normalized to BM were 10.8 ± 1.1 and 7.9 ± 0.8 W·kg-1 BM, respectively. Mean FI values were 54.2% ± 10.9%. Goalkeepers' PP and MP was significantly higher (p11.3, 10-11.3, and 8.3, 7.4-8.3, and 59.8%, 47.5% - 59.8% and <47.5% were classified as high, medium, and low. Conclusions: The reference values developed in this study can be used in soccer specific training and research programs to more accurately assess soccer players' anaerobic fitness and to monitor changes resulting from anaerobic training.

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P028| The kinetic differences of two plyometric exercises in youth football players

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Football can be characterized as an intermittent activity with great directional changes and a very short duration. These movements involve a combination of vertical and horizontal plyometric efforts. But the kinematic differences between playing positions during vertical (VDJ) and horizontal (HDJ) plyometric jumping in junior athletes have been little studied. This study compared two protocols based on vertical drop jumping and horizontal drop jumping on kinetic variables reported on a force platform. Twenty-two male football players (age 16.9 ± 0.61; weight 61.41 ± 8.09 kg, height ± 1.66 ± 0.05 cm and IMG 22.07 ± 1.90). Three VDJ and three HDJ trials were performed during a single session. The drop was 30 cm to a Klister force platform where reaction force (GRF), horizontal flight time (TV), impulse (INT), velocity (Vo) and contact time (GCT) were recorded. The integrated OptoJump was used to record the flight time in HDJ. Before the evaluation, a warm-up, plyometric jump familiarisation and anthropometric measurements were taken. Significantly higher peaks were identified during GFD_1 (VDJ 3068.69; sd 785.33) versus (HDJ 2353.59; sd 170.66). Significant differences were observed between VDJ vs HDJ (GCT p≤ 0.01; 18.322) (TV p≤ 0.01-33.493), but no significant differences were observed (GRF_1 p≤ 0.05; INT p≤ 0.507; Vo p≤ 0.295). No difference was found between Goalkeepers (P), Forwards (D) and Defenders (Df) (P vs D p≤ 0.998; P vs Df p≤ 0. 872; D vs Df p≤ 0. 967). This research showed that VDJ and HDJ show no differences in this specific sport for these ages.

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P029| Small sided game as fitness assessment in young soccer players

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This study examined the relationship between changes of running performance during small sided games (SSG) and fitness state. Sixteen elite young male field soccer players performed four SSG format thrice per week during four weeks, involving 3 vs. 3 and 3 vs. 3 + 2 goalkeepers (GK): 2 x 3 min with 6 min of rest on small pitch area: 25 x 18m (75 m2) (ssg-WGK and ssg-GK) and large pitch area 36 x 25m (150 m2) (SSG- WGK and SSG-GK). Time-motion characteristics were recorded during SSG by GPS with the next activity ranges (1, 2): total distance covered (TD), high-intensity running (HIR; running speed from 14.4 to 19.8 km·h−1), the mean velocity (Vmean), maximal velocity (Vmax) achieved (3) and number of high accelerations (Acc) and decelerations (Dec) above 3 m.s-2 (4). Pre-SSG heart rate variability (HRV), countermovement jump (CMJ) and maximal isometric force (MIF, LMIF and RMIF) was measured. During ssg-GK large relationships were found between CMJ with TD and Vmean ($r = 0.60$; 0.59; $p < 0.05$) and negative between HRV and Dec ($r = -0.61$; $p < 0.05$), while very large correlation between HRV and HIR ($r = 0.72$; $p < 0.05$) during ssg-WGK. Conversely, negative correlation between MIF and HIR ($r = -0.50$; $p < 0.05$) during SSG-WGK. Our findings suggest that ssg-GK could be useful to detect fatigue state in soccer players.

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P030| Is training intensity of 3v3 small-sided games related to aerobic performance and hemoglobin concentrations of professional soccer players?

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Objective: This study aimed (i) to examine session-to-session variations of both internal and external training intensity (TI) measures during small-sided games (SSGs); and (ii) to examine the influence of TI measures on aerobic performance and hemoglobin (Hb) concentrations during SSGs. Methods: Sixteen professional soccer players (age: 27.2 ± 3.4 years; height: 174.2 ± 3.6 cm; body mass: 69.1 ± 6.4 kg; body fat%: 10.4 ± 4.1%) participated in this study. Aerobic performance was assessed through the 30-15 Intermittent Fitness Test (30-15IFT) using the velocity reached during the last stage of the test (VIFT) as the final outcome. While Hb was collected via blood samples. A program of 3v3 SSG format was conducted during three weeks. During this period, internal and external TI measures were collected. Results: Both internal and external TI measures during SSGs revealed trivial to small differences from session-to-session. VIFT presented large to very-large associations with the following external TI measures: total distance (TD; r: 0.69; 0.87), high-intensity running (HIR; r: 0.66; 0.75), and mechanical work (MW; r: 0.56; 0.68). On the other hand, Hb concentrations had moderate to large associations with the following internal TI measures: Edwards' TRIMP (r: −0.36; −0.63), %HRmax (r: −0.50; −0.61), and red zone (r: −0.50; −0.61). However, the VIFT and Hb concentrations presented unclear associations with internal and external TI, respectively. Conclusion: Session-to-session variations of TI measures during 3v3 SSGs are not meaningful. Moreover, while the VIFT is better suited to make inferences regarding external TI measures, the Hb is more related to internal TI measures during 3v3 SSGs. From a practical perspective, coaches may benefit by the use of 3v3 SSGs as a training integrated tool to monitor athlete's performance.

Keywords: Soccer; hemoglobin; aerobic performance; SSGs, training intensity

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P031| How many scenarios greater than 75% of the most demanding passages occur in female official football matches?

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The analysis of the most demanding passages (MDP) during competition in soccer has increased in recent years (1). The aims of this study were to compare the MDP between halves according to playing position and between positions based on the whole match. Eight official league matches of a semi-professional football team belonging to the Women's Second Division of Spain were analysed. To calculate the MDP (using a 1-minute rolling average) the following physical variables were recorded: total distance (TD), high- speed running distance (HSR, >19 km/h) and acceleration distance (ACC, >2 m/s2). These MDP were described in meters, number of actions greater than 75% of the MDP and average of the percentage of the actions greater than 75% of the MDP. The player positions were: central-defender (CD), fullback (FB), midfielder (MF), wide-midfielder (WMF) and forward (FW). Data were collected using global positioning WIMU PRO devices (RealTrack-Systems, Almería, Spain). Differences between halves were determined using a Student's paired t-test. Differences between the playing positions were tested by a one-way ANOVA analysis of variance, using post-hoc Tukey's test. Effect-size (ES) was also calculated to determine meaningful differences. Significance was set at $p<0.05$. There were differences between halves for CD in percentage (85.7±7.6% vs 84.3±8.1%; ES=-0.2) in ACC, for FB in number of actions (4.3±2.4 vs 2.4±2.2; ES=-0.8), and for MF in number of actions (2.3±1.5 vs 4.3±2.0; ES=1.1) and percentage (92.0±5.5% vs 87.1±3.9%; ES=-1.0) in TD. Additionally, there were differences between FB and FW (44.2±4.7 m vs 76.2±19.1 m; ES=2.7), and MF and FW (45.9±3.7 m vs 76.2±19.1 m; ES=2.7) in HSR, and between CD and MF (86.1±7.3% vs 92.7±4.5%; ES=1.1) in TD. In conclusion, it seems there was a hardly significant effect between halves in terms of distance covered of the maximum efforts, number of actions greater than 75% of the MDP and average of the percentage of those actions. There was also a hardly significant effect on the activity between positions.

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P032| The influence of contextual factors on physical performance in women's football

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Introduction:

Research examining the influence of contextual factors as level of opposition (top, middle, bottom), and location (home, away), on physical match play performance is scarce in women`s football compared to men`s.

Methods:

102 top level matches from Norway constituted the data. Using linear mixed modelling we estimated the effects of the interaction between home or away, team strength, and opposition strength, controlling for the variation of position and players (both random effects). Variables were total distance, high-speed distance (>16 kmh-1), sprint distance (>20 kmh-1), acceleration distance (>2,26 ms-2), and deceleration distance (> -2,26 ms-2).

Results:

Top teams covered greater total distance than bottom (433 m; 95% CL [199, 666], $p<0.0001$) and middle teams (196 m; 95% CL [4, 388], $p<0.05$) playing bottom teams. There was also a greater total distance for middle (482 m; 95% CL [105, 859], $p<0.01$) and top teams (365 m; 95% CL [122, 608], $p<0.01$), compared to bottom teams, when playing a middle team. Greater total acceleration distance was covered by top teams compared to bottom teams when playing middle teams (42 m; 95% CL [5. 80], $p<0.05$). For total deceleration distance, bottom teams covered more distance compared to top teams (50 m; 95% CL [15 -85], $p<0.05$) when the opposition was a top team. When playing away, middle (502 m, 95% CL [202-802], $p<0.001$) and top (409 m; 95% CL [136-322], $p<0.001$) teams covered more distance than bottom teams. When playing away, more high-speed distance was covered by middle teams (219 m; 95% CL [63, 374], $p<0.01$) and top teams (130 m; 95% CL [9, 251], $p<0.05$) compared with bottom teams.

Conclusion:

Playing bottom and middle teams, top and middle teams cover more distance during match play than bottom teams. For away matches more high-speed distance is covered by top and middle level teams than bottom teams.

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P033| Differences in psychological factors between elite female football players in Norway

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The development and professionalization of female football has increased throughout the last decades, and improving levels of physiological, technical, and tactical abilities has resulted in improved performance of professional players and teams. Knowledge about how psychological factors predict performance in elite female football players, however, is scarce. Previous literature has suggested that higher leveled players display higher scores on the personality trait conscientiousness, executive functions, and mental toughness. However, the number of studies is limited, and the quality of measurement instruments are varying. The current study's purpose was to investigate the differences in motivational climate, personality, mental toughness, grit, motivation, and self-regulated learning between player levels in the top and second league in Norway. In total 156 elite female footballers (M = 21.49 years, SD = 3.37) participated in the study, 59 from the top league and 97 from the second league. The results showed that top-level players had significantly higher scores on the mental toughness subscale control and the self-regulated learning subscale evaluation compared to the second league players, who on the other hand had higher scores on the motivational subscales amotivation and introjected regulation. There were no significant differences in the scores of grit, motivational climate and personality. Some of the results are consistent with previous research, while others are contradictive. There is still a need for well designed, longitudinal studies, to examine the causal effects of the development of these psychological traits which are associated with performance in women's football shown in other studies (Pettersen et al., 2021). Identifying and training the psychological traits associated with player and team performance could increase the quality of women´s football in the future.

Pettersen, Susann Dahl, Frode Adolfsen, and Monica Martinussen. "Psychological factors and performance in women's football: A systematic review." Scandinavian Journal of Medicine & Science in Sports (2021).

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P034| Study of the efforts of each club to realise the philosophy of the Women Empowerment League —Focus on the organisation of the coaching staff

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The first professional female soccer league in Japan began in September 2021. The league was called ‘The Women Empowerment League’ (WE League).The WE League is the first Japanese sports organisation that requires the promotion of women in its entry criteria and includes original requirements such as ‘at least one female coach must be included in the coaching staff’ on the field. However, some clubs have not met the entry criteria, and only one is female among 11 managers. Therefore, certain aspects should be improved for women to play an active role as coaches.

The purpose of this study is to clarify the efforts of clubs in organizing their coaching staff and the associated issues when entering the WE League and to clarify the characteristics of clubs where female coaches are active.

Therefore, a semi-structured interview was conducted with three selected clubs. The interview data were analysed using the Steps for Coding and Theorization (SCAT).

Consequently, the following six characteristics of clubs with active female coaches were clarified: (1) an awareness of the gender equality and diversity of their coaching staff, (2) developing and strengthening female coaches in their own clubs, (3) an awareness of the benefits of employing female coaches, (4) an awareness of certain factors that prevent clubs from employing female coaches, (5) determining solutions to (4), and (6) an awareness of the requirement of a work–life balance system for coaches and the preparation of an environment in which female coaches can continue their careers.

The results of this study are expected to be useful for WE clubs and the clubs that intend to enter a league in the future. However, these are only the clubs’ perspectives. Hence, the focus should be on female coaches who work in the field to clarify the similarities and differences between the opinions of the clubs and the field.

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P035| Transient reductions in running intensity following periods of high intensity in women's football

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Introduction

A previous study found small but significant decreases in the running intensities of several metrics in the 5 minutes following periods of higher intensity [1]. However, the intensity fluctuations within these 5-minute periods were not investigated. In line with findings from the men's game [2], we hypothesize that female players experience a similar drop in external output following 1-minute high-intensity periods of total distance, high-speed distance, and average acceleration/deceleration.

Methods

102 top-level matches from Norway constituted the data. Using linear mixed modelling we estimated the difference between the average match intensity output and the 1st, 3rd, and 5th minute following high- intensity periods of 1-minute for the metrics: relative total distance, relative high-speed distance (< 16km/h), and average acceleration/deceleration.

Results

For all variables the mean output was reduced (total distance: -7.53 ± 3.53 m/min, $p<0.001$; high-speed distance: -8.03 ± 1.94 m/min, $p<0.001$; average acceleration/deceleration: -0.04 ± 0.02 ms-2, $p<0.001$) in the first minute following the respective periods of high intensity. Relative high-speed distance returned to match average during the third minute (-0.60 ± 1.94 m/min, $p=0.91$), whilst relative total distance returned to match average within the third minute (-3.23 ± 4.03 m/min, $p=0.16$) before dropping off in the 5th (-6.83 ± 4.03, $p<0.001$). Average acceleration/deceleration returned to match average by the fifth minute (-0.009 ± 0.03 ms-2, $p=0.05$) having been reduced during the third minute (-0.02 ± 0.02 ms-2, $p=0.02$).

Conclusion

The external output of top-level female players is temporarily reduced after univariate periods of high intensity lasting 1-minute.

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P036| Evolution of the tactical peak dimensions during competition in female soccer

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The aim of this study was to compare the tactical peak dimensions of collective behaviour between periods of five minutes using three different rolling averages (1, 3 and 5 minutes). Eight official league matches of a semi-professional soccer team belonging to the Women's Second Division of Spain were analysed. The collective tactical variables recorded were: width, length, height and surface area. Players were monitored with global positioning WIMU PRO devices (RealTrack Systems, Almería, Spain). A repeated measures ANOVA (with post hoc Tukey's test) was performed to test for differences ($p<0.05$) in the variables between the 5-minute periods for each rolling average. Effect size (ES) was also calculated to determine meaningful differences. First, significant differences were found in 1-minute rolling average in surface area between 0-5 = 15-20 from 45-50 to 80-85 (1443.0±223.8 vs ranged between 1209.7±279.1 and 1149.8±253.7 m2; ES ranged between -0.9 and -1.2), 30-35=50-55>80-85 (1356.3±204.8 and 1354.8±233.8 vs 1149.8±253.7 m2; ES = -0.9 and -0.8, respectively) and from 0-5 to 75-80 >85-90 (ranged between 1254.3±240.1 and 1277.4±281.7 vs 1040.9±177.0 m2; ES ranged between -0.9 and -2.0). Second, significant differences were found in 3-minute rolling average in surface area between from 20-25 to 50-55 >85-90 (ranged between 1135.3±158.9 and 1138.2±184.7 vs 935.1±149.6 m2; ES ranged between -1.2 and -1.9). Third, significant differences were found in 5-minute rolling average in surface area between 0-5 85-90 (ranged between 1077.2±158.4 and 1080.8±132.9 vs 891.4±154.4 m2; ES ranged between -1.2 and -1.9). In conclusion, it seems as the match passed the team's collective use of space was increasing until the beginning of the second half, which was when it began to come together, that is, to show less and less collective use of space until achieve the lowest values at the last periods of the match. It is worth mentioning that the shorter rolling average (1-minute) could have a greater impact on the outcomes of the collective tactical variables.

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P037| Prevalence of supressed RMR as a marker of energy deficiency in professional female soccer players

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Background

Low energy availability (LEA), defined as inadequate energy intake relative to exercise energy expenditure has shown to be prevalent in many sports. LEA is also the precursor to Relative Energy Deficiency in Sports (RED-S), a condition where several impairments of bodily systems occur. Suppressed resting metabolic rate (RMR) has been reported during periods of low EA in both male and female athletes, and is suggested to be a valid proxy marker for LEA and RED-S, which is calculated as the ratio between objectively measured RMR (e.g,, indirect calorimetry) and predicted RMR, normally the Cunningham equation. We present preliminary data indicating the prevalence of suppressed RMR from an ongoing study on professional female soccer players in Norway.

Methods

Eighteen athletes have so far completed the data-collection (age 23.9 ± 4.5, height 170.1 ± 5.7 cm, weight 64.5 ± 5.2 kg, fat free mass 50.3 ± 4.1). All measurements were completed in a fasted state between 7 and 9 a.m. Participants laid in supine position for 5 minutes, before a canopy hoodie, connected to a metabolic cart was positioned. VO2 and VCO2 were then measured for 25 minutes, where the last 20 minutes was used for analysis. RMR ratio of 0.90 had a mean value of 1.0 ± 0.06 (1493 ± 151 kcal). The two groups did not differ statistically in terms of anthropometric measurements.

Discussion

These findings indicate that the prevalence of LEA and-or RED-S may be higher than previously indicated in this population. However, it must be interpreted with caution until results are available from the full sample (n=58) and accompanied with study data from other proxy markers such as bone mineral density and hormonal values (e.g., Leptin, Cortisol, Thyroid hormones).

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P038| Evaluation of body composition in adult female soccer players using concurrent technologies: bioimpedance and dual-energy x-ray absorptiometry

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Background: Increased body fatness has been negatively associated with poorer physical performance, particularly in soccer involving large amounts of covered distance during games. Bioimpedance (BIA) as a method that could provide a quick and accurate assessment body composition is often adopted for monitoring large samples of athletes. Meantime, dual-energy x-ray absorptiometry (DXA) was developed for assessing fat mass, lean body mass and bone mineral content following relatively simply procedures but is limited to laboratory. This study was aimed to examine the agreement between field and laboratory assessments of fat mass among adult female soccer players. Methods: The sample included 50 female soccer players aged 15.4-37.8 years. BIA analyzer (Akern, model BIA101, Akern Srl, Florence, Italy) and the specific software recommended by the manufacturer (Bodygram - version 1.3 Akern Srl, Florence, Italy) was used passing an electric impedance with very low intensity (800μA) and with a constant frequency (50kHz). In parallel, during the same day, DXA scans were completed in the laboratory by a certified technician using Lunar iDXA (enCORE version 13,60,033, GE Medical Systems Lunar3030, Ohmeda Drive, Madison, WI 53718 USA). Results: Mean values for stature and body mass were 161.7±6.1 cm and 58.7±7.6 kg. In addition, predicted absolute fat mass were 16.0±4.7 kg and 16.9±5.2 kg respectively by DXA and BIA. The two protocols evidenced a nearly perfect correlation (r=0.932; 95%CI: 0.883 to 0.961; r2=0.869). Conclusion: In summary, field and laboratory measurements of fat mass as assessed in the current study allow estimates having an acceptable degree of accuracy and BIA may be adopted for monitoring fat mass in field conditions, particularly if protocols was performed as recommended by the manufacturer.

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P039| Day-off before a match-day? Effects on match physical performance in elite women's soccer

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Introduction

The distribution of weekly training load has been associated with match results in professional male players [1]. This distribution usually conceives a day-off either on the match-day (MD)+1 or MD+2. However, some female teams rest the day before competition (MD-1), and the causal effects on match performance remain unknown. Study aim was to compare the match physical performances in microcycles with and without a day-off before the match-day in elite female soccer players across the season 2020/21.

Methods

12 professional Portuguese players were tracked in 26 official matches. Player data was collected using GPS APEX (STATSports, 10Hz) including: total distance (TD), high-speed running distance (HSRD), sprint distance (SpD) and acceleration distance (ACCdist). Match data split into two conditions: a) microcycles with a day-off on MD-1; b) without a day-off on MD-1. Data was analysed if: (1) players completed ≥60 min of the match and (2) the player presented ≥3 match observations in each condition. For each GPS metric, linear mixed modelling was used to estimate the effect of MD-1, setting match ID and player ID as random effects.

Results & Discussion

Despite not statistically significant, players performed higher TD (107 ± 3 vs. 105 ± 4 m/min), HSRD (7.1 ± 1.1 vs. 5.9 ± 1.6 m/min), SpD (1.5 ± 0.4 vs. 1.1 ± 0.7 m/min) and ACCdist (15.3 ± 0.7 vs. 14.6 ± 0.8 m/min) with a day-off on MD-1 included in the microcycle. Non-significant results caused by statistical type two error due to the small sample size cannot conclusively be ruled out.

Conclusion

Preliminary results revealed an interesting, though non-significant, trend towards an increase in match physical performance when resting on MD-1.

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P040| Allometric modelling of left ventricular mass in female soccer players aged 12–16 years

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The aim of this study was to examine the contribution of concurrent body size descriptors often used to explain inter-individual variability in left ventricular mass (LVM, g) among female adolescent soccer players, separately for competitive age groups. The sample included 124 female soccer players aged 12.1–16.9 years. Stature, body mass (BM) and skinfolds (triceps, medial calf) were measured. Fat and fat-free mass (FFM) were calculated (Slaughter et al. 1988). Echocardiography was used to estimate LVM. Skeletal age (SA) was determined using Fels method (Roche et al. 1988) that is part of the medical examination in Portugal. Participants were grouped according to SA: 13-14 years (group A) and 15-16 years (group B). Correlations between LVM and BM were 0.511 (Group A) and 0.551 (group B). Coefficients for FFM were 0.443 and 0.576, respectively for groups A and B. When using FFM as size descriptor, scaling coefficients crossed linearity for group A (k=0.836; 95%CI: 0.295 to 1.378) and B (k=0.945; 95%CI: 0.643 to 1.247. In contrast, simple allometric modelling based on body mass as size descriptor approached linearity among group A (k=0.739; 95%CI: 0.352 to 1.126) but failed in group B (k=0.659; 95%CI: 0.434 to 0.884). This study suggests ontogenetic allometric modelling among female adolescents who participate in competitive soccer and particularly among late adolescent players grouped by SA geometric similarity should not be assumed to explain the variance of LVM based on body mass.

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P041| Chronological age at different moments of the career, in five major women's soccer leagues

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The relative age effect (RAE) is linked to the effects caused by the differences on birthdate within the same chronological age group (Wattie et al., 2008). This effect has been studied in women's sports at the professional level (Smith et al., 2018), showing to be specially accentuated in invasion team sports.

In soccer, there are contradictory findings about the existence of RAE in different female professional leagues, showing some of them that this phenomenon is more prevalent at the beginning of the professional career (Brustio et al., 2022).

The present study aims to analyze the distribution of the RAE in the last three seasons of the five major women's soccer leagues, taking into consideration in which stage of their career were the players.

4512 players (Mage=23.95 ±4.43) were grouped in G1: <=23 years old "talent group", G2: between 24 and 29 years old "peak age group", G3: >=30 years old "veterans group". Within this different groups players were classified depending of their birth quartile (Q1-Q4). A significant effect of RAE was observed in the total sample analyzed ($p<.05$), all age groups showed greater Q1 representation, although this effect was statistically significant and consequently of higher magnitude only in talent group ($p<.05$).

Our findings confirm a trend towards the presence of RAE in the five major professional female soccer leagues, which tends to decrease as the age of the players increases.

Keyword: RAE, Age group, professional soccer.

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P042| Relative and biological age in Spanish male and female elite vs. non-elite soccer academies

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Elite soccer clubs make huge financial investment in the processes of identification, selection and development of youth players (Larsen et al., 2013). These processes have been shown to be influenced by physical bias which favours older and early developed players (Johnson et al., 2017). Recent literature (Cumming et al., 2017) encourages treating maturating age independently of the relative age effect “RAE”. The aim of the study is too deep into the knowledge about the RAE and stage of maturation in male and female Spanish elite and non-elite soccer academies. 603 players belonging to U12, U14 and U16 Spanish soccer academies were divided and grouped by birth quarter (Q1-Q4). Player´s maturity stage (Early, On time or later) was estimated based on their distance to the Peak Height Velocity (PHV).

The main findings were: a) larger presence of the RAE in elite academies and male players ($p<.05$), b) greater number of early developed players in elite academies ($p<.05$), c) advanced or on-time maturity stage for Q4 payers in elite academies.

Keyword: Talent Selection, Youth Soccer, gender

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P044| Measuring Team Synergic Behavior in Female Football

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Female football has increased more than 20% in the last decades, but the literature available is mainly related with male players, and generalizations to female players should be made with caution. Most studies with female players address injuries, profile description and evaluation of fitness programs. Match dynamic patterns and tactical behaviors are essentially focusing male football. The scarce existing studies with female players revealed differences between male and female behaviors, exposing the need for further studies about the female football reality (Maneiro et al., 2019).

Particularly about tactical and decision-making behavior, the ecological dynamics approach offers an explanation to individual and group dynamic decision-making following the same underlying theory. Particularly team behavior can be considered as a group synergy. A synergy is a collective property of a task-specific organization of individuals (Araújo & Davids, 2016). There are four properties of a synergy: dimensional compression, reciprocal compensation, interpersonal linkages and degeneracy. A high connection between players and the performance environment was already been shown with male players where variations in synchronization indicated changes in the equilibrium of the performance of the team which can be related to changes in performance outcomes (Carrilho et al., 2020) The purpose of the present research is to study how team synergic properties explain female team coordinated behavior and contrast findings with what is known about male behavior.

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P045| Playing time according to chronological age in elite women's soccer

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There are multiple variables influencing the career of a soccer player (Allen & Hopkins, 2015). Chronological age is a critical factor that has been closely related to sports performance, affecting among others; talent identification, playing time and the market value of soccer players (Kalén et al., 2019).

The objective of the present study was to analyze performance and playing time in the five major women's soccer leagues, taking into consideration the career stage (age) of the players.

4512 players (Mage=23.95 ±4.43) were grouped in G1 "talents": =30 years old (Mage = 31.84 ± 1.98). Participation in official matches, presence in the starting eleven and overall playing time were analyzed for each player.

Our results showed an overrepresentation of "talent" players (48,8%), and a smaller number of "veteran players" in the sample (11,7%). This finding depicting the higher participation of young players may be explained by the exponential increase in the popularity of women's soccer recently. However, it is interesting to note that players from the "veterans" group showed greater participation in official matches and more playing time than younger players (ps<.05).

Further research is required to keep tracking the evolution of playing time in a sport (women´s soccer) which is experiencing very significant changes in recent years.

Keywords: Age, sport performance, female soccer.

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P046| In-season Microcycle Quantification of Professional Women Soccer Players – External, Internal and Wellness Measures

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Although there is already some knowledge about the intensity in the women's football match, the knowledge about training is still scarce. Therefore, the aim of this study was to quantify external (locomotor activity) and internal (psychophysiological) intensities, as well as the wellness profile of the typical microcycle from professional female soccer players during the 2019/20 in-season. Ten players (24.6 ± 2.3 years) from an elite Portuguese women soccer team participated in this study. All variables were collected in 87 training session and 15 matches for analysis from the 2019-20 in-season. Global positioning variables such total distance, high-speed running, acceleration, deceleration and player load were recorded as intensity while Rated Perceived Exertion (RPE) and session-RPE were recorded as internal measures. The Hooper Index (HI) was collected as a wellness parameter. The results showed that internal and external intensity measures were greater in matches compared to trainings during the week (match day minus [MD-], MD-5, MD-4, MD-2), $p<0.05$ with very large effect size (ES). In the same line, higher internal and external intensity values were found in the beginning of the week while the lowest values were found in MD-2 (p0.05). This study confirmed the highest intensity values during MD and the lowest on the training session before the MD (MD-2). Moreover, higher training intensities were found in the beginning of the training week sessions which were then reduced when the MD came close. Wellness parameters showed no variation when compared to intensity measures. This study confirmed the hypothesis regarding internal and external intensity but not regarding wellness.

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P047| Activity profile in female soccer players – a comparison between under-19 and senior athletes

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Literature has followed the interest and growth in women's football. This study aimed to outline the activity profile in senior and in under-19 female football players. Therefore, differences in the total match, 1st and 2nd halves, effect of home location (home vs away), and position-related variation were explored according to competitive age-group. The total sample was composed by 30 athletes, organized by age-group: under -19 (n=17; 16.18±1.28 years; 57.57±9.16 kg; 157.18±18.420 cm), and seniors (n=13; 22.83±6.74 years; 63.29±7.26 kg; 162.85±5.18 cm). Global positioning systems technology (SPI-Pro GPSports, Canberra, Australia – 15 Hz) was used to collect activity data during 6 competitive matches in each age-group. Differences were generally found between age-groups in covered distance, acceleration, deceleration, total sprints, mean sprints, maximum speed and speed zones, with the exception of mean speed (4.95±1.18 vs 5.46±6.26 km/h; p=0.311) and zone5 speed (> 24 km/h) (20.17±23.80 vs 17.60±23.09 km/h; p=0.569) when the total match was analysed. This same trend was noted between groups according to the 1st half and the 2nd half ($p<0.05$). The effect of match location was also consistent for the above-mentioned variables. Position-related variation was examined for each age-group, revealing significant differences in activity profile for defenders, midfielders, and forwards. Interestingly, differences were only found for acceleration (2.5–3.5 m/s2) (2.20±1.32 vs 0.50±0.67 m/s2), total sprints (11.33±8.62 vs 4.08±2.64) and zone1 speed (0– 6 km/h) (619.21±217.73 vs 1052.40±283.33 km/h) among goalkeepers. Although there is an increasing interest and participation in women's football, our results showed that there is an apparent meaningful difference between the activity profile in the last stage of youth female football development and the senior level. Physical demands in female football must be considered in the structure and organization of female football, particularly when athletes are regularly playing in higher competitive age-groups.

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P048| Relative age effect in European Women's elite Soccer

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An over-representation of players born in the first months of the cut-off date is known as the relative age effect (RAE). This phenomenon is usually found in different geographical areas (Padrón-Cabo et al., 2016). During early ages, the RAE and maturity can influence playing position in soccer, although this relationship is controversial and depend on different contextual variables (Saavedra-García et al., 2019).

We analyzed the RAE in different playing positions of women's football to explore also is this effect might be influenced by the player´s confederation nationality.

4512 female players (Mage=23.95 ±4.43) belonging to five European Leagues (France, Italy, Spain, United Kigdom and Germany) from seasons 2018-19 to 2020-21, were grouped by playing postition (Goalkeeper, defender, midfielder and forward). FIFA confederation was used for grouping nationalities (UEFA, CONMEBOL, CONCACAF, CAF, AFC, OFC).

Results showed significant differences ($p<.05$) in the distribution of RAE by playing position and by confederation where the players were born.

Our findings highlight the differences in talent selection processes between different confederations while showing that the specialization in different playing positions may be influenced by the maturational development of the player.

Keyword: RAE, FIFA Confederation, demarcation, Women's Soccer

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P049| Inter-observer agreement in the assessment of bone developmental stages using TW2 score systems among male pubertal soccer players

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Background: Skeletal age (SA) is considered the best method to assess biological maturation. Tanner- Whitehouse (TW) is among the valid protocols to determine SA from hand-wrist x-ray. Youth soccer literature often classified participants according to maturity status (late, average, early). The preceding classification is believed to explain selective dropout and sport selection (Malina et al. 2000). An obvious question refers to data quality while assessing SA. This study was aimed to assess inter-observer agreement of bone specific developmental stages using TW criteria and, additionally, examine the impact of disagreement on the three concurrent 1000-point scoring systems representing the progresses from immaturity to adult state. Methods: The sample included 142 male soccer players aged 11.0-15.3 years. Bone stages were assessed by two independent trained observers (first and second authors) according to the second version of TW method (Tanner et al. 1975). Subsequently, stages were converted into points following the recommendations for the three scoring systems: 20-Bone (20 bones), Carpals (7 bones), RUS (Radius, Ulna and Short bones). The three systems define a maximum of 1000 points corresponding to mature state. Results: Mean values for stature and body mass were respectively 154.4 cm and 46.4 kg. At these ages, distribution of developmental stages, independentely from the assessor, tended to cover stages F, G, H and I dependending on the bones. Meantime, inter-observer discrepancies did not tend to exceed more than one stage. In general, agreement rates were >80%. The preceding had a negligible impact on scoring systems given by intra-class correlation coefficient (ICC) and coefficient of variation (%CV): 0.990 (1.62%), 0.967 (2.40%), 0.987 (5.1%), respectively for 20-bone, Carpal and RUS. Conclusion: In summary, agreement between experienced observers, although not nearly perfect is acceptable. It is clear that determination of SA requires trained and experienced observers. The results are specific for the circumpubertal participants aged 11-15 years and future research is needed at younger ages.

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P050| 12-month intra-individual changes in bone health among male adolescent soccer players

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Background: Puberty is a period of intense changes in human body size and composition. Additionally, participation in sports is a relevant form of physical activity among male adolescent years. Soccer is considered an osteogenic activity. This study was aimed to examine the magnitude of intra-individual changes on aBMD assessed at various sites among male adolescent soccer players engaged in competitive soccer during a complete season. Methods: The sample included 20 male adolescent soccer players aged 12.57±0.37 years at baseline. Stature and body mass were measured, bone mineral content (BMC), areal bone mineral density (aBMD), lean soft and fat tissues assessed using DXA. Data collection was completed at baseline (TM1) and after 12 months (TM2). Paired t-test was used to compare intra-individual mean differences. Results: Soccer players completed 63 sessions and 94.9 training hours. Fat mass did not substantially fluctuate. In contrast, significant increments were noted on lean soft tissue (TM1: 30.6 kg; TM2: 35.8 kg; $p<0.001$) and bone mineral content (TM1: 1696 g; TM2: 1964 g; $p<0.001$) . Regarding aBMD, intra-individual mean differences were always significant with effect size ranging from trivial (upper limbs) to moderate (trunk > lower limbs > trochanter > whole body > shaft). Conclusion: This study confirmed puberty as a period of significant intra-individual developmental changes in bone health parameters among male adolescent soccer players. The preceding was less pronounced in the upper limbs compared to the trunk and lower limbs.

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P051| Talent Identification and Talent Development in Football - A Qualitative Study

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With the present study we intend to understand the common and differentiating characteristics that coaches consider as characterizing football talent in the European and South American continents. In this way, it was intended to understand: (1) what identifies a European talent and a South American talent; (2) what are the training standards for talent development; (3) decision-making training as a differentiating factor in football, and (4) what should guide us to boost a talented player to the elite.

Semi-structured interviews were carried out with 12 sports coaches in youth football from several European and South American countries, who have practical experiences and experiences related to the problem in question, to present a qualitative study. with the objective of obtaining in-depth information about their perspectives and reflections, thus developing a descriptive knowledge about the topic. Data were analyzed using the qualitative content analysis technique using the software NVivo version 13.

The results of this qualitative analysis allowed us to conclude: (1) the design of a macro profile of the European and South American football player, through the characteristics mentioned in the interviews; (2) that European and South American coaches opt for a common line of mixed training style, which includes analytical training and globalized training; (3) that both European and South American coaches recognize the inclusion of decision-making games in the fundamental part of their training plans as essential; and (4) there are several factors that can lead a talented young player to achieve high performance.

Keywords: Expertise, Footballers, Youth, Potential

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P052| Sprint training adaptations in youth soccer players: the role of biological maturation

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Introduction: Sprint training seems to lead to different adaptations in young athletes, accordingly to their biological maturity status. However, results are scarce and inconsistent [1]. We aimed to evaluate the impact of maturity status on sprint training adaptations in youth soccer players.

Methods: 152 youth soccer players (10 to 18 years old) were divided into three groups, according to their peak height velocity offset (pre-PHV, mid-PHV and post-PHV) and then allocated to either a control (CG) or an intervention group (IG). In addition to the team training, IG and CG performed respectively either a sprint (12 x 20m maximal sprints) or a low-intensity technical protocol, twice a week for eight weeks. Performance in 30m-, 20m-, 10m- and 5m-sprint, 5-10-5 agility test (5-10-5) and standing long jump (SLJ) were evaluated before and after the training period.

Results: Within-subjects analysis showed a time effect on 30m-sprint in CG at mid-PHV (+0.07 sec [0.00 to 0.14], p=0.041) and in IG at post-PHV (+0.11 sec [0.01 to 0.20], p=0.034), on 5-10-5 in IG at pre-PHV (-0.11 sec [-0.21 to -0.01], p = 0.027) and at post-PHV (+0.14 sec [0.04 to 0.24], p=0.008), in CG at mid-PHV (+0.14 sec [0.02 to 0.25], p=0.018) and at post-PHV (+0.10 sec [0.01 to 0.19], p=0.030) and on SLJ in CG (+5.5 cm [1.2 to 9.9], p=0.013) and in IG at pre-PHV (+9.1 cm [5.1 to 13.1], p0.05) among maturity states at the end of intervention.

Conclusions: Although our intervention seems to improve 5-10-5 and SLJ performance at pre-PHV and mid- PHV respectively, compared to low-intensity training, no evidence of differences in adaptations was shown among intervention groups with different maturity states. Accordingly, coaches should be aware that only sprint training, twice a week, could be insufficient to enhance horizontal jump, acceleration and change-of- direction performance at every biological maturity status.

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P053| Gold Score Soccer: Prognostic Validity of Different Talent Identification Models for Future Success of Young Soccer Players

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Studies have provided empirical evidence on the prognostic relevance of batteries of tests and coaches' subjective evaluations in the soccer talent identification and development process. This study compared the effectiveness of coaches´ eye and athletes' self-assessment only or combined vs. multidimensional data for prognostic of future success in soccer. A sample of 132 male young soccer players from the age groups U13 to U17 and their coaches participated in multidimensional battery of tests (coach assessments, motor performance tests, biological maturation, technical and tactical skills, motivational orientation, coping skills, perceived competence, familial support, laterality, training and competitive history) of Projeto Atletas de Ouro® (Werneck et al., 2020). Four models for estimating sporting potential were created – Gold Score Soccer (GSS). In the logistic model, estimated age of peak height velocity and laterality were added to GSS. The area under the curve (AUC [95% CI]) from receiver operating characteristic indicated the prognostic validity of each model in predicting player status three to five years after the assessments (professional [n = 21] vs. non-professional [n = 111]). Athletes´ model (.83 [.73; .92]; specificity: 73.0%; sensitivity: 76.0%; accuracy: 73.0%) did not differ from the Coaches´ Eye model (.85 [.78; .95]; specificity: 73.0%; sensitivity: 76.0%; accuracy: 73.0%) whilst Athletes´ plus Coaches´ Eye model (0.90 [0.85; 0.96]; specificity: 80.0%; sensitivity: 81.0%; accuracy: 80.0%) and Multidimensional model (0.93 [0.87; 0.98]; specificity: 82.0%; sensitivity: 86.0%; accuracy: 83.0%) showed a bigger AUC and accuracy. Besides, a linear increase of explained variance were found between the models (29.0%, 37.0%, 50.0%, 58.0%, respectively). In conclusion, combined talent selection approaches, especially the use of athletes and coaches' assessments together or both plus a battery of tests were better at predicting future success of young soccer players.

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P054| Body composition or biological maturation? What variables are more influenced by linear sprint performance in teenage female soccer players?

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INTRODUCTION: Speed is considered a main determinant of performance in soccer [1]. This action is the most dominant when scoring goals in teenage players [2]. However, there is a scarce information about the possible effect of age on sprint performance in this population.

PURPOSE: To analyse age related differences in sprint performance in different age groups of teenage female soccer players and to examine the influence of body mass, body mass index (BMI) and biological maturation on sprint performance.

METHODS: A total of 80 youth female soccer players participated in this study. According to the soccer federation rules the players were grouped on the basis of chronological age (U14, U16 and U18). Participants were assessed within a single testing session on 40m linear sprinting with 10m, 20m and 30m split times. Also, pubertal timing was estimated according to the biological age of maturity of each individual (i.e. age at peak height velocity (APHV). Analyses of variance were performed. A post-hoc Bonferroni analysis was used to determine the origin of any differences. Between-group differences according to age category in sprint performance were assessed using analysis of covariance (one-way ANCOVA). Body mass, BMI and APHV were used as covariates.

RESULTS: Post-hoc analysis revealed better performance in all split sprint times of older soccer players (U18 and U16) compared with younger category. On the contrary in all split sprint times, there were no significant changes between U16 and U18. ANCOVA revealed differences in all parameters between groups, controlled for APHV. In contrast, all between-group differences disappeared after body mass and BMI adjustment.

CONCLUSIONS: Players may improve their anthropometric characteristics and their results in sprint tests as older they are. The age effects on running speed qualities during growth was likely related to anthropometric factors rather than biological maturation per se in teenage female soccer players.

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P055| How is mental factors prioritized in female elite football? An experience-based study from Norway

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Background: The well-known generic interplay between physical and mental factors has been increasingly acknowledged as important to achieve good performances in sports in general, and within female football. However, compared with mental factors, strategies to improve physical performance may be easier to operationalize, and improvement may be easier to measure. This possible disparity may imply a risk of a lower priority to mental factors among coaches and within the support team. If so, this is unfortunate given that athletes need to cope with high internal and external expectations towards peak performances. To set trainers and coaches in the position to prioritize and focus, it is important to investigate what aspects of mental health and well-being that is important from the athletes' perspective. Moreover, in team sports like football, mental health and well-being is not an individual issue, but encompasses interpersonal and team relevant implications.

Purpose: The purpose of the present study has been to explore what kind of mental health and well-being aspects are experienced as important for elite female football players.

Methods: Semi-structured interviews were conducted with five professional female football players at an alite level in Norway and analysed by the systematic text condensation approach.

Results: The informants experienced that in general, support teams and coaches focused on mental health and well-being was somewhat unsystematic and inconsistent in nature. The informants voiced a need for coaches and teams to focus on 1) the players' being emotionally connected to the club and bonding with club mates 2) the players' need for emotional support during training and matches, and 3) on the players' total life situation. They highlighted that such needs may be accomplished in a mixture of individual coaching as well as in the building of a supporting club culture and using mental trainers with competence in sports psychology.

Conclusions: The findings point to a need for coaches and support teams to focus on the players' mental health and psychosocial well-being to promote individual and collective performance and to prevent drop- out.

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P056| The training of football athletes in Brazil: the illusion of the successful footballer

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This study aimed to locate, in the literature, how the sports training of footballers and basic education in Brazil are jointly processed, as well as the consequences of this process for the working class of the modality. Understanding that the simple contemplative observation of such a phenomenon is insufficient to understand it, we tried to make a mediation with the concept of a dual sports career, which corresponds to the simultaneous dedication between two routine activities, being sports and studies a usual example of conciliation faced by athletes both in formation and in a professional context (COSTA; FIGUEIREDO, 2021).

The research was characterized as exploratory, qualitative, bibliographic and documental. The data were collected considering the systematic review conducted by Miranda, Santos and Costa (2020), the Report “Educação e as Categorias de Base” (Education and the Basic Categories), the main sports (Law No. 9.615/98 - Pelé Law) and educational legislation (Law 9.394/96 – Law of Directives and Bases of National Education/LDB), as well as scientific articles, books and dissertations that could support and ground the development of this research.

As the main findings, it was noticed the need for an urgent policy that supports the Brazilian sport and school education, made compatible beyond enrolment, attendance control and progression, because football disguises a deficient basic school education (although formally completed), low and delayed salaries, nomadic and unemployed athletes. Therefore, the compatibilization between training and formal studies, with balanced actions between the two educations, is necessary, especially for those who, being unsuccessful in football, need to establish themselves in other occupations, besides the need for an emancipatory and cultural education of quality.

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P057| Football spectacle in the context of capital realisation strategies: aesthetic innovation and the construction of the "magical aura" of commodities

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This study aimed to scrutinize the intertwining between football spectacle, television and sports marketing in the context of late capitalism. Its development involved literature review, documentary research and theoretical analysis/discussion. Thus, its results point to the emergence, in the wake of the industrialization of the sport, of a movement that raised it to the condition of an important "vehicle/channel of communication" of an expressive series of products and services linked or not to the sport.

Signs of these processes may be found as one observes the promotion of events and/or championships; the fostering of governing bodies; the supply of sporting materials; team sponsorships; advertisement by players; naming rights; in addition to advertising spaces on sporting arenas' signs, on the name of certain sectors or even in promotional environments such as the backdrop of stadium gates, which are, as a rule, occupied by merchandising. In addition, of course, to the advertisements for countries, regions and cities that host major competitions.

To sum up, the football spectacle, which implies complex patterns of socioeconomic interaction, enables the construction, the association and, above all, the dissemination of various advertising pieces (BROHM, 1982). These, according to the precepts of aesthetic innovation (HAUG, 1997), end up "kidnapping", manipulating and modulating the spectacularized football images. Thus, the "new football" endorses campaigns of aesthetic renewal and, consequently, the production of a kind of "magical aura" of merchandise. In doing so, it ends up operating as an influential advertising communication platform, becoming an indispensable mechanism for the early regulation of consumption; for the promotion of the obsolescence of specialized products and services; and for the commercial ambitions that yearn for new and promising market niches.

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P058| Us versus them mentality in football fans: Reward and mentalization brain networks as basis of affiliation

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Social affiliation is one of the most relevant requirements for the conformation of more complex social phenomena. Social affiliation is characterized by a desire to become part of a group, enjoying rights, and assuming obligations. Psychology has explained social affiliation and out-group conflict as the interaction between two mental mechanisms: The “ingroup love”, in which individuals from the same group are willing to benefit and treat more favorably to their in-group members, and the “out-group hate”, in which people are motivated whether to increase the gap between the groups or to compete and hurt to their out-group members.

Neuroscience studies have described that the misfortune of an out-group member gives pleasure (known as schadenfreude), and could correlate with likelihood to harm those rivals. It has been observed that another’s misfortune displays a greater striatal activation. Group identification and competitive context such as being a fan of a football team have been described as elements that facilitate schadenfreude.

Here, we report the study of forty-three healthy male volunteers’ supporters of the two most popular Chilean football teams. fMRI recordings were performed in 22 supporters of the Colo-Colo (CC) team and 21 supporters of the Universidad de Chile (UCh) team while they watched a total of 63 goals in a compilation of football matches.

The” Brain activations were observed in fans when their team scores goals against the emblematic rival, showing a subcortical activation, specifically in ventral striatum, caudate and lentiform nucleus, that are important areas associated to the reward dopaminergic circuit. This is a mechanism that participates in causing sensations of pleasure. On the contrary, when their team receives goals from the emblematic rival, the canonical activation pattern of the mentalizing network was observed, including the superior temporal sulcus, orbitofrontal cortex, dorsolateral prefrontal cortex, precuneus, and the inferior frontal junction. This could be understood as the strategy that the brain develops through the rationale mitigating pain of an adverse result. Together, these findings could be new inputs for future research about different expressions of fanatism.

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P059| The effects of self-talk and body posture on performance in soccer players

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Introduction: The study of self-talk has shown that what athletes say to themselves influences their performance (Tod et al., 2015; for a review). On the other hand, embodied validation is based on the self- validation theory, which establishes that the meta-cognitive validity that an individual grant to their own thoughts determines to what extent those thoughts have an influence on their judgments and behaviors (Briñol et al., 2018). Thus, the main hypothesis of the present study was that the effects of self-talk (positive vs. negative) on performance would be greater for soccer players in the upright posture condition (embodied validation) than for soccer players in the slumped posture condition (embodied invalidation).

Method: In a study with a sample of 130 active soccer players, the participants were randomly assigned to generate a positive self-talk or a negative self-talk. Next, they were randomly assigned to adopt an upright or slumped posture, while saying the previously generated self-talk to themselves, to finally evaluate their performance in different tests relevant in soccer (e.g., slalom).

Results: As expected, the results showed that in the upright posture condition (embodied validation), a significantly higher performance in slalom was found for the participants who told themselves the positive self-talk than for the participants in the negative self-talk condition. In contrast, in the slumped posture (embodied invalidation) condition, no significant differences in performance were found between participants in the two types of self-talk.

Discussion: These findings support the main hypothesis of the research, showing that upright posture (vs. slumped) interacts with self-talk and, as a consequence, influences performance in soccer players. Understanding how movements and body states influence cognition is extremely relevant in the study of soccer performance.

Keywords: self-talk, embodied validation, soccer performance

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P060| Self-Regulation of Learning During Soccer Practices: An Ecological Dynamics Approach

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Self-regulation of learning (SRL) in sports has been an area of interest among sport scientists. Zimmerman's theory of SRL, derived from Bandura's social cognitive theory of self-regulation, is widely cited in sport psychology, including soccer. Consequently, the tools and methods used to measure SRL during soccer practices, have been individually centered and focused in questionnaires, self-reports or observation categories. Despite all the contributions to the field, this theoretical standpoint and respective methods have some limitations, such as organismic asymmetry for the explanation of behaviour; bias associated with self-reports and questionnaires; assessment of judgments about action instead of action itself. This limits the precision and utility of such data and, therefore, the understanding and evaluation of SRL during soccer practices.

Alternatively, we present an ecological dynamics perspective of SRL, one that values the transactional relationship between performer and the environment (i.e., performer-environment system), instead of attributing the explanation of goal directed behaviour to metacognitions, as the individual self-regulates his/her performance behaviour. Ecological dynamics demands methods of analysis that can continuously record the reciprocal constraining relation that exists between the task, the environment and the performer. Eco-physical variables are able to unveil how the performers capacities fit the performance environment and how this mutually constraining relation evolves while individuals try to achieve performance goals. Eco- physical variables include measurements of action in relation to ecological events and express how human behaviour emerge under multiple constraints (individual, task and environment).

In the present communication, we propose the use of an eco-physical variable to measure SRL. Specifically, heart rate variability is to be computed in relation to the time to start each soccer training task, in order to assess how players self-regulate their behaviour during soccer practice.

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P061| Developing cognitive and motor decision-making skills through tactical principles and Game Sense Approach in youth soccer

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Introduction: Research on sports development in soccer showed that perceptual-cognitive and perceptual- motor decision-making skills are essential to be developed during sports formation. In this line, research in sports pedagogy has demonstrated that approaches focusing on inquiry-based strategies, such as the Game Sense Approach, provide a rich environment to foster the players' decision-making and tactical skills. In this context, tactical principles have been pointed out as an important part of soccer curriculums during sports formation. However, up to date, no research addressed the assessment of perceptual-cognitive decision-making skills and their interaction with perceptual-motor skills in interventions with tactical principles.

Purpose: This study aimed to verify the influence of 25 training sessions based on tactical principles and the Game Sense Approach in developing cognitive and motor decision-making skills of U-12 soccer players.

Methods: Participants were 25 U-12 elite male soccer players (12.0 ± 0.2 years) from a Brazilian first division national club. Perceptual-cognitive decision-making skills (quality and response time) were assessed with an objective video-based test (TacticUP®). Perceptual-motor decision-making skills (tactical efficiency) were assessed with FUT-SAT. Both instruments were developed based on the same theoretical background (core tactical principles of soccer). The 25 training sessions were organized based on the Game Sense Approach and the core tactical principles of soccer. The within-group differences among pre- and post-test were verified through a paired sample t-test or Wilcoxon test.

Results: Results showed improvements ($p < 0.05$) in: 1) perceptual-cognitive decision-making skills related to the decision-making time for both offensive and defensive actions; and 2) perceptual-motor skills for defensive actions. We also found unexpected results for the quality of decision-making. It decreased for the defensive phase in post-test.

Conclusions: We concluded that 25 training sessions based on core tactical principles and the Game Sense Approach improved perceptual-cognitive related to decision time and perceptual-motor decision-making skills. Improvement of decision-making time apparently is related to improvement in tactical efficiency of U -12 soccer players. To the best of our knowledge, it was the first study to use complementary information about perceptual-cognitive (TacticUP®) and perceptual-motor (FUT-SAT) decision-making skills based on the same theoretical background (core tactical principles).

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P062| Acute, locomotor, heart rate and neuromuscular responses to added wearable resistance during soccer specific training

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Purpose:

Wearable resistance (WR) training is an ecological modality of resistance training which allows athletes to perform sports-specific movements while loaded and is designed to deliver a higher specificity to on-field sport than traditional gym-based resistance training1. WR training may offer a practical solution to improve transference of strength and power adaptations from gym-based exercises to on-field sport-specific performance2. The study aimed to investigate the acute locomotor, heart rate (HR) and neuromuscular responses to using WR loading for soccer-specific training.

Methods:

Twenty-six soccer players (27.6±5.0years) from a French 5th division, semi-professional team participated in this study. Participants completed a 9-week parallel-group training intervention, where the intervention group (WR) trained with WR (200g on the posterior, distal portion of each calf) on D+2 and D+4 and unloaded on D+5. Between-group differences in locomotor (GPS variables) and HR data were analysed for full training sessions, small (190m2/player) game situations (GS). Neuromuscular status (velocity- load/force-load ratio) was evaluated using pre- and post-training standardized running tests. Data was analysed using linear mixed-modelling with the magnitude and likelihood of changes shown using effects sizes ± 90% confidence limits (ES±90%CL) and magnitude-based decisions.

Results:

For full training sessions, the WR group showed possibly greater total distance (ES±90%CL:0.25±0.19), sprint distance (0.27±0.19) and mechanical work (0.32±0.19) compared to control. There were Unclear between-group differences in RPE scores.

For small GS, the WR group showed likely slightly lower mechanical work (0.45±0.31), mechanical work/min (0.48±0.31) and likely moderately lower average HR (0.68±0.66) compared to control. Unclear between-group differences were observed for large GS.

Training induced most likely small to moderate increases in vL/fL during post-training compared to pre- training box-to-box runs for the WR (0.46±0.15) and control (0.73±0.20) respectively.

Conclusion:

WR loading for small GS may have acutely lower locomotor and HR responses compared to large GS. Football-specific training performed with WR loading did not impact neuromuscular status differently than training without load.

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P063| A Review on Talent Identification and Development in Male Futsal

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The aim of this review was to identify and synthesize the most significant literature addressing talent identification and development in futsal. We identified the most frequently researched topics and characterized their methodologies.

A systematic review (Web of Science, Scopus, PubMed and SPORTDiscus) was performed according to Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines. The selection was for the original articles in English, Spanish or Portuguese containing relevant data about talent development/identification on male futsal players.

The search returned 238 records. After screening against set criteria, a total of 32 manuscripts were fully reviewed.

Results indicate that the most successful players present technical, tactical, anthropometric, physiological and psychological advantages, and they are distinguished from lower-level players for their earlier dedication to the sports training. These findings should be carefully considered by those involved in the identification and development of futsal players. Moreover, an optimal balance between specialization (deliberate practice) and diversification (deliberate play) appears to be related to higher levels of performance. Finally, close attention should be paid to the supportive psychosocial environments created in the sport academies. Overall, talent identification and development programmes in futsal must be dynamic, providing opportunities for changing evaluation parameters in the long-term.

Keywords: expertise; elite futsal; youth development.

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P064| Patterns of Play in Offensive Sequences that Result in Goal Scored in Portuguese Futsal

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The main aim of this study was to analyze the regular patterns of play in offensive sequences that resulted in goal scored in elite futsal.

Observational methodology was used to analyze those patterns of play. An observational instrument tool (field formats and systems of categories) has been developed and validated for this purpose.

The offensive sequences of 143 scored goals (26 games) were analyzed trough the sequential analysis technique using the SDIS-GSEQ program (Bakeman & Quera, 1996), to verify the probability of significant association relations among the different categories of the observational instrument tool, as well to verify the cohesion strength between the criterion and the object conducts. Inter and intra observer agreement was calculated.

The results showed that the phase of the game which guarantees more goals is the positional attack with 33,57%, followed by set pieces with 28,67%. These situations result in more than 60% of the goals scored. It was also concluded that the regulamentar interruptions of the game (in favor), with a percentage of 62.94%, are the most relevant factor that determine the start of the effective offensive process.

Concerning sequential analysis, the results demonstrated that the play patterns were performed in simple plays with a strong presence of the pivots, that supports the game model of the observed team. Additionally, there are important patterns emerging from the set plays and individual dribbles.

Keywords: Offensive process; Sequential Patterns; Observational Methodology.

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P065| Mechanical Profiles in Professional and Elite Futsal Competitions

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Introduction: Futsal is an intermittent team sport characterized by short high-intensity actions, including accelerations (ACC) and decelerations (DEC). While previous research has characterized both physical and physiological demands, detailed analysis and profiling of ACC and DEC demands during competition remains unexplored.

Objectives: To profile the ACC and DEC demands of futsal and explore differences between professional (club) and elite (national) futsal teams during competition.

Methodology: Local positioning system tracking data were collected from 12 official futsal matches (6 professional and 6 elite matches). ACC and DEC performance, defined as either high (±2-3m/s2), very high (±3-4m/s2), and intense (±4-5m/s2), were analyzed. Actions with initial (ACC) and final (DEC) velocities of 0 km/h, were characterized as explosive actions (EXPL), whereby ACC and DEC efforts that resulted in changes in running velocity were characterized as rolling (ROLL). The duration, absolute maximal acceleration, resultant velocities, of EXPL and ROLL ACC and DEC were compared between competition levels.

Results and Discussion: Results revealed that EXPL ACC and DEC actions, and the magnitude of velocity in intense EXPL DEC were greater in club teams, across all thresholds. However, the duration, and the final velocity of such actions were greater in national teams. The magnitude of velocities in ROLL ACC, across all thresholds, was greater in national teams, as well as the initial and final velocities during intense (4

-5m/s2) ROLL ACC, when compared to club teams. Similarly, initial and differences in velocities in very high and intense ROLL DEC was greater in national teams than club teams.

Conclusions: The intensity and magnitude of ACC and DEC efforts were greater in national compared to club level futsal competition Differences between competition levels suggest differences in physical (strength and power development) performance profiles with implications for training and recovery protocols. Also, the differences in EXPL ACC / DEC and ROLL ACC / DEC should be considered to improve the process of monitoring and for the design of specific futsal training protocols. Further analysis of contextual and situational variables should be considered in the future.

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P066| Multilevel Analysis of Sociocultural and Ecological Determinants of Playing Styles in Football: An Ecological Dynamics Perspective on Cross-Cultural Research

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Guided by the ecological premise that the footballing playing field/niche mirrors higher level (i.e., societal) social processes and dynamics, the authors sought to uncover empirical evidence linking footballing styles of play to ecological and sociocultural aspects of the environments in which the game is played. First, a pilot study was run on a sample of 21 national leagues (2018/19 season). Drawing on these results, preliminary hypotheses were formulated and tested on a 45-league sample (2020/21 season). Mixed level modeling was applied to a two-level design comprising variables at (1) team level (i.e., cultural diversity, average temperature, precipitation, and the number of red/yellow cards) and (2) league (country) level (i.e., thermal heat, homicide rate index, ingroup collectivism, ingroup favoritism and self-expression/traditionalism values). For each of three playing styles (i.e., two offensive and one defensive operationalized through principal component analysis with 55.8% of explained variance), an optimal model was derived to explain the association with playing styles in a step-by-step analytical process. Null model ICC values ranged from 13.6% (possession) and 20.5% (attacking) to 45.2% (defensive).

The results showed that the two offensive styles were associated with a more individualistic societal orientation in environments (countries) characterized by lower temperatures and higher precipitation levels. Contrarily, the defensive style appeared less dependent on specific climatic/weather conditions, but emerged as strongly related to conformity and disindividualization that typifies ingroup favoritism as well as to traditional values, which reinforce a more hierarchical and rigid culture. Cultural diversity affected variance in the utilization of all three styles either directly, at team level (i.e., for possession; $p<.001$) and indirectly with cross-level effects (i.e., for attacking, $p<.01$; for defensive, $p<.00$). These findings strengthen the argument, which stems from ecological dynamics, that environments solicit certain behaviors that are consequently reflected in pervasive patterns of collective behaviors. The authors also found that the effect of contextual constraints was altered, that is, weakened or strengthened, depending on the cultural composition of football teams. Finally, multilevel modeling indicated that the contextual effects were less pronounced in leagues with greater reliance on defensive style than in leagues where the offensive styles dominate, with defensively oriented leagues being more homogenous (i.e., within-league) but less similar to each other (between-league) compared to offensive leagues.

The findings carry applied utility that can benefit football practitioners working with culturally diverse teams to raise awareness of the salience of sociocultural and ecological aspects of skill development and training design.

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P067| Quantifying Nonlinearity in school football

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Over the last decade, research in skill acquisition have provided strong evidence to underpin coaching practices that account for the dynamism and complexity inherent in learning a sports skill (Chow et al., 2016;Renshaw et al., 2016). An implication of this is that coaches should redesigned training to include tasks that offer opportunities for players to explore and adapt movement solutions that closely represent competitive sports performance. One such practice that has a growing interest over the years is Nonlinear Pedagogy (NLP) that can provide coaches with key principles to design practice such as on the structure of practice tasks, delivering instructions and providing feedback (Chow, Renshaw, Button, Davids, & Tan, 2013). Quantifying coaches' practice can provide information to coaches on how nonlinear their practice was and to further guide them in increasing the degree of nonlinearity in their sessions; in order to benefit from the effects of an NLP approach. This study aims to quantify the degree of nonlinearity of coaches' practice in schools football training. During a training session, all the three pedagogical channels (practice, instruction and feedback) are used by coaches at the same time and as the practice organization interacts with instructions and feedback from coaches; quantifying the degree of nonlinearity should account for this complex interrelationship between the pedagogical channels to provide a holistic perspective of the session. An NLP observation tool will be used to observe the pedagogical activities within the three pedagogical channels of practice, instruction and feedback of football coaches in secondary school training to get an index of nonlinearity of each session. No specific instructions will be given to the coach on how to conduct the sessions as it is important to observe a typical training session. This study will contribute to understanding the application of NLP principles at the micro level of coaching practice and provide a benchmark of the current practices of coaches in school.

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P068| The influence of playing position and contextual factors on running performance in professional portuguese soccer players

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The purpose of this study was to assess varying running intensities across different playing positions in professional Portuguese soccer players. The effects of contextual variables (match location, half and result) on running intensities were also analyzed. Match performance observations were collected using Global Navigation Satellite System devices across 11 matches during a competitive season (2019-2020). Data were analyzed using IBM® SPSS® Statistics v.27 discretely for five playing positions: goalkeepers (n = 11), central defenders (n = 42), wide defenders (n = 31), central midfielders (n = 34), open attackers (n = 28), and centre forwards (n = 14). Open attackers covered the greatest high-speed running distance (18 - 23.9 km/h; 561.4±143.2 m), while central defenders covered the least (211.8±58.3 m). The highest sprint distance (≤ 24 km/h) was covered by the open attackers (199.6±89.9 m) and the lowest by the central defenders (33.9±23.9 m). Contextual variables did not influence running performance. The data demonstrate that varying differences in running performance occur between positions, but such disparities are not influenced by contextual variables. These findings be used to inform position-specific physical training to prepare players for the specific demands of competition.

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P069| Physical & Physiological Maximal Intensity Periods of Elite Youth Soccer Match Play

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This study quantified the MIP of match play with both external (physical) and internal (physiological) variables and investigated the effects of contextual factors (positions, starting status - starter vs. substitute, timing of occurrence, match location, match result, score-line and formation) on the MIP in elite youth soccer. Data was collected through Micro-electro-mechanical System (MEMS) devices from 26 youth male soccer players at an English Championship club's academy (age: 18 ± 0.8 years, height: 180.8 ± 7.4 cm, weight: 70.4 ± 8.4 kg) across 31 matches. Players' positions were categorised into central defender (CD), full-back (FB), central midfielder (CM), wide midfielder (WM) and Striker (ST). MIP for total distance (TD), distance at 5.5-7 m·s-1 (high-speed running; HSR) and at >7 m·s-1 (sprinting; SPR), average acceleration/deceleration (AveAcc), PlayerLoadTM (PL) and heart-rate (HR) were calculated using moving average approach across different durations (1-10 minute). Additionally, the timing of occurrence for each variable was quantified to investigate the association between physical and physiological characteristics.

The majority of the MIP for TD, AveAcc, PL and HR occurred during the first 15 min of match play across a range of period length; >33%, >36% and >40% for 3-, 5-, and 10-min MIP, respectively. The MIP for HSR and SPR were similarly distributed to each half, regardless of the duration. CD showed the lowest MIP for TD, HSR, SPR and HR (effect size [ES] = 0.58-0.86), while the MIP for HR was the highest for CM across all durations (194-183 bpm; ES = 0.48-0.6). The starting status did not elicit differences with any variables. The MIP for SPR were higher for games at home (ES = 0.25-0.35), across losing (ES = 0.39-0.71) or winning (ES = 0.36-0.65) conditions.

The MIP is likely to occur under multivariate conditions and does not occur concurrently for physical and physiological variables. Nor is it consistent for positions. The MIP for both physical and physiological variables with contextual factors taken into account would provide more feasible scientific evident and may assist to develop soccer-specific training modalities.

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P070| Efficiency of the offensive process in elite football teams

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This study aimed to compare and describe how goals were scored in two major professional football leagues (English and Spanish Leagues). First, we analyze the goals scored through the variables: Offensive Pattern; Duration of Ball Possession; Ball Possession Type; Start of Ownership; Finishing Zone. Subsequently, a description and comparison of the data obtained in the three competitions were made.

In total, 1409 goals were analyzed (video images obtained from Wyscout ®) from the sporting season 2020/2021. Data were analyzed through SPSS V.23.

Concerning the offensive patterns of play, La Liga stood out with positional attack/fast attack (46%), the most frequent counterattack in the Premier League (34%). Concerning the duration of ball possession, the shortest possession seems to increase the probability of scoring a goal. The offensive sequences with the lowest number of passes resulted in a greater number of goals (between 56% and 62%). The attacking third was the field zone, where more offensive sequences resulted in goals (between 43% and 54%). Concerning the finishing areas, the ones that stood out the most were ZPA (between 22% and 24%), ZCEPPA (between 22% and 41%), ZCEGAP (between 8% and 34%). We concluded that short-term possessions are more effective, both in the number of passes and duration. Positional attack/quick attack was the most used offensive playstyle. Set pieces represented many goals, highlighting their importance in decisive moments.

Keywords: Match analysis; Offensive Patterns; Game Style; Patterns of play

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P071| Detection and analysis of regular behaviour structures in effective offensive sequences in two elite portuguese teams

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The main objective of this study was to analyse the offensive actions of the Under-19 and senior teams of two elite teams in Portugal (FCP and SLB). The observational methodology was used for data collection, through a nomothetic/follow-up/multidimensional study design. The offensive sequences of 147 goals were recorded, corresponding to 60 goals from FCP and 87 from SLB, during the 2018/19 season. To perform the sequential delay analysis, the SDIS GSEQ software was used. The quality of the data collected was guaranteed through the analysis of 23 goals, with an interval of 15 days after the first record, having obtained agreement values above 0.90 for all variables. Overall, the results showed that: i) in the offensive phase, there are behaviours that maintain an excitatory relationship with certain behaviours to the detriment of others, allowing the determination of sequential patterns of behaviour and excitatory relationships of some behaviours in relation to others that precede or succeed; ii) the midfield sector emerges as the area where the greatest number of ball possession recoveries occurred; iii) complete description of all data prior to the goal ; iv) there are excitatory relationships that certain behaviours maintain with each other and that increase the probability of positive transitions towards the end of offensive sequences that end with a goal; v) the sequential patterns revealed specific characteristics of the teams under study. Effective actions, that is, ending with a goal, occur more frequently when ball recoveries are made by interception, in the offensive midfield. Also, the type of ball recoveries and their zones indicated that these teams tend to control, mostly, ball possession in the opposing midfield. The counterattack seems to be the play method that most often induces successful offensive action endings. The most preferred area for finishing is the opponent's penalty area, and both teams performed, with greater frequency, sequences that include a set of 3/4 passes to obtain a goal. The understanding of the trends and offensive development of a team, allows coaches to understand where the players interact the most in spatial terms, and the most stimulated areas of the field.

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P072| Systematic Observation of Corner Kick Strategies in Portuguese Football Players

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Set pieces are important for the success of football teams, with the corner kick being one of the most game defining events. The aim of this research was twofold: (1) to analyze the corner kicks of a senior football amateur team, and (2) to compare the corner kicks of successful and unsuccessful teams (of the 2020/21 sporting season). In total, 500 corners were observed using a bespoke notational analysis tool, using a specific observational instrument tool (8 criteria; 25 categories). Out of the 500 corner kicks, 6% resulted in a goal. A greater number of direct corners using inswing trajectories were performed (n = 54%). Corners were delivered to central and front post areas most frequently (n = 79%). Five attackers were most predominantly used for offensive corners (n = 58%), but defenders won the ball more frequently (n = 44%). Attempts at goal occurred following a corner most commonly from outside of the box (n = 7%). Goals were scored most frequently with the foot (n = 16%) and head (n = 15%). Successful teams are more effective at reaching the attackers and score more goals directly from corners. Unsuccessful teams deliver more corner kicks out of play, the first touch is more frequently from the opposition defenders, and fewe goals are scored from corner kicks. The study provides an insight into the determining factors and patterns that influence corner kicks and success in football matches. This information should be used by coaches to prepare teams for both offensive and defensive corner kicks to increase team success and match outcomes.

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P073| Physical demands according to tactical match dynamics: a research project

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Team sports, such as Futsal, are complex adaptive systems, consisting of many components (e.g., players, ball, etc.) which interact in particular environments (e.g., teammates, ball, court dimensions, etc.) to achieve task goals (Travassos et al., 2011). From an ecological dynamics perspective, it is key to understand how players coordinate and act as a team. Players perceive and act constrained by match events to achieve a particular performance goal (Araújo & Davids, 2016). Futsal is managed considering rolling substitutions with players who are not starting lined up. It is a physically demanding intermittent sport where players are constantly exposed to intermittent high-intensity actions, including a great number of accelerations, changes of direction, and sprints, with short recovery times (Spyrou et al., 2020).

We aim to understand the physical demands related to match phases and critical events, like attacking, defending, transitions, goals scored, goals conceded, considering numerical (in)balance. This ecological dynamics approach offers a description of how fatigue and metabolic energy can be used tactically and for goal achievement. With the use of a local positioning system, metrics like total distance covered, accelerations and sprints will be computed. Moreover, to capture the properties of synergic behavior in futsal, we will measure the eco-physical variable player-goal-corner angle for every player and compute the team cluster phase (Carrilho et al., 2020). This variable describes team synergies over different match phases and critical events. Such integrated explanation offers precise knowledge for representative practice design.

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P074| “Play what you train?”: the example of set pieces in youth football

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The fotttball training environment should provide the same sources of information, decisions and variability as matches in order to prepare players for the match demands, but still there are few investigations where match and training thactical demands are related. In this study, it was intended to observe whether the training and game conditions and outcomes were similar in terms of ofensive and defensive tactical demands of set pieces, in youth football teams of portuguese championships U15, U17 and U19. Three complet microcycles (all training sessions and the game) from six teams, two teams in each category, in total 18 microcycles, 59 training sessions, 18 matches. In total, 8650 codified actions were observed. It was found that set pieces were not always performed in competition in the same way as they were trained, especially with regard to goal kicks, throw-ins and free kicks. It was found that teams that normally used a most similar way of marking set pieces in training and game, had higher success. Regarding the finishing situations, in the training five shots were required to score a goal, and in the game ten shots were needed to score a goal, we found that were not the teams that had more finishing and most goals scored in training sessions that had more shots and more goals scored in game. On the defensive set pieces not always the defensive methods used in the game were the same ones used in training as well as regarding the placement of players in the posts (in the corner kick), in training was often not put any players on the posts but in competition usually put one player in the first post. We conclude that the teams gave more prominence to the training of offensive set pieces, instead of the defensive, however suffered more goals following set plays than they have scored. The most trained set pieces in training were corner kicks, free kicks and penalties, and the teams scored more goals from free kicks and conceded more goals from corner kicks.

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P075| An attempt to quantify the difficulty in a goalkeeper's defensive response to a cross ball

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Our research group used data from the 2010 FIFA World Cup held in South Africa to construct a regression equation that quantifies difficulties in a goalkeeper's shot blocking (Hirashima et al., 2014). Using that regression equation, we evaluated goalkeepers who participated in the 2014 and 2018 World Cups and presented the results from Rennes 2017(Hirashima et al., 2017) and Melbourne 2019(Hirashima et al., 2019). Subsequently, this study used logistic regression analysis to identify factors that influence the success or failure of goalkeepers' defenses against crosses. Then, sample data were obtained from 550 scenes (134 successful and 416 unsuccessful) of a defending goalkeeper's crossing during the 48 qualifying league matches of the 2018 FIFA World Cup held in Russia. Results showed that the main factors influencing the success or failure of a goalkeeper's defense to crosses were set play or open play, presence of defenders in front of the crosser, presence of defenders in contact with the crosser, presence of changes in the trajectory of the cross by other players, the number of opposing players within five meters of the arrival point of the cross, the number of friendly players within five meters of the arrival point of the cross, the number of friendly players between the arrival point of the cross and both posts, the distance from the goal to the sending point of the cross, the distance from the goal to the arrival point of the cross, the distance from the goal to the last line of defense, and the crossing speed. Therefore, a future task is to construct a regression equation to quantify the degree of difficulty in dealing with crosses on the basis of the 11 factors extracted in this study. The fulfillment of this task will enable the development of an objective index for evaluating goalkeepers' ability to defend against crosses.

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P076| Analysis of the interaction and offensive network of the Portuguese national team at the 2016 European Championship

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This study investigated the offensive actions preceding shots, using a combination of pass sequences and network analysis of the Portuguese national football team in the European Championships. The sample consisted of 118 collective offensive actions that ended in a shot based on seven European Championships games (e.g., 3 x group stage matches, 1 x round of 16, 1 x quarter-finals, 1 x semi-finals and 1 x final). The InStat© platform was used to access the games in a video file format and consequently coded through the VideObserver® and Upato® software's. Results highlighted that 87 pass sequences were performed from the moment the team regained possession until they finished the offensive process. The results show that 488 intra-team interactions were performed, and the highest level of interactions occurred between player number 10 (midfielder) and player number 7 (forward), with a total of 11 interactions. Player number 7 (forward) obtained a total of 103 interventions, and thus was considered a key player regarding passing sequences. Much of the finishing resulted from shorter ball-possession sequences. Most of the number of passes were made during the group phase (97.3 ± 50.1 passes), compared with the knockout phase (49 ±

23.6 passes), assuming that the team adapted to their rivals during the last phase of the competition. This study demonstrates important trends in relation to passing sequences and adds key insights into interactional context within and between players during a European Championships.

Keywords: Network, Metrics, Football, Game Analysis, VideObserver®, UPato®.

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P077| The influence of audience on the home advantage in football matches in UEFA and CONMENBOL competitions

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This main aim of this study was to analyze the effect of home advantage in championships belonging to the UEFA confederation in Europe and the CONMEBOL confederation in South America, considering the presence (or no) of public, due the specific conditions of the pandemic.

Data was collected from the matches held in the years of 2019 and 2020 in UEFA (55 countries) and CONMEBOL (10 countries) domestic competitions (first national division). The data collected refer to the 2019/2020 sports season, until March 15, 2020, the day on which most championships stopped. The second phase of data collection began as the championships started again (without an audience in the stands) and lasted until September 13, 2020.

Descriptive statistics and chi-square test were calculated using the software SPSS V.27.

It was possible to verify that there was a reduction in the global average of 45% (in both UEFA and CONMENBOL competitions) of home wins in matches with audience to 43% and 40% (UEFA and CONMENBOL, respectively) for matches without an audience.

Only five countries displayed a significant association between the home factor and presence of audience, namely Germany, Greece, Sweden, Georgia and Peru.

The results of our study proved to be inconclusive. It seems to have been shown that the presence or absence of an audience did not significantly influence the results of the matches.

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P078| Capturing bi-directional synergy formation in elite football teams through multilevel hypernetworks

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Managing bi-directional synergy formation during competitive performance is of chief importance as such co-existing processes allow enhancing team functionality (Ribeiro et al., 2019a). Nevertheless, ascertaining the interplay of global-to-local and local-to-global self-organizing tendencies is challenging as it requires the adoption of adequate tools and methods to assess the complexity of interrelated levels (from micro-meso- macro levels). Therefore, our aim is to provide a brief demonstration on how multilevel hypernetworks (Ribeiro et al., 2019b), a novel and potent methodological approach, can be used to capture the bi- directional synergy formation processes during competitive performance. The positional raw data (2D) of twenty-eight male professional football players (22 starting players and 6 substitutes) was provided by STATS. These data were acquired through a multiple-camera match analysis system from which the movements of all 28 players performed during the match were recorded with the cameras placed at the top of the stadium. The frames were processed at 1Hz using an automated system that synchronized the video files. The effective playing area was 68m wide and 105m long. A computer procedure for calculating the simplices' hyperedges, set with the proximity-based criteria, was conducted using GNU Octave version 4.4.1 and implemented to each frame of the match. A visual representation of multilevel hypernetworks regarding four consecutive frames of the match was used to verify variations in the number and types of simplices. Variations in the number and types of simplices were observed and involved ongoing and simultaneous changes in global topology (i.e., topological evolution) and local dynamics (through players' reorganization of team synergies). Multilevel hypernetworks seem to constitute an adequate and sophisticated method for capturing the bi-directional synergy formation processes in football teams.

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P079| Home Advantage in Professional Soccer: the Case of Real Madrid

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Home advantage in team sports has an important role in determining the outcome of a game. The aim of the present study was to identify the soccer game-related statistics that best discriminate home and visiting teams according to the team quality. The sample consists of all 38 matches played by Real Madrid (19 matches at home and 19 away) in the 2018-2019 Spanish La Liga (n = 38). The independent variables were game location (home or away) and the team quality. Teams were classified into four groups according to their final ranking at the end of the league. The game-related statistics registered were divided into three groups: (i) variables related to goals scored; (ii) variables related to offense and (iii) variables related to defense. A univariate (T-test and Mann-Whitney U) analysis of data was done. Overall, the findings suggest when play at home have significantly higher means for Shots (P=0.024), Total passes (P=0.029), Accuracy passes (P=0.025), Accuracy passes% (P=0.017), Short passes (P=0.019), Accuracy short passes (P=0.02), Passes number (succeed) 3/3% (P=0.016) and Crosses (P=0.001), while at away presented significantly higher means for Shots received (P=0.012) and Shots on goal received (P=0.026). In addition, the findings of the current study confirm that game location and the quality of opponent are important in determining technical and tactical performances in matches, Real Madrid had different performance of home advantage when play with different qualities of opponents.

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P080| Executing penalty kicks in the Danish football top-tier – Do match-related circumstances matter?

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The purpose of this study was to examine whether situational indicators have an impact on the shot placement in penalty kicks in an elite football league. A retrospective observational longitudinal study design was adopted to examine 263 penalty kicks from the Danish top-tier from the 2015/16 to the 2019/20 competitive season (pre-COVID-19). 74.1% of all shots (n = 195) resulted in a goal, 19.4% of all shots (n = 51) were saved, 6.5% of all shots (n = 17) were missed. 70.7% of all shots (n = 186) targeted the lower section of the goal, while the remaining 29.3% (n = 77) targeted the upper section of the goal.

A binary logistic regression analysis was conducted to examine a difference in shot placement distribution caused by multiple situational variables. The analysis demonstrated a difference ($p<0.05$) between shot placement distribution in the first and last 15 minutes of each half, with higher probability of a penalty kick targeting the lower section of the goal in the first 15 minutes of a match half ($p = 0.024$). In terms of match score when the penalty kick was awarded, kicking team level, playing at home or away, shooter's tactical position, season and match day, no significant difference was found. Nagelkerke R Square was determined at 0.65.

The study finds that penalty kicks have a significantly higher probability of being directed towards the upper section of the goal, when a penalty kick is awarded during the last 15 minutes of a football match compared to the rest of the match, as well as when a penalty kick is awarded during the last 15 minutes of a match half, compared to the first 15 minutes of a match half.

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P081| Match demands differences between youth soccer teams

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Currently, playing high performance soccer determines the need of a growing set of physical abilities for all players involved. Despite considering the development of young footballers as a comprehensive process, there seems to exist physical requirements that urge to be attained, enabling young players to be prepared for the elite level. To guarantee the effectiveness of this development process, training programmes in elite soccer academies should be specifically determined by the physical demands observed in competition matches. This study aimed to analyze match demands in four youth teams of a portuguese elite soccer academy (U-15, U-17, U-19, and U-23), using the Global Positioning System (GPS). Male soccer players (n=138, 17 2,6 yrs) were monitored over 35 competition matches, distributed throughout the season. Total distance (TD), high speed running (HSR), sprint running (SR), explosive distance (ED), and high metabolic running distance (HMRD) data, were collected and further analyzed. Due to the different match durations, all values were normalized for total competition minutes. Players from U-15 present significantly lower absolute values for TD ($p<0.05$) when compared to all other teams, however, these differences did not sustain when TD was relativized for total competition minutes, except for the U-19 tier (+7.7%, p U15, p U -17, p U15, $p<0.05$). Importantly, HMRD/min and TD/min only show differences between the U15 and the U -19 ($p<0.05$), and U-19 and U-23 did not present any significant differences in all variables. In this study, it also has been shown that in competition settings, running differences between elite youth soccer teams, are fundamentally observed in high-speed running's (HSR and SR). Based on our results, it seems crucial to add a relative view of the running distances (m/min), to the absolute external load produced by the players, to better understand youth teams match demands. Moreover, results indicate that the major differences between these youth teams occur on high-speed running distances (HSRD and SD), particularly between the U-15 and all other teams.

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P082| Are match physical performances correlated with weekly training load? - a pilot study with elite female soccer players

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Introduction

Training- (TL) and match load (ML) have become relevant research topics in team sports and load quantification has become an important method to personalize training stimulus' prescription to players [1]. Despite previous research investigating the variation of weekly load across the season [2], scarce information is available regarding the effects of the weekly TL that precede competition. The aim of this study was to analyse the correlation between the TL of typical microcycles with the match physical performances in elite women´s football.

Methods

13 professional players from a Portuguese football club were tracked during the 2020/21 season. Player data was collected using GPS APEX (STATSports, 10Hz) including total distance (TD), high-speed running distance (HSRD), sprint distance (SpD) and acceleration distance (ACCdist). Match and training data of 13 microcycles with 4 training sessions and 1 official match each cycle was analysed. Training and match data was analysed if: (1) player completed the entire training week and played ≥60 min of the match and (2) the player presented ≥3 match observations within the 13 microcycles. Four models were built, one for each GPS metric. Each model was built with the scaled relative match load metric as the independent variable, and the scaled weekly load for the given metric as the dependent variable. Due to non-independence of cases, player and microcycle were set as random effects.

Results & Discussion

Results revealed significant and positive correlations ($p<0.001$) between TL and ML variables, specifically for TD ($r=0.54$), HSRD ($r=0.76$), SpD ($r=0.86$) and ACCdist ($r=0.44$). Although, this relationship is expected to be non-linear, since the fatigue accumulated during the training week may, at some point, diminish the players' match performance.

Conclusion

Preliminary results revealed moderate to strong correlations between match physical performances and weekly training loads.

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P083| Use of technological devices to quantify external and internal load in soccer players in competition: A systematic review

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The main aim of this study was to review and synthetize the available literature concerning the use of devices for the determination of external and internal load in soccer players.

The review followed the PRISMA guidelines. The search was conducted in three databases (Scopus, PubMed and SciELO), and original articles contained relevant information concerning the topic, published in the period of 2015-2020 were included. The keyword was: Football OR Soccer, each one associated with “physical load”, “internal load”, “external load” and “electronic device”. Evaluation of the quality of the included papers was done through the Critical Review Forms Law et al. (1998) for quantitative studies.

The search retrieved 1163. After the screening process, 54 original articles were included in this review. The results revealed that for the quantification of the external load: (1) 44% used video systems; (2) 35% used GPS devices; (3) 7.4% used a combination of GPS and accelerometers; (4) 5.6% used accelerometers or microwave devices, and (5) 1.9% based their measurements on GPS and video systems. Only 5% of the studies reported an assessment of internal load (heart rate, subjective perception of exertion, and metabolic rate).

We concluded that there is a meaningful technological tool that are used to quantify the load on soccer players during competition; however, most of these tools do not include internal load variables and, in those studies that report these types of variables, there is no in-depth analysis of the data collected

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P084| Associations between physical performance changes and training intensity in professional soccer players

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Objective: The present study had two aims: (i) examine the team physical performance changes after the pre-season period; and (ii) test the associations between internal and external training intensity (TI) measures and the observed physical performance changes. Methods: Twenty-two professional soccer players (age: 27.2 ± 3.4 years; height: 174.2 ± 3.6 cm; body mass: 69.1 ± 6.4 kg; body fat%: 10.4 ± 4.1%) participated in this study. Internal TI was collected via a heart rate (HR) monitor and session-rate of perceived exertion (sRPE), while external TI was collected by a global positioning system in all sessions. Pre- and post-physical performance assessments were conducted using the Vameval and 30-15 intermittent fitness test (30-15IFT), using the velocity reached in the final stage of both tests (Vvameval and VIFT, respectively) as the final outcome. Results: VIFT had very large associations with Vvameval (r = 0.81). However, Vvameval presents lower sensitivity (−22.4%, [−45.0 to 9.4]), ES −0.45 [−1.05 to 0.16]) than the VIFT to track small changes in aerobic performance. Despite VIFT had unclear relationships with sRPE, moderate associations were found with all HR and external TI measures. On the other hand, Vvameval showed very large associations only with sRPE. Conclusion: Although VIFT and Vvameval presented very large associations between them, these outcomes relate with different dimensions of TI. Thus, external and HR-based TI measures can be good indicators of cardiorespiratory changes during the pre-season period in professional soccer players.

given the greater sensitivity of the VIFT to track small changes

Keywords: Soccer; physical fitness; training intensity; dose-response

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P085| The relationship between iTRIMP and aerobic fitness: A re-analysis

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The relationship between training load (TL) measures and aerobic performance has received recent attention. When a range of TL measures have been used to form a dose-response relationship with aerobic performance, the individualised training impulse (iTRIMP) method seems to provide the strongest relationship. In soccer, this method has shown relationships with field and lab-based aerobic fitness assessments. However, designing TL dose-response studies is problematic due to low sample sizes. To increase the sample size and generalisability of the dose-response data between iTRIMP and aerobic fitness, a re-analysis of all raw iTRIMP data within soccer would provide more information on the uncertainty of this TL measure. Thus, this study aims to identify whether pooling all soccer iTRIMP data can provide practitioners with a less uncertain estimate of the dose-response relationship.

All authors (n=3) who conducted soccer research with iTRIMP complied with a request for data. The percentage change in running speed at which blood lactate reaches 4 mmol L-1 (S4) was used as the dependent variable as this was reported across all studies. Bayesian analysis was used to reanalyse the data as it is more suited to the smaller sample sizes as the MCMC methods used to produce posterior distributions do not depend on asymptotic the same way that traditional frequentist methods do. Four outliers were removed via Pareto-smoothed importance scaling as these would considerably affect the posterior distribution and left a total of 31 participants for analysis. The results indicate that iTRIMP explained 47% (95%CI; 22%-62%) of the variance to the changes in S4 using a 2nd order polynomial fit. Regression analysis demonstrates the uncertainty in the required dose (553 AU, 95%CI; 164-940 AU) to maintain fitness at S4.

Re-analysing the data to provide a more generalisable estimate to prescribing TL to inform exercise prescription is still uncertain. Factors unique to each team, environment, and individual may affect the dose- response relationships between TL and fitness, making it difficult to generalise beyond that group. Given this finding developing dose-response frameworks for homogeneous teams and individuals should be considered for longer periods of time over amalgamation of data from different teams.

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P086| Training loads responses in young soccer players

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The aim of this study was to quantify internal training load (session-RPE) and to assess its correlations with external training load (training plan) designed by coaches.

During a regular training week, three groups of Portuguese national level young soccer players were monitored; 14 under-15 (age 14.8±0.2 yrs; stature 171.2± 4.8 cm; body mass 59.5±5.7 kg; body fat 20.3±1.4%), 15 under-17 (age 16.6±0.4 yrs; stature 175.5±6.7 cm; body mass 67.8±8.2 kg; body fat 13.2±3.1%), 18 under-19 (18.3±0.4 yrs; stature 174.7±5.2 cm; body mass 66.6±4.6 kg; body fat 11.8±4.1%). Perceived exertion was obtained using the category ratio (0-10) RPE scale of Foster. Training sessions were designed by the coaches and were not influenced by the study. Coaches analyzed their training sessions using the methodology proposed by Issurin (2008).

Sperman RHO correlations between coach´s stress rates and athletes´ RPE and between coach´s stress rates and training load were calculated using the software SPSS V28.

In U-15 and U-17, the correlation was higher with RPE and coach´s intensity ($r=0.999$, $p<0.01$ and $r=0.982$, $p<0.01$, respectively) and with coach´s intensity and training load ($r=0.993$, $p<0.01$ and $r=0.944$, $p<0.01$, respectively). In U-19 group, the correlation was moderate with RPE and coach´s intensity ($r=0.760$, $p<0.05$) and with coach´s intensity and training load ($r=0.620$, $p<0.05$).

The results of our study demonstrated that the session-RPE can be considered a good indicator of global internal load of soccer training. This method does not require expensive equipment and can be very useful and practical for coaches to monitoring and controlling internal load.

Issurin V. (2008). Block periodization versus traditional training theory: a review. J.Sports Med Phys Fitness., 48(1),65-75.

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P087| Weekly external load in an amateur soccer: A match reference study by positions of play

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Ensuring adequate levels of training and recovery to maximize player performance is critical, however there are methodological challenges in designing a periodized training program for soccer teams, and a common problem for coaches is determining the appropriate training loads during the week. This study aims to describe and characterize the daily and weekly external load in an amateur soccer team and based on the weighting factors determined by the match reference, compare the external loads between playing positions. Twenty-four amateur soccer players (22.6 ± 2.3 years) were monitored using a global positioning system. Data collected comprises 19 competitive microcycles with a standard structure composed of 3 training sessions (MD-5, MD-3, and MD-2) and one match. Match-reference values were calculated as the mean of the five best values recorded during official matches. The results show, on MD-5 session, the existence of significant differences between playing positions relatively to rTDC ($p=0.050$), rSpD ($p=0.001$), rMI Acc. ($p<0.001$), rHI Acc. ($p=0.003$), rMI Dec. ($p<0.001$) and rHI Dec. ($p=0.017$). On MD-3 session, there are significant differences relatively to rVHSRD ($p=0.017$) and rMI Dec. ($p=0.014$). On MD-2 session, there are significant differences relatively to rHSRD ($p=0.025$), rVHSRD ($p=0.008$) and rMI Dec. ($p<0.001$). Weekly, significant differences are observed between the playing positions in relation to the rMI Acc. ($p=0.002$), rHI Acc. ($p<0.001$) and rMI Dec. ($p<0.001$). We conclude that the weekly load is characterized by a greater weighting on accelerations and decelerations, compared to distances at very-high speed and sprint, measures of weekly load where players tend not to fulfill the requirements demanded by the match. It will be essential to attend to exercises that require higher running speeds, for which the definition of suitable playing areas is crucial. The differences observed in the loading of the different playing positions demonstrate that the training loads must respect a standard training model, which contemplate the individualization of the physical demands of the match

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P088| The effects of game timing on warmup and in-game player load in an American college men's soccer team

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The effort that a soccer player exerts in a game, as well as the warmup, is a crucial aspect of team performance and an important consideration for recovery and injury prevention. Player load per minute (PLPM) has become increasingly used as a reliable measure of player workload in soccer. The aim of this observational study was to examine the relationship between game timing (weekday/weekend, afternoon/evening) on PLPM, separately for both the warmup and the game itself. Playertek 10 Hz GPS sensors (Catapult Innovations, Melbourne, Australia) were used to measure the PLPM for each player (N=19) in an American college men's team across 19 games of a typical soccer season. For each event, day was coded as 0 (weekday) or 1 (weekend), and start time was coded as 0 (before 16:00) or 1 (at/after 16:00). We used dynamic multilevel modeling to analyze the extent to which day and start time were associated with warmup PLPM and in-game PLPM. In both the warmup and in-game analyses, we found that weekend games and later starting times were associated with higher PLPM (i.e., main effects). Most notably, there were significant interaction effects of day and start time such that average warmup PLPM was highest for weekend games with later starting times, while the average in-game PLPM was the lowest for these games. Our findings suggest that American college men's soccer players exert more workload during the warmup, but less in-game workload, for weekend evening games. This contradiction suggests that players may be over-exerting themselves in the warmup for these games and consequently unable to sustain their usual effort levels during the game itself. It will be important to replicate this study over multiple seasons, with other workload metrics, at different levels of soccer, and in women's soccer. Coaches may want to consider strategies to ensure consistent workload levels in warmups and within games regardless of scheduling days and times.

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P089| Player global profiles for match and training sessions

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Tracking systems generate so many external load parameters that analysing them individually seems unreasonable. Objectively, the available time to plan and evaluate training and game sessions is short, compelling sports scientists to choose a small set of parameters which, ultimately, should translate the expectations defined by the coach and technical staff. Nevertheless, there is no consensus on which key performance indicators to choose. The scientific literature, along with the empirical knowledge of sports scientists, coaches, and technical staff, contribute to identify, at least, the ones being used the most. However, in practice, even with a small set of parameters, players performance and comparisons are often supported by single parameter analysis, being difficult to present an “overall picture” of their behaviour. In fact, the global approach should be the starting point, before going deeper in the analysis of single parameters. Thus, we present a methodological approach to calculate a global player profile from compilation of external load parameters. For the case, a set of 27 parameters (based on time, distance, speed, and acceleration), from 18 elite players of a Portuguese team playing at Liga Portugal, was used to calculate player physical profiles from 13 official matches and the corresponding 70 training sessions. Firstly, the data from each player in each parameter were converted into standard scores, after being ranked and transformed into percentiles. Then, the mean of the 27 standard scores was calculated for each player resulting in a ranked match and training profile for the team. Results suggested a positive association between exposure time to match and match physical score, while no association was found between exposure time to training and training physical score. The two profiles were compared, and the results also suggested there was no explicit relationship between them. For example, players with high physical scores in training sessions may present low physical scores in match sessions, and vice versa. A global match and training profile was also calculated being observed that the ranking changes with normalization to exposure time, but no association was found between the two variables.

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P090| Differences of high-speed actions between matches and training sessions in semi- professional soccer players

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High intensity physical efforts such as high sprint running, sprint running and peak speed, are considered to be key factor in elite soccer (1). Moreover, these actions in competition have increased in recent years (2) and have been shown to be important for injury prevention (3). As a consequence, their implementation for both conditioning purposes and injury prevention is recommended. Therefore, the aim of this study was to compare the differences between these variables collected in matches vs those recorded in different training sessions (TS).

Global positioning system (GPS, Catapult EVO) data were collected from 8 local competitive matches (CM) and 8 training weeks during the 2020–21 season. Training data were analyzed with respect to the number of days before or after a match (MD; MD+1; MD-4, MD-3 and MD-2). Running activity from fourteen semi- professional soccer players (22.4 ± 2.0 years) was recorded in the following ranges: distance covered between 19,9 and 25,2 km.h-1 (HID), distance covered at above 25,2 km.h-1 (SP) and peak speed (PS).

Regarding MD significantly lower values were observed for HID and SP during MD+1; MD-4, MD-3 and MD-2 ($p < 0.001$), while no differences were found for PS during MD-3.

In relation to compare the high-intensity actions of semi-professional soccer players in MD with TS, our findings show that high velocities responses obtained in TS were significantly lower than those obtained in MD . Therefore, these soccer players may not be sufficiently stimulated to face the competition with guarantees.

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P091| The weekly external load relative to game demands by positions of play: a first approach in a portuguese professional football team

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Ensuring adequate levels of training to expose athletes to an appropriate training stimulus it's the big challenge for coaches. Coaches use to say that players maximum effort must be at game day, so this study aims to describe the external load of one portuguese first League professional team, from season 2021/22 and based on the weighting factors determined by the match reference (as the 100%) and analize between playing positions. Twenty-tree soccer players were monitored using a global positioning system. Data collected comprises one competitive microcycle with a standard structure composed of five training sessions (MD+2, MD-4, MD-3, MD-2 and MD-1) and one match. Match-reference values was calculated as the mean of the players best values, by playing position (CB_central back, FB_full back; MD_midfielder; ST_striker and W_winger), recorded during official match.

The results have been calculated relative to the demands of the game (as being 100%) and the more importante were on MD+2 session, most positions had more then 100% in m/min and player load/min, because its was the training sessions for the non playing squad. The total number of acceleration was higher then in game, for all playing positions at MD-4 (CB 123%; FB 191,49%; MD 135,38%; ST 105% and W 103,49%). A surprising result was on MD-3, were only the CB (58,39%) show a lower percentage in sprint/m, for all others positions were more demanding then the game (FB 141,39%; MD 121,64%; ST 106,8% and W 158,87%). In all the other results, the demands were louwer them in the game. Other interesting result were that in maximum speed, none position could get a better result in training session then in the game.

We can conclude that the training microcycle is constituted by different requirements regarding the game, and according to the playing positions there also appears to be differences even within the same training day. It should be noted that some external training loads metrics are little stimulated during training (number of sprints) and others are more demanding then the game (total accelerations), so further studies are needed to deepen this information.

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P092| 3D-MOT training improves dynamic attention and field vision in youth soccer players

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In soccer, players need the ability to anticipate future events from components of an action sequence of opponents or teammates under time pressure, an ability known as “reading the game”. Previous research has shown that this ability can differentiate between high- and low-level athletes. However, athletes do not have superior vision characteristics. Conversely, sports scientists identified that perceptual-cognitive ability is related to superior performance, such as visual attentional ability is likely associated with anticipation and decision-making, and suggest that cognitive ability predicts the success of athletes. Furthermore, previous studies reported that athletes' dynamic visual attention program training setting had a significant positive impact on athletes' decision-making of passing. As such, several researchers propose the possibility of transferring non-specific cognitive function training in the laboratory to performance on the football pitch. The 3D-MOT training technique has already shown evidence in enhancing cognitive function by improving attention, visual information processing speed and working memory. In summary, in order to assess the training effect of 3D-MOT on youth soccer players, this study used 3D-MOT technology to train youth football players' dynamic visual tracking ability. 127 young males from the soccer team of Experimental Middle School Affiliated to Beijing Sports University. We used a computer randomization script to allocate players into 6 separate groups including 13 (n =20), 15 (n =20), 17 (n =9) year old experimental group, 13 (n =22), 15 (n =20), 17 (n =19) year old passive control group. The participants of the experimental group completed three times of 3D-MOT training every day, and no instruction or training was provided for the passive control group. The experimental results found that five days of 3D-MOT training can significantly improve the dynamic visual tracking ability of young soccer players, and all but one player reported increased field of view.

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P093| Speed of decision making as a key element for professional and academy soccer players' performances

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This study aimed to: 1) compare the number of decisions made in official matches between youth academy and professional soccer players and 2) compare the quality and speed of decision making between youth academy and professional players. In experiment 1 we assessed 12 soccer matches (7 professional and 5 academy matches) through notational analysis. In experiment 2 we assessed 138 soccer players from professional (n = 42) and academy (n = 96) levels. The TacticUP® was used to assess game reading and decision-making skills. Results indicated that professional players make around 56% more decisions than youth academy players in official matches of their respective tournaments. In addition, professional players are quicker in making decisions for all match situations: with the ball (offensive phase), without the ball (offensive and defensive phases), near and distant from the ball. Based on the results, we verified that both in situ (official match) and in vitro (controlled test) situations the speed of decision making was a distinguishing feature of performance between professional and youth academy players.

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P142| Using wireless inertial measurement units and the fourier transform for the analysis of effective activity time in soccer

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In recent years, the use of wearable microtechnology to track player's performance has significantly increased. Previous research suggested that the consideration of the effective time, which is the time that the players are actively involved in the game, may provide more accurate information about the competitive physical demands. However, the effective time is a variable which is usually reported by video-based tracking systems since this technology allows ball tracking. However, our hypothesis was that inertial measurement units may be used to calculate of Fast Fourier Transform (FFT) to the data collected by accelerometers and then, obtain effective activity time. Therefore, our aim was to investigate the correlation between physical performance variables and FFT time. Data were collected from 19 professional soccer players. A total of 25 matches were analyzed using WIMU Pro (RealTrack Systems, Almeria, Spain). Pearson's correlation coefficient (r) was obtained to analyze the FFT time and the physical performance variables. The statistical analysis was performed on SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA). The results showed a strong positive correlation between FFT time and total distance covered ($r=0.76$; $p<0.001$), total of steps ($r=0.72$; $p<0.001$), and player load ($r=0.70$; $p<0.001$). In addition, significant moderate correlations were observed between the FFT time and average speed ($r=0.66$; $p<0.001$), high- metabolic load actions ($r=0.61$; $p<0.001$), explosive distance ($r=0.58$; $p<0.001$), high-metabolic load distance ($r=0.57$; $p<0.001$), total of impacts ($r=0.56$), average acceleration ($r=0.52$), high-intensity accelerations ($r=0.47$), distance decelerating ($r=0.46$; $p<0.001$), high-speed running actions ($r=0.34$; $p<0.001$; $p<0.001$), and high-intensity impacts ($r=0.3$; $p<0.001$). Also, there was a moderate negative correlation with average deceleration ($r=-0.57$; $p<0.001$). Finally, a significant but weak correlation was observed for high-speed running distance ($r=0.29$; $p<0.001$), high-intensity accelerations ($r=0.25$; $p<0.05$), distance accelerating ($r=0.22$; $p<0.05$), and total of jumps ($r=0.2$; $p<0.05$). In conclusion, FFT time might be an interesting load indicator to measure effective activity time in soccer.

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