(https://sport-science.org/index.php/scientific-programme/scientific-programme)

RELATIONSHIPS BETWEEN WHOLE-BODY KINEMATIC STRATEGIES, BIOMOTOR CAPACITIES, SHIN ROLL MECHANICS AND INITIAL ACCELERATION IN ELITE SPRINTERS

Author(s): OEPPERT, T.J., KLEIN, J., BRAUNSTEIN, B., SCHAPSCHROEER, M., Institution: GERMAN SPORTS UNIVERSITY COLOGNE, Country: GERMANY, Abstract-ID: 1933

INTRODUCTION:
Initial acceleration from starting blocks is considered a complex task. While ground reaction forces associated with improved acceleration performance are well established, kinematic aspects during stance and physical characteristics are less clear [1]. In addition, recent findings in rugby players suggest that different acceleration techniques result in similar sprint times [2]. Therefore, this study aimed to investigate the influence of biomotor capacities, technical abilities (particularly the shin roll [3]) and spatiotemporal parameters on initial acceleration and to investigate if different whole-body kinematics within a group of sprinters exist.
METHODS:
25 female (100 m PR: 11.99±0.37 s) and 19 male (100 m PR: 10.72±0.42 s) national to elite level sprinters performed 10 m sprints from starting blocks and completed countermovement (CMJ), triple broad (TBJ) and drop jumps (DJ). Pearsons correlation coefficients and stepwise regression determined relationships between variables and the V/T ratio (instantaneous velocity at 10 m divided by 10 m time). Participants were categorised into step length (SL) or step rate (SR) and contact time (CT) or flight time (FT) dominant based on normalised SL/SR and CT/FT ratio z-scores (resulting in four subgroups). One-way ANOVA with Tukey post-hoc test identified significant ($p < 0.05$) technical and capacity differences.
RESULTS:
CMJ relative peak power (59.2±3.5 W/kg, $r = 0.85$, $p < 0.001$), TBJ distance (788±152 cm, $r = 0.76$, $p < 0.001$), and DJ RSI (2.05±0.4, $r = 0.72$, $p < 0.001$) showed very large correlations with V/T ratio. The mean sagittal plane shin angle during the heel lock' position relative to the supporting ground was negatively related to V/T ratio (56.5±3.5°, $r = -0.79$, $p < 0.001$). Forward stepwise regression analyses highlighted CMJ relative peak power, DJ RSI, and heel lock angle as predictive variables for V/T ratio (R2 adj. = 0.78). FT and SR dominant athletes showed a significantly reduced shin roll motion (change in shin angle from late flight to late stance) compared to the SL and CT ($\Delta = 6.1°$, $p = 0.03$) and SL and FT dominant athletes ($\Delta = 6°$, $p = 0.02$). However, no significant differences in V/T ratio and biomotor capacities were observed.
CONCLUSION:
At a group level, mechanical power, reactive capabilities, and acute shin angles during stance are crucial for acceleration performance. However, no single optimal technique appears to exist, as evidenced by the lack of significant differences in the V/T ratio across distinct whole-body kinematics. Whilst recent research has advocated for the design of tailored training based on the identification of different kinematic strategies [4], the lack of differences in biomotor capacities between identified subgroups may suggest the need for further individualised analyses.

1) Haugen et al. (2011) J Appl Phy
2) Wild et al. (2022) J Sports Sci
3) Alt et al. (2022) J Sports Bio
4) Wild et al. (2023) J Sports Phy

Back