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Hierdurch versichere ich: Ich habe diese Arbeit selbständig und nur unter Benutzung der angegebenen Quellen und technischen Hilfen angefertigt; sie hat noch keiner anderen Stelle zur Prüfung vorgelegen. Wörtlich übernommene Textstellen, auch Einzelsätze oder Teile davon, sind als Zitate kenntlich gemacht worden.

Hierdurch erkläre ich, dass ich die "Leitlinien guter wissenschaftlicher Praxis" der Deutschen Sporthochschule Köln in der aktuellen Fassung eingehalten habe.

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Introduction

Physical inactivity has been intimately associated with the way our society functions. The 2002 Report from the World Health Organization (WHO) stated that at least 31% of the world population performs insufficient physical activity. In order to maintain our living standards, we are required to spend long hours at the workplace with little or no free time in between. To make the best out of our time, we use cars to commute to work during the week and to go shopping during the weekends. The never ending rush has made physical activity a luxury in our schedule. As a result, people are generally too tired to exercise and lead an inactive lifestyle.

The promotion of physical activity is a key strategy to deal with many public health problems. There is positive evidence suggesting that the regular practice of physical activity reduces the risks of cardiovascular diseases, prevents strokes and diabetes type 2, and improves blood pressure (Cavill *et al*., 2006). Active people have lower chances of developing colon, breast, lung and prostate cancer (Cavill *et al*., 2006; Schüle, 2006). Moreover, it helps to reduce weight, to prevent or manage musculoskeletal back problems and to enhance both physical and psychological well-being (WHO-Global Strategy on Diet, Physical activity and Health, 2004; Airaksinen *et al*., 2004; Biallas *et al*., 2007).

The promotion of physical activity is not an easy task. The dropout rates for supervised exercise and sport activities are generally high, ranging from 16% (Brehm *et al*., 2001) to more than 60% (Pahmeier, 2004). Depending on the focus of the intervention, different strategies have been used to increase adherence to exercise programs. Applying health promotion programs near to where people live, study or work has reduced the most cited barrier to physical activity performance: the lack of time. Accordingly, one can build green parks with walking and cycle paths, implement exercise programs in community centers and schools, and provide incentives for employees to participate in corporate exercise programs.

Even though the lack of time is the most reported barrier to physical activity performance (Steinhardt & Dishman, 1989), programs as the ones mentioned above have shown that the first step towards a more active lifestyle is heavily dependent on personal factors. For this reason it is important to focus the intervention program on

the individuals taking part. A good experience with exercises may favor positive beliefs regarding physical activity, improve self confidence towards exercise performance and favor social interactions among the participants (Biddle & Mutrie, 2008). These processes may positively influence the intention to exercise.

Moreover, it is well accepted that an individual who has the intention to exercise may pass through many phases (stages) before physical activity becomes a habit. A person may enroll in a supervised exercise program, but as barriers arise maintenance turns into a challenge and the person may relapse and stop the practice. However, this does not mean that he/she will never exercise again. As soon as favorable conditions overcome the barriers this person may once more enroll in physical activity, initiating again the circle of exercise adoption.

Many interventions classify the participants according to their stage of motivation prior to the initiation of the program. This enables choosing the best approach aiming at fostering adherence to physical activity. For more sedentary participants, for example, a low to moderate intensity exercise program might promote positive feelings and beliefs. This will give subjects a successful experience when faced with barriers to physical activity thereby enhancing their motivation to exercise. In order to increase adherence, an exercise program for less active individuals should match the skills of their participants. If the exercises are strenuous they may promote discomfort instead of feelings of pleasure and satisfaction. As the individuals become comfortable with physical activities of lower intensity, gradual increases in exercise intensity should take place (Biddle, 1994).

While enrolling in a supervised exercise program the participants may experience many barriers. However, if the individual is able to successfully complete the program, he/she may feel better capable of organizing a schedule where professional and family duties do not compete with a regular performance of physical activity. The workplace is a perfect setting to promote physical activity since it generally has an ample communication system and a group of individuals who spend a large amount of their time together (Kreis & Bödeker, 2003). These characteristics can be used to easily spread the health benefits of physical exercises, to attract people to enroll in a fitness facility, or to organize campaigns for using stairs instead of elevators. A great step towards health promotion in the workplace can usually be reached if the intervention proves to be effective in enhancing the physical activity levels of its participants. Even though there are many phases between physical activity adoption and its maintenance, learning and experiencing an easy to perform exercise program

eventually favors an active lifestyle.

In this study, a low-intensity, calisthenic exercise program was applied to office employees of a telecommunication company. The exercise program consisted of 20 minute sessions, three times a week, applied for 12 consecutive weeks. To my knowledge, no previous study applied in the workplace has used this kind of program to promote the adoption of an active lifestyle.

The aim of this study was to investigate the effectiveness of a low-intensity exercise program in the workplace in order to encourage physical activity practice. The secondary aims involved measuring the program´s impact on the level of back pain and general health among the participants. Additionally, I explored the possible relation between self-motivation and physical activity. Finally, I investigated the motives and barriers for engaging in exercise programs.

Low intensity exercises were provided to the participants. The hypothesis was that this procedure would promote active behavior, specially among those who were less active or chronically inactive.

Chapter 1 starts with an evaluation of the recommended amounts of regular physical activity necessary for maintaining a good health standard. I then describe the health benefits of regular exercises followed by the determinants of physical activity and of physical activity promotion in the workplace. The intervention program applied during the execution of this project was designed and adapted to the context of a German telecommunication company. Chapter 2 describes this context and justifies the characteristics of the program applied. Chapter 3 describes the methodological approach in detail and Chapter 4 presents the results obtained. Finally, Chapter 5 provides a discussion of the results while Chapter 6 poses some final considerations, suggestions and perspectives for future research on the field.

"Many people may believe exercise is a good thing, but few people exercise." (Dishman & Gettman, 1980, p. 306).

I. State of art in physical activity and health promotion

This chapter describes the main theoretical points involved in the promotion of physical activity.

1.1 Physical activity and health

Nowadays, sedentary lifestyles are very common in our society. People spend almost half of their daily time in sitting positions at work. Once at home they are usually too tired to undertake physical activity of any sort.

Not only the time spent sitting behind a desk is characteristic of our sedentary society. Although most people have yearly vacations this does not mean that they will invest this time in outdoor physical activities (*e.g*. riding a bicycle, swimming, playing with their children, hiking, trekking or simply walking). As mentioned before, people tend to adopt sedentary leisure activities such as reading, playing computer games, surfing in the internet or watching television (Cavill *et al*., 2006).

Sedentary lifestyles have serious consequences for public health. Around 600.000 deaths per year are attributed to the effects of physical inactivity in the European region (5-10% of total mortality rate depending on the country, Cavill *et al*., 2006).

The definition of physical activity (PA) adopted here includes everyday movement such as walking and climbing stairs, while exercise will refer to structured physical activity (Biddle, 1994). A more standard definition considers physical activity „any bodily movement produced by skeletal muscles that results in energy expenditure" (Carpensen *et al*., 1985). One can perform physical activity while carrying out domestic duties, transporting oneself (*e.g*. cycling to work), during leisure-time (*e.g*. doing sports or conditioning exercises) and while at work (*e.g*. climbing stairs or when one performs manual tasks) (WHO-Europe, 2007). In general, one could say that normal and simple activities such as walking, cycling, climbing stairs, manual labor, swimming, hiking, gardening, recreational sport and dancing are the main sources of health-enhancing physical activities (WHO-Europe, *op.cit*.).

Despite this fact, around 17% of the world population over 15 years of age is

sedentary, while 31% to 51% perform physical activity below recommended levels (*i.e*. below 2.5 hours per week of moderate physical activities) (WHO, 2002).

1.1.1 Recommendations for maintaining good health

The World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health (2004, p.7) describes the recommended amount of physical activity required to keep an adult healthy:

"It is recommended that individuals engage in adequate levels of physical activity throughout their lives. Different types and amounts of physical activity are required for different health outcomes: at least 30 minutes of regular, moderate-intensity physical activity on most days reduces the risk of cardiovascular disease and diabetes, colon cancer and breast cancer. Muscle strengthening and balance training can reduce falls and increase functional status among older adults. More activity may be required for weight control."

This recommendation was first proposed in 1995 by the Center for Disease Control and Prevention and by the American College of Sports Medicine (Pate *et al*., 1995), and differs from the previous guidelines that were based on the amount of activity needed for developing and maintaining cardiorespiratory fitness (Am. College of Sports Medicine, 1990). This change was probably motivated by the fact that less strenuous levels of physical activity are more likely to be performed by the normal population than the more structured, vigorous-intensity prescription suggested in previous guidelines (Welk, 2002).

1.1.2 Intensity of physical activity

Estimating the intensity of physical activity required to maintain health is no easy task. First of all, the total amount of caloric expenditure associated with physical activity depends on the amount of muscle mass producing the bodily movements, as well as on the intensity, duration and frequency of the muscular contractions. Moreover, this may vary considerably from individual to individual, as well as over time for the same individual (Carpensen *et al*., 1985). Health status is one important factor to take into consideration when administrating physical activity. The same exercise given to improve or maintain the flexibility of a person with arthritis will require a different intensity when applied to a gymnast. Similarly, the amount of effort made by an individual may vary widely depending on the type of activity being

performed and on his/her physical capacity. Running is of higher intensity than brisk walking, and a young fit individual will find it easier to walk at a higher pace than an older and less fit person (Cavill *et al*., 2006).

In general, one can say that for most inactive people brisk walking is considered a moderate-intensity physical activity. However, for active and fit individuals fast walking or slow jogging are needed to raise heart beat rate and to leave them feeling warm and slightly out of breath, which are typically reactions for moderate-intensity activities. In the same way, vigorous-intensity physical activity (Fig. 1.1) usually makes people sweat and become out of breath.

While moderate-intensity activity increases body metabolism by 3 to 6 times the resting energy expenditure (3-6 METs), vigorous-intensity activity raises the metabolism by at least six times (6 METs, Welk, 2002). Physical activities leading to increases under 3 METs (or those leading to a heart rate which is under 50% of the maximal), such as stair descent and slow waking, are considered low-intensity activity (Eves & Webb, 2006; Murphy, 2004).

Moderate-intensity Physical Activity (Approximately 3-6 METs) Requires a moderate amount of effort and noticeably accelerates the heart rate.	**Vigorous-intensity Physical Activity (Approximately >6 METs)** Requires a large amount of effort and causes rapid breathing and a substantial increase in heart rate.
Examples of moderate-intensity exercise include:	Examples of vigorous-intensity exercise include:
• Brisk walking	• Running
• Dancing	• Walking / climbing briskly up a hill
• Gardening	• Fast cycling
• Housework and domestic chores	• Aerobics
• Traditional hunting and gathering	• Fast swimming
• Active involvement in games and sports with children / walking domestic animals	• Competitive sports and games (e.g. Traditional Games, Football, Volleyball, Hockey, Basketball)
• General building tasks (e.g. roofing, thatching, painting)	• Heavy shovelling or digging ditches
• Carrying / moving moderate loads (<20kg)	• Carrying / moving heavy loads (>20kg)

Figure 1.1 Examples of moderate and vigorous-intensity physical activities (WHO, 2004).

Welk (2002) explains that the criterion of 6 MET is often used as a cutoff for vigorous physical activity because for most people it represents about 60-70% of maximal heart rate (Biddle, 1994). However, as explained above, this value is generally too low for younger or more-fit adults, and too high for older or less-fit adults.

1.1.3 Health benefits of physical activity

Health benefits of physical activity depend both on the intensity and on the kind of exercise practiced. There is evidence that the performance of aerobic activity promotes the prevention of several diseases (Cavill *et al*., 2006; Kokkinos, 2008; Schüle, 2006). Regular aerobic training improves blood pressure and cholesterol levels, which in turn reduce the risk of cardiovascular problems (Cavill *et al*., *idem*; Kokkinos, *idem*). Associating aerobic training with a diet of low calorie intake helps to maintain body weight and further prevent cardiovascular diseases and diabetes type 2 (Pritchard *et al*., 1997; WHO-Global Strategy on Diet, Physical activity and Health, 2004). Anaerobic training, on the other hand, increases bone density and promotes stability while standing or walking (Cavill *et al*., 2006). In this way, strength, flexibility and balance exercises help to avoid hip fractures by preventing falls and osteoporosis, specially among older people. Finally, regular performance of physical activity of any kind promotes several psychological benefits. Evidence suggests that physical activity affects psychological well-being by reducing symptoms of depression, stress and anxiety (Cavill *et al*. *op.cit*.; NHS, 2008).

Health problems	Active lifestyle
Cardiovascular diseases	50% less risk
Diabetes type 2	30% less risk
Colon cancer	40-50% less risk
Breast cancer	30-40% less risk for postmenopausal women
Prostate cancer	Possibly 10-30% less risk for individuals engaged in vigorous exercises
Lung cancer	30-40% less risk
Hip fractures due reported falls	Reduced risk
Osteoporosis	Reduced risk
Depression, anxiety, stress	Reduced risk
Obesity / overweight	Reduction in weight gain
Back pain	Possible preventive effect and a better rehabilitation outcome after pain incidents
Cognition performance	Better results associated with aerobic activities

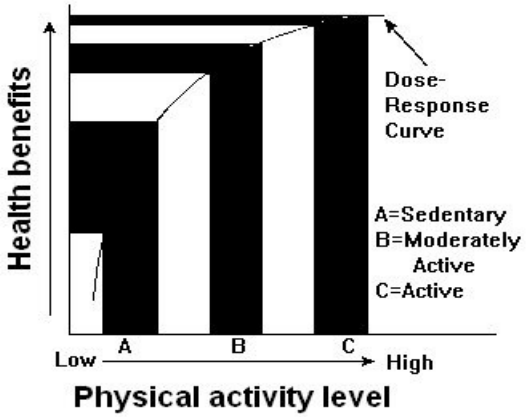
Table 1.1 Health benefits due to physical activity.

Interestingly, physical fitness is also associated with cognitive performance. A cohort study investigated the relationship between physical fitness and intelligence performance in a sample of over 1 million Swedish men (Aberg *et al*., 2009). These results were associated with school and professional achievements, as well as with the socioeconomic status attained later in life. Cardiovascular fitness, measured by ergometer cycling, was positively associated with intelligence. Moreover, the changes

in cardiovascular fitness taking place between 15 and 18 years of age predicted the cognitive performance at 18 years of age. Finally, cardiovascular fitness at the age of 18 years predicted educational achievements later in life. It is important to note, however, that muscle strength was not associated with cognitive performance (Aberg *et al*., *op.cit*.). A brief summary of the health benefits resulting from an active life style is presented in Table 1.1.

As described above, there are many advantages resulting from an active lifestyle. The benefits, however, depend on the level of physical activity adopted. Fig. 1.2 shows the general dose-response curve for the adoption of an active lifestyle, illustrating the relationship between physical activity intensity and the health benefits that a person can obtain by exercising at a specific level. Engaging in low intensity physical activity can be easier than engaging in higher intensity ones, but one must be aware of the limited outcomes for the health or for the physical conditioning.

Figure 1.2 Dose-response for physical activity and health (Pate et al. 1995).



While the benefits of physical activity for the cardiovascular system are well known, the benefits of an active lifestyle for the prevention of low-back problems are less clear. Vuori (2001) suggests that the prevalence of musculoskeletal disorders such as low-back pain is increasing partly because of population aging and changes in lifestyle and environment. Moreover, there is increasing evidence that physical inactivity is related to the development of musculoskeletal disorders. This issue will be more specifically addressed in the next session.

1.2 Physical activity and back pain

The following section presents the common issues related to physical activity and back pain. The prevalence of back problems and their risk factors will be accompanied by a description of the impact of physical activity on back pain prevention and recovery.

1.2.1 Epidemiology and effects of physical activity on the back

Back pain is a pain, tension or stiffness in the muscles of the back region. Back pain can sometimes be associated with pain in the leg or in the arm (sciatica or brachialgie, respectively), and is classified either as acute or chronic depending if it persists for a period shorter or longer than 12 weeks (Vuori, 2001). An EU Commission study (2007) reported that around 67 million people in the European region suffer from pain in their lower or upper back. Germany, UK and France were the countries reporting the highest prevalence of back pain (Fig. 1.3).

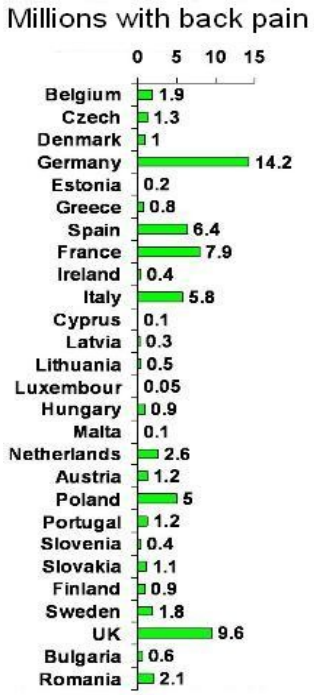


Fig. 1.3 Back pain prevalence in European countries (European Commission, 2007).

The upper and lower parts of the back are the regions with the highest reported incidence of back pain. The first back region to be addressed in this study will be the neck. Nonradiating neck pain is often referred to as tension neck syndrome. This suggests that it has a muscular origin, particularly the muscles in the neck-shoulder region (Silverstein & Evanoff *apud* Levy *et al*., 2006). In general, around 67% of the adults will have neck pain at some moment in their lives (Viljanen *et al*., 2003). Only in the United States, for people working in office environments, the annual incidence of neck pain lasting for more than 1 week is around 34% (Silverstein & Evanoff *apud* Levy *et al*., 2006).

Silverstein & Evanoff (*apud* Levy *et al*., *op.cit*.) elaborated a list of risk factors for nontraumatic neck and neck/shoulder disorders. Age, female gender and insufficient physical activity practice were among the factors related to the individual. Prolonged

siting positions, excessive neck flexion and rotation, prolonged shoulder shrugging, repetitive shoulder and hand work, and inappropriate keyboard location were listed among the physical factors. The authors also reported that some professionals such as video display terminal workers, dental workers, microscopists, surgeons, nurses/assistants and electronic assemblers have a particularly higher incidence of neck pain.

For those already suffering from neck pain, especially a traumatic neck injury such as whiplash (motor vehicle-induced neck injury), the regular performance of physical activity may help recovery. Geldman *et al*. (2008) studied the recovery of patients who suffered from whiplash injury. Comparisons between sedentary and physically active individuals 3 months after the injury showed no improvement for the former group but a 42% reduction in disability for the latter.

Despite the high incidence of neck/shoulder disorders, the most frequent form of back disturbance is the low-back pain (LBP). LBP is a pain located below the costal margin and above the inferior gluteal folds. In Europe, it has a reported lifetime prevalence ranging between 59 to 90% (Beeck & Hermans, 2000). In Germany alone, prevalence is around 85.8% (Schmidt *et al*., 2007). Among the general adult population, 70 to 85% of the individuals will have LBP sometime in their life, with a recurrence rate at around 80% (Vuori, 2001). Fortunately, 80 to 90% of the patients will have recovered within 6 weeks after pain onset, regardless of treatment. However, 5 to 15% of the cases will eventually develop into chronic low-back pain (Liddle *et al*., 2004; Stanton *et al*., 2008). Even though most of the LBP cases will resolve within weeks after pain onset, disability and work loss due to LBP affect around 16 to 34% of the general population (Hanney *et al*., 2009). Low-back pain is one of the most common musculoskeletal disorders among employees. Between 50 to 80% of active workers have already presented or will present some sort of isolated or recurrent episode of LBP (Levy *et al*., 2006; Frank *et al*., 1996).

The risk factors for LBP are poorly understood (Vuori, 2001). However, it is common sense that the performance of heavy physical work such as frequent bending, twisting, lifting, pulling and pushing represent a consistent risk factor for LBP, as well as repetitive work, vibrations and static postures maintained for long periods of time. Surprisingly, there is no direct evidence that sitting while at work is associated with increased LBP risk (Hartvigsen *et al*., 2000; Bakker *et al*., 2009). Hildebrandt *et al*. (2000), however, have reported that workers in sedentary jobs tend to have more LBP when they do not practice sports (odds ratio of 1.31).

What happens is that physical activity might have a protective effect on back muscles. Suni (2000 apud Vuori *et al*., 2001) proposes the following explanations for the action of physical activity on back pain:

- higher strength of the muscles in the back and trunk might protect the back against injuries or at least minimize its effects;
- higher endurance of the trunk muscles may help to maintain motor control and avoid fatigue. This decreases the risk of overloading spine structures;
- better flexibility may decrease the risk of injury, especially during lifting and bending activities;
- good motor skills may decrease the risk of injury while performing physical tasks;
- better weight control may help prevent obesity and favor good posture (Vuori et al., *op.cit*.).

Despite the potential benefits of physical activity to the back region, around 40% of the individuals who suffer from LBP reduce their active leisure activities as a result of pain symptoms (Hanney *et al*., 2009; Fritz & George, 2002; Vowles & Gross, 2003; Smeets *et al*., 2006; Baumann *et al*., 2008). Physical inactivity or prolonged immobilization induce muscle imbalance, which in turn may increase the risk of developing LBP (Vuori, 2001; Leino, 1993). Thus, people who decrease their physical activity levels due to LBP are more likely to develop long-term disability (Klenerman *et al*., 1995; Vowles & Gross, 2003).

In general, musculoskeletal problems are among the main factors reducing labor potential and causing disability to work (Silverstein & Evanoff *apud* Levy *et al*., 2006). Only in the United States, around 1 million people yearly report taking time away from work to treat and recover from musculoskeletal pain (Bureau of Labor Statistics, 1999 in National Research Council, 2001).

Back pain problems have human and financial costs in both the individual and the institutional level. The employee with neck or low-back pain has a personal burden with direct impact on his/her freedom of physical movement and well-being. This will inevitable result in some sort of reduced level of life quality and capability for work. Direct financial costs and loss of productivity are first observed when the employee is recurrently absent from work due to musculoskeletal illnesses. The burden then falls upon the social security system, which will have to cope with the financial load of an injured individual. This may include costs related to health assistance, early

retirement and physical disability (Frank *et al*., 1996).

In order to avoid or minimize these costs one can only try to prevent the appearance or the recurrence of the symptoms. The prevention of back problems can be facilitated by promoting an active lifestyle (Vuori *et al*., 2001; Airaksinen *et al*., 2004; Biallas *et al*., 2007; Burton *et al*., 2006; Tveito *et al*., 2004; Hildebrandt, 2005; Lühmann, 2005; van Poppel *et al*., 2004; Hanney *et al*., 2009). However, the acquisition of this habit is a challenge. Understanding the determinants or correlates of active behavior may help promoting the acquisition of a more active lifestyle. The next section will address this issue.

1.3 The determinants of physical activity

Interventions are most effective when they alter the underlying variables influencing the performance of physical activity (Trost *et al*., 2002). Determinants or correlates are variables that describe or help us to understand the factors which influence active behavior (Welk, 2002). Therefore, studying and identifying these determinants are important prerequisites for designing relevant policies and effective programs (Trost *et al*., *op.cit*.). Individual factors, the characteristics of the exercise program and environmental conditions are among the variables that have been suggested to influence active behavior.

1.3.1 Correlates of physical activity in adults at the individual level

The correlates or determinants of physical activity in adults at the individual level include demographic, biological, psychological and cognitive factors (Tab. 1.2). The most consistent demographic determinants are age and gender. While older adults are less active than younger ones (Trost *et al*., 2002), older women exercise more than men of similar ages (Callahan *et al*., 2008; King *et al*., 1992; Brassington *et al*. *apud* Dishman, 2004). For young adults, men are more likely to perform activities of vigorous intensity, while no gender differences appear to be related to the performance of moderate intensity exercises (Dishman, 2004).

Among the biological factors, overweight and obesity are related to poor physical activity levels (King *et al*., 1992). Trost *et al*. (2002) reported that low active subjects are 50% more likely to be classified as obese than active ones. Furthermore, it is

possible that the high failure rate to maintain weight after a diet may additionally influence the lack of confidence in adhering to an exercise program (Dishman, 2004).

Influence	Dishman & Sallis (1994)	Sallis & Owen (1999)	Trost *et al*. (2002)
Demographic & Biological Factors			
Age	--	--	--
Blue-collar occupation	-	-	-
Childless	+	+	+
Education	++	++	++
Gender (male)	++	++	++
Hereditary	n.a.	++	++
High risk for heart disease	-	-	-
Income/Socioeconomic status	++	++	++
Injury history	+	+	+
Marital status (married)	n.a.	0	-
Overweight/obesity	00	00	--
Race/ethnicity (non-white)	--	--	--
Psychological/Cognitive Factors			
Attitudes	0	0	00
Barriers to exercise	--	--	--
Control over exercise	0	+	+
Enjoyment of exercise	0	++	++
Expected benefit	+	++	++
Health locus of control	n.a.	0	0
Intention to exercise	++	++	++
Knowledge of health and exercise	0	00	00
Lack of time	-	-	--
Mood disturbance	--	--	--
Normative beliefs	0	00	00
Perceived health or fitness	++	++	++
Personality variables	n.a.	+	+
Poor body image	n.a.	-	-
Psychological health	n.a.	+	+
Self-efficacy	++	++	++
Self-motivation	+	++	++
Self-schemata for exercise	+	++	++
Stage of change	n.a.	++	++
Stress	0	0	0
Susceptibility to illness	0	00	00
Value of exercise outcomes	0	0	0
Social and Cultural Factors			
Exercise models	0	0	0
Past family influences	0	0	0
Physician influence	+	++	++
Social isolation	-	-	-
Social support from friends/peers	++	++	++
Social support from spouse/family	++	++	++
Social support from staff/instructor	n.a.	n.a.	n.a.
Physical Environment Factors			
Access to facilities: actual	n.a.	+	+
Access to facilities: perceived	n.a.	00	+
Adequate lighting	n.a.	n.a.	0
Climate/season	0	--	--
Cost of programs	0	0	0

Disruptions in routine	n.a.	n.a.	n.a.
Enjoyable scenery	n.a.	n.a.	+
Frequently observe others exercising	n.a.	n.a.	+
Heavy traffic	n.a.	n.a.	0
Home equipment	0	0	+
High crime rates in the region	n.a.	n.a.	0
Hilly terrain	n.a.	n.a.	+
Neighborhood safety	n.a.	n.a.	+
Presence of sidewalks	n.a.	n.a.	0
Satisfaction with facilities	n.a.	n.a.	+
Unattended dogs	n.a.	n.a.	0
Urban location	n.a.	n.a.	-

Tab. 1.2 Correlates of physical activity (adapted from Trost, 2004)

Legend: ++: repeatedly documented positive association with physical activity; +: weak or mixed evidence of positive association with physical activity; 00: repeatedly documented lack of association with physical activity; 0: weak or mixed evidence of no association with physical activity; --: repeatedly documented negative association with physical activity; -: weak or mixed evidence of negative association with physical activity; n.a.: not available.

Understanding the psychological factors related to physical activity performance can help explaining why exercise level varies among people with similar age, gender, education, health status and body composition (Dishman, 2004). Self-efficacy, intention to exercise and self-motivation are among the psychological variables related to active behavior.

Self-efficacy is defined as the confidence that one has of being able to successfully perform a specific activity (King *et al*., 1992; Velice *et al*., 1990). It is the most consistent psychological determinant of physical activity performance. Additionally, it has been related to the performance of physical activity of higher intensities (Trost *et al*., 2002). Lechner & De Vries (1995) and King *et al*. (1992) reported that individuals with high self-confidence are more likely to perform activities of vigorous and moderate intensity. In the same way, the self-efficacy of an inactive or not-so-active individual might increase if their physical activity program offers easy to perform and light exercises.

Furthermore, intention to exercise is highly related to exercise performance. In other words, it is only possible to persuade a person to enroll on an exercise program if this person wants to join it, which means that he/she has the intention of being physically active. Moreover, because intention to exercise is a construct which is directly related to the program´s characteristics (Badura, 1997 *apud* Motl *et al*., 2003), a highly motivating supervised exercise program may actually favor adherence (Häkkinen *et*

al., 2005; Ostelo *et al*., 2009).

Finally, self-motivation is related to adherence or persistence to an exercise program (Fuchs, 1997; Motl *et al*., 2003). This means that "a person is reinforced more by his/her ideas or goals than by those of others" (Dishman, 1984). Studies have shown that individuals who adhere to physical activity have higher motivation than those who have dropped out from exercise programs (Dishman & Ickes, 1981; Dishman 1984; Dishman *et al*., 1985; Raglin *et al*., 1990; Rampf, 1999). Thus, high self-motivation might be present also in the case where an individual increases his/her physical activity habits after a positive experience with exercises.

1.3.2 Characteristics of the exercise program

Exercise intensity, frequency, duration and mode are all factors that influence the habit of physical activity practice. More intensive, more frequent and longer sessions are usually negatively correlated with the maintenance of exercise practice (Dishman, 2004; Rhodes *et al*., 2009; Dishman, 1994b; Pahmeier, 2004; Dishman & Buckworth, 1996). Some evidence suggests that perceived effort and perceived fatigue can also influence physical activity performance (Dishman, 2004). In a community study in California (Sallis *et al*., 1986 apud King *et al*. 1992) it was found that, in general, men and women are more likely to adopt moderate rather than vigorous physical activities. This finding suggests that intensity and exertion may be particularly important during the adoption phase of physical activity practice. Another study with overweight adults compared adherence among subjects performing vigorous or moderate intensity exercises (Gossard *et al*., 1986 apud NCCDPHP, 1996). After a test period of 12 weeks, higher adherence was observed for the moderate intensity group. Too frequent sessions of moderate intensity exercises have also been related to poor adherence. Another study with 269 adults also compared adherence among individuals performing vigorous or moderate intensity exercises (King *et al*., 1995 apud NCCDPHP, 1996). However, vigorous intensity exercises were performed 3 times a week while moderate intensity exercises were performed 5 times a week. After a two year follow-up, a higher adherence was found for the vigorous intensity home-based exercise program. The authors speculated that the 5 times a week schedule of exercises was more difficult to follow than the one 3 times a week.

There is an ongoing debate whether home-based exercise programs result in higher adherence rates as compared to supervised-based programs. While the study of King *et al*. (1995) and the report from NCCDPHP (1996) favor home-based programs,

supervised programs have resulted in higher adherence rates for cases of back problem post-surgery rehabilitation (Häkkinen *et al*., 2005).

Finally, appropriate exercise intensity and the mode of physical activity are factors that influence the feeling of enjoyment and satisfaction with the program. Pleasant feelings are reported to be positively correlated with adherence rate (King *et al*., 1992; NCCDPHP, 1996). For this reason, it is important that the supervisor carefully plans how the intensity of the exercise program should progress (Huber, 1999; Häkkinen *et al*., *op.cit*.). Alterations in both the intensity and in the mode of physical activity should be gradual since unexpected and abrupt changes usually favor drop out (Huber, 1999; Pahmeier, 2004).

1.3.3 Environmental issues and its impact in physical activity practice

Since the last 15 years some health promotion institutions (NHS, 2008; CDC; WHO 2007) have increasingly emphasized the role of the environment in the adoption of active behavior. This is based on the idea that it may be difficult for a person to become active if the surrounding environment, both urban and natural, does not contribute to this change. Thus, promoting a more active lifestyle should include basic infrastructure modifications in the transport systems, schools, workplaces and public open facilities (NHS, 2008).

In the last 30 years the distances that have been walked or ridden by bicycles have decreased by around 23% (Cavill *et al*., 2006; NHS, *op.cit*.). One reason for this drop might lie on the existing network of roads, routes and paths which make walking or cycling a difficult task. Therefore, in addition to making roads and streets more pedestrian and cyclist friendly, one should widen pavements and introduce new cycle paths. The adoption of these procedures are likely to contribute to the WHO goals for the year of 2015, which aim at increasing the proportion of trips made by bicycle or walking: from 10 to 20% for adults, and from 40 to 60% for children and adolescents (WHO, 2007). Furthermore, the infrastructure of schools and workplaces influence the physical activity habit of its users. Strategies to encourage the use of active locomotion include providing convenient, safe and attractive access to staircases. These should be well-decorated and strategically positioned in order to reinforce its use (NHS, *op.cit*. and Cavill *et al*., *op.cit*.; The Toronto Charter for Physical Activity, 2010).

Finally, living or working near public open spaces may favor the performance of

physical activity during leisure time. Public spaces offer a green and calm atmosphere, which encourages outdoor physical activity (Cavill *et al*., 2006). Another way to increase the use of these spaces is by providing good accessibility by public transport or by bicycle.

In conclusion, there are many variables which may be related to physical activity behavior. First, characteristics linked to the individual influence the motivation, confidence and intention to exercise. Second, the intensity and frequency and type of exercises during intervention programs need to be planned in order to encourage adherence. Finally, the surrounding environment plays an important role in the personal decision to become active. Some studies defend the hypothesis that the greatest challenge is not exercise adoption but its adherence. The next section will address issues related to exercise adherence.

1.4 Adherence to exercise programs

The definition of adherence varies considerably depending on the amount of sessions that a participant can consecutively miss once engaged in an exercise program (Oldridge *et al*., 1982 *apud* Pahmeier, 2004; Lechner & De Vries, 1995; Dishman & Gettman, 1980; Wagner, 2000 *apud* Fuchs, 2003; Ward & Morgan, 1984). The only consensus is that a dropout person is someone who has failed to complete the program he or she has started (Bruce *et al*., 1976; Pahmeier, 2004). Independent of the country or setting, adherence rates are generally modest. Sport-based therapeutic programs offered for the treatment of LBP, cardio-vascular diseases, chronic obstructive pulmonary diseases, and musculoskeletal disorders have reported adherence rates ranging from 30% to 92% (Bruce *et al*., 1976; Dishman & Gettman,1980; Ljubic *et al*., 2006; Göhl *et al*., 2006; Schreiber & Biermann, 1988). Health-enhancing and fitness programs, on the other hand, have reported adherence rates ranging between 40% and 84% (Brehm *et al*., 2001; Brehm & Pahmeier, 1990; Dishman *et al*., 1980; Cox, 1984; Pahmeier, 2004).

The dropout curve for exercise programs has been a matter of long investigation. Not all dropouts occur on the first week after the start of the program. In fact, they usually take place throughout a relatively long period of time. The curve for therapeutic programs is very similar to one observed for fitness settings. In both cases, most of the dropouts take place within the first 24 weeks. Therefore, the initial two to six months exhibit a more or less rapid decline in adherence. After this period, the curve reaches a stable plateau which persists for the following 12 to 15 months.

(Bruce *et al*., 1976; Dishman & Gettman, 1980; Ward & Morgan, 1984; Brehm & Pahmeier, 1990; Brehm *et al*., 2001; Pahmeier, 2004; Häkkinen *et al*., 2005; Ljubic *et al*., 2006).

1.4.1 Barriers for physical activity

The study of the barriers that prevent people from exercising has a crucial importance to public health since they may help to understand why some people are able to maintain active behavior while others are reluctant to adopt it. Therefore, studying the barriers may offer ideas on how to deal with adherence problems. One of the most reported barriers for adherence to exercise programs is the lack of time due to job and family responsibilities (Iverson *et al*., 1985; Dishman *et al*., 1985; Steinhardt & Dishman, 1989; Trost *et al*., 2002). Both sedentary and active individuals report lack of time as a barrier to exercise. Intriguing, however, is that active people did not consider this factor as a justification for inactivity. This suggests that "lack of time" actually reflects lack of interest or inadequate motivation to be active (Dishman *et al*., 1985; King *et al*., 1992; Dishman *et al*., 1980; Sljuis, 1991 *apud* Ljubic *et al*., 2006). Motivation may increase when exercises are performed in groups (Häkkinen *et al*., 2005; Pahmeier, 2004). A study comparing group versus individualized exercise programs found dropout rates of 18.2% and 52.6%, respectively (Massie & Shephard, 1971 *apud* Pahmeier, 2004). It is possible that group sessions promote a more intense interaction among participants, which might in turn increase the social support and the enjoyment while performing physical activity (Pahmeier, 2004; Unger, 2001; Kaewthummanukul *et al*., 2006).

Perceived barriers to perform exercises usually lead to physical inactivity and to low adherence to physical activity programs (CDC, 1996). This subjective factor has been incorporated in some theories of how behavior can be changed in order for an individual to adopt an active lifestyle. The following section describes the Transtheoretical Model for physical activity which addresses how perceived barriers contribute to exercise behavior.

1.5 The Transtheoretical Model and its application to exercise behavior

Below is a brief description of the transtheoretical model (TTM) and how it aims at explaining the dynamics of exercise behavior (Biddle & Mutrie, 2008). The TTM describes five stages commonly undertaken by individuals when starting to exercise.

In the model, an individual can advance or return to previous stages while in the process of attaining maintenance to physical activity. This process is thereby described as spiral or cyclical due to the fact that people commonly relapse and return to inactivity before regaining active behavior (Fig. 1.4).

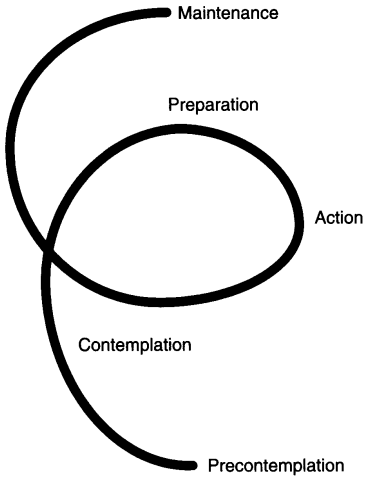


Figure 1.4 Cyclical stages of behavior change (Biddle & Mutrie, 2008).

The five stages consist in the following (adapted from Prochaska *et al*., 1994):

- Precontemplation: the individual is not planning on engaging in physical activity (at least not in the next six months).
- Contemplation: the individual is seriously planning on starting some sort of physical activity within the next six months.
- Preparation: is period in which the individual who has tried to engage in some sort of physical activity within the previous year seriously thinks about initiating physical activity within the next month.
- Action: a period ranging from 0 to 6 months after the individual has engaged in physical activity.
- Maintenance: is the period beginning six months after action has started in which the individual is still performing physical activity.

A time frame of 6 months is used here because this is about as far in the future as most people are able to plan a specific behavioral change (Prochaska *et al*., 1994). Observe that each stage in the model has an associated temporal dimension for the behavioral change to occur (Marcus & Simkin, 1994).

Research shows that there are some factors able to predict the progression of an individual along the various stages of the TTM. These include the decisional balance

(benefits, costs and barriers to change; Prochaska *et al*., 1994) and self-efficacy (Velicer *et al*., 1990). Additionally, a so called 10 processes of change has been described which include the strategies and techniques people use as they progress through the consecutive stages in the TTM model (Prochaska & DiClemente, 1983 apud Marcus *et al*., 1992). While in the process of changing one's behavior, an individual is constantly weighing the benefits and barriers of enrolling in an exercise program. Studies have reported that only after the preparation phase do the benefits overweight the barriers (Prochaska *et al*., *op.cit.*). Self-efficacy scores, on the other hand, have been shown to increase in a linear fashion as one advances along the stages (Marcus & Simkin, 1994; Plotnikoff *et al*., 2001).

The 10 processes of change, described in Table 1.3, represent both experiential and behavioral constructs.

Process	*Definition*
Experiential processes	
Consciousness raising	Efforts by the individual to seek new information and to gain understanding and feedback about the problem
Dramatic relief	Affective aspects of change, often involving intense emotional experiences related to the problem behavior
Environmental reevaluation	Consideration and assessment by the individual of how the problem affects the physical and social environments
Self-reevaluation	Emotional and cognitive reappraisal of values by the individual with respect to the problem behavior
Social liberation	Awareness, availability, and acceptance by the individual of alternative, problem-free life styles in society
Behavioral processes	
Counterconditioning	Substitution of alternative behaviors for the problem behavior
Helping relationships	Trusting, accepting, and utilizing the support of caring others during attempts to change the problem behavior
Reinforcement management	Changing the contingencies that control or maintain the problem behavior
Self-liberation	The individual´s choice and commitment to change the problem behavior, including the belief that one can change
Stimulus control	Control of situations and other causes that trigger the problem behavior

Table 1.3 Processes of behavior change (Marcus *et al*., 1992).

Different processes are employed when moving from one stage to another. People in the precontemplation stage, for example, use much less of the 10 processes described in Table 1.3 than do individuals in other stages. Individuals in the action phase, on the other hand, use experimental and behavioral processes more than individuals in the preparation stage (Marcus *et al*., 1992). Efficient self-change depends both on doing the right thing (processes) at the right time (stages) (CDC, 1996).

The TTM is the most employed theoretical framework for designing interventions

aiming at increasing the levels of physical activity. Verifying at which stage within the TTM model an individual finds himself offers valuable information on his/her motivation to adopt and maintain active behavior (Marcus & Owen, 1992 *apud* CDC, 1996). For instance, people who voluntarily accept to participate in a supervised exercise program are at least in the preparation stage. Therefore, this model can assist in the development of strategies aiming at increasing self-efficacy and overcoming barriers for the adoption of active behavior. If most of the individuals already exercise regularly for more than 6 months and are thereby in the maintenance stage, strategies should be taken to help these individuals from relapsing to previous stages (Lechner & De Vries, 1995; Marcus *et al*., 1998).

In conclusion, the TTM gives a (cyclical) perspective of how individuals change their physical activity behavior by classifying them under one of five different stages. Below, I will describe how an intervention program can be developed in order to match the individual's readiness for changing exercise behavior.

1.6 Intervention approaches focused on the individual

Two basic individual approaches have been employed while planing interventions aiming at increasing the levels of physical activity practice: the cognitive and the supervised exercise classes. Depending on the motivation of the individual to become physically active, one or the other approach may be more effective (Dunn, 1996).

Cognitive based interventions have been shown to be particularly effective for people in less active stages of the TTM (Biddle, 1994). People who are sedentary need to be taught on how to identify the barriers for adopting active behavior and on ways to overcome them. Intervention for these individuals should focus on educational and environmental changes (Cavill *et al*., 2006; Biddle, *op.cit*.). If on the one hand they must receive information regarding the mental benefits of exercising and how to deal with barriers, changes in their immediate environmental will support behavioral change. Provision of walking routes and cycle paths are some examples of environmental reinforcement strategies (Dunn *et al*., 1999; Biddle, 1994; Cavill *et al*., 2006).

For people who are already engaged in some sort of regular physical activity, the intervention program should focus on increasing the total amount of physical activity to at least 30 minutes of moderate exercises carried out 5 days per week. In this case, a combination of habitual physical activity and regular structured exercises is

likely to motivate the participants. For people practicing physical activity with irregular frequency, one can apply the same intervention procedure as the one adopted for individuals in less active stages of the TTM (*i.e*. contemplation stage). Light to moderate-intensity structured exercises may help these individuals reach the 30 minutes goal of physical exercises per week because they might experience well-being, enjoyment and self-confidence regarding their physical capacities (Biddle, 1994; Dishman *et al*., 1985).

For individuals who are regularly engaged in an exercise program, it is important to educate them about the phases of such a program (Biddle, 1994):

- Beginners in the early stages of exercise practice should participate in moderate and enjoyable exercises that increase self-confidence and minimize feelings of discomfort. The changes in their lifestyle should happen gradually, starting with low intensity exercises that gradually increase in intensity while keeping the participants comfortable. Therefore, the emphasis of this phase is on behavioral change and not on fitness improvement (Rejeski & Kenney, 1988 *apud* Biddle, 1994).
- In the second phase, individuals should increase the intensity of their physical activity in a safe way in order to enhance fitness. Simultaneously, "this increase should ensure that the maintenance of appropriate behavioral patterns is not forgotten" Biddle (*op.cit*.).
- The final phase is maintenance of the physical activity level. For many people, further increase in the exercise intensity is not necessary and can sometimes be "counterproductive for adherence" (Biddle, *op.cit*.).

Finally, for people who are doing regular physical activity, the main focus of the intervention should be on keeping the person motivated to exercise. Studies have shown that the perception of positive outcomes, such as mental and social benefits, as well as learning about strategies to deal with barriers, are important to motivate for continuing engagement (Biddle, 1994; Dishman, 1988; Dishman, 2004). Once the person relapses and stops exercising, Biddle (1994) suggests that the best strategy to encourage these individuals back into vigorous exercises is by using lower intensity exercise programs. There is evidence that a positive experience with physical activity increases the chance that a person will become active again in the future. Jaakkola *et al*. (2008) found out that the situational motivation, which is directly related to the

events taking place during the exercise classes, was the best predictor of high involvement in consecutive exercise classes. The next section will describe the different kinds of intervention programs that can be applied in the workplace.

1.6.1 Promotion of physical activity in the workplace

The workplace has great potential in influencing the level of physical activity practiced. The majority of the adult population spends at least eight hours a day at the workplace. Combined with its internal communication facilities, the work environment is a very attractive place for implementing health enhancing programs (Kreis & Bödeker, 2003; Cavill *et al*., 2006). Interventions in this setting can eliminate various barriers for the adoption of active behavior. This can be done by offering different types of physical activity during work time, by lowering the prices of the programs offered, by giving the employees time flexibility in order to use the on-site fitness facilities, by promoting campaigns to increase the use of staircases, or simply by increasing the awareness regarding the health benefits of physical activity (Veitch *et al*., 1999; Shephard, 1996; Kreis & Bödeker, 2003; Green *et al*., 2007).

Since 1974 several corporate programs for physical activity practice have been implemented in the US and Canada (Emmons *et al*., 1999; Pritchard *et al*., 1997; Nichols *et al*., 2000). Examples of such programs include health risk appraisals, fitness facilities, and exercise programs (Dunn, 1996). The first National Survey on Worksite Health Promotion Activities in the US (Fielding & Piserchia, 1989) found a prevalence of 22.1% for exercise and fitness programs among interviewed companies, and a prevalence of 28.5% for back pain prevention programs (Cox, 1984).

In Germany, around 29% of the companies offer health promotion activities. Most of these companies are large worksites (Hollederer, 2007). The most commonly offered activities are: analysis of absenteeism (9%); questionnaires about health and accident prevention (8%); courses on health enhancement such as weight control and smoking risk (6%), and health coordination boards (4%) (Hollederer, *idem*). Shephard (1996a) described that many large companies choose to build exercising spaces within their own facilities. Many expensive fitness spaces, however, remain largely unused during much of the working week (Boutelle *et al*., 2000). It has been reported that worksite health promotion programs have adherence rates ranging from 20 to 80% (Steinhardt & Dishman, 1989; Marshall, 2004).

Robroek (2008) reviewed several factors influencing the engagement of workers in

corporate health promotion programs. The author concluded that smaller worksites and stronger management support are directly related to higher participation rates. However, small companies only rarely promote health enhancing programs. In a survey performed in Germany, only 25% of the small companies (with less than 10 employees) offered some sort of health promotion activity (Hollederer, 2007). In contrast, 79% of the companies with more than 200 employees were shown to offer such programs, even though management support was usually weak. Marshall (2004) suggested that offered programs should include also measures which are of interest to managers, such as valid and reliable measures of productivity, job stress and absenteeism. The evaluation of these outcomes might improve management support, which might directly influence adherence rate.

Management support alone is not enough to increase participation. In the German "Erlanger Modell", 6 companies (total of 1748 employees) received logistic and financial support from health insurance companies in order to promote health measures in the workplace. The authors investigated the participation rate in the offered health promotion courses (*e.g*. Yoga, relaxation training, balanced diet) and found that despite management support and advertisement, 48% of the employees reported no intention of engaging in such activities (Broding *et al*., 2009). The main reasons reported by the workers included the lack of interest in remaining in the company during their free time, insufficient information regarding health promotion activities, time management conflicts, and living too far away from work (Broding *et al*., *op.cit*.). If on the one hand on-site fitness facilities are convenient for some people, they may be a barrier for those individuals whose working hours conflict with those of the offered programs, or for those who do not wish to spend extra time at the worksite (Dishman, 2004; Broding *et al*., 2009).

The main critic regarding interventions in the workplace refers to how their effectiveness is measured (King *et al*., 1992; Dunn, 1996). There is a lack of methodological studies accessing the best intervention approach to be adopted (Proper *et al*., 2002; Iverson *et al*, 1985; Shephard, 1996a; Shephard, 1996b; Karas *et al*., 1996; Heirich *et al*., 1993; Maes *et al*., 1998; Nurminen *et al*., 2002). However, large effect sizes have been observed for interventions that use a combination of exercises, health-related advices and motivational components (Dishman *et al*., 1998; Kreis & Bödeker, 2003; Heaney & Goetzel, 1997; Marshall, 2004).

In conclusion, although the health benefits of physical activity practice are well documented, awareness about the benefits of exercising and about the strategies to

deal with barriers seem to be insufficient to increase adherence to exercise programs in the workplace. Many studies have tried to describe the relevant factors influencing health promotion interventions. Population setting, methodological approaches and the underlying theory on which the study was based seem to influence the outcome.

The present study describes and evaluates an exercise intervention program applied in the workplace of a German telecommunication company. Low intensity exercise classes were offered to the employees. It was hypothesized that the exercise program would increase physical activity levels, specially for those individuals who were sedentary or rarely performed any kind of physical activity. Long-term effects were evaluated six months after the intervention had ended. The next section describes the main issues related to the development of the intervention.

II. Intervention Concept

The first part of this chapter will describe the context in which the intervention program was applied. This description will also help to understand the conditions which influenced the implementation of the exercise program. In the second part, aspects related to the intervention itself are described and explained.

2.1 Contextual framework – health promotion in a German workplace

The program here developed was applied in a German telecommunication company. Germany policy, through its so called *Gesundheitspolitik* (health policy), provides support to the implementation of health promotion programs within companies. There are three areas covered by this policy: the prevention of accidents and work-related illnesses, the promotion of health in the workplace and the re-integration of disabled employees (Fig. 2.1). All these areas are supported by governmental laws which not only indicate which organism should plan the strategies but also which organism should provide the means of controlling their implementation. For example, the § 20 from the Social Book V (§ 20 SGB V) delegates the prevention of work-related diseases to the health insurance companies (Wilke *et al*., 2007).

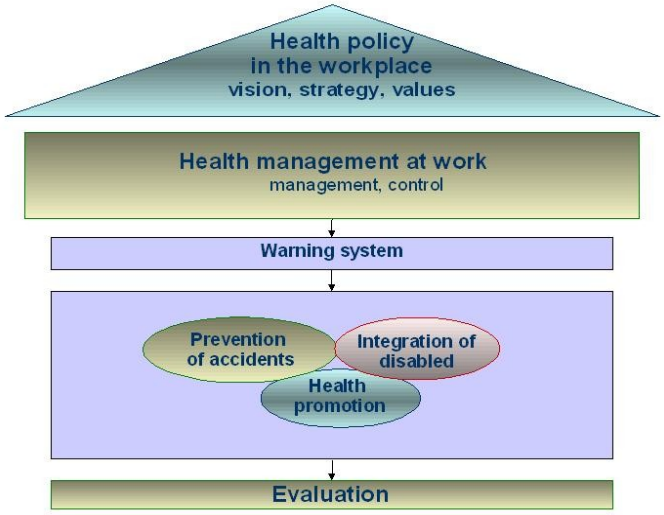


Fig. 2.1 Health management in the workplace in Germany (adapted Wilke *et al*., 2007, p. 32).

As can be seen in Fig. 2.1, public policy provides the guidelines for the implementation of health-enhancing strategies in the workplace. In order to implement this policy, a management board is usually created. This board controls three main sectors: health promotion, prevention of accidents or work-related illnesses in the workplace and the re-integration of disabled individuals due to working conditions.

The sector responsible for the prevention of accidents or work-related illnesses applies not only general ergonomic measures to improve working conditions but also specific measures to prevent accidents. The latter include reducing the exposure to dangerous chemicals, implementation of warning signalization in the workplace and eye protection. In order to lower the costs of such measures, companies generally cooperate with health insurance companies and with companies aiming to prevent accidents (*Unfallversicherungsträger*).

The re-integration management sector *(Eingliederungsmanagement)* aims at avoiding long-term absenteeism due to illnesses that are related or not to the workplace. When an employee is away from work for more than six weeks in a year, this sector intervenes in order to restore the individual's ability for work and prevent long term absences (Frohnweiler *et al*., 2007). The intervention process includes meetings with the employee and with the health department in a stepwise re-integration approach.

The health promotion sector (*Gesundheitsförderung*) is an important component of the health management system in companies. The strategies for health promotion are based on the demands from many different areas within the company which include the human resources department, the medical department, security at work and the employees representative board. The board, which is formed by individuals from all these areas as well as by representatives of the health insurance company, regularly meet so as to agree on which strategy to adopt and how it will be financed. Many German companies adopt strategies which are based on the corporation´s view, counting on their own budget from the financial department. An intern department is usually responsible for the coordination of such activities (Wilke *et al*., 2007). Stress management workshops, continuing education for managers and employees and low-cost membership in fitness centers are some examples of health promotion projects which aim not only at enhancing the employees health and working conditions, but also at increasing their responsibility for their own health (Kehr, 2001). Volkswagen AG in Germany, for example, invested in 1999 circa 260 DM per employee in health promotion and accident prevention. The planning of this strategy was based on health screenings, absenteeism, questionnaires, job demands, health risks and ergonomic evaluation. Back schools and courses on stress and conflict management were offered to employees and managers. As a result, both accidents and absenteeism were reduced (BKK, 2001). Other studies and interventions performed in Germany are listed in the table below (Table 2.1). The table describes interventions which focused on the general health of the employee, specially those reporting back pain. Most of the interventions were applied by large companies, and some of the measures

benefited both employer and employee. The participation of the employees, however, were generally modest.

Company and/or author	**No. of employees**	**Intervention**	**Results**
DaimlerChrysler-Gaggenau, Germany (Goebel, 2004)	5424	Back training on machines; 1790 participants (33% of working population)	424 participants (8%) reported pain reduction; back related absenteeism reduced from 11% to 2% after 12 months
DaimlerChrysler-Wörth, Germany (Brenneis & Stroheker, 2005)	9000	5 minutes strengthening of back muscles 1-3 per week; seminars on back school and stress relaxation training	85% and 36% rate of manager and employee participation, respectively; 21% increase in muscle strength after 12 training sessions; reduction of back pain after 32 training sessions; 20% absenteeism reduced
BASF, Ludwigshafen, Germany (Oberlinner *et al*., 2007)	34000	Physical activity programs; information on obesity prevention and calorie values for the meals in the cafeteria	2062 overweight or obese employees enrolled. Dropout rate of 46%. From 708 employees, 92% successfully reduced weight
Fraport, Frankfurt (Rückenmanagement, unpublished data)	23078	Employees from the luggage and cargo logistic service. Muscle training on machines and stretching 2x60 min/week during free time	Participants reduced absenteeism from 10.9 to 4 days/year
Siegen Hospital; Heirich Georg GmbH; Krupp Edelstahlprofile and Krupp Elastomer, Siegen, Germany (Rückenmanagement, unpublished data)	n.r.	200 employees with back pain. Training in a fitness facility 1-2x60min/week; ergonomic advice; stress relaxation advice	Better quality of life; back pain reduction; reduction in medication intake; increase in 19% of back muscle strength
Neff, Bretten, Germany (Rusnak, 2005)	1300	Ergonomic advice; on-site fitness activities; sport; physical therapy facility and 2xweek gym at the workstation	Absenteeism reduced
A German harbor company (Dalichau *et al*., 2005)	n.r.	Gym and sport therapy for back problems; ergonomic advice; back school	118 longshoremen. Back pain reduced; better quality of life; higher muscle strength (back flexion and extension)
Several health provision centers in Munich, Germany (Ewert *et al*., 2009)	n.r.	11x60 min of general physical strengthening and stretching or 17x1.75h of additional exercises; ergonomic advice; psychological support	183 nurses, but only 169 (92%) performed all assessments. After 12 months, modest improvements in pain intensity and health-related quality of life

Table 2.1 Examples of corporate health promotion programs in Germany; n.r.: not reported.

Germany increased its interest on corporate health promotion programs especially

after the elaboration of the Luxembourg Declaration in 1997 by the members of the European Community (Luxembourg Declaration, 2005). Literature about such programs, however, is still modest (see Table 2.1). Some factors may help to understand this discrepancy. First of all, it is possible that many of the applied interventions were not evaluated in a way that permitted its publication in international scientific journals. Furthermore, while expensive costs with the private health insurance system motivate companies to promote health and fitness campaigns in the United States, the existence of a National Health Service (such as the one in the United Kingdom) or of governmental health insurance system (such as the one in Germany) "removed the urgency to address such issues" (Biddle & Mutrie, 2008, p. 325).

Despite of this, social pressures, aging working population and unemployment rates justify investments in corporate health-promotion programs. As a result, many companies around Europe (Scania, METRO, Unilever, Volkswagen, etc) have committed themselves to promote the health and well-being of their employees so as to better deal with their aging workforce. Additionally, this attitude helps to support an affordable health system, increase productivity and enhance the company´s image (Biddle & Mutrie, 2008; BKK, 2001; Breucker & Weber, 2009).

So far, it has been argued that many factors favor health-promotion investments within the workplace in Germany. These factors include strong public health policies, boards within companies that create and manage health promotion projects, and financial support which enables the implementation of the various programs. A deficiency in the evaluation of such programs, however, has resulted in a lack of published results.

2.1.1 The case of a telecommunication company in Germany – study field

The company where this intervention was applied has been developing a health management structure since the 1990s (Craes & Mezger, 2000). In 1997 the health management board, together with the health and the accident-prevention insurance companies, elaborated a corporate agreement regarding health promotion. The board was composed of one company director, several individuals from different service areas (commercial, production, call center and others), members of the human resources, members of the medical and accident-prevention departments and representatives for the employees (Craes & Mezger, *idem*). A general agreement established which subjects should be involved in health promotion, how the decision

regarding programs should be made and implemented, and how should the representatives of the employees participate in the local health teams (Craes & Mezger, *op.cit*.).

In 2003 a new health promotion project was launched to encourage the self-commitment to health and to enhance not only the physical health of the employees but also their psychological well-being. A corporate on-site health center was built consisting on a physical therapy clinic, a relaxation space, a play-room and a fitness facility. Those who needed physical therapy care could obtain a prescription from a physician. Employees who wished to use the fitness facility got a reduction in their membership fee. A silent room offered employees the possibility of relaxing. Additionally, employees had access to a room where they could play billiard and other games (Gesundheitsförderpreis, 2005).

The intervention program carried out during this study was conducted in the fitness center of the company mentioned above. An intranet article advertised the project and called for participants. A start-up presentation was given to those who volunteered to participate. Information was provided regarding the objectives of the project, how it would be evaluated and where the exercise classes would take place. The exercise program took into consideration various factors: 1) the typical physical workload found during normal office activity; 2) the possibility that some individuals already suffered from back problems prior to the start of the program; 3) the need to address a heterogeneous population composed both of active and sedentary individuals; 4) the participants had to be able to exercise with their job clothes (jeans, trousers, pants or shirts), and therefore not sweat during the execution of the exercises; 5) the program would be carried out during the normal working hours in a way that the program represented an active break of their job activities.

2.2 Focus on the intervention

2.2.1 Intensity of the exercises

By generating positive feelings during the performance of physical activity, the main goal of this intervention was to encourage the participants to adopt an active lifestyle. In order to generate positive feelings, the exercise needs to have the correct intensity. Exercises that are easy to perform can be more easily integrated into the daily life of the participants (Murphy, 2004). Sallis & Hovell (1990) described that "The key to enhance adherence is to structure exercise experiences such that the probability of

perceiving exercise as rewarding is increased" (Biddle & Mutrie, 2008, p. 130).

Middle-age adults generally enroll in exercise programs because they wish to improve their health, or because they find pleasure in doing physical activity, or simply because they want to relax (Biddle & Mutrie, 2008). Vigorous exercises for sedentary individuals may represent an unpleasant experience favoring a relapse or a discontinuity in their exercise program (Biddle, 1994; Dishman, 2004; Unger, 2001). Less active individuals usually require less intensive and easier-to-perform exercises than more active participants. Additionally, by using low intensity exercises there was no need to switch between working and exercise clothes. This was possible because the participants did not sweat while performing physical activity. Some of the employees had only very short breaks. Performing the program in their working clothes favored the integration of the exercise classes with their daily working activities. All these factors were thereby taken into consideration when determining the intensity of the exercises applied (Biddle, 1994; Dishman, 2004; Unger, 2001). Even though the intensity of the exercises used during this project were below the levels recommended by the WHO/ACSM, they were still considered suitable for this particular program.

2.2.2 Frequency of the exercise classes

It was clear that if low intensity exercises were used, then a higher frequency of sessions would be required in order to reach the equivalent physiological benefits. In this case, 3.5 hours per week of light intensity exercises would be desirable (Murphy, 2004). But prior to the physiological benefits, the intervention aimed at encouraging an active lifestyle for those who rarely exercised. Therefore, sessions with a frequency of three times per week and 20 minutes duration were chosen. For those individuals whose job and family obligations were seen as the main time consumers, this schedule actually represented a high frequency of physical activity (Bruce *et al*., 1976; Oldridge *et al*., 1978 *apud* Unger, 2001; Pahmeier, 2004).

Many health-enhancing exercise programs offer a single 60-minute session per week (Brehm *et al*., 2001; Pahmeier, 2004). We assumed, however, that in order to change exercising behavior a more frequent schedule was required. A compromise between weekly "show up" for the program and the spontaneous engagement into physical activity should be ideally reached at some point of the intervention process. If this happens, one can eventually achieve the WHO/ACSM recommendation levels of weekly physical activity.

2.2.3 Type of exercises

The program was composed of calisthenics exercises with no aerobic training. Exercises for dynamic muscle training, for static stabilization, for stretching and for relaxation were applied during each session. The secondary aims of the program were to strengthen the muscles required for trunk stabilization and to provide flexibility and relaxation for the participants. Many employees performing office work usually present musculoskeletal problems, specially on the back (Biallas *et al*., 2007; Rhodes *et al*., 2009; Hartvigsen, 2000). The exercises were therefore designed to strengthen the back muscles and not pose an extra overload for the employee. Typically, one session would initiate with warm-up activities such as active rotational exercises for the hip and shoulder. This would prepare the joints and muscles for the forthcoming exercises. Endurance training or dynamic muscle training would then follow. The last five to seven minutes would be used for cool-down exercises and to promote relaxation. Some examples of the applied exercises can be found in the Appendix (Brochüre). Some of them were adapted from the back exercises described in Froböse (2006).

2.2.4 Duration of the sessions and program

The German health insurance system works with the notion that a twelve-week program is already enough to increase the awareness of the participants towards a physically active lifestyle. For this reason the intervention program lasted for twelve weeks. The Transtheoretical Model states that behavioral changes usually occur within six months after this change in awareness takes place (Biddle & Mutrie, 2008).

During a study in the primary care sector, general practitioners gave their patients advice regarding the benefits of physical activity (Biddle, 2004). Additionally, they gave advise on how to initiate physical activity practice and on how to deal with the barriers related to exercising. It was observed that such a practice promoted the adoption of a healthier lifestyle among the participants. These changes, however, were not translated into biologically significant results such as a reduction in the body mass index. The author concluded that "it may be not realistic for short-term intervention to produce much more than small psychological changes. These in turn may translate into behavioral and biomedical change over time" (Biddle, *idem*, p. 354). Structured exercise interventions are expected to promote long lasting effects. Depending on the focus of the exercises (aerobic versus anaerobic), they should also translate into

biological benefits. Due to the low intensity of the exercises adopted during my study, the probability that such benefits would show-up was actually very low. Therefore, instead of biological changes, the major aim of this study was to induce a motivational change in the participants in a way that they would maintain physical activity practice after the terminus of the program.

Finally, in order to be easily integrated into the working schedule of the employees, the sessions had a relatively short duration (20 minutes). But they were still long enough so as to promote some feeling of enjoyment in the participants. This followed the principle that in order to a habit, physical activity needs to be easy, sustainable, convenient and enjoyable (Pratt, 1999 *apud* Biddle, 2004).

2.2.5 Organization of classes

The exercise classes were allocated during the normal working hours of the employees. There were various options for the exercise classes (Table 2.2). Each employee was asked to select six from the nine possible time slots and was eventually assigned to three of them. This approach facilitated the randomization procedure while constructing the final time table. The offered time slots were based on the usual break periods taken by the employees: the day period when the cafeteria was most visited as well as during the lunch break and before work.

Active pause at workplace				
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
	8:40 - 9:00			
12:00 - 12:20	**12:00 - 12:20**	**12:00 - 12:20**	**12:00 - 12:20**	**12:00 - 12:20**
15:30 - 15:50		**15:30 - 15:50**	**15:30 - 15:50**	

Table 2.2 Time table with the various options for the active pause sessions.

For most of the sessions, only exercises were performed. However, several studies suggest that the best strategy to prevent back problems is to combine exercises with counseling (Kreis & Bödeker, 2003; Airaksinen *et al*., 2004; Burton *et al*., 2004; van Tulder *et al*., 2004; Biallas *et al*., 2007). Therefore, there was an educational component to six of the classes. This was performed during the initial 5-10 minutes, prior to the routine exercises. Counseling focused on workplace-related factors leading to musculoskeletal discomfort or pain, on the importance of physical activity as a mean of pain release, and on providing information on how to initiate aerobic training

(see Table 2.3 for an overview of the topics and see "Brochüre" in Appendix for an overview of the contents given during the educational classes). Two of the educational sessions were directly related to activities offered by the company's fitness center, such as training on machines (body-building) and step. When subjects develop a regular habit of exercising they may aspire to a higher level of fitness (Cox, 1984). Therefore, some of the participants in this study could be eventually encouraged to join the fitness facility after program´s completion.

Educational Classes	
Week	*Topic*
2nd or 3rd	Good posture versus bad posture and its consequences.
6th	Sitting position at the workplace.
7th	Back problems: what you can do and what you should not do.
8th	How should I start an aerobic training? Which activities to choose?
9th	Description of fitness center facilities
10th	Training on machines (for back problems and well-being)

Table 2.3 Topics of the educational classes.

The exercise classes were given by three different supervisors. In this way, participants were not particularly bound to any specific supervisor. Additionally, it provided the program a more general aspect, making it easier to be replicated in other settings.

The content and composition of the program, together with its intensity, mode, frequency and duration were elaborated in a way as to encourage the participants to adhere to a more active lifestyle after the program had ceased. Even though some of the applied exercises were based on other methods (Froböse, 2006), the concept developed here followed this general goal.

"Exercise dissipates tension, and tension is the enemy of serenity." Nelson Mandela (Long Walk to Freedom, p. 673)

III. Methodology

This chapter describes the methodological approach of the intervention. The first section poses the research questions and the main hypothesis. This will be followed by a description of the population studied and a description of the randomized controlled design which was here applied. A description of the assessment instruments and the statistical analysis will be part of the last two sections of this chapter.

3.1 Research questions and study hypothesis

The aim of this work was to promote active behavior among employees of a telecommunication company. To reach this goal a program with low-intensity exercises was applied within the workplace.

Research question: Can people become motivated to increase their physical activity levels by engaging in a low intensity exercise program within their workplace?

The main hypothesis:

- Participants would enhance their physical activity behavior after experiencing an intervention program with low intensity exercises. This would be specially the cases for less active or chronically inactive individuals.

Secondary questions:

Which are the effects of the intervention on musculoskeletal complaints and on the perception of life quality?

How active are the participants six months after the end of the intervention?

Which are the main barriers to adopt an active lifestyle after participating in a corporate supervised exercise program?

Which are the potential barriers related to the low adherence to an exercise program?

Which are the main motives for engaging in physical activity programs? Which are the

main motives to maintain the physical activity behavior?

Secondary hypothesis:

- participants reporting musculoskeletal problems before intervention onset would have their levels of pain reduced after the start of the intervention. However, these beneficial effects would decrease six months after the terminus of the program;
- the subjective perception of health-related life quality, especially among the less active participants, would improve after their enrollment in the exercise classes;
- individuals performing more physical activity after the terminus of the program would present higher self-motivation;
- individuals with a positive change in physical activity levels would maintain this behavior six months after the intervention had ceased.

3.2 The study population

The study population was composed of employees of a telecommunication company in Germany who volunteered to participate in the project. The program was advertised in the intranet of the company. Interested individuals registered by sending an email to the human resources manager. This sort of recruitment has been applied in several other worksite programs (Kreis & Bödeker, 2003; Dallow & Anderson, 2003; Shephard, 1996b).

Male and female individuals with current employment status and belonging to the main corporation were eligible to participate. Employees without intranet access were automatically excluded from the program. There were some additional inclusion criteria. The volunteers were required to sign a formal statement consent (see Appendix: *Einverständniserklärung*) prior to their enrollment and were asked to choose six time slots for the exercise classes (see Intervention Concept). Finally, individuals failing to return the first assessment questionnaire were automatically excluded from the program.

The volunteers were assigned to the intervention group or to the control group by means of a manual randomization procedure. The statement consent of each employee was put by chance in one of two paper boxes (the researcher did not see

the names on the sheets). A total of 31 participants were allocated to the intervention group and 22 participants were allocated to the control group.

3.3 Study design and data collection

At the beginning of the intervention process (pre test or T1), the experimental group (designated exp1) was submitted to 20 minute classes of low-intensity exercises, 3 times a week during 3 months. No intervention was applied to the control group during this period. The control group was also not encouraged to change their physical activity behavior during this period. After the terminus of the program for exp1, exactly the same intervention was applied to the control group (designated exp2).

Questionnaires were applied simultaneously to both groups in order to evaluate the efficacy of the intervention. Individuals were required to answer the questionnaires before and after the completion of the intervention, as well as three and six months after the intervention had ended. Because exp2 served as a control group for exp1 during period T1, and because exp2 was latter submitted to the same intervention as exp1, group exp2 received in total 5 questionnaires (see Fig 3.1).

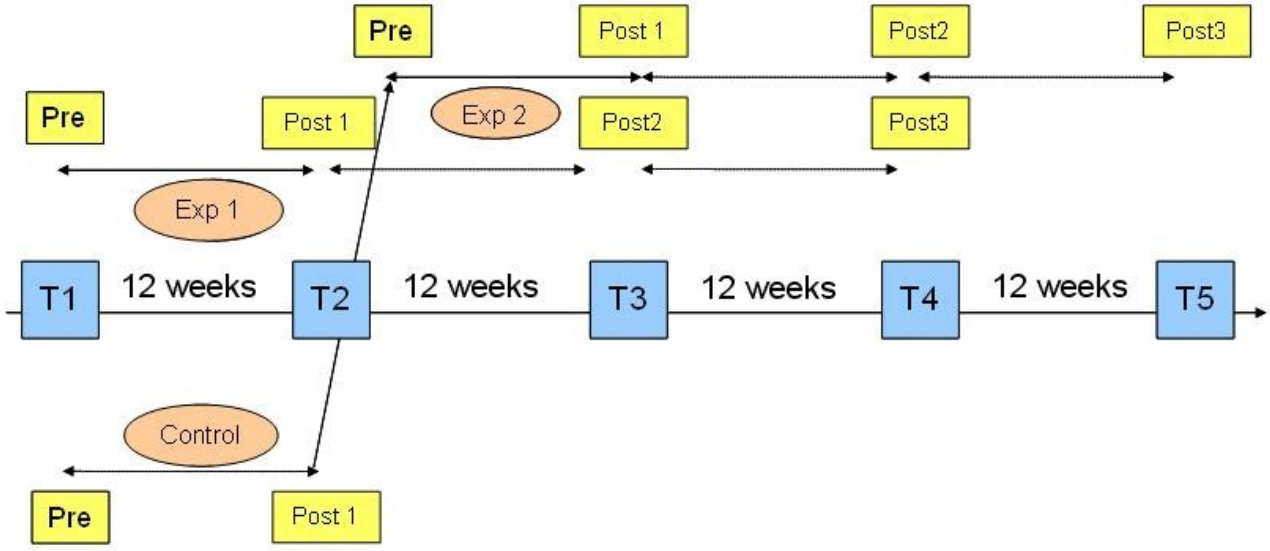


Fig. 3.1 Study design. Yellow boxes correspond to the questionnaire assessments. Blue boxes correspond to the different time points of the project (T1 = before initiating the exercise classes; T2 = 12 weeks (3 months) after program onset; T3 = 24 weeks (6 months) after program onset; T4 = 9 months after program onset and T5 = 12 months after program onset). Circles represent the two groups. Exp1= experimental group 1; Exp2= control group or experimental group 2; Pre = first questionnaire; Post1 = immediately post intervention questionnaire; Post2 = questionnaire applied three months after the intervention was completed; Post3 = questionnaire applied six months after the intervention was completed.

T1 and T2 evaluate a Randomized Controlled Trial because exp2 served as a control to exp1. In an additional analysis, data from groups exp1 and exp2 were merged together in order to access the long-term effects of the intervention (six months after the completion of the program). Therefore, even though the latter did not have a corresponding control group, it analyzed long-term effects within a larger population (here designated the pre-experimental design).

3.4 Material and Instruments

3.4.1 Physiological data

Healthy employees engaged in supervised exercise classes for this study. Already at the first week of the program the volunteers were asked to participate in the first assessment procedure. No medical screening was required because all the participants were able to perform their normal working activities. Additionally, the exercise program did not require any special physical capability nor did it promote any overload to the normal physical activity levels of the participants. This assessment aimed only at providing a short screening of the population being studied.

Three physiological parameters were collected: height, weight and blood pressure. Weight was measured with a digital balance instrument (Model DMV-91Qb S/N 23117143 - Curamed). A digital blood pressure monitor (Model Nr.: HL-168 A, S/N 0309069137 - DOC+) assessed the systolic and diastolic blood pressures. After an exercise session, the left arm was rested on a table and the measurement was performed at the wrist (positioned at heart level). Height was asked by means of a coded sheet. The BMI (body mass index) was then calculated for each employee using the formula: weight / squared height. BMI values between 18.5-25 were considered within the normal range. Values under 18.5 indicated that the individual was under the normal weight. Values between 25-30 indicated that the individual was above weight. BMI values above 30 indicated obesity (WHO classification).

The classification of blood pressure for adults is still controversial. Some associations for cardiology consider as normal blood pressure only values under 120/80 mmHg. Values between 120-139 mmHg (systolic) and 80-89 mmHg (diastolic) are considered prehypertension. Stage 1 of hypertension characterizes people with systolic pressure values ranging between 140 and 159 mmHg, and diastolic pressure values ranging

between 90 and 99 mmHg (American Heart Association). Individuals with pressure values above this range are considered to be in hypertension stage 2 (American heart association). In Germany and United Kingdom, systolic pressure values between 110-140 mmHg and diastolic pressure values between 70-90 mmHg are considered normal for a healthy individual (NHS, 2006; TK, 2009).

3.4.2 Questionnaires

The main questionnaire employed in this study was constructed by using standardized scales from already validated instruments.

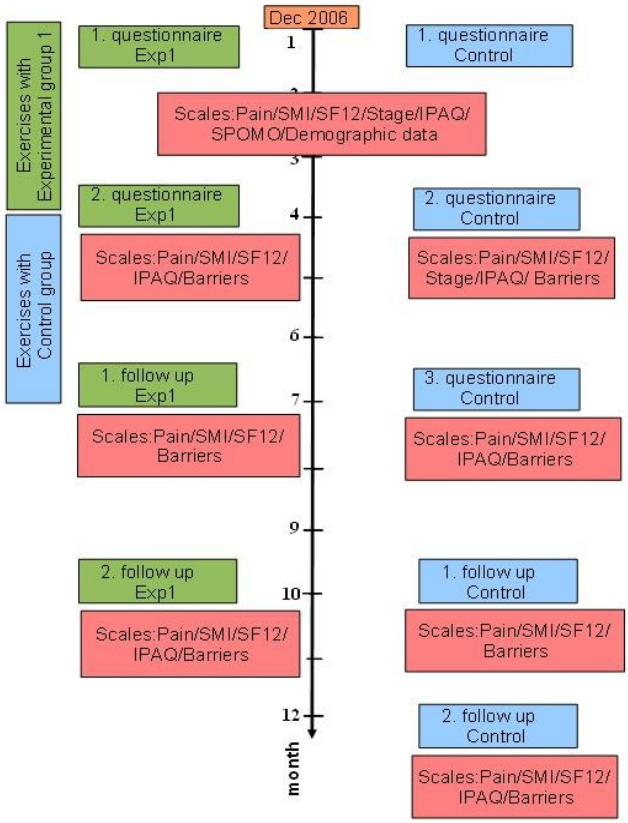


Fig. 3.2 Time-line of the scales/questionnaires applied during the project (Exp1= experimental group 1; Pain= pain drawing reports and verbal rating scale; SMI= self-motivation inventory scale; SF12= short-form of the 12 Health Survey; Stage= stages of motivational behavior change; IPAQ= international physical activity questionnaire; SPOMO= sport motivation questionnaire; Barriers= barriers to exercise questionnaire).

This enabled comparisons with other studies which employed the same tools. The questionnaire assessed the prevalence, location and severity of musculoskeletal pain (pain drawing, VRS). It also accessed self-motivation (SMI), the subjective health-related quality of life (SF-12) and the amount of physical activity practiced (IPAQ-

short). However, some assessments using other validated scales were also applied: stage of motivational change to physical activity (SoC), motives for physical activity engagement (SPOMO) and barriers to exercise. For details regarding the specific questions applied see Appendix. Figure 3.2 illustrates the time-line along the program in which the different scales/questionnaires were applied.

3.4.2.1 "Stages of Change" questionnaire (SoC)

The SoC questionnaire, described as an assessment instrument in the Transtheoretical Model, is widely used in programs aiming at promoting physical activity (Martin-Diener *et al*., 2004). Marcus *et al*. (1992b) adapted this tool for evaluating physical activity behavior. For these authors, the assignment of an individual to a certain motivational stage should be based on the current behavior of the individual rather than on his or her intention to change. As first proposed by Prochaska & DiClementi (1983 in Marcus *et al*., *op. cit*.), the SoC is composed of five questions and classifies the individuals in one of five stages of motivational behavior change: pre-contemplation; contemplation; preparation; action and maintenance of the behavior (for the definition of the various stages see the Introduction Chapter). The reliability of this instrument was tested by Marcus *et al*. (1992) and resulted in a Cronbach alpha of 0.90. The SoC version focusing on physical activity behavior (Marcus *et al*., *op.cit*.) was based on the translations made by Fuchs (1997) and Martin-Diener *et al*. (2004).

3.4.2.2 Pain assessment

Two instruments were used in order to assess musculoskeletal pain and its severity: the pain drawings report and the verbal rating scale (VRS).

I. Pain drawings report

This consists in a multidimensional descriptive report which indicates the localization and distribution of reported musculoskeletal pain in a schematic drawing of the human body. Ransford (1976) first used these drawings to assess the location and distribution of pain among people with hypochondriasis problems. The individuals are asked to make schematic representations of their pain on pictures of the human body (front and back views). Today, pain drawings as the ones illustrated in Figure 3.3 are well known and broadly used to investigate musculoskeletal disorders such as back pain

and in the orthopedic rehabilitation (Pfingsten *et al*., 2003; Pande *et al*., 2005; McKenzie Institute International).

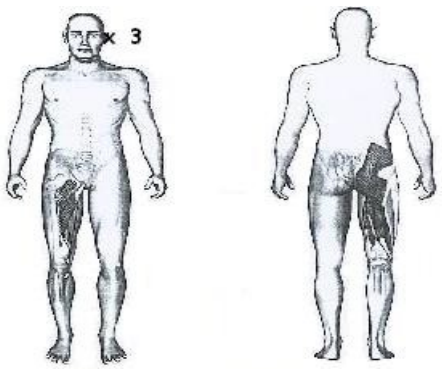


Fig. 3.3 Pain drawings

II. Verbal Rating Scale

Among the instruments available to assess the intensity of pain symptoms, the Verbal Rating Scale (VRS) and the Visual Analog Scale (VAS) are the ones most frequently used. These tools are simpler than the McGill Pain Questionnaire or the Wisconsin Brief Pain Questionnaire. The VRS and VAS consist in simple unidimensional tests which rate only the sensory components of pain rather than its affective and psychosocial aspects. Moreover, VRS and VAS are shorter and easier to respond. For this research, the VRS was chosen as the method to assess the intensity of musculoskeletal pain. In a study with post-surgery patients (Loos *et al*, 2008), VRS was shown to have lower failure rates as compared to VAS (VAS: 12.5% vs. VRS: 2.8%, $p<0.05$). Additionally, VRS exhibited higher test-retest reliability values (Loos *et al*., *idem*). The VRS rates pain intensity in four different levels: no pain, mild pain, moderate pain and severe pain. In the present study, pain was rated in four different levels: 1- indicating mild intensity pain (*leichter Schmerz*); 2- indicating moderate intensity pain (*mittel-starker Schmerz*); 3: indicating strong pain (*starker Schmerz*); and 4- indicating very strong or severe pain (*unerträglicher Schmerz*). If the participant reported no musculoskeletal pain, he/she was instructed to proceed to the next question.

3.4.2.3 Self-motivation inventory scale

The self-motivation inventory scale (SMI) was developed and validated by Dishman,

Ickes & Morgan (1980). In the original SMI version (Dishman & Ickes, 1981), 40 items were used to assess the self-motivation of individuals. To each one of the 40 items in the questionnaire the individuals were required to give an answer based on a scale that ranged from 1 to 5 (a Likert scale); with 1 corresponding to "extremely uncharacteristic of me" and 5 corresponding to "extremely characteristic of me". Dishman & Ickes (idem) reported a Cronbach alpha (internal consistency reliability) of 0.91 for the SMI.

A German version of this questionnaire was published in 1999 in the dissertation of Rampf (1999). This dissertation reported the unpublished results of Abele & Brehm (1990) regarding the validation of the German version of this assessment tool. Abele & Brehm chose 18 items from the original SMI in order to investigate self-motivation. For this modified version of the SMI they reported a Cronbach alpha reliability test of 0.73. Scores obtained for 14 of the items in the questionnaire were able to classify a low self-motivation. Scores for the other 4 items were able to classify a high self-motivation. Items 1-5, 7-9, 12 and 14-18 were re-codified and were used to compute the final motivation score (Rampf, 1999).

3.4.2.4 Subjective health-related quality of life - Short-form 12 (SF12) Health Survey

The subjective health-related quality of life was here investigated by using the short-form (SF12) Health Survey. This questionnaire has been used both for healthy individuals as well as for individuals with depression, with musculoskeletal disorders and for patients who had suffered a stroke. The long version of this form is called the SF36, which is a multi-purpose health survey consisting of 36 questions. The SF36 is one of the best known instruments to assess health-related life quality. It measures functional status and well-being and thereby provides an overall health evaluation of the individual (Biddle & Mutrie, 2008). It was initially developed by J. Ware, QualityMetric Inc., IQLA-Project Group (www.qmetric.com). In 1994 a shorter-version of the SF36, the SF12, was developed, validated and patented. SF12 has 8 questions representing 8 different scales: physical functioning; role physical; bodily pain; general health; vitality; social functioning; role emotional and mental health. Two final scores are given: one representing the physical health component (PCS) and the other representing the mental health component (MCS) (see www.sf-36.org).

The German version of the SF12 was translated by Bullinger & Kirchberger (1998). Additionally, the authors provided a syntax-script which enable data analysis using the SPSS program. The internal consistency reliability (Cronbach alpha value) for the

German version ranged between 0.64 and 0.94 depending on the scale employed. There was also a good correlation between the evaluation obtained with the SF12 and those obtained with other methods for measuring health-related life quality (www.iqpr.de).

3.4.2.5 Physical activity – International Physical Activity Questionnaire - short-form (IPAQ)

The IPAQ short-form was used here to access the amount of physical activity practiced by the participants. This questionnaire was developed in 1998 by the International Consensus Group and it´s validity has been tested in 12 countries (Craig *et al*., 2003). There was a high correlation between the results obtained for the different countries (Spearman's Rho of around 0.8). Additionally, De Cocker *et al*. (2008) found a moderate correlation between the results obtained with the IPAQ questionnaire and data obtained by pedometers, which estimated the total amount of steps performed by the individuals in a period of time.

The IPAQ short-form categorizes physical activity in 3 different intensity levels. Each level is associated with a different coefficient which is used for the computation of the MET (metabolic equivalent of task). The coefficients are 3.3, 4.0 and 8.0 for low, moderate and vigorous intensity activities, respectively. Each coefficient is multiplied by the duration (in minutes) and the frequency (days of practice per week) of the physical activity practiced (the unit of MET is in minutes/week). Therefore, both the total amount and the intensity of physical activity practiced is considered for the analysis. The total MET is computed by the sum of all values. Depending on the total MET, the participants were thereby classified as low, moderate or highly active. The results are expressed as the median (rather than the mean) of the MET. This is because several populations have been shown to have a non-normal distributions of energy expenditure (IPAQ-Guidelines for Data Processing and Analysis, 2005 available at www.ipaq.ki.se/ipaq.htm).

The German version of IPAQ was published in Switzerland by BASPO (Bundesamt fuer Sport) (Maeder *et al*., 2006). The authors reported that the reliability of this questionnaire could be rated between fair and good (Spearman´s correlation coefficient between 0.43-0.68).

3.4.2.6 Motives to exercise - Questionnaire Sportmotivation (SPOMO)

The *Sportmotivation* (motives for doing sport) questionnaire aims at describing the cognitive aspects involved with the intention to exercise. The questions address the motives for performing physical activity and the expectations regarding the possible outcomes of active behavior (Brehm & Sygusch, 2001). SPOMO was developed and tested by Brehm *et al*. (1994, *apud* Brehm & Sygusch, 2001). There are 15 items within the questionnaire which attempt to quantify four different aspects of active behavior: 1- *Soziale Erfahrung* (social interaction/experiences); 2- *Gesundheit, Fitness und Wohlbefinden* (health, fitness and well-being); 3- *Leistung* (performance); and 4- *Körperarbeit* (esthetic/body action). These four factors have each a Cronbach alpha of 0.82, 0.77, 0.71 and 0.62, respectively. The answers are given in a 7-point Likert-type scale, where 1 corresponds to: *trifft für mich überhaupt nicht zu* (uncharacteristic of me) until 7 corresponds to: *trifft für mich sehr stark zu* (very characteristic of me) (Brehm & Sygusch, *op.cit*.).

3.4.2.7 Barriers to exercise - Questionnaire Barrieren sportlicher Aktivität

Barriers may substantially hinder exercising behavior and its maintenance. Brehm *et al*. (2001) emphasized that it is important to distinguish between objective barriers (such as job obligations) and subjective perceptions. One can learn to deal with objective barriers. Therefore, having a realist perception of the barriers to exercise can be important in the maintenance of active behavior. The "Barriers to Exercise" questionnaire was developed by Brehm, Pahmeier & Tiemann (1994) and it is composed of 14 items which together evaluate three different factors: *Unsicherheit in Bezug auf körperliche Aspekte* (lack of confidence in one´s own physical ability, 5 items, Cronbach alpha 0.80); *Zeitmangel / Belastung* (time conflict, 4 items, Cronbach alpha 0.83); and *Fehlende Motivation* (lack of motivation, 5 items, Cronbach alpha 0.83) (Brehm & Sygusch, 2001). As in the SPOMO, the answers range within a 7-point Likert-type scale, where 1 corresponds to: *trifft für mich überhaupt nicht zu* (uncharacteristic of me) and 7 corresponds to: *trifft für mich sehr stark zu* (very characteristic of me) (Brehm & Sygusch, *op.cit*.).

3.5 Statistical analysis

The Chi square and the Kolmogorov-Smirnov tests were used to evaluate if the samples of the different variables (categorical or metrical, respectively) were normally

distributed. The Spearman's and the Pearson's correlation coefficients were used, respectively, as the non-parametric and the parametric measures of dependence between two variables (Howell, 1999). T-tests and ANOVAs for independent (comparisons between experimental and control groups) and repeated measures (pre- versus post-intervention comparisons within the same group) were used to evaluate the effectiveness of the intervention program (Howell, *op.cit.*). ANOVA for repeated measures was used to test for the long-term effects of the intervention (Tang *et al*., 2007), such as the designs with more than one post-intervention assessment. In the randomized controlled design, the short-term effects of the intervention were compared both between groups as well as within the same group. Long-term effects were evaluated by using a pre-experimental design (one group with pre-post analysis). In this type of design, data from both groups were merged together. This procedure was only possible because both groups underwent the same intervention program.

The 95% confidence interval (CI) was sometimes calculated in order to better evaluate the effects of the intervention. The significant level was at 95% ($p<0.05$). All statistical analyses were conducted using SPSS versions 14.0 and 17.0 for Windows.

"I found that I worked better and thought more clearly when I was in good physical condition, and so training became one of the inflexible disciplines of my life." Nelson Mandela (Long walk to freedom)

IV. Results

The Results are divided in three different sections. The first section describes the general (socio-demographic) characteristics of the population prior to the start of the intervention program. The second section focuses on the effects of the intervention itself. Essentially, a comparison is made between the experimental group (exp1, N=26) and the control group (control, N=19) regarding the effectiveness of an intervention program which employs low-intensity exercises. Questionnaires given to the participants at several time points during the course of the program focused on the following aspects: 1- the prevalence, location and intensity of pain; 2- the health-related quality of life; 3- the level of physical activity practiced; 4- self-motivation; 5- motives to practice physical activity; 6- barriers to the performance of physical activity. The third and last section describes the long-term effects of the intervention (6 months follow-up period). To this aim a pre-experimental design was adopted and the results from all participants were merged together into a single large group (N=45).

According to the classification of the World Health Organization (WHO), individuals are considered sufficiently active when they perform regular physical activity of moderate intensity for at least 30 minutes (average of 2.5 hours per week). Therefore, for the analyzes performed in Sections 2 and 3, the participants were further subdivided into low/high adherents, and into less/more active participants in order to further evaluate the main factors influencing the results obtained. Prior to the start of the program, control and exp1 groups were statistically homogeneous regarding their proportion of less/more active individuals. Approximately, 45.8% (N=11) and 43.8% (N=7) of the individuals of both groups, respectively, performed the recommended levels of physical activity (p=0.8, Chi-square).

4.1 Characteristics of the Population

A total of 45 individuals (26 males and 19 females) participated in the intervention program. Even though there was a larger proportion of males as compared to female participants, there was no significant difference in gender between both groups

(p=0.6, Chi-square). The control had a mean age of 41.2 years (95%CI 39-43.3) while exp1 had a mean age of 39.3 years (95%CI 36.7-41.8). The analysis of body composition showed a normal body mass index (BMI) for both groups (average for control: 25.18 Kg/m^2; average for exp1: 25.12 Kg/m^2). The members of both groups also showed normal blood pressure. The average systolic (diastolic) pressure was of 127.89 mmHg (82.05 mmHg) and 131.77 mmHg (84.62 mmHg) for the control and exp1 groups, respectively (for further details regarding BMI and blood pressure see Methodology). The groups showed no significant differences for age, body composition and blood pressure at the onset of the intervention program.

The classification of the participants regarding their educational level is illustrated in Figure 4.1 (no significant statistical difference between the groups). The population had in general a high educational background. Around 62.5% and 50% of the participants in control and exp1, respectively, held an university degree.

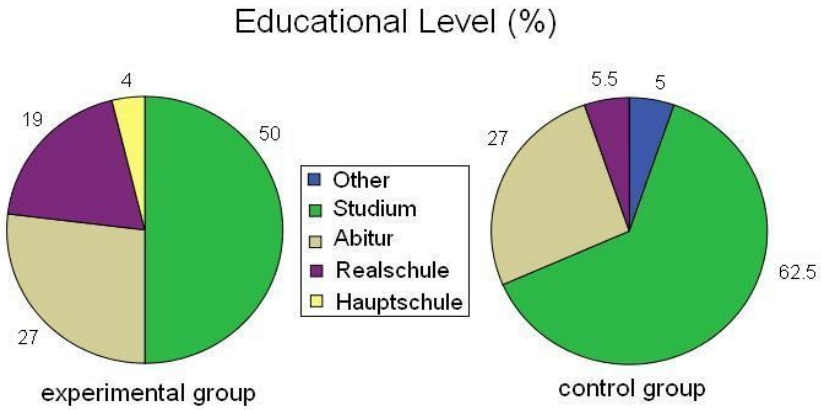


Fig. 4.1 Educational level for the control and exp1 groups. *Studium*: University degree; *Abitur*: high school diploma; *Realschule*: secondary school; *Hauptschule*: first school; *Other*: other educational background.

Similarly, there was a homogeneous distribution regarding the stage of motivational change (Figure 4.2). Most of the participants found themselves in the preparation stage (53% for the control and 42.5% for the exp1). This implied that most of the individuals were indeed engaged in some sort of physical activity, but not in a regular basis. Only 7.5% of the members of exp1 performed regular physical activity (action stage), compared to none of the control group. Additionally, only 15.5% of the control group had been active for more than six months (maintenance stage), compared to 35.5% for the exp1. Finally, it was interesting to observe that many of the participants (26% in control and 15.5% in exp1) were already looking for an opportunity to become physically active (contemplation stage) before the intervention started.

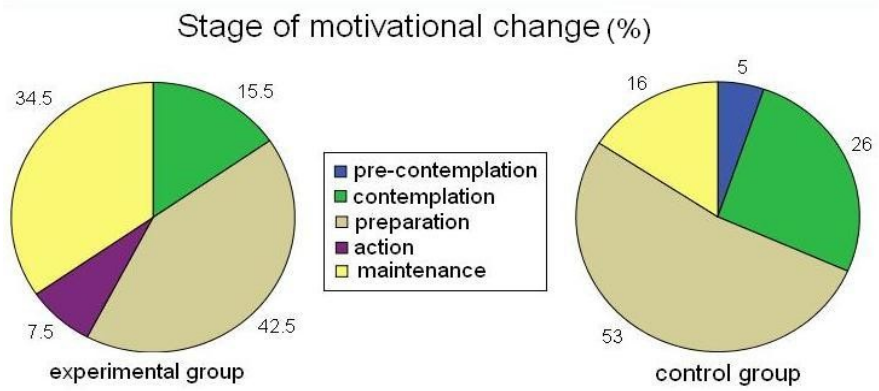


Fig.4.2 Stage of motivational change regarding the performance of physical activity among participants belonging to the control or experimental groups.

4.2 Randomized Controlled Trial Analysis (RCT)

4.2.1 Return of questionnaires

The first questionnaire was applied to all participants (control, N=22; exp1, N=31) and had a return-quote of 100%. At the end of the intervention the control returned 86.36% (N=19) and exp1 returned 83.87% (N=26) of the questionnaires. Therefore, the analysis of the intervention was based on 45 questionnaires.

4.2.2 Drop out quote

Since there is no standard definition for a dropout individual, we applied the classification used by Wagner (2000 *apud* Fuchs, 2003). In the study of Wagner, a weekly exercise program was applied during a 12 month period. Dropout was defined as someone who missed 6 consecutive classes without presenting any justification. Therefore, for the present study, a person who initiated the program but missed more than 6 consecutive exercise classes (2 weeks) without presenting a justification was considered a dropout. There were some dropouts for exp1. From the initial 31 employees that engaged in the 20 minutes 3 times per week exercise classes, 5 (16.1%) had dropped out by the end of the intervention. The reasons for dropping out were the following: one suffered a sport injury, one moved away from the city and three reported having no time for physical activity due to family or job obligations.

4.2.3 Comparison between groups (exp1 versus control)

4.2.3.1 Pain evaluation

Pain drawings and the Verbal Rating Scale were used to investigate pain localization and intensity. The frequency and duration of the reported pain was also inquired. The hypothesis was whether the intervention positively influenced pain prevalence and intensity for those having musculoskeletal complaints.

Before the intervention, pain prevalence was 46.2% for exp1 and 57.9% for the control. The pain was classified as chronic (>12 months duration) for 30.8% and 31.6% of the exp1 and control group members, respectively. Pain episodes were relatively frequent for both groups. At the end of the intervention, exp1 had a pain prevalence of 38.5%, which was not statistically significant lower ($p>0.05$, McNemar ´s test) than the prevalence for the control group (52.6%).

Pain location and intensity for exp1 in both the pre and post 1 are shown in Figure 4.3. The corresponding data for control is illustrated in Figure 4.4.

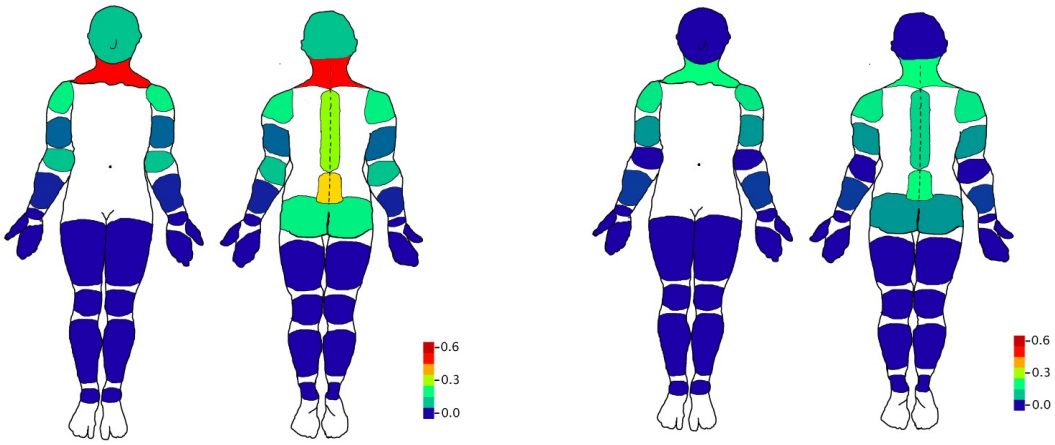


Fig.4.3 Pain location and its mean intensity for exp1 in the pre (pair of illustration on the left) and post 1 (pair of illustration on the right) assessments. Pain intensity is given by a color code, where blue corresponds to the absence of pain and red corresponds to strong pain in a specific body location. The participants were required to assign a value between 0 (minimum) and 4 (maximum) to their pain.

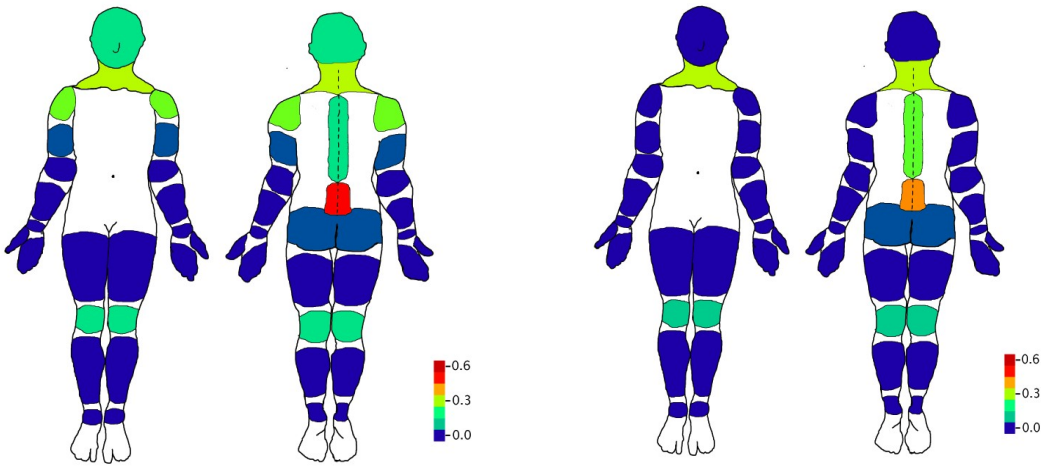


Fig.4.4 Pain location and its mean intensity for the control group. Conventions as in Fig. 4.3.

Before the intervention, 42.3% of the pain complaints reported by exp1 were assigned to the back region, while 23.1% were assigned to the upper limb. After the terminus of the intervention, only 28% of the individuals reported back pain and 12% reported upper limb pain. Prior to the intervention, pain was most intense in the neck region (mean 0.58, SD 0.94) followed by the low-back (mean 0.31, SD 0.73). Comparisons within the same group (exp1) before and after the intervention revealed a decrease in pain intensity for the neck region which was at the limit of statistical significance (mean 0.19, SD 0.56 after the intervention; p=0.05; repeated-measures ANOVA).

Based on these findings it can be concluded that low-intensity exercises had a tendency to decrease the prevalence of musculoskeletal pain. However, since the results did not reach statistical significance, it cannot be assumed that the prevalence and the intensity of musculoskeletal complaints were reduced at the population level. It was interesting to observe that participants who were sedentary or not so active before the intervention onset reported more pain (61.5%; N=8) as compared to the already active individuals (27.3%; N=3). Finally, there was a decrease in pain prevalence after the terminus of the intervention (38.5%; N=5). This improvement, however, was not statistically significant when compared to the values reported by the control group (36.4%; N=4).

4.2.3.2 Self-motivation evaluation (Scale of the SMI)

The Self-Motivation Inventory was applied to assess the self-motivation of the participants. The hypothesis of this study was that individuals performing higher levels of physical activity after the terminus of the intervention would exhibit higher self-motivation scores. Additionally, it was also investigated whether self-motivation was correlated to adherence to the exercise program.

No significant correlation was found between the amount of physical activity practiced and the self-motivation scores at the onset of the intervention. After the terminus of the intervention, however, participants from exp1 exhibited self-motivation scores which were positively correlated with physical activity performance (Pearson´s correlation: 0.59, $p<0.05$; N=22). As shown in Figure 4.5, highly motivated individuals also performed physical activity more frequently. Additionally, the subdivision of exp1 into less and more active individuals revealed that only the less active participants showed a positive correlation between self-motivation and the amount of physical activity performed after the intervention (Pearson´s correlation at T2 for self-motivation and days of physical activity: 0.79, $p<0.05$, N=10). Based on these results it can be assumed that the hypothesis "individuals who perform more physical activity after the terminus of the intervention also have higher self-motivation" is true, especially for those individuals who were previously classified as insufficiently active.

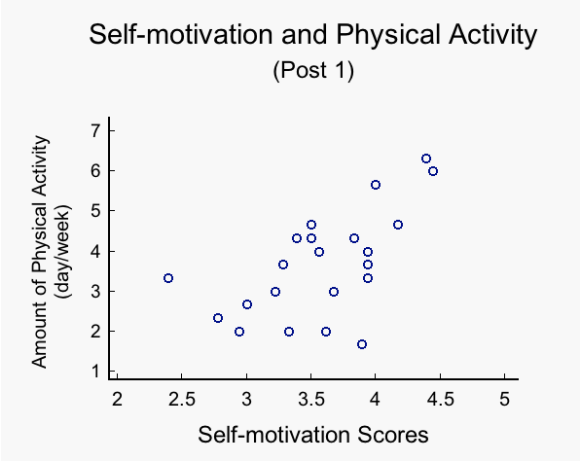


Fig. 4.5 Relationship between self-motivation scores and the amount of physical activity practiced among exp1 participants in the post1 assessment (N=22).

Contrary to what was expected, a highly motivated participant was not necessarily assiduous. This is shown in Figure 4.6 by the significant negative correlation between self-motivation scores and adherence to the exercise program (Pearson´s correlation coefficient, r=-0.39, $p<0.05$, N=26).

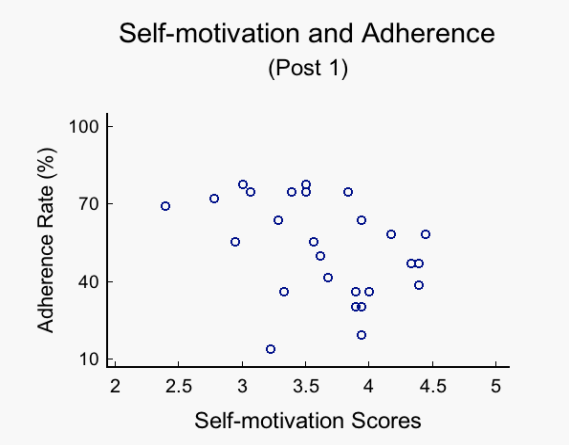


Fig. 4.6 Relationship between self-motivation scores and the adherence rate to the exercise program among exp1 participants in the post 1 assessment (N=26).

4.2.3.3 Health-related quality of life (SF12)

The health-related quality of life was assessed by the SF12 questionnaire. Two scores were reported: one for the physical component (PCS) and one for the mental component (MCS) of health. It was investigated whether the subjective health-related quality of life (especially among less active participants) improved after the terminus of the intervention.

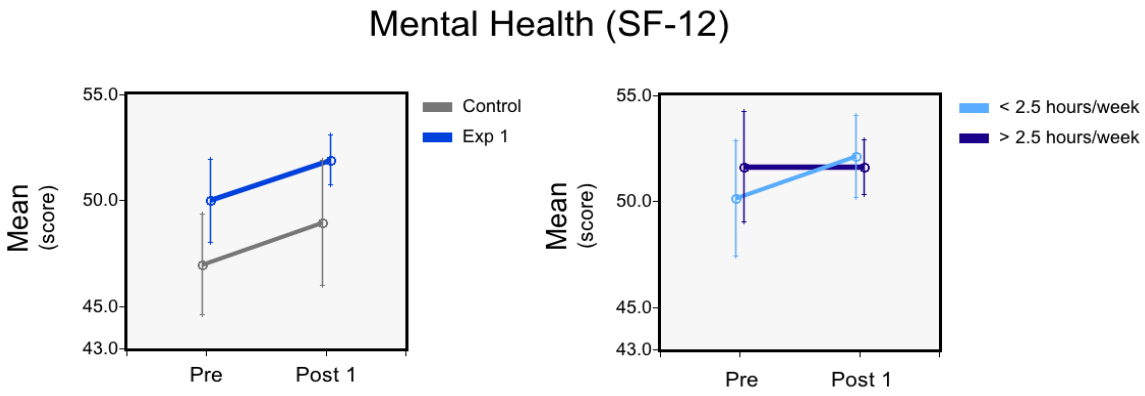


Fig. 4.7 Mental health scores obtained by the SF12 questionnaire. Left panel: comparison between control and exp1 for the pre and post 1 periods. Right panel: mental component scores for when exp1 was subdivided into less active (less than 2.5 hours per week of moderate physical activities) and more active (at least 2.5 hours per week of moderate intensity physical activity) individuals. Vertical bars correspond to the standard error of the mean.

The intervention led to improvements both in the physical and in the mental components. None of the effects, however, reached statistical significance when compared to the control group. Data for the MCS is shown in Figure 4.7 (left panel). The same analysis was performed for when exp1 was subdivided into less and more

active individuals. The PCS was similar to the data obtained before the subdivision. The MCS, however, showed improvement only for the less active individuals (Fig. 4.7, right panel).

Based on these results it can be concluded that the hypothesis: "subjective health-related life quality (especially among less active individuals) improved after the intervention" is false. However, larger sample sizes could have yield significant positive results for the MCS among less active individuals.

4.2.3.4 Physical activity levels (IPAQ-short)

The International Physical Activity Questionnaire short-form (IPAQ-short) assesses the amount of physical activity practiced by a individual, classifying it in three different categories: low (walking), moderate and vigorous intensity. Additionally, the time spent in sitting positions was also assessed in order to evaluate the sedentary habits of the individual. Here, it was hypothesized that the intervention program would increase the level of physical activity practiced, specially among the less active participants.

4.2.3.4.1 Days per week of physical activity

The baseline scores for the IPAQ-short questionnaire showed that the control and exp1 groups were homogenous before intervention onset (*i.e*. there was no statistical difference between them; see Table 4.1). After the intervention, however, individuals in exp1 significantly increased the frequency in which they practiced physical activity (Fig. 4.8). Comparably, the control group showed no effect (Table 4.1).

Days of physical activity (number of days/week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Control	*Mean (SD)*	2,56(1,95)	2,64(1,67)	F<1 n.s.	
	N	19	19		
Exp1	*Mean (SD)*	2,66(1,53)	3,68(1,31)	**F(1,39)=7.59 p<.05**	**F(1,39)=1.6 p=0.06**
	N	26	22		
One-way ANOVA		F<1 n.s.	**F(1,39)=6.1 p<.05**		**Interaction F(1,39)=4.25 p<.05**
p group comparison		n.s.			

Table 4.1 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of physical activity practiced (days per week) as a function of time (pre and post 1) and group (control and exp1). Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score; n.s., not significant; N, sample size.

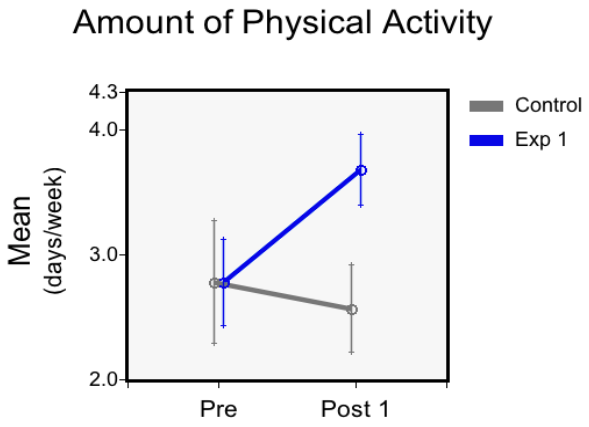


Fig. 4.8 Amount of physical activity practiced by the exp1 and control groups before (pre) and after (post 1) the intervention program. Vertical bars correspond to the standard error of the mean.

4.2.3.4.1.1 Gender comparison

Prior to the intervention program, the amount of physical activity performed by both genders was not uniform. Women exercised more frequently than men (women: 3.3 days per week, 95%CI 2.34-4.27, N=19; men: 2.23 days per week, 95%CI 1.61-2.86; N=19; p=0.04, Oneway ANOVA). For this reason, the analysis investigating the effect of the intervention on the amount of physical activity performed was carried out separately for both groups.

Days of physical activity (number of days/week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Control	*Mean (SD)*	4.66(2.66)	3.26(1.65)		
	N	5	5	n.s.	
Exp1	*Mean (SD)*	3.07(1.6)	3.51(1.27)		
	N	11	11	n.s.	n.s.
One-way ANOVA		n.s.	n.s.		**Interaction**
p group comparison		n.s.			**F(1,14)=5.1 p<.05**

Table 4.2 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of physical activity practiced (days per week) as a function of time (pre and post 1) and group (control and exp1). Same data as the one shown in Table 4.1 but only women were selected for the analysis. Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score; n.s., not significant; N, sample size.

Before the start of the program, women in both control and exp1 exercised similarly. After the terminus of the intervention, however, a significant group-time interaction

was observed (Table 4.2). These results imply that women in exp1 increased their level of physical activity practice (as compared to the control) as a result of the intervention (Fig. 4.9).

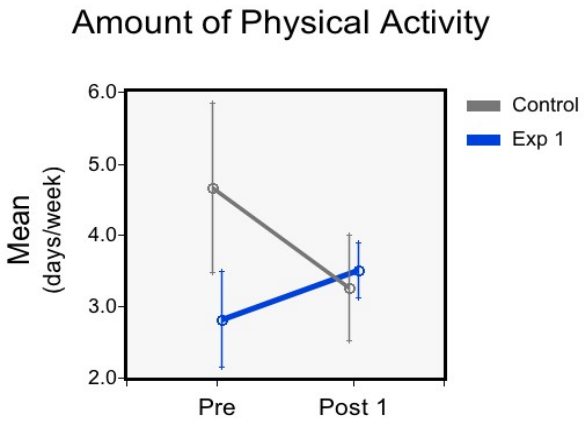


Fig. 4.9 Amount of physical activity practiced by women only in the exp1 and control groups. Data is shown for the periods before (pre) and after (post 1) the intervention program. Vertical bars correspond to the standard error of the mean.

Equivalent results as the ones obtained for the women-only analysis were also obtained for male participants (Fig. 4.10 and Table 4.3). Note that paired values were used to compute the repeated-measures ANOVA. Therefore, the unpaired values which were used for Figures 4.9 and 4.10 were excluded while carrying out the analysis shown in Tables 4.2 and 4.3.

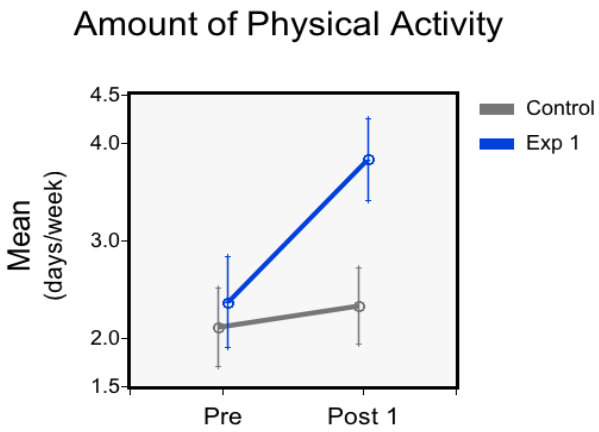


Fig. 4.10 Amount of physical activity practiced by men only in the exp1 and control groups. Data is shown for the periods before (pre) and after (post 1) the intervention program. Vertical bars correspond to the standard error of the mean.

Days of physical activity (number of days/week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Control	*Mean (SD)*	2.11(1.52)	2.33(1.46)	n.s.	**F(1,23)=5.04 p<0.05**
	N	14	14		
Exp1	*Mean (SD)*	2.5(1.64)	3.84(1.39)	**F(1,10)=9.31 p<0.05**	
	N	11	11		
One-way ANOVA		n.s.	**F(1,24)=6.85 p<0.05**		
p group comparison		**F(1,23)=3.6 p=0.07**			Interaction n.s.

Table 4.3 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of physical activity practiced (days per week) as a function of time (pre and post 1) and group (control and exp1). Same data as the one shown in Table 4.1 but only men were selected for the analysis. Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

4.2.3.4.1.2 Comparison between less and more active participants

Group exp1 was subdivided into less and more active individuals in order to analyze how their exercising habits before the program influenced the changes in the amount of physical activity practiced after the terminus of the intervention. Each of the two subgroups (less and more active individuals) was thereby composed of 10 individuals (4 participants were excluded from this analysis because they did not answer the relevant question in the post 1 assessment).

As it can be observed in Table 4.4, the intervention increased the exercising habits of the participants. However, this increase was only significant for the less active subgroup (Figure 4.11).

Days of physical activity (number of days/week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Less active	*Mean (SD)*	1.81 (1.09)	3.33 (1.31)	**F(1,17)=10.85 p<0.05**	**F(1,18)=6.77 p<0.05**
	N	10	10		
More active	*Mean (SD)*	3.85 (1.45)	4.03 (1.39)	n.s.	
	N	10	10		
One-way ANOVA		**F(1,23)=2.21 p<0.05**	n.s.		Interaction F(1,18)=4.16 p=0.05
p group comparison		**F(1,18)=7.7 p<0.05**			

Table 4.4 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of physical activity practiced (days per week) as a function of time (pre and post 1) and subgroup (less and more active individuals). Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

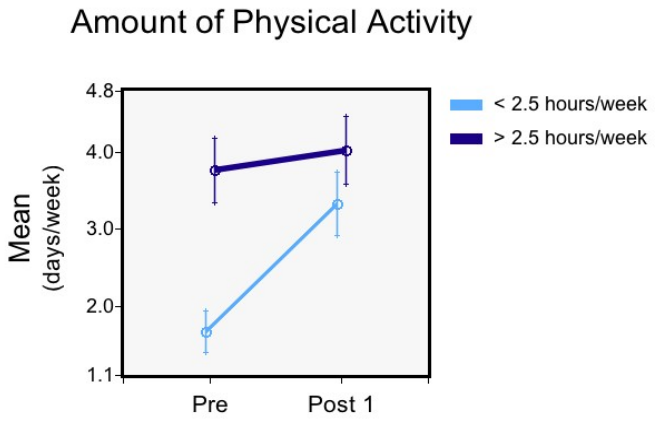


Fig. 4.11 Amount of physical activity practiced by less and more active individuals before (pre) and after (post 1) the intervention program. Less and more active individuals were defined, respectively, as those practicing less or more than 2.5 hours of moderate physical activity per week. Vertical bars correspond to the standard error of the mean.

4.2.3.4.2 Categories of physical activity

Prior to the intervention onset, the participants reported performing all different kinds of physical activity (low, moderate and vigorous activities) during their free time. No significant differences were thereby observed between exp1 and control for these three categories (Fig. 4.12, left panel).

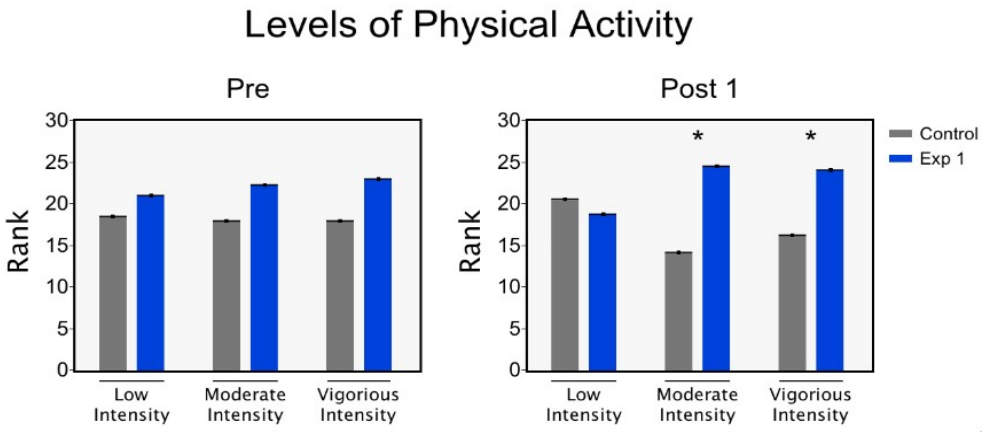


Fig. 4.12 Rank values comparing the intensity of physical activity practiced by individuals (N = 38) both in the control and exp1 groups before (pre) and immediately after (Post 1) the intervention. Asterisks indicate significant difference between the groups.

The intervention program significantly influenced the intensity of the physical activity performed (Fig. 4.12, right panel). Compared to control, individuals in exp1 engaged both in more moderate and vigorous activities after the terminus of the exercise

classes ($p<0.05$, Mann-Whitney-Test rank sum).

4.2.3.4.3 Time spent in sitting positions

Prior to the start of the intervention, the participants reported spending around 8 hours a day in sitting positions. Individuals in exp1 significantly decreased the amount of time spent sitting after the terminus of the intervention (Table 4.5 and Fig. 4.13). No significant differences were observed for the control group.

Time spent sitting (min /week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Control	*Mean (SD)*	3271.57(938.64)	3372.63(771.64)	n.s.	n.s.
	N	19	19		
Exp1	*Mean (SD)*	3506.5(691.14)	3204(739.285)	**F(1,37)=8.67 p<.001**	
	N	20	20		
One-way ANOVA		F<1 n.s.	F<1 n.s.		**Interaction F(1,37)=5.005 p<0.05**
p group comparison		n.s.			

Table 4.5 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of time spent sitting as a function of assessment period (pre and post 1) and group (control and exp1). Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

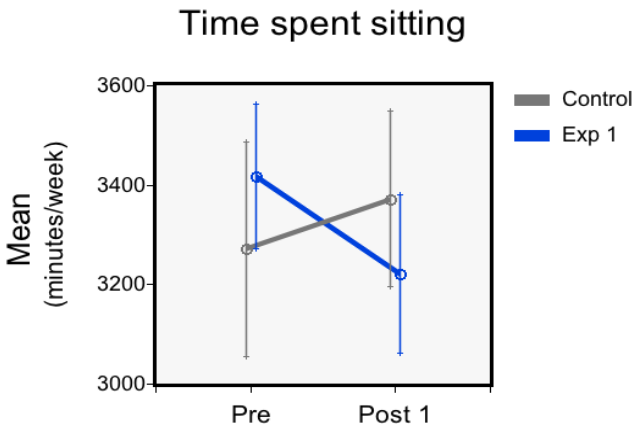


Fig. 4.13 Amount of time spent sitting by the exp1 and control groups before (pre) and immediately after (post 1) the intervention program. Vertical bars correspond to the standard error of the mean.

4.2.3.4.3.1 Gender comparison

Before intervention onset, women participants spent significantly less time sitting as compared to male participants (2988.75 versus 3484.8 minutes per week,

respectively; p<0.05, Chi-square). For this reason, separate analyses were performed for each of the two genders.

Women in the exp1 group reduced the time they spent from 3320 to 3006 minutes per week after the intervention. This decrease, however, did not reach statistical significance (p=0.5, paired T-Test). Male participants in exp1 also reduced the time they spent sitting after the terminus of the intervention. This reduction, however, was statistically significant and consisted in an average decrease of approximately 1 hour in sitting position during the day (from approximately 9 to 8 hours per day, see Fig, 4.14 and Table 4.6).

Time spent sitting (minutes /week)					
		Pre test	**Post1 test**	**ANOVA prepost**	**p pre-post effect**
Control	*Mean (SD)*	3471,42(985.08)	3608.57(698.86)		
	N	14	14	F<1 n.s.	
Exp1	*Mean (SD)*	3693.5(845.98)	3402(906.33)	**F(1,9)=9.71**	
	N	10	10	**p<0.05**	n.s.
One-way ANOVA		F<1 n.s.	F<1 n.s.		
p group comparison		n.s.			Interaction n.s.

Table 4.6 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of time spent sitting as a function of assessment period (pre and post 1) and group (control and exp1). Only the data from male participants were used in this analysis. Note that paired values were used to compute the repeated-measures ANOVA. Therefore, the unpaired values which were used for Figure 4.14 were excluded while carrying out the analysis shown here. Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

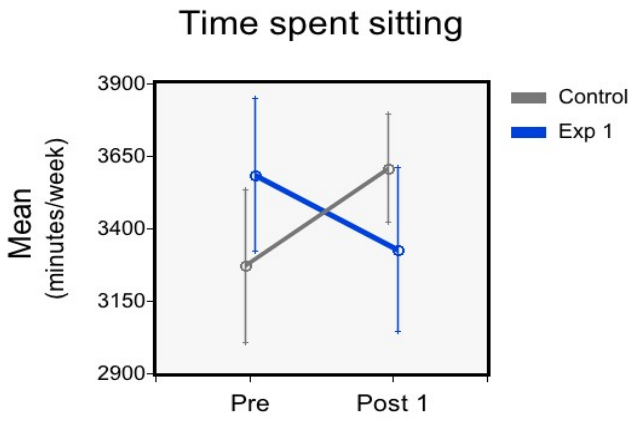


Fig. 4.14 Amount of time spent sitting by the male participants in the exp1 and control groups. Data is shown for the periods before (pre) and after (post 1) the intervention program. Vertical bars correspond to the standard error of the mean.

In summary, it can be concluded that the hypothesis "by providing an experience with low intensity exercises, the participants (mainly the less active ones) tended to increase their levels of physical activity practice" is true. This conclusion is based on the following observations: the increase in the amount of physical activity performed (days per week), the reduction in the time spent sitting, and the selective increases in the amount of moderate and vigorous activity practiced after the terminus of the intervention as compared to the period before the start of the program.

4.3 Pre-experimental design (one group with pre-post analysis)

The individuals from the groups previously denominated exp1 and control were merged together in order to carry out the analyses shown below. This merged group was then studied during different phases of the intervention program. For the sake of clarity, the group previously denominated as control will be from now on referred to as exp2 (exp1 will remain with the same designation). The merging of the data was only possible because both groups exhibited a similar pattern of responses for the questionnaires applied after the terminus of the intervention. A similar procedure has been also employed by other authors investigating how interventions can promote physical activity practice (Schnieders, 2005; Callahan *et al.*, 2008).

4.3.1 Population characteristics

Some socio-demographic characteristics of exp1 and exp2 were compared before merging the data of both groups. No significant differences were observed for the variables gender, age, educational level, blood pressure, Body Mass Index and stage of motivational change. Furthermore, both groups showed a similar proportion of individuals belonging to both the less and more active subgroups (see Appendix 2). Additionally, individuals were classified in low and high adherent participants. Subjects were assigned to the low adherent group when they participated in less than 50% of the exercise classes. Otherwise, they were classified as high adherers.

4.3.2 Return of questionnaires

The return-quote of the first questionnaire was of 94.34% (N=50 out of the 53 participants). Immediately after the intervention (period T2), 44 (83.02%) participants returned the questionnaire. Three (period T3) and six (period T4) months after the terminus of the intervention, 35 (66%) and 36 (67.9%) employees returned

their questionnaires, respectively (T1 will refer to the period prior to the onset of the intervention).

4.3.3 Drop out quote

As previously mentioned, 31 employees in the exp1 group engaged in the program. At the end of the intervention, 5 (16.1%) participants had dropped out. In the exp2 group, 22 employees initially engaged in the exercise classes. At the end of the intervention, 4 (18.1%) participants had dropped out. The reasons for the exp2 drop outs were two. One participant reported having no time to exercise due to family duties (birth of the son). The other three individuals had problems scheduling the exercise classes during their working hours. The overall dropout quote for the program was around 16.9% (N=9). In total, 44 individuals (mean age of 40.11 years, SD of 0.84; men: N=26, women: N=18) successfully completed the exercise classes. Out of these 44 individuals, 29 (66%) were classified as high adherents and 15 (34%) as low adherents. Finally, 22 and 18 of the total of 44 participants were classified, respectively, as less and more active individuals. Four individuals were left unclassified due to incomplete data.

4.3.4 Long-term effects of the intervention

4.3.4.1 Pain evaluation

Prior to the intervention program (T1), 22 (50%) of the employees reported some sort of musculoskeletal pain. Pain symptoms for 27.3% of these individuals already persisted for more than 12 months and were therefore classified as chronic. For another 22.7% of the participants, pain episodes appeared with some regularity. Immediately after the intervention (T2), pain prevalence decreased to around 38.6% (compared to 50% at T1). Three (T3) and six (T4) months later, pain prevalence was around 29.5% and 47.2%, respectively. Complaints were mainly assigned to the neck and low-back regions. There was a decrease in neck pain immediately after the intervention and in the 6-months follow up period. Neck pain prevalence for T1, T2, T3 and T4 were 27.3%, 15.9%, 20% and 20%, respectively. Note that even though pain prevalence in the follow up periods (T3 and T4) was higher than immediately after the intervention (T2), it was still below the baseline value (i.e. T1). Complaints specifically for the low-back also decreased: T1, T2 and T3 values of 20.5%, 18.2% and 20%, respectively. At T4, however, low-back pain prevalence increase above baseline values

(22.2% at T4).

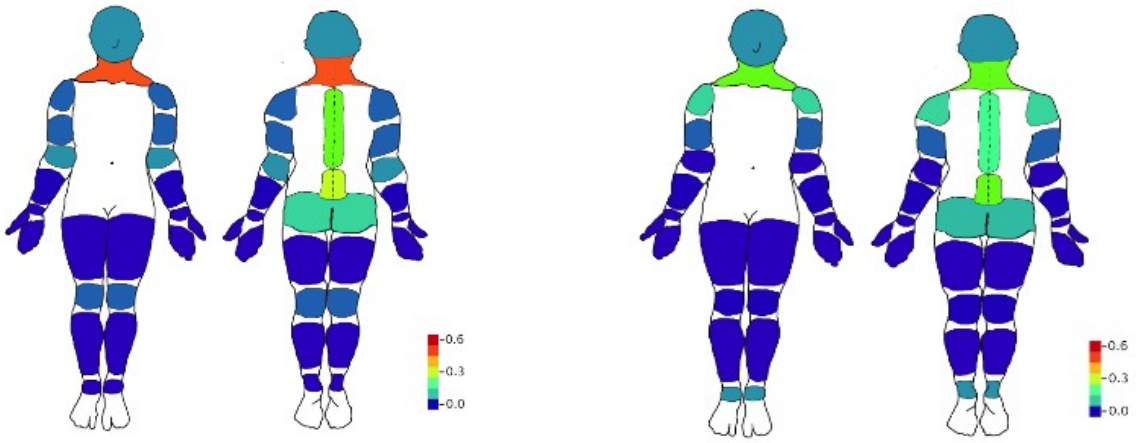


Fig. 4.15 Pain location and its mean intensity for T1 (pair of illustration on the left) and T2 (pair of illustration on the right). Pain intensity is given by a color code, where blue corresponds to the absence of pain and red corresponds to strong pain in a specific body location. The participants were required to assign a value between 0 (minimum) and 4 (maximum) to their pain.

The location and the intensity of reported pain for the T1 and T2 periods are shown in Figure 4.15. The equivalent data for the T3 and T4 periods are shown in Figure 4.16. At T1, pain complaints were strongest for the neck region (mean = 0.48; SD = 0.84) followed by the low-back region (mean = 0.32; SD = 0.74). At T2, the intensity of neck pain decreased to 0.27 (SD = 0.66), and at T4 it further decreased to 0.22 (SD = 0.54). The strength of low-back pain also decreased after the intervention. At T2, its mean intensity decrease to 0.27 (SD = 62), as compared to 0.32 at T1. At T4, however, pain intensity for the low-back again increased to 0.44 (SD = 0.87).

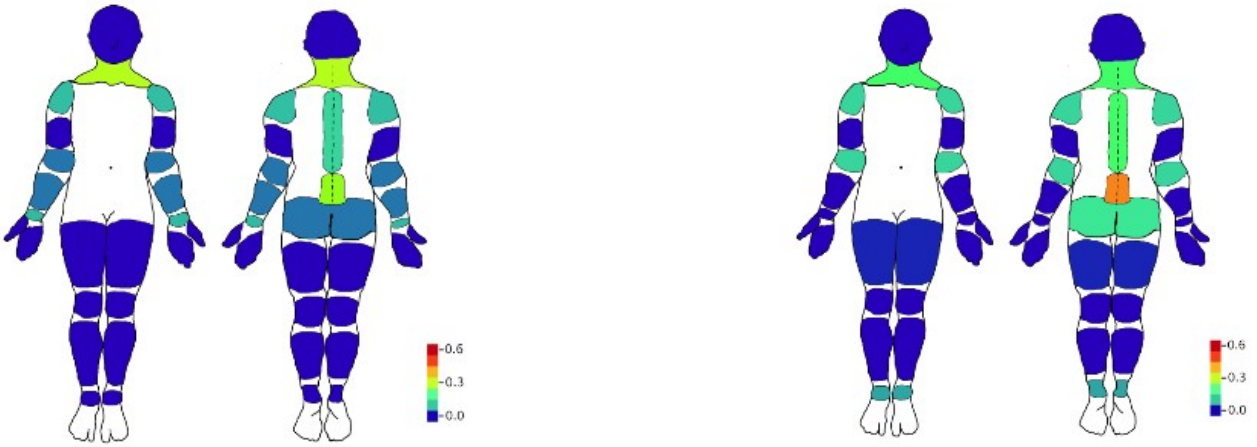


Fig. 4.16 Pain location and its mean intensity for T3 (pair of illustration on the left) and T4 (pair of illustration on the right) assessments. Conventions as in Fig. 4.15.

Overall, the pain prevalence observed prior to the start of the program had a clear tendency to decrease immediately after the terminus of the intervention. Most of this improvement was due to a reduction in neck pain. Low-back pain also improved after the intervention but this improvement did not persist until the first 6-months follow up period (*i.e.* pain intensity was back to the baseline level). All of these results, however, remained on the descriptive level. None of them reach statistical significance. Therefore, a larger sample size would be required in order to reach a more definitive conclusion regarding the impact of low-intensity exercises on musculoskeletal pain.

4.3.4.2 Self-motivation evaluation (Scale of the SMI) and Health-related quality of life (SF12)

Self-motivation scores were relatively stable throughout the project. Therefore, no significant differences were observed between the various assessments. Similarly, the scores for the health-related quality of life questionnaire (SF12) did not show any significant alterations, neither for the mental nor for the physical components.

4.3.4.3 Physical activity levels (IPAQ-short)

Prior to intervention onset, 45% (N=18) of the participants performed at least 2.5 h of moderate intensity physical activity per week (Figure 4.17). Immediately after the intervention (T2), the majority of the population (72.2%, N=26) became sufficiently active to the point of meeting the ACSM/WHO guidelines for physical activity practice ($p<0.05$, Chi-square). This proportion remained high (64.9%, N=24) even six months (T4) after the terminus of the intervention ($p<0.05$, Chi-square). A more detailed analysis showed that 50% of the less active participants reached the recommended guidelines levels for the practice of physical activity immediately after the intervention. For those individuals that were already active before the start of the program, 93.8% of them maintained their physical activity levels after the end of the program. In the 6-months follow up assessment (T4) around 47.1% of the less active and 81.3% of the more active individuals still met the ACSM/WHO recommendations. Note that the amount of physical activity practiced and the amount of sitting time were not evaluated for the 3-months follow up period (period T3). Therefore, only the 6-months follow up assessment (period T4) was available for analysis.

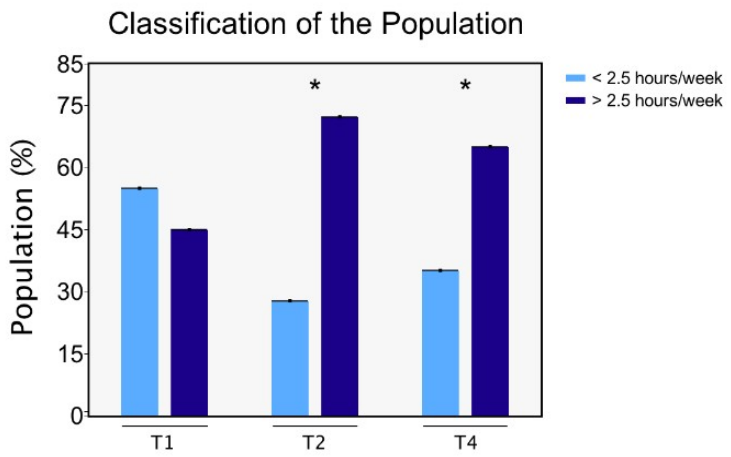


Fig. 4.17 Proportion of individuals classified as less or more active based on the WHO guidelines. Data is shown for the three different assessment periods (T1, T2 and T4). The number of participants for each one of the assessment periods is the following: T1 or prior to intervention onset: N=40; T2 or immediately after intervention terminus: N=36; T4 or 6-months follow up period: N=37. Asterisks indicate statistically significant differences (Chi-squared, $p<0.05$) relative to baseline (T1).

4.3.4.3.1 Days per week of physical activity

There was an overall increase in the amount of physical activity performed for the period after the terminus of the intervention as compared to the baseline period (T1, prior to the initiation of the program). This increase was evident both immediately after the end of the intervention (T2) as well as for the 6-months follow up assessment (T4). The average amount of physical activity performed for the T1, T2, and T4 periods were, respectively, 2.91 days, 3.53 days and 4.2 days ($F(2,62) = 11.73$, $p<0.05$, repeated-measures ANOVA).

In order to better evaluate the impact of the intervention on exercising habits, the group was subdivided into less and more active participants (performing less or more than 2.5 hours of moderate physical activity per week, respectively). As shown in Fig. 4.18, the sedentary or less active participants were mainly responsible for the results mentioned above. When analyzing the two groups throughout the three assessment periods (T1, T2 and T4), both showed an increase in the amount of physical activity practiced. However, only for the less active group were these increases statistically significant (Table 4.7).

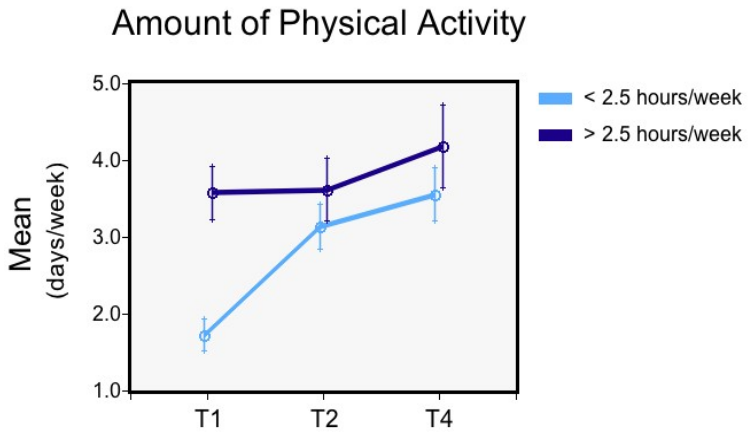


Fig. 4.18 Amount of physical activity practiced by less and more active individuals before (T1), immediately after (T2), and 6-months after the terminus of the intervention program (T4). Less and more active individuals were defined, respectively, as those practicing less or more than 2.5 hours of moderate physical activity per week. Vertical bars correspond to the standard error of the mean.

Days of Physical Activity (number of days / week)						
		Pre test	**Post1 test**	**Post3 test**	**ANOVA prepos**	**p pre-pos effect**
More active	*Mean (SD)*	3.79(1.58)	3.69(1.63)	4.54(2.04)		
	N	14	14	14	F<1 n.s.	
Less active	*Mean (SD)*	1.72(1.01)	3.16(1.22)	3.78(1.32)	**F(2,26)=40 p<0.05**	**F(2.52)=17.58 p<0.05**
	N	14	14	14		
One-way ANOVA		**F(1,39)=22.7 p<0.05**	F<1 n.s.	F<1 n.s.		**Interaction F(2,52)=6.18 p<0.05**
p group comparison		**F(1,26)=5.01 p<0.05**				

Table 4.7 Analysis of variance (repeated-measures ANOVA) testing for the differences in the amount of physical activity practiced (days per week) as a function of time (pre, post1 and post3 tests) and subgroup (less and more active individuals). Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

4.3.4.3.2 Categories of physical activity

During the period before the onset of the intervention, participants performed all three categories of physical activity (low, moderate and vigorous) in an approximately uniform way (Figure 4.19). During the course of the program, significant changes in the amount of low- and moderate-intensity physical activity could be observed (Friedman test, $p<0.05$, $N=28$; Chi-squared = 6.68 and 7.6, respectively). No changes for the performance of vigorous intensity activities were found. Pairwise comparisons were made in order to pin down the phase of the program in which low and moderate activity actually increased. The largest increases for both categories occurred during the 6-months follow up assessment (T4) when compared to baseline (T1). The changes, however, were only in the limit of significance (Wilcoxon test

comparing T1 versus T4: Z = -1.89, p=0.058 for low intensity activities and Z = -1.82, p=0.068 for moderate intensity activities; N=32 for both cases).

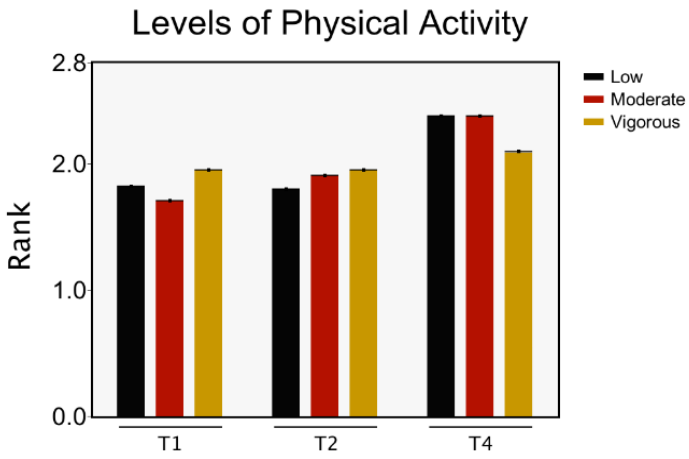


Fig. 4.19 Amount of physical activity performed (split by intensity: low, moderate and vigorous) during the three different assessment periods (T1, T2 and T4). Since the data was not normally distributed, the amount of physical activity practiced is represented as rank values. The Friedman test (rank comparisons) revealed significant increases for the low and moderate intensity exercises. Pairwise comparisons, however, revealed no significant effect.

Since the previous analysis yielded inconclusive results, the initial group containing all participants was further subdivided into less and more active individuals. Here, the effects of the intervention were much more evident. The effects, however, impacted only the less active participants (Figure 4.20). Significant statistical effects were observed only for moderate and vigorous intensity activities (Friedman test, $p<0.05$, N=14, Chi-squared= 14 and 8.45, respectively). The increase for low-intensity exercises did not reach significance level (Friedman test, p=0.09, N=13, Chi-squared= 4.77). Pairwise comparisons revealed that significant increases occurred both for T2 and T4 assessments when contrasted with baseline (Wilcoxon test; $p<0.05$, N=16; values of Z for moderate and vigorous activities, respectively: T1 versus T2: Z = -3.07 and Z = -2.85; T1 versus T4: Z = -2.78 and Z = -2.37).

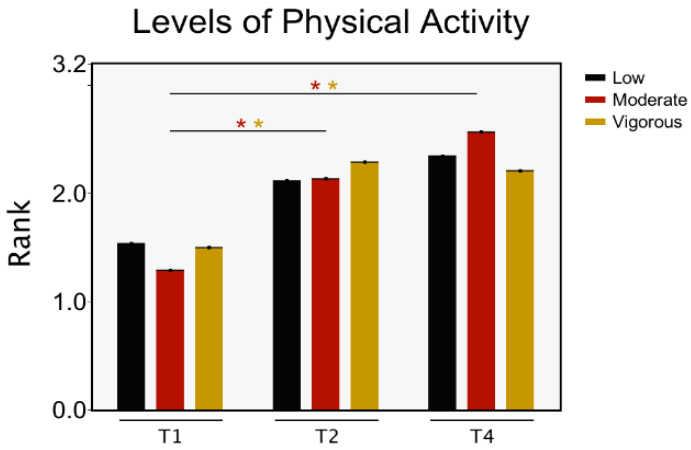


Fig. 4.20 Same analysis as the one shown in Fig. 4.19 but considering only the data for the less active individuals. Asterisks indicate the pair of assessment periods exhibiting significant differences in the amount of physical activity performed. The color of the asterisk represents the category (low, moderate or vigorous intensity) being compared.

4.3.4.3.3 Time spent in sitting positions

Before intervention onset, the participants spent on average 8.2 hours per day in sitting positions. This value showed a significant reduction to 7.2 hours per day at the period immediately after the intervention ($p<0.05$, paired T-test). The amount of time spent sitting was still low at the 6-months follow up period, but ceased to be significantly different from baseline (T1).

4.3.4.3.3.1 Comparing low and high adherent groups

Both low and high adherents decreased the time they spent sitting immediately after the terminus of the exercise classes (Figure 4.21). However, this reduction was only significant for the high adherers and for the period immediately after the intervention ($T(22)=3.11$, $p<0.05$, paired T-test).

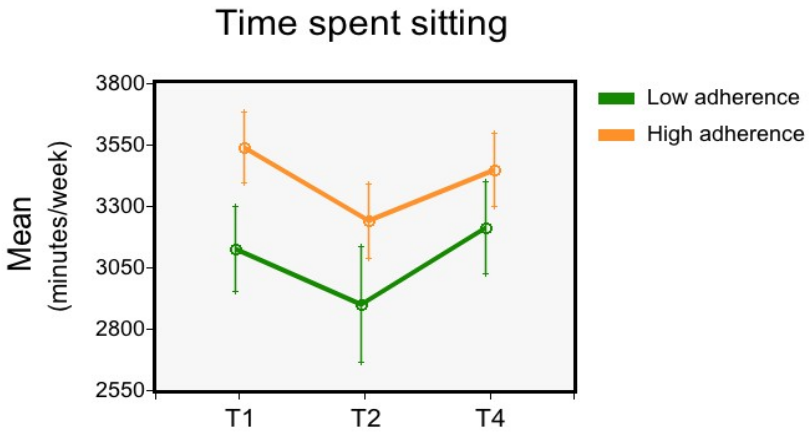


Fig. 4.21 Amount of time spent sitting (minutes per week) by low and high adherers to the exercise program. Data is shown for periods T1 (prior to the start of the intervention), T2 (immediately after the intervention) and T4 (6 months after the terminus of the intervention. Vertical bars correspond to the standard error of the mean.

Several analyses were performed in order to evaluate the long-term effects of the intervention (*i.e*. 6 months after the program had ended). It was shown that the amount of physical activity practiced increased significantly immediately after the terminus of the program. Notably, this gain was shown to be maintained at the 6-month follow up assessment. This was particularly true for the participants which were less active prior to the intervention onset. Moderate and high intensity exercises were the categories of physical activity that were most affected. Here, the results were only significant for the less active participants. A decrease in sitting time was also observed immediately after the intervention. This effect, however, did not persist in the long term. Therefore, the hypothesis "individuals showing a positive change in exercising habits immediately after the intervention were capable of maintaining active behavior 6 months after the intervention had ended" is overall true.

4.3.4.4 Motives for performing physical activity

The motives for the engagement in an exercise program were assessed by means of the SPOMO questionnaire (applied prior to intervention onset). This variable was again assessed six months after the terminus of the intervention so as to identify the motives for maintaining exercising activity. Four variables evaluated the motives for performing exercises: 1- social interaction; 2- health, fitness and well-being; 3- performance; 4- esthetic/body action motives (see Methodology for further details).

4.3.4.4.1 Motives for engaging in the exercise program

Before the start of the program, the main factor motivating the subjects to engage in physical activity practice was "health, fitness and well-being" (mean score = 5.77, SD 1.03). The improvements in "physical performance" (mean score = 3.5, SD = 0.96), in "esthetic/body" (mean score = 3.36, SD = 1.22) and the search for new "social interactions" (mean score = 2.64, SD = 1.34) were of relatively less importance.

4.3.4.4.2 Motives for maintaining the practice of physical activity

The motives for maintaining physical activity practice were assessed 6 months after the terminus of the intervention (period T4). The factors responsible for motivating the subjects to perform physical exercises remained essentially unchanged. Enhancement of "health, fitness and well-being" still remained the most important motive (Figure 4.22).

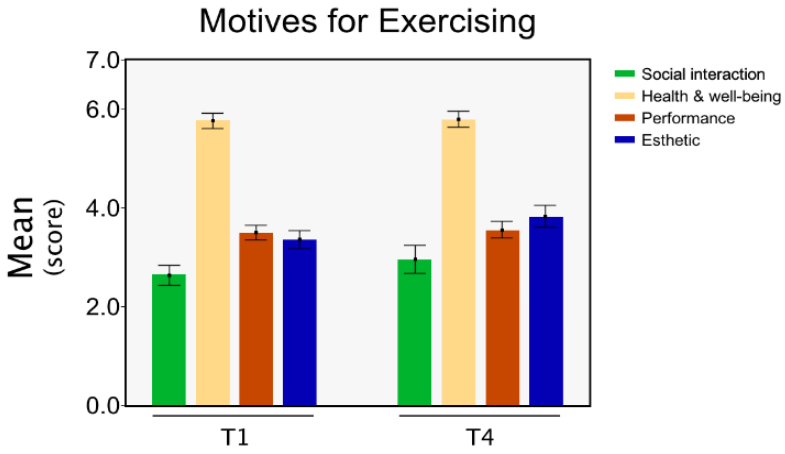


Fig. 4.22 Assessment of the motives for both engaging in exercise classes (T1, prior to intervention onset), and for maintaining exercise practice in the long-term (T4, 6-months follow up period). Scores were obtained by means of the SPOMO questionnaire which evaluated four different variables: social interaction, health, fitness and well-being, performance and esthetic/body. Bars correspond to the standard error of the mean.

4.3.4.5 Barriers to exercise

Since the subjects had already volunteered to take part in the program, it was not possible to investigate the "barriers to initiate exercise classes". Instead, the "barriers to exercise" were assessed. Immediately after the terminus of the classes, all participants were inquired regarding their intention to continue performing physical

activity. Additionally, they were asked about their perceived barriers to perform physical exercises. The later question was also posed 3 and 6 months after the end of the intervention. Three variables evaluated the barriers to physical activity performance: 1- lack of confidence in one´s physical capacity; 2- time conflict and 3- lack of motivation (for further details see Methodology). It was expected that both the less active group and low adherers would present high scores for all three variables.

Immediately after the intervention, the most reported barrier was "time conflict" followed by "lack of motivation" (Figure 4.23). The least reported barrier was "lack of confidence in one´s physical capacity". The scores for all three variables, however, remained relatively stable throughout all three assessment periods (T2, T3 and T4; repeated-measures ANOVA, n.s.).

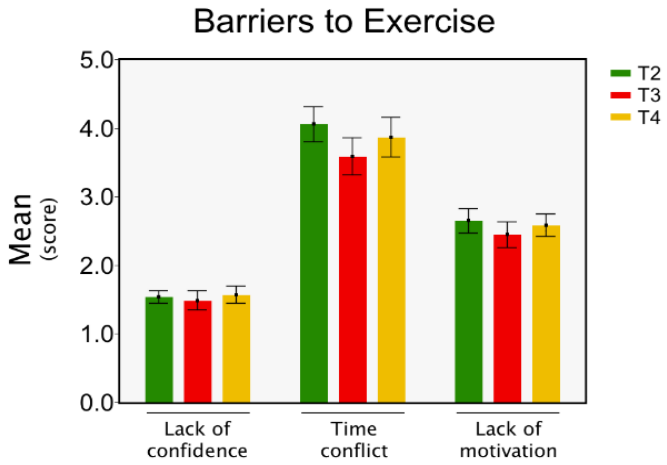


Fig. 4.23 Assessment of the barriers to exercise. Scores were obtained by mean of the "Barrieren sportlicher Aktivität" questionnaire which evaluated the following variables: lack of confidence in one´s physical capacity, time conflict and lack of motivation. Assessments were performed immediately (T2), three months (T3) and six months (T4) after the terminus of the intervention. Bars correspond to the standard error of the mean.

As expected, less active individuals reported significantly more "time management-related" barriers to exercising than was the case for the more active individuals (Figure 4.24 and Table 4.8). Due to the lack of statistical significance, no conclusions could be made about the perceptions of barriers among low and high adherents.

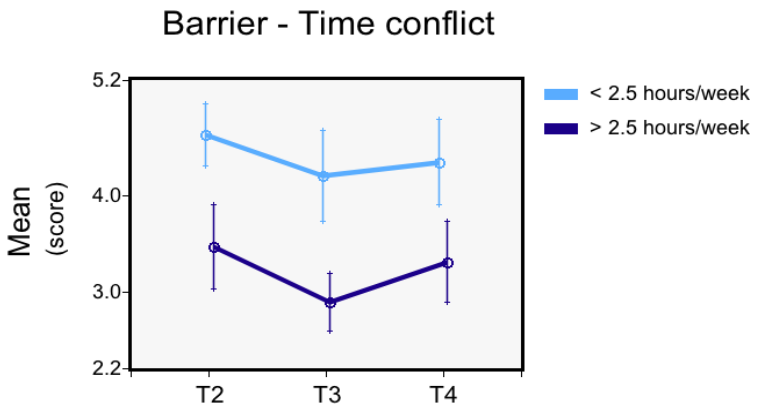


Fig. 4.24 "Time conflict" as a barrier for performing physical activity. Analyses focused on the comparison between less and more active individuals. Assessments were performed immediately (T2), three months (T3) and six months (T4) after the terminus of the intervention. Less and more active individuals were defined, respectively, as those practicing less or more than 2.5 hours of moderate physical activity per week. Bars correspond to the standard error of the mean.

Barrier – Time conflict (score)						
		T2	**T3**	**T4**	**ANOVA prepos**	**p pre-pos effect**
More active	*Mean (SD)*	3.08(1.48)	2.91(1.21)	2.98(1.47)		
	N	14	14	14	F<1 n.s.	
Less active	*Mean (SD)*	4.19(1.38)	4.36(1.82)	4.32(1.81)		
	N	13	13	13	F<1 n.s.	F<1 n.s.
One-way ANOVA		**F(1,39)=4.81 p<0.05**	**F(1,30)=5.72 p<0.05**	F<1 n.s.		
p group comparison		**F(1,25)=5.83p<0.05**				F<1 n.s.

Table 4.8 Analysis of variance (repeated-measures ANOVA) testing for "time conflict" as a barrier to perform physical activity as a function of time (T2, T3 and T4 periods) and subgroup (less and more active individuals). Abbreviations are as following: SD, standard deviation; p, significance level; F, variance score ; n.s., not significant; N, sample size.

Summarizing, "time conflict" (specially regarding family and job obligations) was the main reported barrier to engaging in exercise classes. Furthermore, less active individuals reported significantly more difficulties to engage in physical activity as compared to more active individuals.

"I have always believed that exercise is not only a key to physical health but to peace of mind." Nelson Mandela (Long Walk to Freedom, p. 673).

V. Discussion

This chapter is divided in two parts. The first part will discuss the effectiveness of an intervention program adopting low-intensity exercises. The second part will present a critical analysis of the study design that was here employed.

5.1. Results

5.1.1 Interpretation of the findings on reported physical activity

5.1.1.1 Amount of physical activity

We found that a 3 times-a-week, 20 minute low-intensity exercise program offered in the workplace is capable of motivating individuals to adopt a more active lifestyle. This was particularly true for those individuals who were either chronically sedentary or low active prior to the onset of the program. Several measurements support this conclusion. First, there was an increase in the weekly performance of physical activity, especially for moderate and vigorous intensity exercises. Additionally, there was a significant reduction in the time that the participants spent in sitting positions throughout the day.

The effects of the intervention were mainly analyzed by means of comparisons between a group which was submitted to the intervention program (experimental group) and a second group which was not (control group). Since the analyses were performed simultaneously for both groups, this procedure provided additional robustness regarding the results obtained. Similarly to our work, Nichols *et al.* (2000) carried out a 12-week semi-supervised low-intensity exercise program with a group of 64 low-active employees. They showed that their intervention program led to a significant increase in energy expenditure, as evidenced by an increase in the practice of both moderate and vigorous intensity exercises. The intervention of Nichols and collaborators contained a behavioral component in addition to the exercising part. In our study only an informal behavioral component was offered to the participants (see Intervention concept). However, we were also able to measure significant increases in

the performance of both moderate and vigorous intensity physical activities as a result of the intervention. This suggests that a program containing only low-intensity exercises might be just as effective in enhancing physical activity performance as a program containing a combination of both educational information and low-intensity exercises.

The study of Nichols *et al*. (*op. cit*) contained a 6 month interval immediately after the terminus of the exercise classes. During this period, however, the intervention group still undertook 4 behavioral training classes. A follow up assessment revealed that the enhanced energy expenditure levels observed immediately after the terminus of the exercise classes were maintained after the 6 months interval. Also maintained were the levels of moderate and vigorous intensity exercises practiced. In order to evaluate the long-term effects of the intervention in our study, we merged the data obtained for both experimental groups (exp1 and exp2). We also observed a maintenance of physical activity levels 6 months after the intervention had ceased despite the fact that we did not provide any sort of intervention (physical or behavioral) after the end of the exercise classes. Since the very beginning of the intervention, more walking and more moderate-intensity physical activity practice were reported. These findings therefore show that the hypothesis "individuals with a positive change in their physical activity levels immediately after the intervention were capable of maintaining their active behavior in the long-term (6 months follow up period)" is true.

In our study, 45.8% of the experimental group and 43.8% of the control group exercised at least 2.5 hours of moderate physical activity per week prior to the start of the intervention program (ACSM/WHO guidelines). A higher proportion of the individuals in the experimental group (77.3%), however, was capable of improving their physical activity levels for the period immediately after the intervention. Therefore, a significant difference in active habit between experimental and control groups was observed due to the exercise classes. Finally, around 65% of the merged group (data from both experimental groups) could be classified as sufficiently active six months after the end of the intervention. These findings suggest that even though many participants from the experimental group (around 45%) were already active prior to the program, enrollment in exercise classes was effective in further motivating these individuals to enhance their physical activity levels and reach the ACSM/WHO guidelines. Additionally, despite no further incentives to remain active the participants still maintained the recommended levels of physical activity 6 months after the terminus of the program.

Green *et al*. (2007) carried out a physical activity promotion program in the worksite and was also able to show significant differences in physical activity level for the 6 month follow up period, as compared to the baseline period. Their intervention, however, did not provide formal supervised exercise classes. It was based instead on the competition between teams where minutes of performed physical activity by the participants were converted in points to their team. The proportion of the participants that were able to meet the ACSM/WHO recommendation levels increased from 34% at the beginning of the program to 48% at the 6 months follow up period. Unfortunately, the study of Green *et al.* (*op. cit*.) did not comprise a control group. Therefore, one can not know be sure if the observed changes were related to engagement in the program or to other confounding factors (Dishman *et al.*, 1998).

Several studies have consistently reported that physical activity programs have a positive effect on the the exercising habits of male participants but fail to impact women participants (Dishman & Sallis, 1994 and Sallis & Owen, 1999 *apud* Trost *et al.*, 2002; Trost, 2004). Interestingly, for the population studied during this work, female participants performed physical activity more frequently than men for the period prior to the start of the intervention. After the terminus of the intervention, however, only the male participants showed a significant increase in exercising behavior. Even though no significant changes in the level of physical activity was observed for women, a significant interaction (as measured by the ANOVA) could still be detected. That means that female participants in the experimental group increased their exercising behavior after the intervention, while female participants in the control group showed a relative decrease. Overall, the main conclusion here is that low-intensity exercises are especially effective in increasing the exercising behavior among male participants. Dishman (2004) observed that a larger proportion of men engage in vigorous exercises as compared to women, while both genders are more or less equally engaged in moderate intensity activities. Our findings suggest that low-intensity exercises might also be beneficial for men.

Only a few studies have investigated the impact of exercise classes on the time spent in sitting positions. De Cocker *et al*. (2008), for example, compared data obtained during different health promotion interventions such as those applied in the workplace, community centers and by local media campaigns (*e.g*. advertisement). This multi-strategy comparison probed the changes in physical activity behavior by applying the IPAQ questionnaire and by counting the number of walking steps the participant carried out during the course of a day (pedometers were used). After 12 months of study, there was a reduction of approximately 12 minutes in the amount of

time the participants spent sitting. This result was only observed, however, for the subjects that had shown an increase in their number of walking steps. A contrary effect was concomitantly observed for the control group. They showed an average increase of about 18 minutes in the time that they spent in sitting positions during the course of a day. Similarly, our findings showed a significant decrease in sitting time for the experimental group (circa 43 minuter per day), as compared to an increase in sitting time for the control group (circa 14.5 minutes per day), for the period immediately after the intervention. Therefore, even though we did not employ pedometers to quantify the number of walking steps carried out by the participants in our study, we observed similar reductions in sitting time among the individuals who reported an increase in the levels of physical activity after the intervention.

5.1.2 Interpretation of the findings on the reported self-motivation

We hypothesized that individuals who increased their exercising behavior after the terminus of the intervention would show correspondingly higher self-motivating scores. We indeed found a significant correlation (r= 0.59) between self-motivation and the number of days that physical activity was performed for the period immediately after the intervention. A more detailed analysis revealed that only the less active participants showed a significant correlation (r= 0.79) between exercising behavior and self-motivation. Likewise, the study of Motl *et al*. (2003) also found a positive correlation between self-motivation and the performance of sport among adolescent girls. Therefore, our and several other studies (Dishman & Sallis, 1994 and Sallis & Owen, 1999 *apud* Trost *et al*., 2002*;* Trost, 2004) support the notion that self-motivation is a correlate of physical activity performance.

It was also assumed that motivation is a necessary component when pursuing ones goals (Dishman & Ickes, 1981; Dishman *et al*., 1985). This means that a highly self-motivated individual will persevere in their personal objectives despite barriers and fluctuation in mood (Dishman & Ickes, 1981; Dishman *et al*., 1985). Our finding corroborate with this assumption, especially for those individuals who were less active prior to the start of the intervention. These individuals significantly increased their exercising behavior despite the perceived barriers for exercising (*e.g.* time conflict). Interestingly, they had their self-motivation scores highly correlated with the amount of physical activity that they performed. It is also possible that the characteristics of the exercise program, such as its intensity, play a role in motivating individuals to acquire active behavior (King *et al*., 1992). Low intensity exercises might have been

more attractive and motivating for the less active participants as compared to those individuals who were already active prior to the start of the program. This might explain why only the less active participants showed a significant positive correlation between their self-motivation scores and the amount of physical activity that they performed. Finally, the significant correlation between self-motivation and amount of physical activity performed for the less active individuals is also in accordance with a cognitive-based change process as suggested by the transtheoretical model (TTM). This is because individuals in less active stages are more engaged in evaluating the benefits of exercising as well as in judging the risks of an inactive lifestyle. Consequently, they are constantly establishing their goals and changing their concept in what concerns active behavior (Biddle & Mutrie, 2008). In short, they are constantly seeking justifications to increase their motivation to exercise.

Interestingly, contrary to the findings of Olson & Zanna (1982, *apud* Fuchs, 1997) and Rampf (1999), our results showed that the participants with less than 50% adherence rate exhibited higher motivation scores as compared to the high adherers. If on the one hand Olson & Zanna (*op cit*.) found higher self-motivation scores among high adherents when engaged in a 3-month exercise intervention, Brehm & Pahmeier (1990, *apud* Fuchs, 1997) reported higher self-motivation scores among dropouts participants previously engaged in a 16-week gymnastic program. Due to the discrepancy of the results obtained by these different studies, we decided to perform a more detailed analysis in order to further investigate the relationship between self-motivation and adherence. To this aim we analyzed the high adherent group which contained an equal proportion of both less and more active individuals. A significant negative correlation between adherence and self-motivation was only found among the more active fraction of the participants (Pearson´s correlation coefficient: r= -0.67). Therefore, it is possible that the individuals who were already active prior to the start of the intervention did not find a low-intensity exercise program sufficiently motivating or challenging. For these individuals, intervention programs containing a more competitive character might be indeed more adequate (Dishman *et al*., 1980; Fuchs, 1997).

5.1.3 Interpretation of the findings on the reported general health

The intervention program promoted a limited but positive change in health perception. Even though both the physical (PCS) and the metal (MCS) components of subjective health showed improvements, these changes we not significantly different from the

values obtained for the control group. Our results are similar to the ones reported by Proper *et al*. (2003). They also found inconclusive evidence regarding the impact of exercise programs on the health perception of the participants.

A ceiling effect can be a possible explanation for our findings (Sjögren *et al*., 2006). The population that we studied was composed exclusively of healthy employees. It was therefore difficult to enhance health perceptions that was already high to start with. Our baseline scores for both physical and mental health (49.9 and 50.1, respectively) are similar to those found in the literature (Lahti *et al*., 2010; Burdine *et al*., 2000). Patients, on the other hand, are known to report substantially lower scores for perceived health (PCS= 36 and MCS= 41.1 in the work of Alles, 2007).

There is substantial evidence showing an association between health and the amount of physical activity performed. There is also evidence showing that individuals who perform high intensity exercises have better health perceptions as compared to less active or sedentary individuals (Lahti *et al*., 2010). Our results found worse health perceptions among less active individuals prior to the start of the intervention (baseline period). But as soon as the program started and these individuals increased their exercising levels they concomitantly improved their health perception scores.

The type of the exercise applied is also thought to influence health perception. Sjögren *et al*. (*op.cit*.) found a significant improvement in physical well-being after applying workout training to office workers. Other studies support the idea that aerobic exercises, regardless if they are associated with strengthening training, lead to improvements in health perception (Pohjonen & Ranta, 2001; Mandic *et al*., 2008). This is based on the assumption that exercises which enhance fitness are better able to support physical functioning and good general health (Lahti *et al*., *op. cit*.). Thus, it is possible that we could have enhanced the impact of our intervention program on health perception if we had included an aerobic component in the exercise classes.

5.1.4 Interpretation of the findings on the reported musculoskeletal pain

In our study, approximately 46.2% of the participants in the experimental group reported some sort of musculoskeletal pain or disorder. Most of the complaints (42.3%) were located in the back region. This finding is in accordance with other studies which have also shown a high prevalence of back problems among individuals engaged in sedentary jobs (Hildebrandt *et al*., 2000; Heneweer *et al*., 2009). Additionally, the prevalence of pain was higher among less active individuals, as

compared to the more active ones (61.5% and 27.3%, respectively). Accordingly, several other studies have identified sedentariness as a risk factor for musculoskeletal pain, especially in the back region (Hildebrandt *et al*., *op.cit.*; Hanney *et al*., 2009; Oja & Borms, 2004). The protective effect that physical activity confers to back problems is mostly related to muscular strengthening, flexibility and endurance in the trunk region (Vuori *et al*., 2001; Hanney *et al*., *op.cit*.; Hanney *et al*., 2010; Ylinen *et al*., 2009, Ewert *et al*., 2009; Oja & Borms, *op.cit*.). The major goal of our intervention program was to motivate the participants to acquire an active lifestyle. For this reason, the musculoskeletal issue was tackled by means of low-intensity exercises only and no specific training was directed to the back region. This might have been the reason why our intervention program did not promote significant improvements regarding musculoskeletal back pain complaints. We did observe, however, a marginally significant improvement in neck pain intensity after the intervention. This finding might indeed be a consequence of the increased exercising behavior observed after the terminus of the intervention (Hildebrandt *et al*., 2000; Hanney *et al*., 2010). Future studies employing a larger populations will be necessary in order to draw more definitive conclusions in this respect.

5.1.5 Interpretation of the findings on the reported barriers to exercise adherence

Lack of time is usually the most perceived barrier for active behavior (Iverson *et al*. 1985; Dishman *et al*., 1985; Steinhardt & Dishman, 1989 and Trost *et al*., 2002). Accordingly, in our study, time conflict was the most reported barrier for exercising, followed by lack of motivation and lack of confidence. Perception among the participants remained relatively unchanged immediately after the terminus of the intervention and during the 6 month follow up period.

Our results are similar to the ones obtained by Brehm & Sygusch (2001) and Brehm *et al*. (2001). These authors investigated the barriers to an active lifestyle among volunteers participating in an exercise program which contained both aerobic and anaerobic components. The participants reported time conflict as the main constraint to exercise adherence, followed by lack of motivation and lack of confidence. The mean score that we obtained for the "lack of time" barrier was still clearly higher than the one reported in their work (3.61 versus 2.7, respectively). This discrepancy might be related to the characteristics of the population studied (Steinhardt & Dishman, 1989). While our study population was mainly composed of employees with a mean of 40.11 years of age, the population studied by Brehm *et al*. (*op.cit*.) consisted of a

large proportion (circa 35%) of retired individuals and housewives (mean of 50 years of age). These individuals may not perceive time barriers as intensively as middle-aged employees.

The fact that lack of time was so frequently reported as a barrier to active behavior contradicts some current hypotheses regarding the benefits of offering exercise programs in the workplace. Mainly, it contradicts the assumption that many employees are attracted to exercise programs offered at the workplace because they pose no time conflict due to the proximity of the fitness facility (Shephard, 1996a). Therefore, our results support the argument put forward by Kreis & Bödeker (2003) who reported that on-site fitness centers may pose barriers to active behavior other than time conflict. It is possible that employees are simply unmotivated to perform exercises during their working hours (Dishman *et al*., 1985; King *et al*., 1992; Dishman *et al*., 1980; Dishman, 1994b; Sljuis, 1991 *apud* Ljubic *et al*., 2006).

In our study, sedentary and less active individuals perceived more barriers to exercise than active participants. The first group was specially sensitive to time conflicts concerning their job and family obligations. Despite of this fact, less active participants significantly increased the amount of physical activity that they performed for the period immediately after the intervention and for the 6-months follow up period. A possible explanation might be that less active participants exhibited higher self-motivation scores as compared to the more active participants. Our results would thereby support the idea put forward by Dishman *et al*. (1985), who reported that individuals exhibiting high self-motivation scores appear to be less sensitive to barriers such as inconvenience or competing lifestyle behaviors.

5.1.6 Interpretation of the findings on the reported motives for physical activity performance

Our results revealed that health, fitness and well-being were the main perceived motives for engagement and maintenance of active behavior. These findings support the notion that the most common motives for exercising are health enhancement and well being (Steinhardt & Dishman, 1989; Unger, 2001; Brehm & Sygush, 2001). Furthermore, there is some evidence that social interactions may be an important component for the maintenance of active behavior after the terminus of an intervention program (Brehm & Sygush, 2001). Our results did not reveal any major alteration for this variable for the period after the terminus of the exercise classes. It is therefore possible that the subjects (employees) in our study did not require

additional social contacts, as it may have been the case for the population studied in the work of Brehm & Sygush (*op. cit*.), which consisted mainly of retired individuals and housewives.

5.2. Methodology

5.2.1 Setting and Population

Several considerations should be made regarding the methodology employed during the execution of this study. Many of the studies investigating health promotion in the workplace have compared data obtained from different worksites (Green *et al*., 2007; Emmons *et al*., 1999; Maes *et al*., 1998; Robison *et al*., 1992; Nurminen *et al*., 2002; Dishman *et al*., 2009). Our intervention was offered and implemented at a single worksite. This approach had the advantage of focusing on employees working in the same physical space and under similar conditions (Ward & Morgan, 1984; Pohjonen & Ranta, 2001; Nichols *et al*., 2000). It therefore reduced biases due to employment policies, travel distance to the fitness facility (accessibility), and physical and mental working loads, all factors that influence the readiness of employees to engage in health promotion programs (Torp & Grogaard, 2009).

On the other hand, participants who work in the same environment may share among them information regarding the intervention program. Consequently, the control group, which is supposed to be unaffected by the intervention program, ends up being influenced by the experimental group (Nichols *et al*., op. cit.). One way to minimize this contamination effect is to apply the same intervention to both control and experimental groups but at different time points. The control group is thereby able to participate in the intervention but in a delayed period (Callahan *et al*., 2008). Offering an alternative intervention to the control group, such as a free-membership to a fitness facility, might significantly affect their exercising behavior (Dallow & Anderson, 2003; Nichols *et al*., 2000; Dunn *et al*., 1999).

The intervention program we offered was widely advertised in the company. Engagement in the study was done voluntarily by those employees who were interested in participating in the exercise classes. This is an often criticized approach since it can be a source of bias. Shephard (1996a) pointed out that only those individuals who are already aware of the importance of an active lifestyle volunteer to participate in such programs. On the other hand, most of the health promotion studies

which offer exercise or education classes rely on self-selected volunteers (Nichols *et al*., 2000; Dallow & Anderson, 2003; Robison *et al*., 1992; Callahan *et al*., 2008; Dunn *et al*., 1999; Maes *et al*., 1998; Green *et al*., 2007; Ward & Morgan, 1984; Nurminen *et al*., 2002; Ljubic *et al*., 2006). Therefore, this selection criteria offers a common framework in which comparisons among different studies can be made.

Finally, the heterogeneous distribution of male and female participants or of different age groups in the study population can be a potential confound in projects like the one executed here. For this reason, a randomized manual procedure for the allocation of the individuals to the control or experimental group was adopted (Schwarz, 2002). The analysis of the demographic and lifestyle data showed no significant differences between both groups for the following variables: age, gender, smoking habit, BMI, blood pressure and stage of motivational change.

5.2.2 Sample size and attrition rates

The communication facilities in the workplace makes it potentially easy to reach many individuals at the same time (Dishman *et al*., 2004). However, few are the people that are usually interested in participating in such interventions (Shephard, 1996a). In our study, only 53 participants agreed to enroll in the project. Small sample sizes are a common problem among studies which offer exercise classes at the workplace. This obviously poses a challenge for the detection of small magnitude effects (Robison *et al*., 1992; Nichols *et al*., 2000, Pohjonen & Ranta, 2001; Dallow & Anderson, 2003; Cohen, 1988). Additionally, interventions performed on small samples are generally subject to critics when they try to generalize their results to a wider population (Shephard, 1996a; Howell, 1999).

Randomized controlled trial studies in the workplace using large population sizes are usually rare and difficult to perform (Proper *et al*., 2003). When the sample size is large, it is usually the case that the authors combine data from multiple worksites. The study of Emmons *et al*. (1999), for example, investigated the change in exercising behavior among 2055 employees from 11 different worksites (11 matched-pairs; employees randomly allocated either to the control or the intervention group). Another health promotion program evaluated data from 137 employees, but the sample was not randomized and the participants were originally from 6 different worksites within a university (Robison *et al*., 1992). Maes *et al*. (1998) studied a sample of 264 employees during the application of a health promotion program as well as during a subsequent 3 year follow up period. The data in their study, however,

was not randomized and was collected from 3 different worksites. Similarly, data in the studies of Pohjonen & Ranta (2001), Heirich *et al*. (1993) and Green *et al*. (2007) all originated from different worksites and were neither randomized nor controlled. The study of Nichols *et al*. (2000) is the only published study which offered a three month behavioral and semi-supervised exercise program to 82 employees. The 6 month follow up evaluation test, however, contained complete data for only 64 of the initial participants.

As it can be observed, studies in this field face several methodological challenges. In addition to the lack of randomization procedures and to small sample sizes, they face problems related to assessment compliance, program adherence and employee turn-over (Emmons *et al*., 1999; Gidlow *et al*., 2008; Dallow & Anderson, 2003; Nichols *et al*., 2000; Pohjonen & Ranta, 2001; Wloka, 1996; Einhoff, 2001). After reviewing the dropout rates for intervention studies performed in the workplace, Marshal (2004) estimated a value ranging from 20% to 60%. In our work, 45 employees successfully completed the intervention program. However, for the 6 month follow up assessment, only 36 individuals (80%) returned their questionnaires for analysis.

One way to minimize the dropout rate is through contracts and competition-based strategies. The study of Robison *et al*. (*op. cit*.) offered incentives to the participants by means of contract assignments, lotteries and team competition. They obtained an adherence rate of around 90% for their intervention group, as compared to 10% in the control group. We had initially proposed to offer prizes (free massages) to the high adherent participants. This idea, however, was refuted by the company. Our study suffered from a small sample size. The methodological approach that we used was nevertheless rigorous and well planed, and comparable to the one adopted by Nichols *et al*. (2000).

5.2.3 Subjective measures

Questionnaires are the main assessment instruments used in corporate health promotion programs (Nichols *et al*., 2000; Heirich *et al*., 1993; Green *et al*., 2007; Nurminen *et al*., 2002). We used only well established and previously validated questionnaires for the various assessments performed in our study. The use of questionnaires, however, is subject to various criticisms. For instance, some authors believe that the amount of self-reported physical activity practice is usually overestimated (Dallow & Anderson, 2003; Shephard, 1996a; Prince *et al*., 2008). Other authors, however, view such assessments as sufficiently accurate (Craig *et al*.,

2003; Lahti *et al*., 2010; Slootmaker *et al*., 2009; Dishman *et al*., 2009). In our study, we employed the IPAQ-short questionnaire. This questionnaire has been shown to have a fair to moderate agreement with data obtained by means of accelerometers (Craig *et al*., 2003). In a world-wide validation study, 781 participants wore accelerometers during a one week period. Subsequently, using the IPAQ questionnaire, they were asked about the amount of physical activity that they performed during that week. A Spearman correlation of 0.30 was found between the two variables, while approximately 75% of the individuals were similarly classified by the two methods regarding the amount of physical activity that they performed (Craig *et al*., *op. cit*.). Additionally, this study observed that the IPAQ questionnaire showed validity scores at least as good as other well established self-reported measures. Despite these facts, future intervention studies in the workplace should make an effort to adopt objective measures of physical activity performance such as pedometers and accelerometers (Gidlow *et al*., 2008).

In conclusion, although care should be taken when extrapolating the results of our study to a wider population, we made a true effort to employ a realistic intervention design in the workplace. It is important to keep in mind that the methodological challenges that we faced here is a general problem faced by all intervention studies involving human subjects. Dropout rate, compliance with questionnaire responses and subjective measures is also a problem for studies performed in clinical settings (Wloka, 1996; Werner, 2001). The positive results obtained in our study should be readdressed in the future using large population sizes and objective measures of physical activity practice.

VI. General conclusions and perspectives

Sedentariness is a clear reflex of our society's lifestyle. Due to the demands of modern life, managing our time well has become a fundamental component in our daily schedule. The way people administrate their time depends enormously on personal choices, interests and motivation. People can invest, for example, part of their time on active leisure activities. Alternatively, one can dedicate entirely to work without making pauses or breaks.

The problems of sedentariness arise when people typically choose to surf in the internet, watch television or read a book instead of performing more dynamic activities (Cavill *et al*., 2006). When people choose to drive to-and-from work instead of using active transport (such as cycling or walking) they are also settling for a less active lifestyle. The practice of regular physical activity has several benefits. Among them, it may prevent cardiovascular diseases, stroke, diabetes type 2 and several forms of cancer. Moreover, it may reduce back problems, favor weight loss and improve cognitive performance (Pritchard *et al*., 1997; Cavill *et al*., 2006; Kokkinos, 2008; Schüle, 2006; Vuori, 2001; WHO-Global Strategy on Diet, Physical activity and Health, 2004; Aberg *et al*., 2009). Therefore, sedentary jobs associated with less-active habits may lead to severe health problems in the long run (WHO-Europe, 2007).

The workplace is a very attractive site for health promotion programs due to the fact that it can reach many people in one single intervention (Kreis & Bödeker, 2003 and Cavill *et al*., 2006). There are several requirements for implementing an intervention program during normal working hours. Foremost, it must be practical. This means that one should be able to do the exercises with working clothes. Additionally, it should be easy to perform and suitable for both inactive individuals and for those with musculoskeletal problems. From this perspective, low-intensity exercises are physically less demanding and may offer both enjoyment and mental relaxation (Biddle, 1994 and Dishman *et al*., 1985).

Intervention programs applied in the workplace have focused mainly on reducing back problems by means of strengthening and stretching exercises (Goebel, 2004; Brenneis & Stroheker, 2005; Ewert *et al*., 2009; Sjögren *et al*., 2005). Only a few studies, on the other hand, have put emphasis on enhancing physical activity practice

(Emmons *et al*., 1999; Pritchard *et al*., 1997; Nichols *et al*, 2000; Dishman *et al*., 2009; Sternfeld *et al*., 2009). One particular study (Nichols *et al*., 2000) offered a semi-supervised exercise program. Their emphasis, however, was on behavioral training instead of on the exercises per se. To our knowledge, the present study is the first corporate intervention program aiming at enhancing active behavior by applying supervised low-intensity exercise classes during normal working hours.

The present study investigated the motivation of individuals to acquire active behavior while engaging in a low-intensity exercise program at their workplace. We hypothesized that the participants, especially the inactive or less active ones, would adopt a more active lifestyle after the intervention.

By definition, employees who volunteered to join the program had already the intention to become more active. Despite this fact, only 45.8% of them performed at least 2.5 hours of physical activity per week prior to the start of the intervention. Therefore, most of the study population was either sedentary or low active. Immediately after the intervention, 77.3% of the individuals reached the levels of physical activity performance recommended by the WHO (The World Health Organization Global Strategy on Diet, Physical Activity and Health, 2004). The intervention was thereby successful in promoting active behavior among the participants. This finding was supported by three main observations. There was an average increase in the frequency of exercise performance (from 2.66 to 3.68 days per week). Additionally, there was a selective increase for both moderate and vigorous intensity exercises. Finally, the time spent sitting during the day decrease in 43 minutes. These results alone are not sufficient to ascertain that individuals have acquired an active behavior. The benefits provided by the program need to persist in the long term. A 6-month follow-up assessment was thereby performed. It showed that the individuals who participated in the program still maintained a higher level of physical activity practice several months after the terminus of the intervention (the frequency of exercise performance here was at around 4.16 days a week).

Sedentary or insufficiently active participants were the ones that most profited from the intervention, as compared to the individuals that were already sufficiently active prior to the start of the program. Less active individuals showed comparatively higher increases in the frequency of physical activity performance (from 1.81 to 3.33 days per week) immediately after the terminus of the intervention. They also significantly reduced their sitting time in 39 minutes during the day. Finally, their self-motivation scores showed a positive correlation with the amount of physical activity performed

for the period immediately after the program (r=0.79). The 6-month follow-up assessment showed that the less active individuals were capable of mantaining active behavior in the long run. These finding indicate that low-intensity exercises are capable of motivation sedentary individuals in acquiring a more active lifestyle.

The main limitation of the present work was the small sample size. Therefore, one should be cautious when generalizing these results to the wider population. A larger population needs to be studied in order to enable stronger inferences regarding the effectiveness of an intervention based on low-intensity exercises. Having said this, a good starting point for future studies is the assumption that intervention programs focusing on low-intensity exercises are likely to preferentially benefit less active individuals. For those individuals who already have an active lifestyle, intervention programs composed of aerobic activities and higher intensity exercises are more likely to be effective.

Below is a list of further suggestions that could be implemented in future studies:

- The support of the managers is crucial for the success of an intervention program. Future projects should try to include their participation both when planning and implementing an intervention. This may facilitate the employees to leave their workstations and participate in the exercise classes.
- Offer financial benefits, prizes or contract assignments to the assiduous participants. This incentive may increase adherence to the program.
- Also aiming at enhancing adherence, increase the session duration to 30 minutes, and decrease the frequency of the exercise classes to twice a week.
- Reduce the time interval between the different assessments in order to avoid losing data from non-compliant individuals;
- Use objective measures of physical activity performance, such as pedometers and accelerometers. This data should be combined with the subjective measures obtained through the questionnaire responses.
- Use other parameters, such as absenteeism rates and productivity, in order to better evaluate the impact of the intervention at the corporate level.

VII. Bibliography

Aberg M, Pedersen N, Toren K, Svartengren M, Bäckstrand B, Johnsson T, Cooper-Kuhn C, Aberg N, Nilsson M, Kuhn H. *Cardiovascular fitness is associated with cognition in young adulthood.* PNAS 2009;106(49):20906-20911.

Airaksinen O, Brox J, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion A, Reis S, Staal J, Ursin H, Zanoli G. *COST B13 Working Group on Guidelines for Chronic Low Back* Pain. 2004. (www.backpaineurope.org) accessed June 2009.

Alles T. *Anforderungsorientierte Rehabilitation zur Förderung der Teilhabe am Arbeitsleben durch Einsatz von Assessment – eine kontrollierte Interventionsstudie im Rahmen der stationären Rehabilitation von Rückenleiden.* PhD, Deutsche Sporthochschule, Köln, 2007.

American College of Sports Medicine. *The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults – Position Stand.* Med Sci Sports Exerc 1990;22: 265-274.

Bakker E, Verhagen A, van Trijffel E, Lucas C, Koes B. *Spinal mechanical load as a risk factor for Low Back Pain: a systematic review of prospective cohort studies.* Spine 2009;34(8):E 281-293.

Baumann K, Brenneis J, Tintor M. *Gesundheit im Unternehmen – Prämierte Arbeiten des BKK Innovationspreises Gesundheit 2007.* Frankfurt: Mabuse-Verlag, 2008.

Beeck R, Hermans V. *Research on Work-related low-back disorders.* European Agency for Safety and Health at Work, 2000.

Biallas B, Wilke C, Froböse I. *Rückencoaching – neue Wege für ein altes Problem.* In: Deime H, Huber G, Pfeifer K, Schüle K. Neue aktive Wege in Prävention und Rehabilitation. Köln: Deutscher Ärzte-Verlag, 2007.

Biddle S, Mutrie N. *Psychology of physical activity: determinants, well-being and interventions.* 2nd edition, London: Routledge, 2008.

Biddle S. *What helps and hinders people becoming more physically active?* In: Killoran A, Fentem P & Caspersen C. Moving on – International perspectives on promoting physical activity. London: Health Education Authority, 1994.

Biddle S. *Individual and small-group interventions.* In: Oja P & Borms J. Health Enhancing Physical Activity - The multidisciplinary series of Physical Education and Sport Science. v.6, Oxford: Meyer & Meyer Sport, 2004.

BKK Bundesverband. *Beispiele guter Praxis betrieblicher Gesundheitsförderung – Gesunde Mitarbeiter in gesunden Unternehmen: Erfolgreiche Praxis betriebleicher Gesundheitsförderung in Europa*. 3. Aufl. Essen: BKK Europäisches Informationszentrum, 2001.

Boutelle K, Murray D, Jeffery R, Hennrikus D, Lando H. *Associations between exercise and health behaviors in a community sample of working adults.* Prev Med 2000;30:217-224.

Brehm W, Pahmeier I. *Aussteigen oder Dabeibleiben? Bruchstellen einer Breitensportkarriere und Bedingungen eines Ausstiegs.* Spectrum der Sportwissenschaft , 1990;2:33-56.

Brehm W, Sygusch R. *Qualitäten von Gesundheitssport unter den Voraussetzungen eines bewegungsarmen Lebensstils – Methodenbericht.* Bayreuther Beiträge zur Sportwissenschaft, Heft 7, 2001.

Brehm W, Pahmeier I, Tiemann M. *Gesundheitsförderung durch sportliche Aktivierung,* Bd. 2. Methodenband, Bayreuth/Bielefeld, 1994.

Brehm W, Sygusch R, Hahn U, Mehnert G, Schönung A. *Qualitäten von Gesundheitssport unter den Voraussetzungen eines bewegungsarmen Lebensstils – Ergebnisbericht I.* Bayreuther Beiträge zur Sportwissenschaft, Heft 8, 2001.

Brenneis J, Stroheker M. *Das Wörther Wirbelsäulenkonzept "Kraftwerk" - Ein Bericht aus der arbeitsmedizinischen Praxis.* Arbeitsmedizin, Sozialmed, Umweltmed 2005; 40(8):450-454.

Breucker G, Weber V. *Workplace Health Promotion in a Crisis: Time to Invest, not Divest.* EfH- Enterprise for Health (http://www.enterprise-for-health.org/index.php?id=266 accessed July 23rd 2009).

Broding H, Kiesel J, Lederer P, Kötter R, Drexler H. *Betriebliche Gesundheitsförderung in Netzwerkstrukturen am Beispiel des Erlanger Modells - "Bewegte Unternehmen".* Gesundheitswesen, Epub ahead of print, 2009.

Bruce E, Frederick R, Bruce R, Fisher L. *Comparison of active participants and dropouts in CAPRI Cardiopulmonary rehabilitation programs.* The Am J Cardiol 1976;37(1):53-60.

Bullinger M, Kirchberger I. *SF-36 Fragebogen zum Gesundheitszustand – Handanweisung*, Göttingen: Hogrefe, 1998.

Burdine J, Felix M, Abel A, Wiltraut C, Musselman Y. *The SF-12 as a population health measure: an exploratory examination of potential for application.* Health Serv Res 2000;35(4):885–904.

Bureau of Labor Statistics, 1999 in National Research Council, 2001 http://www.bls.gov/opub/mlr/2001/06/lmir.htm

Burton A, Balagué F, Cardon G, Eriksen H, Henrotin Y, Lahad A, Leclerc A, Müller G, van der Beek A. *COST B13 Working Group on Guidelines for Prevention in Low Back Pain: Nov 2004.* Eur Spine J 2006;15(S2):136-68.

Callahan L, Mielenz T, Freburger J, Shreffler J, Hootman J, Brady T, Buysse K, Schwartz T. *A Randomized controlled trial of the People with Arthritis can exercise program: Symptoms, Function, Physical Activity, and Psychosocial Outcomes*. Arthritis & Rheumatism 2008;59(1):92-101.

Carpensen C, Powell K, Christenson G. *Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research*. Public Health Reports 1985;100(2):126-131.

Cavill N, Kahlmeier S & Racioppi F,. *WHO-Europe. Physical activity and health in Europe – Evidence for action*. WHO Regional Office for Europe: Copenhagen, 2006.

CDC- National Center for Chronic Disease Prevention and Health Promotion. *Physical activity and health – A report of the Surgeon* General. U.S. Department of health and Human services, 1996 (http://www.cdc.gov/nccdphp/sgr/contents.htm) accessed Mai 2008.

Cohen, J. *Statistical power analysis for the behavioral sciences.* Hillsdale: Lawrence Erlbaum associates, 1988.

Conn V, Hafdahl A, Cooper P, Brown L, Lusk S. *Meta/analysis of workplace physical activity interventions.* Am J Prev Med 2009;37(4):330-339.

Cotta H. *Der Mensch ist so jung wie seine Gelenke: Bewegung und Verschleiss – Vorbeugung, Erkennung, Behandlung, Sport und Ernährung.* München: Zabert

Sandmann, 2001.

Cox, M. *Fitness and Life-style programs for business and industry: problems in recruitment and retention.* Journal Cardiac Rehabilitation 1984;4(4):136-142.

Craes U, Mezger E. *Erfolgreich durch Gesundheitsmanagement- Beispiele aus der Arbeitswelt.* Bertelsmann Stiftung, Hans-Böckler-Stiftung, Gütersloh: Bertelsmann Stiftung, 2000.

Craig C, Marshall A, Sjöström M, Bauman A, Booth M, Ainsworth B, Bratt M, Ekelund U, Yngve A, Sallis J, Oja P. *International Physical Activity Questionnaire: 12-Country Reliability and Validity.* Med Sci Sports Exerc 2003;35(8):1281-1395.

Croft P, Papageorgiou A, Thomas E, Macfarlane G, Silman A. *Short-Term Physical Risk Factors for New Episodes of Low Back Pain – Prospective Evidence from the South Manchester back Pain Study.* Spine 1999;24(15):1556-1561.

Dalichau S, Stein B, Schäfer K, Buhlmann J, Menken P. *Effekte muskelkräftigender Maßnahmen zur Wirbelsäulenprotektion.* Bewegungstherapie und Gesundheitssport 2005;21:6-12.

Dallow C, Anderson J. *Using self-efficacy and a transtheoretical model to develop a physical activity intervention for obese women.* Am J Health Promot 2003;17(6):373-381.

De Cocker K, De Bourdeaudhuij I, Brown W, Cardon G. *The effect of a pedometer-based physical activity intervention on sitting time.* Prev Med 2008;47(2):179-181.

Dishman R, Buckworth J. *Increasing physical activity: a quantitative synthesis.* Medicine and science in sports and exercise 1996;28(6):706-719.

Dishman R. *Advances in exercise adherence.* Champaign: Human Kinetics, 1994b.

Dishman R, Gettman L. *Psychobiologic Influences on Exercise Adherence.* Journal of Sport Psychol 1980;2:295-310.

Dishman R, Ickes W. *Self-Motivation and Adherence to Therapeutic Exercise.* J Behavioral Med 1981;4(4):421-438.

Dishman R, Ickes W, Morgan W. *Self-motivation and adherence to habitual physical activity.* Journal of applied social psychology 1980;10(2):115-132.

Dishman R, Oldenburg B, O´Neal H, Shephard R. *Worksite physical activity interventions.* Am J Prev Med 1998;15(4):344-361.

Dishman R, Sallis J, Orenstein D. *The determinants of Physical Activity and Exercise.* Public Health Reports 1985;100(2):158-171.

Dishman R, Washburn R, Hearth G. *Physical Activity Epidemiology*. Champaign: Human Kinetics, 2004.

Dishman R. *The measurement conundrum in exercise adherence research.* Med Sci Sports Exerc 1994a;26(11):1382-1390.

Dishman R, DeJoy D, Wilson M, Vandenberg R. *Move to improve: a randomized workplace trial to increase physical activity.* Am J Prev Med 2009;36(2):133-141.

Dugdill L, Brettle A, Hulme C, McCluskey S, Long A. *A review of effectiveness of workplace health promotion interventions on physical activity and what works in motivating and changing employees´s health behavior*, UK: National Institute for Health and Clinical excellence Report, 2007 (http://www.nice.org.uk/Guidance/PH13) accessed February, 2009.

Dunn, A. *Getting started – a review of physical activity adoption studies.* Br J Sports Med 1996;30:193-199.

Dunn A, Marcus B, Kampert J, Garcia M, Kohl H, Blair S. *Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness – a randomized trial.* JAMA 1999;281(4):327-334.

Einhoff G. *Evaluation eines sportmotorischen Programms für Patienten mit chronischen Rückenschmerzen,* Dissertation, Deutsche Sporthochschule Köln, 2001.

Emmons K, Linnan L, Shadel W, Marcus B, Abrams D. *The working healthy project: a worksite health-promotion trial targeting physical activity, diet and smoking.* J Occup Environ Med 1999;41(7):545-555.

ENWHP (European Network for Workplace Health Promotion). *6th European Conference "HEALTHY WORK – HEALTHY LIFESTYLE – HEALTHY BUSINESS"*, (http://www.enwhp.org/index.php?id=636#1063) accessed July, 2009.

European Commission, Special Eurobarometer, 272e, 2007 (www.zimmerspine.eu/z/ctl/op/global/action/1/id/9023/template/PC/navid/9747) accessed September, 2008.

Eves F, Webb O. *Worksite interventions to increase stair climbing; reasons for caution.* Prev Med 2006;43:4-7.

Ewert T, Limm H, Wessels T, Rackwitz B, von Garnier K, Freumuth R, Stucki G. *The*

comparative effectiveness of a multimodal program versus exercise alone for the secondary prevention of chronic low back pain and disability. PM&R 2009;1:798-808.

Faas A. *Exercises: which ones are worth trying, for which patients, and when?* Spine 1996;21(24):2874-2879.

Fielding J, Piserchia P. *Frequency of worksite health promotion activities.* Am J Public Health 1989;79(1):16-20.

Frank J, Kerr M, Brooker A, de Maio S, Maetzel A, Shannon H, Sullivan T, Norman R, Wells R. *Disability resulting from Occupational Low Back Pain – Part I: What do we know about primary prevention? A Review of the scientific evidence on prevention before disability begins.* Spine 1996;21:2908-2917.

Fritz J, George S. *Identifying Psychosocial Variables in Patients with Acute Work-Related Low Back Pain: The Importance of Fear-Avoidance Beliefs.* Phys Ther 2002;82(10):973-983.

Froböse I. *Das neue Rückentraining.* Gräfe & Unzer, 2006.

Frohnweiler A, Jastrow B, Lechtenboehmer C, Frigeri F, Eckerstorfer P, Kaiser H. *Entwicklung und Integration eines Betrieblichen Gesundheitsmanagement (EIBE)* -Projektbericht. Institut für Qualitätssicherung in Prävention und Rehabilitation GmbH an der Deutschen Sporthochschule Köln, www.eibe-projekt.de, 2007.

Fuchs R. *Psychologie und körperliche Bewegung: Grundlagen für theoriegeleitete Interventionen*. Göttingen: Hogrefe, 1997.

Fuchs R. *Sport, Gesundheit und Public Health*. Göttingen: Hogrefe, 2003.

Geldman M, Moore A, Cheek L. *The effect of pre-injury physical fitness on the initial severity and recovery from whiplash injury, at six-month follow-up.* Clin Rehabil 2008; 22:364-376.

Gesundheitsförderpreis. ComVita Bewerbung, 2005 (personal handout).

Gidlow C, Johnston L, Crone D, James D. Methods *of Evaluation: issues and implications for physical activity referral schemes.* Am J Lifestyle Med 2008;2(1):46-50.

Goebel S. *Kieser Training: Reduktion von Ausfalltagen durch betriebliche Prävention.* In: Abstracts der Lifetime Corporate Health. Bewegungstherapie und Gesundheitssport 2004;20:52-53.

Göhl O, Linz H, Schönleben T, Otte B, Weineck J, Worth H. *Effekte eines multimodularen ambulanten Trainingsprogramms für Patienten mit COPD.* Pneumologie 2006;60:529-536.

Green B, Cheadle A, Pellegrini A, Harris J. *Active for Life: a work-based physical activity program.* Prev Chronic Dis (serial online) Jul., 2007. Available from: http://www.cdc.gov/pcd/issues/2007/jul/06_0065.htm.

Häkkinen A, Kautiainen H, Hannonen P, Ylinen J. *Strength training and stretching versus stretching only in the treatment of patients with chronic neck pain: a randomized one-year follow-up study.* Clin Rehabil 2008;22(7):592-600.

Häkkinen A, Ylinen J, Kautiainen H, Tarvainen U, Kiviranta I. *Effects of home strength training and stretching versus stretching alone after lumbar disk surgery: a randomized study with a 1-year follow-up.* Arch Physi Med Rehabil 2005;86(5):865-70.

Hallam J, Petosa R. *The long-term impact of a four-session worksite intervention on selected social cognitive theory variables linked to adult exercise adherence.* Health Educ Behavior 2004;31(1):88-100.

Hanney J, Kolber M, Beekhuizen K. *Implications for Physical Activity in the Population with Low Back Pain.* Am J Lifestyle Med 2009;3(1):63-70.

Hanney J, Kolber M, Schack-Dugre J, Negrete R, Pabian P. *The influence of education and exercise on neck pain.* Am J Lifestyle Med 2010;4:166-176.

Hartvigsen J, Yde C, Lings S, Corder E. *Is sitting-while-at-work associated with low back pain? A systematic, critical literature review.* Scand J Public Health 2000;28(3):230-239.

Heaney C, Goetzel R. *A Review of Health-related Outcomes of Multi-component worksite health promotion programs.* Am J Health Promot 1997;11(4):290-307.

Heirich M, Foote A, Erfurt J, Konopka B. *Work-site physical fitness programs-comparing the impact of different program designs on cardiovascular risks.* JOM 1993;35(5):510-517.

Heneweer H, Vanhees L, Picavet S. *Physical activity and low back pain: A U-shaped relation?* Pain 2009;143(1-2):21-25.

Hildebrandt J. *Paradigmenwechsel im Umgang mit dem Rückenschmerz – Konsequenzen für bewegungstherapeutische Interventionen.* Bewegungstherapie und Gesundheitssport 2005;21:146-151.

Hildebrandt V, Bongers P, Dul J, Dijk F, Kemper H. *The relationship between leisure time, physical activities and musculoskeletal symptoms and disability in worker populations.* Int Arch Occup Environ Health 2000;73:507-518.

Hollederer A. *Betriebliche Gesundheitsförderung in Deutschland – Ergebnisse des IAB-Betriebspanels 2002 und 2004.*Gesundheitswesen 2007;69:63-76.

Howell D. *Fundamental Statistics for the behavioral sciences*. 4th edition, Pacific Grove: Duxbury Press (Brooks/Cole publishing company), 1999.

Huber G. *Evaluation gesundheitsorientierter Bewegungsprogramme.* Waldenburg, 1999.

IPAQ- International Physical Activity Questionnaire. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) short and long forms. 2005 (www.ipaq.ki.se) accessed 2006.

Iverson D, Fielding J, Crow R, Christenson G. *The promotion of Physical Activity in the United States Population: the status of programs in medical, worksite, community and school settings.* Public Health Reports 1985;100:212- 224.

Jaakkola T, Liukkonen J, Laakso T, Ommundsen Y. *The relationship between situational and contextual self-determined motivation and physical activity intensity as measured by heart rates during ninth grade students´physical education classes.* Eur Phys Educ Review 2008;4(1):13-31.

Kaewthummanukul T, Brown K, Weaver M, Thomas R. *Predictors of exercise participation in female hospital nurses.* J Advanced Nursing 2006;54(6):663-675.

Karas B, Conrad K. *Back injury prevention interventions in the workplace – an integrative review.* AAOHN J 1996;44(4):189-196.

Kehr R. *Telekom setzt auf Förderung – Best practice reportage.*AOK Rheinland, Institut für betriebliche Gesundheitsförderung BGF GmbH, 2001 (www.bgf-institut.de/brosch/pdf/BestPractice.pdf) accessed June 6th 2009.

King A, Blair S, Bild D, Dishman R, Dubbert P, Marcus B, Oldridge N, Paffenbarger Jr R, Powell K, Yeager K. *Determinants of physical activity and interventions in adults.* Med Sci Sports Exer 1992;24(6):221-235S.

King A. *Community and public health approaches to the promotion of physical activity.* Med Sci Sports Exer 1994;26(11):1405-1412.

Klenerman L, Slade P, Stanley I, Pennie B, Reilly J, Atchison L, Troup J, Rose M. *The*

prediction of chronicity in patients with an acute attack of low back pain in a general practice setting. Spine 1995;20(4):478-484.

Kokkinos P. *Physical Activity and Cardiovascular Disease Prevention: current recommendations.* Angiology 2008;59(2):26-29S.

Kreis J, Bödeker W. *Gesundheitlicher und ökonomischer Nutzen betrieblicher Gesundheitsförderung und Prävention – Zusammenstellung der wissenschaftlichen Evidenz.* IGA-Report 3, BKK Bundesverband und Hauptverband der gewerblichen Berufsgenossenschaften, 2003.

Lahad A, Malter A, Berg A, Deyo R. *The effectiveness of four interventions for the prevention of Low-back pain.* JAMA 1994;272(16):1286-1291.

Lahti J, Laaksonen M, Lahelma E, Rahkonen O. *The impact of physical activity on physical health functioning – A prospective study among middle-aged employees.* Prev Med 2010;50:246-250.

Lechner L, De Vries H. *Participation in an Employees Fitness Program: determinants of high adherence, low adherence, and dropout.* JOEM 1995;37(4):429-436.

Leino P. *Does Leisure Time Physical Activity Prevent Low-Back Disorders? A Prospective study of metal industry employees.* Spine 1993;18(7):863-871.

Levy B, Wegman D, Baron S & Sokas R. *Occupational and Environmental Health – Recognizing and Preventing Disease and Injury.* 5. ed, Philadelphia: Lippincott Williams & Wilkins, 2006.

Liddle S, Baxter G, Gracey J. *Exercise and chronic low back pain: what works?* Pain 2004;107:176-190.

Lippke S, Ziegelmann J, Schwarzer R. *Initiation and Maintenance of physical exercise: stage-specific effects of a planning intervention.* Research in Sports med 2004;12: 221-240.

Ljubic M, Deane F, Zecchin R, Denniss R. *Motivation, Psychological Distress and Exercise Adherence following Myocardial Infarction.* Austr J Rehabil Counseling 2006; 12(1):21-32.

Loos M, Houterman S, Scheltinga M, Roumen,R. *Evaluation post herniorrhaphy groin pain: Visual Analogue or Verbal Rating Scale?* Hernia 2008;12:147-151.

Lühmann D, Burkhardt-Hammer T, Stoll S, Raspe H. *Prävention rezidivierender*

Rückenschmerzen. In: Sockoll I, Kramer I, Bödeker W. Wirksamkeit und Nutzen betrieblicher Gesundheitsförderung und Prävention, Iga-Report 13, BKK-Bundesverband, 2008.

Lühmann D. *Prävention von Rückenschmerz – Grundlagen und mögliche Interventionsstrategien.* Bewegungstherapie und Gesundheitssport 2005;21:138-145.

Luxembourg Declaration. European Network for Worksite Health Promotion, 2005.

Maeder U, Martin BW, Schutz Y, Marti B. *Validity of four short physical activity questionnaires in middle-aged persons.* Med Sci Sports Exerc 2006;38(7):1255-66.

Maes S, Verhoeven C, Kittel F, Scholten H. *Effects of a Dutch work-site wellness-health program: the Brabantia project.* Am J Public Health 1998;88(7):1037-1041.

Mandic S, Tymchak W, Kim D, Daub B, Quinney H, Taylor D, Al-Kurtass S, Haykowsky M. *Effects of aerobic or aerobic and resistance training on cardiorespiratory and skeletal muscle function in heart failure: a randomized controlled pilot trial.* Clin Rehabil 2009;23:207-216.

Marcus B, Simkin L. *The transtheoretical model: applications to exercise behavior.* Med Sci Sports Exerc 1994;26(11):1400-1404.

Marcus B, Emmons K, Simkin-Silverman L, Linnan L, Taylor E, Bock B, Roberts M, Rossi J, Abrams D. *Evaluation of motivationally tailored vs. standard self-help physical activity interventions at the workplace.* Am J Health Promot 1998;12(4):246-253.

Marcus B, Rossi J, Selby V, Niaura R, Abrams D. *The Stages and Processes of exercise adoption and maintenance in a worksite* sample. Health Psychol 1992a;11(6):386-395.

Marcus B, Selby V, Niaura R, Rossi J. Self-Efficacy and the Stages of Exercise Behavior Change. Res Q Exerc Sport 1992b;63:60-66.

Marshall A. *Challenges and opportunities for promoting physical activity in the workplace.* J Sci Med Sport 2004;7(1):60-66S.

Martin-Diener E, Thüring N, Melges T, Martin B. *The stages of change in three stage concepts and two modes of physical activity: a comparison of stage distributions and practical implications.* Health Educ Res 2004;19:406-417.

Motl R, Dishman R, Felton G, Pate R. *Self-motivation and Physical Activity among*

Black and White adolescents Girls. Med Sci Sports Exerc 2003;35(1):128-136.

Murphy M. *Lifestyle activity for health.* In: Oja P, Borms J. Health Enhancing Physical Activity - The multidisciplinary series of Physical Education and Sport Science 2004 ;6, Oxford: Meyer & Meyer Sport.

NCCDPHP- National Center for Chronic Disease Prevention and Health Promotion. *Physical activity and health – a report of the Surgeon General*, 1996. Available from: (www.cdc.gov/nccdphp/sgr/contents.htm).

NHS – National Institute for Health and Clinical Excellence. *New NICE public health guidance on promoting physical activity in the workplace.* Press release, 2008. Available from: (www.nice.org.uk ref. 2008/034)

NHS – National Institute for Health and Clinical Excellence. *Hypertention: management of hypertension in adults in primary care (NICE clinical guideline 34).* 2006 (www.nice.org.uk) accessed October 2009.

NHS - National Institute for Health and Clinical Excellence. *Promoting and creating built or natural environments that encourage and support physical activity.* NICE Public Health Guidance 8. London, 2008.

Nichols J, Wellman E, Caparosa S, Sallis J, Calfas K, Rowe R. *Impact of a Worksite Behavioral Skills Intervention.* Am J Health Promot 2000;14(4):218-221.

Nurminen E, Malmivaara A, Ilmarinen J, Ylöstalo P, Mutanen P, Ahonen G, Aro T. *Effectiveness of a worksite exercise program with respect to perceived work ability and sick leaves among women with physical work.* Scand J Environ Health 2002;28(2):85-93.

Oberlinner C, Lang S, Germann C, Trauth B, Eberle F, Pluto R, Neumann S, Zober A. *Prävention von Übergewicht und Adipositas am Arbeitsplatz. BASF-Gesundheitsaktion "Weg mit dem Speck" - Abnehmen mit Vernunft.* Gesundheitswesen 2007;69:385-392.

Oja P, Borms J. *Health enhancing physical activity*. Oxford: Meyer & Meyer Sport, 2004.

Ostelo R, Costa L, Maher C, de Vet H, van Tulder M. *Rehabilitation after lumbar disc surgery.* Spine 2009;34(17):1839-1848.

Pahmeier I. *Drop-out und Bindung im Breiten- und Gesundheitssport.* Sportwissenschaft 2004;24(2):117-150.

Pande K, Tripathi S, Kanoi R. Limited clinical utility of Pain Drawing in assessing patients with Low Back Pain. J Spinal Disorders Techniques 2005;18(2):160-162.

Pate R, Pratt M, Blair S, Haskell W, Macera C, Bouchard C, Buchner D, Ettinger W, Heath G, King A, Kriska A, Leon A, Marcus B, Morris J, Paffenbarger R, Patrick K, Pollock M, Rippe J, Sallis J, Wilmore J. P*hysical Activity and Public Health - A Recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine*. JAMA 1995;273:402-407.

Pfingsten M, Baller M, Liebeck H, Strube J, Hildebrandt J, Schöps P. *Gütekriterien der qualitativen Bewertung von Schmerzzeichnungen (Ransford-Methode) bei Patienten mit Rückenschmerzen*. Der Schmerz 2003;17(5):332-340.

Plotnikoff R, Hotz S, Birkett N, Courneya K. *Exercise and the Transtheoretical Model: a longitudinal test of a population sample.* Prev Med 2001;33:441-452.

Pohjonen T, Ranta R. *Effects of worksite physical exercise intervention on physical fitness, perceived health status and work ability among home workers: five-year follow-up.* Prev Med 2001;32:465-475.

Prince S, Tremblay M, Gorber S, Adamo K, Hamel M. *A comparison of direct versus self-reported measures for assessing physical activity in adults: a systematic review.* Abstract from the 2nd International Congress of Physical Activity and Public Health, Amsterdam, Apr., 2008.

Pritchard J, Nowson C, Wark J. *A worksite program for overweight middle-aged men achieves lesser weight loss with exercise than with dietary change.* J Am Diet Assoc 1997;97:37-42.

Prochaska J, Velicer W, Rossi J, Goldstein M, Marcus B, Rakowski W, Fiore C, Harlow L, Redding C, Rosenbloom D, Rossi S. *Stages of Change and Decisional Balance for 12 problem behaviors.* Health Psychol 1994;13(1):39-46.

Proper K, Koning M, van der Beek A, Hildebrandt V, Bosscher R, van Mechelen W. *The effectiveness of worksite physical activity programs on physical activity, physical fitness and health.* Clin J Sport Med 2003;13:106-117.

Proper K, Staal B, Hildebrandt V, van der Beek A, van Mechelen W. *Effectiveness of physical activity programs at worksites with respect to work-related outcomes.* Scand J Environ Health 2002;28(2):75-84.

Raglin J, Morgan W, Luchsinger A. *Mood and self-motivation in successful and*

unsuccessful female rowers. Med Sci Sports Exerc 1990;22(6):849-853.

Rampf J. *Drop-Out und Bindung im Fitness-Sport – Günstige und ungünstige Bedingungen für Aktivitäten im Fitness-Studio.* Band 48. Hamburg: Czwalina Verlag, 1999.

Ransford A, Cairns D, Mooney V. *The Pain Drawing as an aid to the psychologic evaluation of patients with Low-Back Pain.* Spine 1976;1(2):127-134.

Rasmussen-Barr E, Ang B, Arvidsson I, Nilsson-Wikmar L. *Graded exercise for recurrent low-back pain: a randomized, controlled trial with 6-, 12-, and 36-month follow*-ups. Spine 2009;34(3):221-228.

Rauen W. *Betriebliche Gesundheitsförderung in Brasilien.* Diplomarbeit, Deutsche Sporthochschule Köln, 1998.

Rhodes R, Warburton D, Murray H. *Characteristics of physical activity guidelines and their effect on adherence – a review of randomized trials.* Sports Med 2009;39(5): 355-375.

Robison J, Rogers M, Darlson J, Mavis B, Stachnik T, Stoffelmayr B, Sprague H, McGrew C, van Huss W. *Effects of a 6-month incentive-based exercise program on adherence and work capacity.* Med Sci Sports Exerc 1992;24(1):85-93.

Robroek S. *Determinants of participation in worksite health promotion programs.* Abstract from the 2nd International Congress of Physical Activity and Public Health, Amsterdam, Apr., 2008.

Rusnak A. *Vernetztes Gesundheitsmanagement bei der Neff GmbH in Bretten.* Bewegungstherapie und Gesundheitssport 2005;21:26-28.

Schmidt C, Raspe H, Pfingsten M, Hasenbring M, Basler H, Eich W, Kohlmann T. *Back Pain in the German Adult Population: Prevalence, Severity, and Sociodemographic Correlates in a Multiregional Survey.* Spine 2007;32(18):2005-2011.

Schnieders S. *Evaluation von Rehabilitations-Sport nach Apoplex*. Dissertation, Deutsche Sporthochschule Köln, 2005.

Schreiber von J, Biermann J. *Die Senkung des arteriellen Hochdrucks durch Sporttherapie – ein Langzeiteffekt?* Phys Rehabil Kur Med 1988;40:106-116.

Schüle K. *Zum aktuellen Stand von Bewegungstherapie und Krebs.* Bewegungstherapie und Gesundheitssport 2006;22:170-175.

Schultz K, Chalmers I, Hayes R, Altman D. *Empirical Evidence of Bias – Dimensions of methodological quality associated with estimates of treatment effects in controlled trials.* JAMA 1995;273(5):408-412.

Schwarz F. *Das Public Health Buch – Gesundheit und Gesundheitswesen.* 2. Aufl., München & Jena: Urban & Fisher, 2002.

Shephard R. *Do work-site exercise and health programs work?* The physician and sportsmedicine 1999b;27(2):48-72.

Shephard R. *Worksite Fitness and Exercise Programs: a review of methodology and health impact.* Am J Health Promot 1996a;10(6):436-452.

Silverstein B, Evanoff B. *Musculoskeletal disorders.* In: Levy B, Wegman D, Baron S & Sokas R. *Occupational and Environmental Health – Recognizing and Preventing Disease and Injury.* 5. ed, Philadelphia: Lippincott Williams & Wilkins, 2006.

Sjögren T, Nissinen K, Järvenpää S, Ojanen M, Vanharanta H, Mälkiä E. *Effects of a workplace physical exercise intervention on the intensity of headache and neck and shoulder symptoms and upper extremity muscular strength of office workers: A cluster randomized controlled cross-over trial.* Pain 2005;116:119-128.

Sjögren T, Nissinen K, Järvenpää S, Ojanen M, Vanharanta H, Mälkiä E. *Effects of a physical exercise intervention on subjective physical well-being, psychosocial functioning and general well-being among office workers: A cluster randomized-controlled cross-over* design. Scand J Med Sci Sports 2006;16:381-390.

Slootmaker S, Schuit A, Chinapaw M, Seidell J, van Mechelen W. *Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status.* Int J Beh Nutr Phys Act 2009;6,17.

Smeets R, Wittink H, Hidding A, Knotterus *J. Do patients with chronic low back pain have a lower level of aerobic fitness than healthy controls? Are pain, disability, fear of injury, working status, or level of leisure time activity associated with the difference in aerobic fitness level*? Spine 2006;31(1):90-97.

Stanton T, Henschke N, Maher C, Refshauge K, Latimer J, McAuley J. *After an episode*

of acute low back pain, recurrence is unpredictable and not as common as previously thought. Spine 2008;33(26):2923-2928.

Steinhardt M, Dishman R. *Reliability and Validity of expected outcomes and barriers for habitual physical activity.* J Occup Med 1989;31(6):536-546.

Sternfeld B, Block C, Quesenberry Jr C, Block T, Husson G, Norris J, Nelson M, Block G. *Improving diet and physical activity with ALIVE- a worksite randomized trial.* Am J Prev Med 2009;36(6):475-483.

Tang Y, Ma Y, Wang J, Fan Y, Feng S, Lu Q, Yu Q, Sui D, Rothbart M, Fan M, Posner M. *Short-term meditation training improves attention and self-regulation.* PNAS 2007; 104(43):17152-17156.

The Toronto Charter for Physical Activity, Toronto, 2010, (http://www.globalpa.org.uk/) accessed June 13th 2010).

TK- *Bluthochdruck.* Brochure from the Techniker Krankenkasse. Hamburg: TK, 2009

Torp S, Grogaard J. *The influence of individual and contextual work factors on workers ´compliance with health and safety routines.* Appl Ergonomics 2009;40(2):185-193.

Trost S. *Predictors of physical activity behaviors.* Abstract in: Predictors of Obesity, Weight Gain, Diet, and Physical Activity Workshop, Bethesda, 2004 (http://www.nhlbi.nih.gov/meetings/workshops/predictors/abstracts/agenda.htm). Accessed May 20th 2008).

Trost S, Owen N, Bauman A, Sallis J, Brown W. *Correlates of adult´s participation in physical activity: review and update.* Med Sci Sports Exerc 2002; 34(12):1996-2001.

Tveito T, Hysing M, Eriksen H. *Low back pain interventions at the workplace: a systematic literature review.* Occup Med 2004;54(1):3-13,.

Unger E. *Faktoren einer gesundheitssportlichen Motivationsstruktur.* Dissertation, Deutsche Sporthochschule, Köln, 2001.

van Poppel M, Hooftman W, Koes, B. *An update of a systematic review of controlled clinical trials on the primary prevention of back pain at the workplace.* Occup Med 2004;54(5):345-352.

van Tulder M, Becker A, Bekkering T, Breen A, Real M, Hutchinson A, Koes B, Laerum E, Malmivaara A. *COST B13 Working Group on Guidelines for the Management of Acute Low Back Pain in Primary Care:* Nov 2004 (www.backpaineurope.org) accessed June 2009.

Veitch J, Clavisi O, Owen N. *Physical activity initiatives for male factory workers: gatekeepers´perceptions of potential motivators and barriers.* Austr New Zealand J Public Health 1999;23(5):505-510.

Velicer W, DiClemente C, Rossi J, Prochaska J. *Relapse situations and self-efficacy: an integrative model.* Addictive Behaviors 1990;15:271-283.

Viljanen M, Malmivaara A, Uitti J, Rinne M, Palmroos P, Laippala P. *Effectiveness of dynamic muscle training, relaxation training, or ordinary activity for chronic neck pain: randomized controlled trial.* BMJ 2003;327(475-7413):1-5.

Vowles K, Gross R. *Work-related beliefs about injury and physical capability for work in individuals with chronic pain.* Pain 2003;101:291-298.

Vuori I. *Dose-response of physical activity and low back pain, osteoarthritis, and osteoporosis.* Med Sci Sports Exerc 2001;33(6):551-586S.

Ward A, Morgan W. *Adherence patterns of Healthy men and women enrolled in an Adult exercise program.* J. Cardiac Rehabil 1984;4:143-152.

Welk G. *Physical Activity Assessments for Health-Related Research.* Champaign: Human Kinetics, 2002.

Werner E. *Sporttherapie mit präventiven Venensportgruppen am Wohnort.* Dissertation, Ruprecht-Karls-Universität Heidelberg, 2001.

WHO-Europe. *Steps for health – A European Framework to Promote physical activity for health.* Copenhagen: WHO Regional Office for Europe, 2007.

WHO. *Global strategy on diet, physical activity and health- WHA57.17.* Geneva: World Health Organization, 2004.

WHO. *The world health report 2002 - Reducing risks, promoting healthy life.* Chap. 4. (http://www.who.int/whr/2002/en/) accessed October 2006.

WHO. *A guide for population-based approaches to increasing levels of physical activity – implementation of the WHO global strategy on diet, physical activity and health.* Geneva:WHO, 2007.

Wilke C, Biallas B, Froböse I. *Gesundheitsförderung am Arbeitsplatz- Ansätze und Leitlinien.* In: Deime H, Huber G, Pfeifer K, Schüle K. Neue aktive Wege in Prävention und Rehabilitation. Köln: Deutscher Ärzte-Verlag, 2007.

Wloka B. *Ambulante Knieschule – Kursaufbau und Evaluation.* Dissertation, Universitätsklinik der Ruhr-Universität Bochum, 1996.

Ylinen J, Takala E, Nykänen M, Häkkinen A, Mälkiä E, Pohjolainen T, Karppi S, Kautiainen H, Aikaksinen O. *Active neck muscle training in the treatment of chronic neck pain in women.* JAMA 2009;289(19):2509-2526.

Zimmermann M. *Der Chronische Schmerz – Epidemiologie und Versorgung in Deutschland.* Orthopäde 2004;33:508-514.

Appendix

Appendix 1. Population´s sociodemographic data

Category		Experimental group	Control group	Total
Sex	Male n (%)	12 (46.2)	14 (73.7)	26
	Female n (%)	14 (53.8)	5 (26.3)	19
	Total n	26	19	45
Age	Male μ(SD)	40.83 (1.65)	40.57 (0.8)	39.32 (1.62)
	Female μ (SD)	38 (1.8)	43 (3.31)	40.69 (0.85)
	Both μ (SD)	39.31 (1.24)	41.21 (4.28)	40.11 (0.84)

Table Appendix 1. Sociodemographic data from the sample (n)

Appendix 2. Means and standard error and sample size (n) for the variables

RCT

Variable	Exp1 mean (SE),n		Control mean (SE),n	
Assessment	T1	T2	T1	T2
Self-motivation	3.67(0.11),26	3.63(0.1),26	3.60(0.08),19	3.63(0.12),19
SF12 physical	50.17(1.63),26	51.4(1.38),26	49.6(1.73),19	49.7(1.81),19
SF12 mental	49.99(1.88),26	52.09(1.2),26	46.98(2.18),19	48.95(2.7),19
Pain intensity	0.1(0.02),26	0.05(0.01),26	0.11(0.03),19	0.06(0.02),19
Pain prevalence	46.2%, 26	38.5%, 26	57.9%, 19	52.6%, 19

Table appendix 2.1 Mean and standard error of the dependent variables of the study population; sample size (n)

Pre-experimental design

Variable	Exp1 (mean (SE),n)			
Assessment	T1	T2	T3	T4
Self-motivation	3.67(0.11),26	3.63(0.1),26	3.53(0.1),21	3.6(0.12),22
Days/w of PA	2.66(0.3),26	3.68(0.28),22	-	4.16(0.38),22
Sitting time (min/w)	3416.9(145.7),23	3220.9(159.5),22	-	3323.1(145.3),22
SF12 physical	50.17(1.63),26	50.86(1.31),26	52.94(1.32),21	52.11(1.31),22
SF12 mental	49.99(1.88),26	51.92(1.11),26	51.76(1.44)21	50.86(1.48),22
Pain intensity	0.1(0.02),26	0.04(0.01),26	0.06(0.02),21	0.08(0.02),22
Pain prevalence	50%, 26	38.5%, 26	38.1%, 21	45.5%, 22

Table Appendix 2.2 Mean and standard error of the dependent variables for the experimental group 1 (exp1); sample size (n)

Pre-experimental design

Variable	Exp2 (mean (SE),n)			
Assessment	T1	T2	T3	T4
Self-motivation	3.64(0.12),18	3.64(0.11),18	3.63(0.13),14	3.77(0.11),14
Days/w of PA	2.74(0.39),18	3.16(0.43),14	-	3.59(0.46),14
Sitting time (min/w)	3356.6(186.3),18	3004.2(215.3),14	-	3428.5(202.6),14
SF12 physical	49.91(1.9),18	48.16(2.37),18	47.72(2.91),14	52.17(1.7).14
SF12 mental	48.71(2.84),18	52.94(1.73),18	52.36(2.2),14	48.35(2.52),14
Pain intensity	0.06(0.02),18	0.09(0.03),18	0.06(0.02),14	0.07(0.02),14
Pain prevalence	50%, 18	38.9%, 18	35.7%, 14	50%, 14

Table Appendix 2.3 Mean and standard error of the dependent variables for the experimental group 2 (exp2); sample size (n)

Pre-experimental design

Variable	Exp (mean (SE),n)			
Assessment	T1	T2	T3	T4
Self-motivation	3.66(0.08),44	3.63(0.76),44	3.57(0.82),35	3.66(0.87),36
Days/w of PA	2.69(0.23),44	3.48(0.23),36	-	3.94(0.29),36
Sitting time (min/w)	3390.4(114.2),41	3136.6(127.8),36	-	3364.1(117.2),36
SF12 physical	50.07(1.22),44	49.75(1.24),44	50.85(1.45),35	52.13(1.02),36
SF12 mental	49.47(1.59),44	52.34(0.96),44	52(1.21),35	48.88(1.32),36
Pain intensity	0.08(0.01),44	0.06(0.01),44	0.06(0.01),35	0.08(0.01),36
Pain prevalence	50%, 44	38.6%, 44	29.5%, 35	38.6%, 36
Lack of confidence	-	1.51(0.1), 40	1.43(0.14), 31	1.5(0.13), 32
Lack of motivation	-	2.67(0.18), 40	2.41(0.19), 31	2.53(0.17), 32
Time conflict	-	4.11(0.27), 40	3.53(0.29), 31	3.83(0.31), 32

Table Appendix 2.4 Mean and standard error of the dependent variables for both groups together; sample size (n)

Appendix 3. Term of consent (*Einverständniserklärung*)

Projekt

Bewegungspause am Arbeitsplatz bei T- Mobile

EINVERSTÄNDNISERKLÄRUNG

Mit meiner Unterschrift erkläre ich mich bereit, an dem oben genannte Projekt teilzunehmen. Über Wesen und Bedeutung des Projektes bin ich in verständlicher Form mündlich aufgeklärt worden.

Ich weiß, dass meine Teilnahme völlig freiwillig ist und von mir jederzeit auch ohne Angabe von Gründen beendet werden kann.

Mir ist klar, dass die 3x pro Woche à 20 Minuten stattfindenden Übungen keine Arbeitszeit, sondern Pause sind.

Ich bin damit einverstanden, dass Frau Frigeri meine ausgefüllten Fragebögen in **anonymer** Form zu wissenschaftlichen Zwecken speichert und auswertet.

Ich weiß, dass die gemeinsame Ergebnisse dieses Projekts auf einer Abschlußveranstaltung am Ende des Projektsablaufes für die Teilnehmer vorgestellt werden.

Bonn, _____

Teilnehmer:_____ Unterschrift:_____

Projektleiterin:_____ Unterschrift:_____

Appendix 4. Main questionnaire

Sehr geehrte(r) TeilnehmerInnen,

herzlichen Dank für Ihre Unterstützung!

Mit Ihrer Teilnahme unterstützen Sie nicht nur unser Vorhaben, sondern tragen auch dazu bei, dass Ihnen und weiteren Betriebsangehörigen zukünftig, je nach den ausgewerteten Ergebnissen, noch verbesserte Bewegungs- und Gesundheitsaktionen angeboten werden können.

Damit alle Daten anonymisiert bleiben und unser gemeinsames Vorhaben trotzdem erfasst und bewertet werden kann, bitte ich Sie, bei der Erstellung Ihres eigenen Codes durch das folgende Codierungssystem mitzuwirken.

Anonymisierte Codierung (analog Codierungssystem Mitgliederbefragung ComVita):

3. Buchstabe Ihres Geburtsortes

die letzten beiden Ziffern Ihres Geburtsjahres

die ersten drei Buchstaben des Vornamens Ihrer Mutter

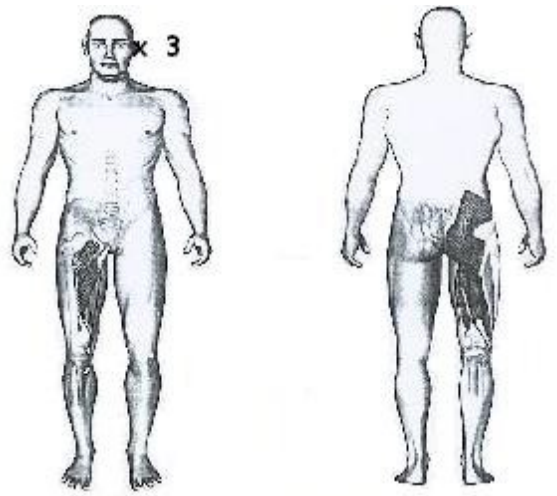
Nachstehend erhalten Sie einen Fragebogen, den Sie **vor** dieser Aktion beantworten sollten. Mit diesem Fragebogen möchte ich wissen, wie es Ihnen heute geht und wie viel körperliche Aktivitäten Sie zur Zeit machen. Bitte beantworten Sie den Bogen vollständig, damit wir alle erfragten Effekte der Intervention erfassen können.

Herzlichen Dank!!
Fernanda Frigeri

1a. Spüren Sie Schmerzen?	Ja	Nein
	☐	☐

1b. Wenn Sie Schmerzen während der Arbeit spüren, kreuzen Sie bitte den Punkt dieses Schmerzes und schreiben Sie daneben die entsprechende Intensität (siehe das Beispiel auf dem Bild): *Wenn Sie keinen Schmerz spüren gehen Sie zu Frage 4*.

1= leichter Schmerz; **2=** mittel-starker Schmerz; **3=** starker Schmerz; **4=** unerträglicher Schmerz



2. Seit wann spüren Sie Ihren Hauptschmerz?

seit weniger als 3 Monaten ☐
zwischen 3 und 6 Monaten ☐
zwischen 6 und 12 Monaten ☐
seit mehr als 12 Monate ☐

3. Wie häufig kommt Ihren Hauptschmerz?

Einmalige Episode ☐
Selten ☐
Manchmal ☐
Ziemlich oft ☐
Meistens ☐
Täglich ☐

4. Bitte lesen Sie nun jede der folgenden Aussagen und entscheiden Sie dann jeweils, wie sehr die jeweilige Aussage auf Sie zutrifft. Sie können dabei zwischen fünf Ankreuzmöglichkeiten entscheiden.	Sehr untypisch für mich (1)	2	3	4	Sehr typisch für mich (5)
Es fällt mir schwer, mich darauf festzulegen, bestimmte Sachen zu tun.	☐	☐	☐	☐	☐
Immer wenn mich Projekte zu langweilen beginnen, höre ich damit auf, um etwas anderes zu tun.	☐	☐	☐	☐	☐
Ich arbeite nicht härter, als unbedingt nötig.	☐	☐	☐	☐	☐
Ich arbeite nur selten mit ganzem Einsatz.	☐	☐	☐	☐	☐
Ich bin einfach nicht der Typ, der sich bei allem und jedem Ziele setzt.	☐	☐	☐	☐	☐
Ich kann mich gut selbst anspornen.	☐	☐	☐	☐	☐
Normalerweise gehe ich den Weg des geringsten Widerstands.	☐	☐	☐	☐	☐
Ich überanstrenge mich nicht gern.	☐	☐	☐	☐	☐
Im Grunde bin ich faul.	☐	☐	☐	☐	☐
Ich arbeite härter als die meisten meiner Freunde.	☐	☐	☐	☐	☐
Ich mag es, mir Ziele zu setzen und auf sie hinzuarbeiten.	☐	☐	☐	☐	☐
Ich bin leicht zu teilnahmslos.	☐	☐	☐	☐	☐

4. Bitte lesen Sie nun jede der folgenden Aussagen und entscheiden Sie dann jeweils, wie sehr die jeweilige Aussage auf Sie zutrifft. Sie können dabei zwischen fünf Ankreuzmöglichkeiten entscheiden.	Sehr untypisch für mich (1)	2	3	4	Sehr typisch für mich (5)
Ich habe viel Willenskraft.	☐	☐	☐	☐	☐
Wenn es geht, halte ich mich aus Sachen eher heraus.	☐	☐	☐	☐	☐
Ich vermeide stressige Situationen.	☐	☐	☐	☐	☐
Ich gehe bei meinen Aktivitäten nicht besonders systematisch vor.	☐	☐	☐	☐	☐
Ich verlange mir nie Dinge ab, von denen ich denke, ich sollte sie nicht tun.	☐	☐	☐	☐	☐
Ich habe nicht viel Selbstdisziplin.	☐	☐	☐	☐	☐

Im Folgenden geht es um Ihre Beurteilung Ihres Gesundheitszustandes. Der Bogen ermöglicht es, im Zeitverlauf nachzuvollziehen, wie Sie sich fühlen und wie Sie im Alltag zu Recht kommen. Bitte beantworten Sie jede der Fragen, indem Sie eine Antwortmöglichkeit ankreuzen, die am besten auf Sie zutrifft.

5. Wie würden Sie Ihren Gesundheitszustand im Allgemeinen beschreiben?	Ausgezeichnet	Sehr gut	Gut	Weniger gut	Schlecht
	☐	☐	☐	☐	☐

6. Sind Sie durch Ihren derzeitigen Gesundheitszustand bei diesen Tätigkeiten eingeschränkt? Wenn ja, wie stark?	Ja, stark eingeschränkt	Ja, etwas eingeschränkt	Nein, überhaupt nicht eingeschränkt
mittelschwere Tätigkeiten z.B. einen Tisch verschieben, staubsaugen, kegeln, Golf spielen	☐	☐	☐
mehrere Treppenabsätze steigen	☐	☐	☐

7. Hatten Sie in den vergangenen 4 Wochen aufgrund Ihrer körperlichen Gesundheit irgendwelche Schwierigkeiten an der Arbeit oder anderen alltäglichen Tätigkeiten zu Hause?	Ja	Nein
Ich habe weniger geschafft als ich wollte	☐	☐
Ich konnte nur bestimmte Dinge tun	☐	☐

8. Hatten Sie in den vergangenen 4 Wochen aufgrund seelischer Probleme irgendwelche Schwierigkeiten an der Arbeit oder anderen alltäglichen Tätigkeiten zu Hause (z.B. weil Sie sich niedergeschlagen oder ängstlich fühlten)?	Ja	Nein
Ich habe weniger geschafft als ich wollte	☐	☐
Ich konnte nicht so sorgfältig wie üblich arbeiten	☐	☐

	Über-haupt nicht	Ein bis-schen	Mäßig	Ziem-lich	Sehr
9. Inwieweit haben die Schmerzen Sie in den vergangenen 4 Wochen bei der Ausübung Ihrer Alltagstätigkeiten zu Hause und an der Arbeit behindert?	☐	☐	☐	☐	☐

10. Wie oft waren Sie in den vergangenen 4 Wochen	Immer	Meistens	Ziemlich oft	Manch-mal	Selten	Nie
...ruhig und gelassen?	☐	☐	☐	☐	☐	☐
...voller Energie?	☐	☐	☐	☐	☐	☐
...entmutigt und traurig?	☐	☐	☐	☐	☐	☐

	Immer	Meistens	Manchmal	Selten	Nie
11. Wie häufig haben ihre körperliche Gesundheit oder seelischen Probleme in den vergangenen 4 Wochen Ihre Kontakte zu anderen Menschen (Besuche bei Freunden, Verwandten usw.) beeinträchtigt?	☐	☐	☐	☐	☐

12. Über Ihre sportliche/körperliche Aktivitäten (hier können alle Aktivitäten über den Tag zusammengezählt werden, die mindestens 10 Minuten dauern):	Stimmt	Stimmt nicht
"Gegenwärtig treibe ich keinen Sport (körperliche Aktivitäten), und ich habe auch *nicht die Absicht*, in den nächsten sechs Monaten mit dem Sporttreiben zu beginnen."	☐	☐
„Gegenwärtig treibe ich keinen Sport (körperliche Aktivitäten), aber ich *überlege* mir gerade, ob ich nicht in den nächsten sechs Monaten mit dem Sporttreiben beginnen sollte."	☐	☐
„Gegenwärtig treibe ich zwar manchmal Sport (körperliche Aktivitäten), aber *nicht regelmäßig*" *(regelmäßig heißt: mind. 3 x pro Woche für wenigsten 20 Minuten pro Gelegenheit)*.	☐	☐
„Gegenwärtig treibe ich regelmäßig *(regelmäßig heißt: mind. 3 x pro Woche für wenigsten 20 Minuten pro Gelegenheit)* Sport (körperliche Aktivitäten), aber ich habe damit erst während der *letzten sechs Monate* begonnen."	☐	☐
„Gegenwärtig treibe ich regelmäßig *(regelmäßig heißt: mind. 3 x pro Woche für wenigsten 20 Minuten pro Gelegenheit)* Sport (körperliche Aktivitäten), und ich tue dies schon *länger* als sechs Monate."	☐	☐

Ich werde Sie nun fragen, wie viel Zeit Sie während einer üblichen Woche für körperliche Aktivität investieren. Bitte beantworten Sie alle Fragen, auch wenn Sie sich nicht für körperlich aktiv halten.

13. Denken Sie nun an all die **<u>intensiven Aktivitäten</u>**, welche Sie während einer üblichen Woche ausüben und die mit größerer Anstrengung verbunden sind. Intensive Aktivitäten verstärken Ihre Atmung *(wenn Sie keine intensive Aktivitäten ausüben, dann gehen Sie weiter zur Frage 14).*

Beispiel: Heben von schweren Gegenständen, Graben, größere Pakete oder Gepäckstücke die Treppe hoch tragen, Aerobic, mit dem Rad zur Arbeit fahren, schnelles Schwimmen und Tätigkeiten mit Laufen wie zum Beispiel Fußballspielen.

13a. An wie vielen Tagen einer üblichen Woche führen Sie für mindestens 10 Minuten oder länger intensive Aktivitäten dieser Art aus? (Die Aktivitäten während der Arbeitszeit zählen auch dazu)	_____ Tage pro Woche
	☐ Keine intensive Aktivitäten

13. Denken Sie nun an all die **intensiven Aktivitäten**, welche Sie während einer üblichen Woche ausüben und die mit größerer Anstrengung verbunden sind. Intensive Aktivitäten verstärken Ihre Atmung *(wenn Sie keine intensive Aktivitäten ausüben, dann gehen Sie weiter zur Frage 14).*

Beispiel: Heben von schweren Gegenständen, Graben, größere Pakete oder Gepäckstücke die Treppe hoch tragen, Aerobic, mit dem Rad zur Arbeit fahren, schnelles Schwimmen und Tätigkeiten mit Laufen wie zum Beispiel Fußballspielen.

13b. Wie viel Zeit wenden Sie insgesamt an solchen Tagen üblicher Weise für diese intensiven körperlichen Aktivitäten auf?	____ Stunden _____ Minuten
	☐ Weiß nicht

14. Denken Sie jetzt an körperliche Aktivitäten, die **mäßig anstrengend** sind und die Sie während einer üblichen Woche ausüben. Mäßig intensive Aktivitäten lassen sie leicht stärker atmen. *(wenn Sie keine mäßig anstrengende Aktivitäten ausüben, dann gehen Sie weiter zur Frage 15).*

Dazu zählt das Tragen von leichten Gewichten, Treppen steigen, gewöhnliches Radfahren, gewöhnliches Schwimmen und ein Tennis-Doppel-Spiel.

14a. An wie vielen Tagen einer üblichen Woche führen Sie mäßig intensive Aktivitäten für mindestens 10 Minuten oder länger aus? (Die Aktivitäten während der Arbeitszeit zählen auch dazu)	_____ Tage pro Woche
	☐ Keine mäßig anstrengende Aktivitäten
14b. Wie viel Zeit wenden Sie insgesamt an solchen Tagen üblicher Weise für mäßig intensiven körperlichen Aktivitäten auf?	____ Stunden _____ Minuten
	☐ Weiß nicht

15. Überlegen Sie sich jetzt, wie viel Zeit Sie während einer Woche für das **Gehen** aufwenden. *(wenn Sie kaum Laufen, dann gehen Sie weiter zur Frage 16).*

Dazu zählen das Gehen während der Arbeit, in der Schule, zu Hause, um von einem Ort an den anderen zu gelangen und das Spazieren, das Gehen als Sport, als Training oder das Gehen in der Freizeit.

15a. An wie vielen Tagen einer üblichen Woche gehen Sie für mindestens 10 Minuten oder länger?	_____ Tage pro Woche
	☐ Kaum Laufen
15b. Wie viel Zeit wenden Sie insgesamt an solchen Tagen üblicher Weise für Gehen auf?	____ Stunden _____ Minuten
	☐ Weiß nicht
15c. Mit welcher Geschwindigkeit gehen Sie gewöhnlich?	☐ Hohe (viel stärker atmen)
	☐ Moderate (ein wenig stärker atmen)
	☐ Langsame (normal atmen)

16. Die letzte Frage betrefft die Zeit während der Sie **sitzen** zum Beispiel, bei der Arbeit, in der Schule, zu Hause, auf dem Weg von einem Ort an den anderen oder während der Freizeit.

Dazu könnte das Sitzen am Tisch, beim Besuch von Freunden, beim Fernsehen oder beim Lesen gehören.

16a. Wie lange sitzen Sie insgesamt an einen üblichen Wochentag?	____ Stunden _____ Minuten
16b. Wie lange sitzen Sie insgesamt an einen üblichen *Wochenenden-Tag*?	____ Stunden _____ Minuten

18. Geschlecht Weiblich ☐ Männlich ☐

19. Alter Unter 35-jährig ☐ 35-50-jährig ☐ Über 50-jährig ☐

20. Wohnen Ihre Kinder mit Ihnen? Ja ☐ Nein ☐ Ich habe keine Kinder ☐

21. Rauchen Sie? Ja ☐ Nein ☐ Ich habe nur früher geraucht ☐

22. Welche Schulbildung haben Sie?

Hauptschule ☐	Hauptschule mit Berufsschule ☐
Mittlere Reife ☐	Abitur ☐
Abgeschlossenes Studium ☐	Andere. Welche? ☐

23. Ihr Kode

Herzlichen Dank für Ihre Mitarbeit!!

Appendix 5. Brochure

Sehr geehrte Teilnehmerinnen und Teilnehmer des Projekts:

„Bewegungspause am Arbeitsplatz"

Diese Broschüre wird Sie dabei unterstützen, bei Ihrer täglichen Arbeit fit zu bleiben. Um Ihre Gesundheit zu erhalten oder sogar zu verbessern, sind oft nur kleine körperliche Aktivitäten nötig, die Sie in Ihren Alltag integrieren sollten. Die hier vorgestellten Übungen sind kurz erklärt und leicht zu erlernen. So werden Sie in die Lage versetzt, mit wenig Aufwand viel für sich und somit Ihre Gesundheit zu tun.

Also, mach mit und bleib fit!

Diese Broschüre wurde von Frau Fernanda Frigeri in Rahmen des Projekts „Bewegungspause am Arbeitsplatz" entwickelt. Sie ist Doktorandin des Instituts von Rehabilitation der Deutschen Sporthochschule – Köln. Alle die hier aufgeführten Übungen sind in ihrer Konzeption und Durchführung von Frau Frigeri einer praktischen Überprüfung unterzogen worden und in Ihre Promotion wissenschaftlich dokumentiert und evaluiert.

Inhalt der Broschüre:

- Eine kurze Skizze über die theoretischen Inhalte
- Der Rücken und die tägliche körperliche Haltung
- Sitzen am Schreibtisch (Ergonomie und das „aktive Sitzen")
- Rückenschmerz – Ursache und mögliche Beseitigung
- Das Herz-Kreislauf Training (Vorteile und Einstieg)
- Wichtige Übungen für einen gesunden Rücken

Teil I – Theoretische Inhalte

1. Der Rücken und die tägliche körperliche Haltung

Bewegungen jeglicher Art bestimmen unser alltägliches Leben. Die Fähigkeit zu laufen, etwas mit den Armen zu erreichen oder zu sitzen wird durch die Bewegung der kleinen Wirbelkörper in unserer Wirbelsäule möglich. Auch das Tragen (Stützen) unseres Kopf- und Schulter-Arm-System sowie das Heben von Gewichten zeigt die vielseitigen Eigenschaften unserer Wirbelsäule. In der Abb.1 ist die Doppel „S"- Form der Wirbelsäule zu sehen, die diese vielseitigen Bewegungen ermöglichen.

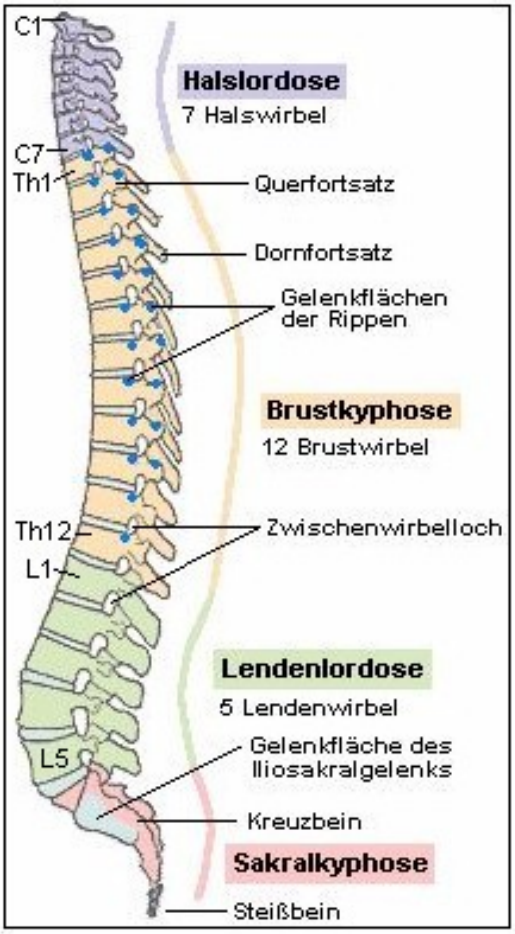


Abbildung 1: Die Wirbelsäule mit ihren Wirbelkörpern

Zwischen zwei Wirbelkörpern liegt je eine Bandscheibe, die zusammen mit der Doppel-S-Form, eine Federungsfunktion übernehmen. So wird beim Springen, Rumpfbeugen und Rumpfstrecken die Wirbelsäule von Stößen und Überdehnungen geschützt.

Die Belastung der Bandscheiben während einer Bewegung, ist in Abb. 2 gut zu erkennen.

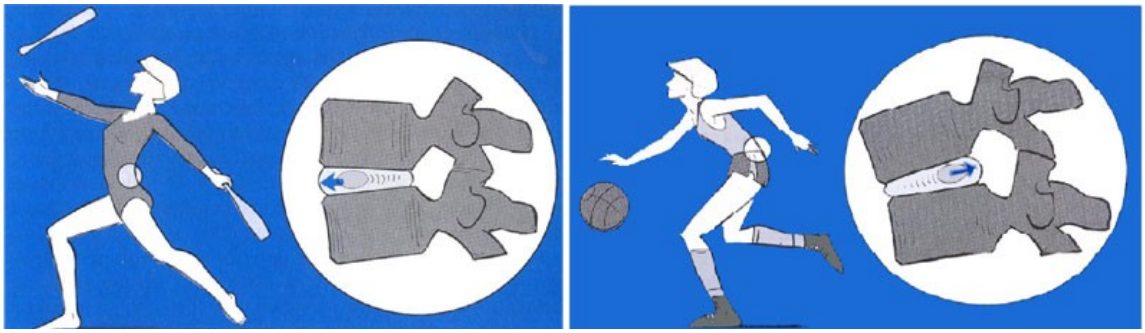


Abbildung 2: Die Belastung der Bandscheiben während einer Bewegung (Cotta 2001)

Durch Bewegung, wie Beugen und Strecken der Wirbelsäule, werden die Bandscheiben mit Nährstoffen versorgt.

Bei richtiger Köperhaltung unterstützt die „Doppel-S-Form" Muskulatur und Sehnen. Ein Flachrücken, Rundrücken oder Hohlrundrücken erhöht die Belastung der Muskulatur, Gelenke und Bandscheiben. Diese Fehlbeanspruchung führt zu frühzeitigem Verschleiß und kann Rückenschmerzen verursachen bis hin zu einem Bandscheibenvorfall. In Abb.3: wird schematisch dargestellt welcher Belastungen die Wirbelsäule bei einer Fehlhaltung ausgesetzt ist. Wie zu sehen ist, wird die größte Entlastung durch die Haltung a erzielt, b-d üben eine starke Belastung auf das System Wirbelsäule aus. Die „Doppel S Form" entlasten die Bandscheiben durch eine gerade entspannte Haltung.

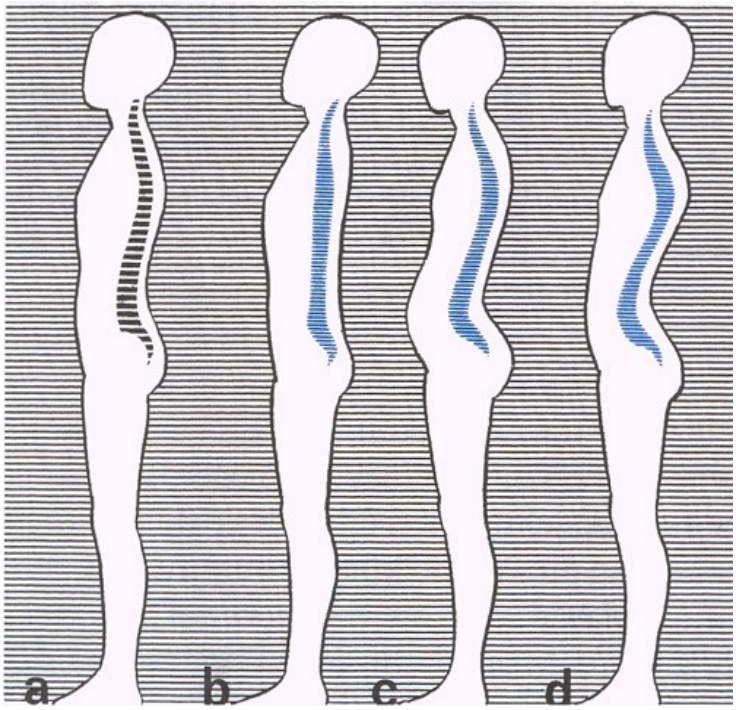


Abbildung 3: Ideale Entlastung a, Belastung durch Fehlhaltungen b-d (Cotta, 2001)

Tipp:
- Heben Sie Ihren Brustkorb an, Sie merken schon den Unterschied beim Stehen.

2. Sitzen am Schreibtisch

Schreibtisch-Tätigkeiten gehen mit langem Sitzen einher. Zwangshaltungen, wie Sitzen oder langes Stehen können Beschwerden im Muskel-Skelett-Apparat verursachen.
Durch den Wechsel von Anspannung und Entspannung wird die Durchblutung und damit Versorgung der Muskulatur, Sehnen, Bänder und Bandscheiben der Wirbelsäule gefördert. Beim langen Sitzen oder Stehen, also Zwangshaltungen, wird dieser Mechanismus eingeschränkt und kann zu dauerhaften Schäden führen. Im schlimmsten Fall, sind sie sogar irreparabel.

Die drei wichtigsten Funktionen der Wirbelsäule sind:
Schutz des zentralen Nervensystems
Federung beim Laufen, Beugen, Strecken und Drehen der Wirbelsäule
Tragen von Gewichten (bis zum 3-fachen des eigenen Körpergewichtes)

Dank Bandscheiben und der „Doppel-S-Form" der Wirbelsäule ist der Rücken zu vielfältigen Bewegungen fähig. Das gelingt nur, wenn dieses System erhalten bleibt. Um zu veranschaulichen, welche Rolle die Bandscheibe spielt, betrachten wir sie genauer.
Die Bandscheiben bestehen aus einem Kern der umgeben wird von mehreren flexible Ringen, die jedoch soviel Stabilität haben, dass sie den Kern vor dem „Austritt", einem Bandscheibenvorfall, schützen. Schon bei geringster Druckbelastung verschiebt sich der Bandscheibe-Kern. Sie weicht immer in die entgegengesetzte Richtung aus. So wird sie bei einer Überstreckung nach hinten, nach vorne hin ausweichen. (Abb. 2). Beim „Beugen" des Rückens wird er nach hinten gedrückt (Abb. 4 links). Bei Seiteneigungen verschiebt sie sich, je nach Richtung, nach rechts oder links. In Abb. 4: wird die Bewegung des Bandscheibe-Kernes beim falschen Heben (links) und beim richtigen Heben (rechts) schematisch dargestellt.

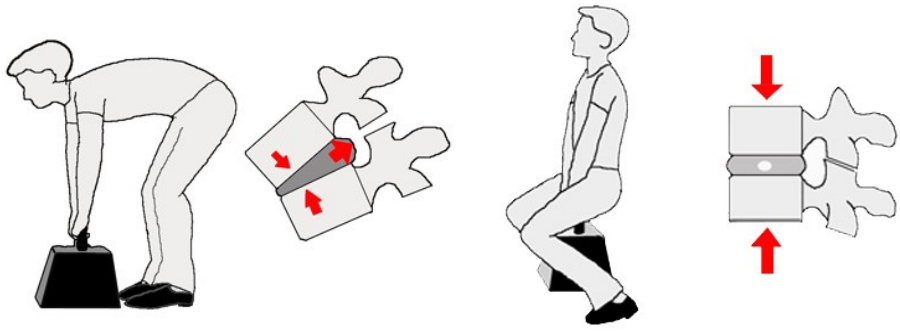


Abbildung 4: Zwei Möglichkeiten das Gewicht zu heben (Cotta, 2001)

Die Bandscheiben werden durchblutet und so mit dem notwendigen Sauerstoff versorgt. Bei schlechter Versorgung verlieren sie an Stabilität. Zusammen mit einer täglichen Zwangshaltung deren Folge den Verlust der Muskelkraft ist, besteht es dann die Gefahr eines Bandscheibenvorfalls.

Bei Schreibtisch-Tätigkeiten sind 2 wichtige Aspekte zu berücksichtigen, wenn man Muskel-Skelett-Beschwerden vermeiden möchte:

die richtige ergonomische Anpassung des Arbeitsplatzes (Anpassung der Tisch und Stuhl- sowie Bildschirmhöhe);
aktives Sitzen nach der Methode: „Die nächste Sitzposition ist die Beste".

Wie in Abb. 5 zu sehen ist, wird durch falsches Sitzen die Gefahr von Rückenschmerzen erhöht (linkes Bild). Die Pfeile zeigen die gefährdeten Stellen. Rechts, wird durch die ergonomische Anpassung des Arbeitsplatzes einer Fehlhaltung vorgebeugt.

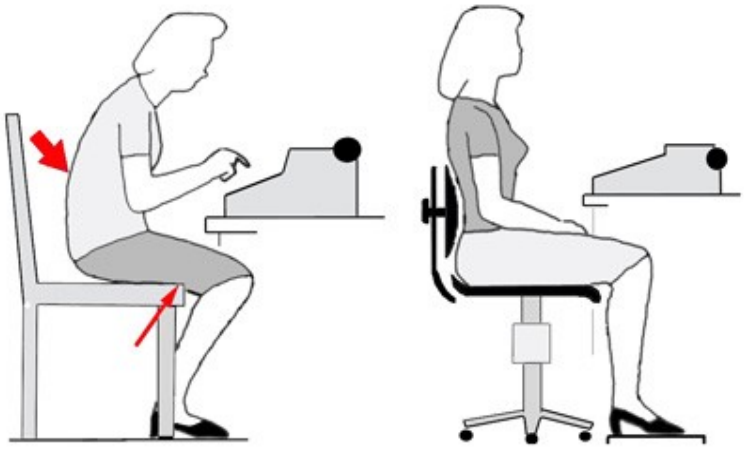


Abbildung 5: Nicht ergonomischer vs. ergonomischer Arbeitsplatz (Cotta 2001)

Tipp:

- Ihr Bildschirm sollte genau vor Ihnen stehen.
- Nutzen Sie die bewegliche Rückenlehne.
- Bei der Höheneinstellung Ihres Stuhls sollten die Füße den Boden berühren.
- Es soll genug Beinfreiheit unter dem Schreibtisch vorhanden sein.
- Das dynamische Sitzen (die nächste Position ist die Beste) ist zu empfehlen.

3. Rückenschmerz – Ursachen und die Möglichkeit vorzubeugen

An Hand der schematischen Darstellung wird deutlich, welche Folgen zu erwarten sind, wenn durch eine Schonhaltung Schmerzen vermieden werden. Diese Haltung bringt nur kurzfristig Erleichterung, da die Ursache des Schmerzes nicht behoben wird. Die daraus entstehende Folge ist zunächst der Verlust an Muskelmasse, was zur Folge hat, das Kraft und Ausdauer nachlassen. Weitere Einschränkungen sind Verlust der Peer-Group was das sich wiederum auf das Selbstvertrauen auswirkt (Abb. 6).

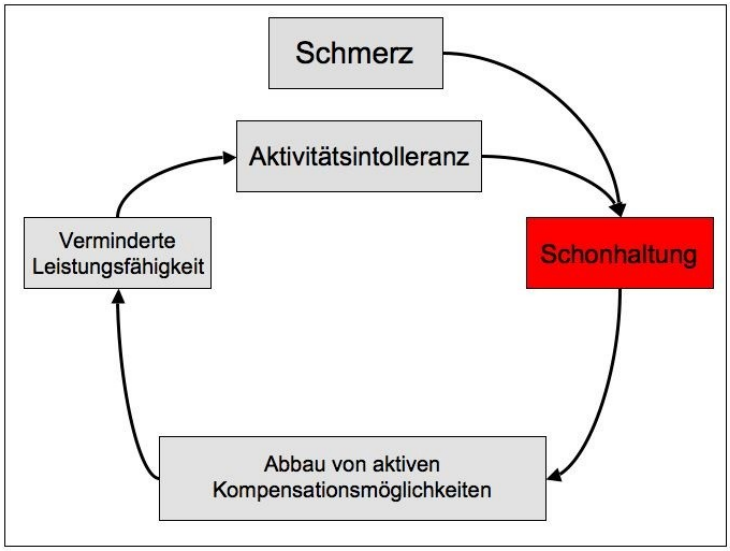


Abbildung 6: Spontaner Dekonditionierungszyklus durch Schonhaltung (Ackerveeken, 1998)

Durch gezielte Übungen und kontinuierliches Training ist es möglich den Zyklus der Dekonditinierung zu durchbrechen und den unvermeintlichen Folgen zu entgehen.

Abb. 7: Therapeutischer Rekonditionierungszyklus bei Schmerzenpatienten

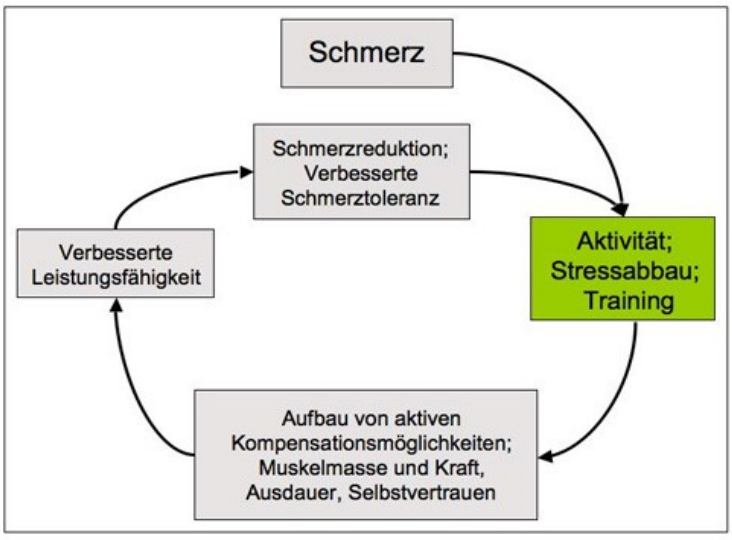


Abbildung 7: Therapeutischer Rekonditionierungszyklus um das Wohlbefinden zu steigern (Ackerveeken, 1998)

Zu beachten ist dabei, dass Beanspruchung und Kapazität im Gleichgewicht stehen (Abb. 8).

Beanspruchungen sind:

- körperliche Belastungen, wie Gartenarbeit, Wasserkästen tragen, Zwangshaltung am Arbeitsplatz
- psychische Überforderung, auch Disstress genannt .

Die Kapazitäten die wir zur Verfügung haben, bestimmen wir selbst!
Sind Wirbelsäule, Bandscheiben, Wirbelgelenke, Bänder intakt, steht einem Konditionstraining zu physischen Fitness nichts mehr im Wege. Selbst bei fortgeschrittener Dekonditionierung ist durch abgestimmte Übungen eine schrittweise Verbesserung zu erreichen, man muss nur beginnen.
Eine gute Kondition ermöglicht uns Verspannung schneller lösen, oder erst gar nicht entstehen zu lassen, und Stresssituationen besser kompensieren.

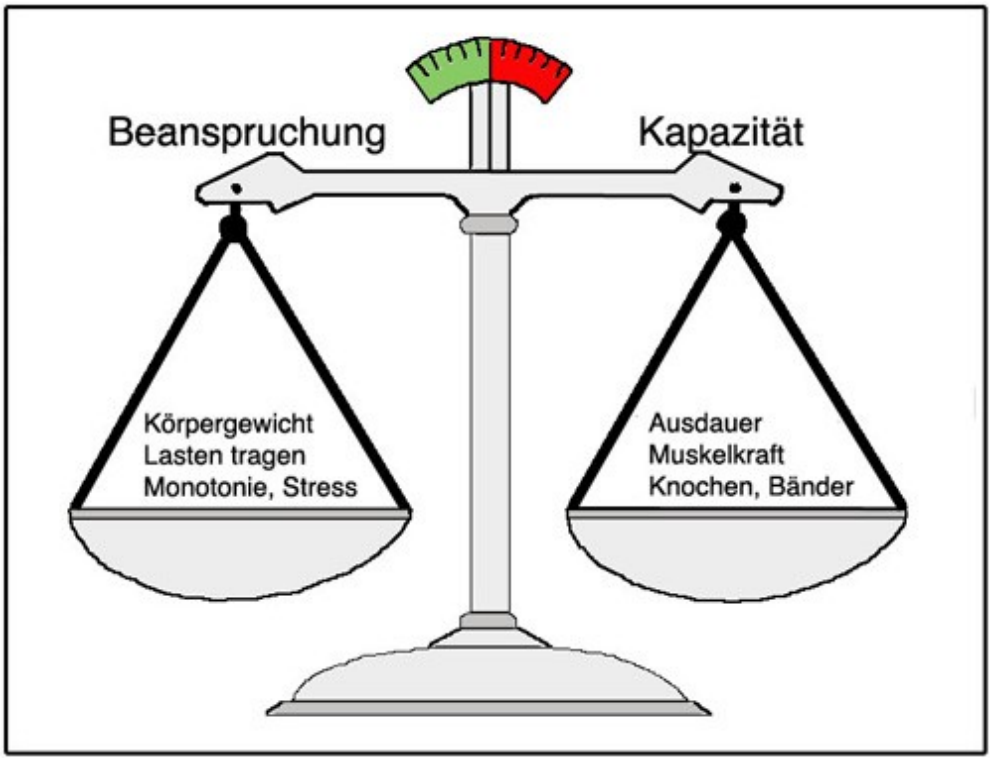


Abbildung 8: Das Gleichgewicht zwischen Beanspruchung und Kapazität

4. Herz-Kreislauf Training / Ausdauer

Welchen positiven Effekt hat Ausdauertraining?
Das Herzinfarktrisiko sinkt erheblich.
Schon 3-4 mal pro Woche 30min. Training bringt den Kreislauf in Schwung und erhöht die Elastizität der Gefäße. Der Mehrverbrauch an Kalorien tut sein übriges damit es uns gut geht.
Die Stärkung des Immunsystems ist ein weitere Gewinn auf dem Weg des „sich Wohlfühlens", unabhängig davon, dass die Belastbarkeit sich erhöht und wir Leistungsfähiger sind.
Der schönste Nebeneffekt ist jedoch, die Ausschüttung von Endorphinen, den Glückshormonen. Sie haben eine euphorisierende Wirkung, die uns die Anstrengungen schnell vergessen machen und den Grundstein der Motivation zum Weitermachen legen.
Die Abbildung 9 verdeutlicht welche Vorteile ein Ausdauertraining hat.

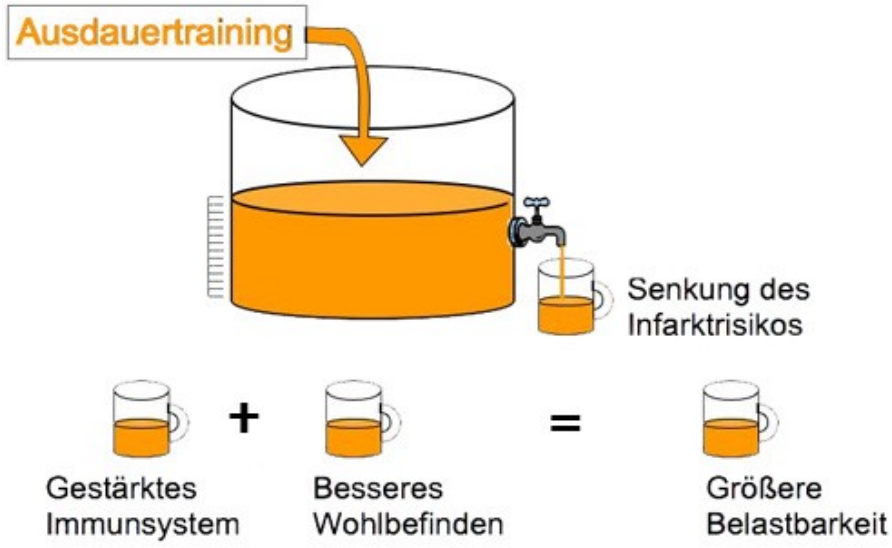
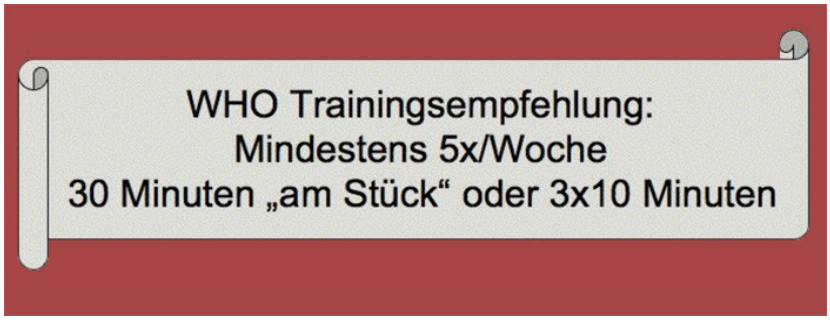


Abbildung 9: Effekte eines Ausdauertrainings

Der erste Schritt ist der schwerste, das weiß jeder, der etwas Neues beginnt.
Beim Ausdauersport ist es wichtig, dass der passive Bewegungsapparat, das sind die Bänder, Sehnen und Knochen, zunächst nicht zu stark beansprucht wird. Gute sportliche Aktivitäten sind zum Beispiel, Radfahren, Walking und Nordicwalking. Sie beanspruchen hauptsächlich die Muskulatur die den passiven Bewegungsapparat stützt und eignet sich deshalb besonders gut für Anfänger.
Schwimmen, Jogging, Laufen sind für Fortgeschrittene zu empfehlen, da sie schon die physischen Voraussetzungen mitbringen.



Teil II - Wichtige Übungen

1. Schulterdreher mit Wirbelsäule Bewegung

Im Stehen oder in der Sitzposition, die Arme hängen neben dem Körper. Handflächen zeigen nach hinten. Kinn auf die Brust nehmen und der Rücken wird etwas „rund gemacht". Dann drehen Sie die Arme nach außen, so dass die Handflächen anschließend nach vorn zeigen.


Wenn die Handfläche nach vorn zeigen, den Kopf heben und den Rücken aufrichten. Von der Ausgangsposition bis zur Endposition sollten Sie sich 5 Sekunden Zeit nehmen und die Endposition kurz halten. Wiederholen die Übungen 5 Mal.

2. Brustkorb anheben

Im Stehen oder in der Sitzposition den Brustkorb anheben und danach absenken. Dabei die Schulter, den Becken und Bauch fixieren. Die Übung langsam und kontrolliert durchführen und 5 Mal wiederholen.


3. Mobilisation des Nackens

Im Stehen oder in der Sitzposition den Kopf langsam nach links drehen und das Kinn anheben. Dann den Kopf nach vorn beugen. Kopf langsam nach rechts drehen und das Kinn anheben.

Von der Endposition links bis zur Endposition rechts sollten Sie 5 Sekunden benötigen und die Endposition kurz halten. Wiederholen Sie die Übung 5 Mal.

4. Mobilisation des Beckens

Im Stand das Becken nach vorn und danach langsam nach hinten kippen. Dabei den Rücken aufgerichtet halten. Die Knie sollten etwas gebeugt sein. 5-8 Mal wiederholen.


5. Die Rückenmuskulatur trainieren

Sie stellen sich einbeinig auf eine gerollte Matte (alternativ auf ein gerolltes Handtuch oder kleines Kissen) und sollten dabei den Rücken aufgerichtet haben. Das andere Bein wird diagonal nach vorne und hinten gependelt. Wichtig ist die aufrechte Körperhaltung während der Übung.

Die beiden Arme helfen Ihnen beim Finden des Gleichgewichts. Wiederholen Sie die Übung 10 Mal jede Seite.


6.Den Rücken trainieren

Knien Sie sich hin und stützen Sie sich mit den Armen ab (entweder auf den Fäusten oder ganzen Handflächen). Strecken Sie das linke Bein und den rechten Arm bis in die Waagerechte. Der Nacken ist gestreckt und der Rücken gerade, sodass kein Hohlkreuz entsteht. Fünf Sekunden halten. Ruhig weiteratmen.

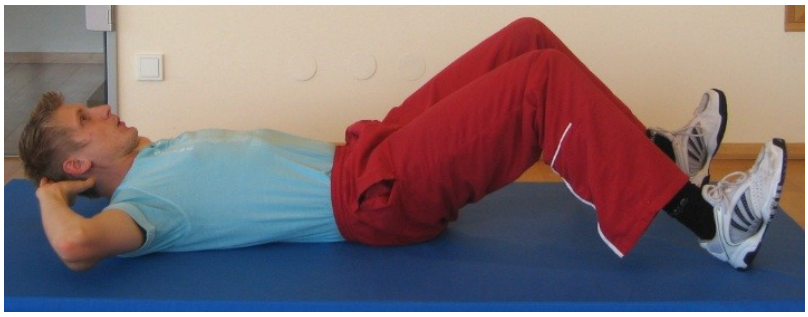
Lassen Sie dann den rechten Ellenbogen und das linke Knie unterhalb des Körpers berühren. Wiederholen Sie die Übung 10-12 Mal und nehmen Sie anschließend wieder langsam die Ausgangsposition ein. Anschließend: Seitenwechsel!

7. Die Obere Rückenmuskulatur trainieren

Legen Sie sich auf den Bauch, Arme und Beine gestreckt. Fußspitze auf dem Boden lassen. Paddeln Sie dann mit Armen wechselseitig auf und ab. Nehmen Sie den Kopf nicht in den Nacken, sondern schauen Sie vor sich auf den Boden. Machen Sie die Bewegung 5-8 Sekunden lang. Wiederholen Sie die Übung 2 bis 3 Mal.

8. Die Bauchmuskel trainieren

In der Rückenlage beide Füße aufstellen und den Bauchnabel durch Anspannen der Bauchmuskulatur einziehen. Die Fingerspitzen berühren leicht den Hinterkopf.



Kopf und Schultern langsam vom Boden abheben; während dessen einen Punkt an die Decke fixieren. Position halten. Weiteratmen nicht vergessen! Dann mit Kopf und Schultern in die Ausgangsposition zurück. Die ganze Übung 10-12 Mal ausführen.

9. Die Nackenmuskel trainieren

In der liegenden Position mit aufgestellten Füßen. Kinn Richtung Brustkorb beugen, damit die Halswirbelsäule parallel zum Boden ist. Den Kopf 2 Millimeter vom Boden heben und 5 Sekunden halten. 2-3 Mal die Übung wiederholen.

Die Kinnposition beibehalten und den Kopf gegen den Boden drücken und 5 Sekunden halten. 2-3 Mal die Übung wiederholen.

Mit entspanntem Nacken drehen Sie den Kopf nach links. Kinn Richtung Schulter beugen und den Kopf 2 Millimeter vom Boden heben. 2-3 Mal die Übung wiederholen. Anschließend: Seitenwechsel!

10. Die Kreuz-Dehnung des Körpers

In der Rückenlage stellen Sie die Füße mit angewinkelten Beinen auf. Arme gestreckt zur Seite.

Lassen Sie beide Knie auf die linke Seite fallen und drehen Sie gleichzeitig den Kopf nach rechts. Dabei sollten Sie die Schultern am Boden lassen. Die Position 15-20 Sekunden halten. Anschließend: Seitenwechsel.

11. Dehnung der Muskulatur des hinteren Oberschenkels

In der liegenden Position beide Beine gestreckt auf dem Boden halten. Mit einem Band (oder Tuch) das rechte Bein in Richtung Decke anheben, bis Sie ein leichtes Ziehen auf der Rückseite des Oberschenkels spüren. Die Knie sollten dabei gestreckt sein. Die Position 10-15 Sekunden halten. Anschließend: Seitenwechsel.

Am Arbeitsplatz

12. Förderung der Durchblutung in den Beinen

Setzen Sie sich mit dem Rücken an die Rückenlehne und stellen sie die Füße auf den Boden. Heben Sie Ihre Fersen an und lassen Sie gleichzeitig die Fußspitzen auf dem Boden stehen. Wiederholen Sie die Bewegung in etwas schnellerer Ausführung. Sie können die Übung mehrmals am Tag durchführen.

13. Nackenmuskulatur trainieren

Setzen Sie sich mit dem Rücken an die Rückenlehne und lassen Sie beide Füße auf dem Boden stehen. Richten Sie die Halswirbelsäule auf, indem Sie geradeaus nach vorne schauen (der Kopf sollte in Verlängerung der Wirbelsäule sein). Drücken Sie nun mit beiden Händen gegen den Hinterkopf. Halten Sie den Druck 5 Sekunden lang und wiederholen Sie die Übung mehrmals am Tag.

14. Dehnung der Halsmuskulatur

Im Stand oder im Sitzen. Im aufrechten Stand neigen Sie den Kopf nach links, dabei nähert sich das Ohr der Schulter an. Der linke Arm wird während dessen hängen gelassen.

Die Schulter sollte nicht hochgezogen und der Kopf nicht gedreht werden. Der rechte Arm sollte in Richtung Boden ziehen. Die Dehnung der Nacken- und Schultermuskeln 15 Sekunden lang halten. Mit der anderen Seite wiederholen Sie die Übung. Atmen Sie dabei ruhig und gleichmäßig.

Hier wurden spezielle Übungen vorgestellt, die Sie zu Hause durchführen können. Es gibt Übungen die einfach an dem Arbeitsplatz durchführbar sind. Führen Sie die Übungen 3 bis 5 Mal pro Woche durch, damit Sie in kürzeren Zeit die Vorteile des Trainings (Stabilisierung des Rückens, Entspannung, Wohlgefühl, usw.) erreichen können!

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Modell für die Bilder: Sascha Martini

Die Authorin möchte sich für die Unterstützung bei der Planung des Projekts bei Frau Vormstein (HR4, T-Mobile Deutschland GmbH) sowie für die Hilfestellung bei der Durchführung der Bewegungspause und bei der Herstellung dieser Broschüre bei Benjamin Brunschier, Sascha Martini und Christoph Lechtenböhmer bedanken.

Bibliographie:

Cotta H. *Der Mensch ist so jung wie seine Gelenke: Bewegung und Verschleiß – Vorbeugung, Erkennung, Behandlung, Sport und Ernährung.* 3. Aufl., München: Zabert Sandmann, 2001.

Ackerveeken P. *Die Behandlung von Rückenschmerz – Ist die Zeit für einen Paradigmenwechsel gekommen?* In: Pfingsten, M. & Hildebrandt, J. (Hrsg.). Chronischer Rückenschmerz – Wege aus dem Dilemma. Bern: Huber, p. 106, 1998.

Bonn, November 2007

Abstract (English version)

The promotion of physical activity is a great public health challenge. At least 17% of the world population over 15 years of age is sedentary, and between 31% and 51% perform insufficient levels of physical activity. The health benefits of regular physical activity are well known, particularly regarding the cardiovascular system. Despite this fact, the adoption and maintenance of active behavior is a difficult challenge. It has been suggested that low-intensity exercises may be the best way of engaging sedentary individuals in physical activity (Biddle & Mutrie, 2008). Health benefits, however, are only gained with higher intensity exercises. This approach is therefore based on two steps. During the first stage, physical activity should be easy in order for it to become a habit. Only then is exercise intensity increased so as to provide the necessary health benefits.

Aiming at engaging individuals in active behavior, a low-intensity exercise program was offered to employees of a German telecommunication company. The program consisted of 20 minute classes offered at the workplace, 3 time a week during a period of 12 weeks. Assessments were performed before the start of the intervention, immediately after its terminus and on a 6-months follow up period. A group of 53 individuals volunteered to participate. The individuals were randomly allocated to the experimental or to the control group. The main focus of the study was to verify whether the participants were able to adopt an active lifestyle or to enhance their practice of physical activity after the completion of the program. The hypothesis was that the intervention program would be specially effective for the less active or chronically inactive individuals.

The participants significantly increased their level of physical activity practice immediately after the intervention. This effect was verified in three different ways. First, the individuals increased from 2.6 days to 3.6 days a week the frequency they spent exercising. Second, they decreased in 43 minutes a day the time they spent in sitting positions. Finally, the intensity of physical activity practiced also increased (*i.e.* specific increases in moderate and vigorous activities were observed). In the long term (6 months after the end of the program), the participants continued to exercise significantly more (4.2 days a week) as compared to the pre-intervention levels.

Less active individuals profited more from the exercise classes as compared to the participants that were already active before the start of the program. They showed

higher increases in the frequency of physical activity performance (from 1.8 to 3.3 days a week), their self-motivation was positively correlated with the amount of exercising (r=0.79), and they practiced relatively higher levels of moderate and vigorous exercises six months after the completion of the intervention.

These results confirm that low-intensity exercises offered in the workplace are effective in promoting active behavior. The effects of the intervention were particularly beneficial for those individuals who were sedentary or low active before the start of the program. Further studies with larger population sizes and longer follow up assessments are required in order to verify the extent of the findings here reported.

Abstract (German version)

Gesundheitsförderung durch körperliche Aktivität ist eine Herausforderung für Public Health-Interventionen. 17% der Weltbevölkerung über 15 Jahren leidet unter Bewegungsmangel und 31 bis 51% bewegen sich körperlich zu wenig. Obgleich die Vorteile eines aktiven Lebensstils insbesondere im Hinblick auf ein Herz-/Kreislauftraining bestens bekannt sind, ist die Bindung an entsprechende Aktivitäten schwierig und oft erfolglos. Wissenschaftliche Untersuchungen deuten darauf hin, dass niedrig dosierte Aktivitäten von Personen, die überwiegend Tätigkeiten im Sitzen ausüben und/oder sehr wenig körperlich aktiv sind, leicht zu erreichen sind. Wenn jedoch auf Dauer ein gesundheitlicher Effekt erreicht werden soll, ist eine langsame, kontinuierliche und stufenweise Steigerung der Intensität erforderlich.

Ein solches niederschwelliges Bewegungsprogramm am Arbeitsplatz, das drei Monate lang dreimal wöchentlich mit einer Dauer von je 20 Minuten durchgeführt wurde, sollte bei den Teilnehmern der vorgestellten Studie zu einer höheren körperlichen Aktivität führen. 53 Mitarbeiter einer Deutschen Telekommunikations-Firma wurden randomisiert einer Interventions- und einer Kontroll-Gruppe zugeteilt. Die zu überprüfende Hypothese ging davon aus, dass Teilnehmer, die wenig körperlich aktiv waren, nach der Teilnahme am Programm einen aktiveren Lebensstil führen würden.

Als Ergebnis kann festgehalten werden, dass es bei den Teilnehmern zu einer signifikanten Steigerung der „Tage mit körperlicher Aktivität" kam (Gruppe x Zeit Interaktion $F(1,39)=4.25$, $p<=.05$ vor Untersuchung (T1)= 2.6 Tage/Woche; nach Untersuchung (T2)= 3.6 T/W). Dieses wurde durch die Reduzierung der „sitzenden Zeit" (Gruppe x Zeit Interaktion $F(1.37)= 8,67$, $p<=.001$; ca. 43 Min/Tag) und durch eine Zunahme von „mittleren Aktivitäten" und „intensiven Aktivitäten" bestätigt. Sechs Monate nach Beendigung des Programms (T4) waren die Teilnehmer immer noch aktiver als zu Beginn des Programms (Mittelwert körperlicher Aktivität 4,2 T/W).

Die zuvor wenig körperlich aktiven Teilnehmer haben aus dem Übungsprogramm mehr Nutzen gezogen als jene, die vorher schon "genügend aktiv" waren. Sie zeigten im Vergleich zu jenen eine höhere Zunahme an körperlicher Aktivität (T1= 1,8 T/W; T2= 3,3 T/W, $p<=.05$), ihre Selbstmotivation korrelierte signifikant mit der körperlichen Aktivität ($r=0,79$). Sechs Monate nach Beendigung des Programms zeigten sie eine höhere Zunahme an körperliche Aktivitäten von mittlerer und intensiver Intensität.

Die Ergebnisse bestätigten die Annahme, dass niederschwellige Bewegungsangebote am Arbeitsplatz zur Steigerung körperlicher Aktivitäten führen können. Dieses gilt insbesondere für zuvor wenig aktive Personen. Zur besseren Untermauerung dieser Aussagen sind allerdings noch weitere Untersuchungen mit einerseits größeren Stichproben und andererseits längeren Nacherhebungszeiten notwendig.

Curriculum Vitae

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PUBLICATIONS

2007	A Frohnweiler, B Jastrow, C Lechtenböhmer, **F Frigeri**, P Eckerstorfer, H Kaiser. EIBE- Entwicklung und Integration eines betrieblichen Eingliederungsmanagements *(EIBE- Development and Integration of a corporate return-to-work management system).* **Report**, Cologne, Germany.
1997	E Barbosa, F Borges, L Dias, G Fabris, **F Frigeri**, C Salmasso. LER em digitadores do Centro de Processamento de Dados do Banestado,

Londrina (Repetitive Strain Injuries (RSI) in typers of the Center for Data Processing of the Bank of Parana – Londrina). **Revista de Fisioterapia da Universidade de São Paulo**, 4(2):pp. 83-91.

1995 C Barbosa, C Sasaki, D Araujo, D Somesi, E Marussi, E Ricardi, **F Frigeri**, F Godoi, F Lauretti, G Godinho, J Moreira, K Fukushigue, L Silva, M Bilia, R Ramos, M Hauly, M Vannuchi. AIDS em uma comunidade de Londrina: população consciente ou desinformada? (AIDS in a community of Londrina: a conscious or an uninformed community?) **Revista SEMINA - Revista cultural e científica da Universidade Estadual de Londrina,** 16:pp. 53-58.

ABSTRACTS

2008 **F. Frigeri** and K. Schuele. Health promotion in the workplace by means of a low-intensity exercise program. **2nd International Congress on Physical Activity and Public Health.** April, Amsterdam, the Netherlands.

2001 A. Rodrigues, E. Christo, F. Terra and **F. Frigeri**. Análise Ergonômica dos Operadores de Caixas de supermercado (Ergonomic Analysis in Supermarket Checkout Operators). **XV Brazilian Congress of Physical Therapy**. CDRom. Sao Paulo.

1999 **F. Frigeri** and M. Vidal. Distúrbios Músculo-esqueléticos relacionados ao trabalho em uma Central de Atendimento ao Consumidor. (Work Related Muskleskeletal Disorders in a Call Center*)*. **ABERGO 99- Brazilian Ergonomic Association**. CDRom. Salvador, Bahia.

1997 E. Barbosa, F. Borges, L. Dias, G. Fabris, **F. Frigeri** and C. Salmasso. LER em digitadores do Centro de Processamento de Dados do Banestado, Londrina (RSI in typers in a Center for Data Processing of the Bank of Paraná). In: **V Brazilian Congress of Public Health, V Congress of Public Health of Sao Paulo – ABRASCO**, Águas de Lindóia.

1997 E. Barbosa, F. Borges, L. Dias, G. Fabris, **F. Frigeri** and C. Salmasso. LER em digitadores do Centro de Processamento de Dados do Banestado, Londrina (RSI in typers in a Center for Data Processing of the Bank of Paraná). In: **XII Brazilian Congress of Physical Therapy.** Sao Paulo.

FELLOWSHIPS

Apr/2008 European Commission (Commission Européenne) travel fellowship, Luxembourg.

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