

The importance of sport

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Abstract

Positive effects from sports are achieved primarily through physical activity, but secondary effects bring health benefits such as psychosocial and personal development and less alcohol consumption. Negative effects such as the risk of failure, injuries, eating disorders, and burnout, are also apparent. Because physical activity is increasingly conducted in an organized manner, sport's role in society has become increasingly important over the years, not only for the individual but also for public health. In this paper, we intend to describe sport's physiological and psychosocial health benefits, stemming both from physical activity and from sport participation per se. This narrative review summarizes research and presents health-related data from Swedish authorities. It is discussed that our daily lives are becoming less physically active, while organized exercise and training increases. Average energy intake is increasing, creating an energy surplus, and thus, we are seeing an increasing number of people who are overweight, which is a strong contributor to health problems. Physical activity and exercise have significant positive effects in preventing or alleviating mental illness, including depressive symptoms and anxiety- or stress-related disease. In conclusion, sports can be evolving, if personal capacities, social situation, and biological and psychological maturation are taken into account. Evidence suggests a dose-response relationship such that being active, even to a modest level, is superior to being inactive or sedentary. Recommendations for healthy sports are summarized.

Key words: Sport, quality of life, relative age effect, strength, exercise,

Introduction

Sport is a double-edged sword regarding effects on health. Positive effects are achieved primarily through physical activity, which is the main part of most sports. Many secondary effects of sport also bring health benefits, such as psychosocial development of both young [1] and old [2], personal development [3], later onset, and less consumption of alcohol [4]. Finally, those who play sports have a higher level of physical activity later in life [6], and through sport, knowledge of nutrition, exercise, and health can be developed [7]. Negative effects include the risk of failure leading to poor mental health, risk of injury, eating disorders, burnout, and exercise-induced gastrointestinal tract discomfort. In sport, there are unfortunately also reports of physical and psychological abuse [9]. Negative aspects are more common in elite-level sports, where there is a fine balance between maximum performance and negative health. A somewhat unexpected effect of sport participation is that people submitting to planned training in some cases perform less physical activity compared to those who are exercising without a set schedule.

spontaneous physical activity in the latter group [8]. Because physical activity is increasingly executed in an organized manner [5], sport's role in society has become increasingly important over the years, not only for the individual but also for public health. In this paper, we describe the health effects of sport from.

Definitions of Physical Activity, Exercise, Training, Sport, and Health

Definitions and terms are based on "Physical activity in the prevention and treatment of disease" World Health Organization (WHO) [12] and the US Department of Human Services. The definition of physical activity in FYSS is: "Physical activity is defined purely physiologically, as all body movement that increases energy use beyond resting levels". Health is defined according to the World Health Organization (WHO) as: a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" [9]. Physical activity can occur spontaneously (leisure/work/transport) or organized and be divided according to purpose: Physical exercise is aimed primarily at improving health and physical capacity. Physical training is aimed primarily at increasing the individual's maximum physical capacity and performance [2]. Physical inactivity is described as the absence of body movement, when energy consumption approximates resting levels. People who do not meet recommendations for physical activity are considered physically inactive and are sometimes called "sedentary". Sport can be

organized by age, sex, level of ambition, weight or other groupings [4]. Sport can also be spontaneous [7] and defined as a subset of exercises undertaken individually or as a part of a team, where participants have a defined goal. General recommendations for physical activity are found in Table 1, not considering everyday activities. One can meet the daily recommendations for physical activity by brief, high-intensity exercise, and remaining physically inactive for the rest of the day, thereby creating a “polarization” of physical activity: Having a high dose of conscious physical training, despite having a low energy expenditure in normal life due to high volumes of sedentary time. Polarization of physical activity may lead to increased risk of poor health despite meeting the recommendations for physical activity. During most of our lives, energy expenditure is greater in normal daily life than in sport, physical training, and exercise, with the exceptions of children and the elderly, where planned physical activity is more important [8].

Aerobic and Muscle-Strengthening Physical Activity

Physical activity is categorized according to FYSS as: (1) Aerobic physical activity and (2) muscle-strengthening physical activity. Physical activity in everyday life and exercise training is mainly an aerobic activity, where a majority of energy production occurs via oxygen-dependent pathways. Aerobic physical activity is the type of activity typically associated with stamina, fitness, and the biggest health benefits [6]. Muscle-strengthening physical activity is referred to in everyday language as “strength training” or “resistance training” and is a form of physical exercise/training that is primarily intended to maintain or improve various forms of muscle strength and increase or maintain muscle mass [5]. Sometimes, another category is defined: Muscle-enhancing physical activity, important for maintenance or improvement of coordination and balance, especially in the elderly [7]. According to these definitions, muscle-strengthening activities primarily involve the body’s anaerobic (without oxygen) energy systems, proportionally more as intensity increases.

Health Effects of Physical Activity and Training

Human biology requires a certain amount of physical activity to maintain good health and wellbeing. Biological adaption to life with less physical activity would take many generations. People living today have, more or less, the same requirements for physical activity as 40,000 years ago [12]. For an average man with a body weight of 70 kg, this corresponds to about 19 km daily walking in addition to everyday physical activity [2]. For most people, daily physical activity decreases, while planned, conscious exercise and training increases [5]. Unfortunately, average daily energy intake is increasing more than daily energy output, creating an energy surplus. This is one reason for the increasing number of overweight people, and a strong contributor to many health problems [4]. More sedentary living (not reaching recommended level of physical activity), combined with increased energy intake, impairs both physical and mental capabilities and increases the risk of disease. Despite this, Swedes (as an example) seemed to be as physically active and stressed but had better general health in 2015, compared to 2004. Compared to 2004–2007, the Swedish population in 2012–2015 reported better overall health (more county-dots are blue) and less fatigue (smaller county-dots) with similar level of physical activity (~65% indicated at least 30 min daily physical activity) and stress (~13% were stressed).

How does the Body Adapt to Physical Activity and Training?

Adaption to physical activity and training is a complex physiological process, but may, in the context of this paper, be simplified by a fundamental basic principle:” The general adaptation syndrome (GAS)”. This principle assumes that physical activity disturbs the body’s physiological balance, which the body then seeks to restore, all in a dose-related response relationship. The overload principle states that if exercise intensity is too low, overload is not reached to induce desired physiological adaptations, whereas an intensity too high will result in fatigue and possibly overtraining. Thus, for adaptation to occur, greater than normal stress must be induced, interspersed with sufficient recovery periods for restoration of physiological balance [3]. During and immediately after physical exercise/training, functions of affected tissues and systems are impaired, manifested as temporarily decreased performance. You feel tired. In order to gradually improve performance capacity, repeated cycles of adequate overload and recovery are required [4]. In practice, positive effects can be seen after a relatively short period of a few weeks, but more substantial improvements if the training is maintained for a longer period. As a rule of thumb, it is assumed that all people can adapt to physical activity and exercise, but the degree of adaptation depends on many factors, including age, heredity, the environment, and diet [1]. The hereditary factor (genetics) may be the most critical for adaptation [3]. The degree of adaptation also depends on how the person in question trained

previously; a well-trained athlete usually does not have the same relative improvement as an untrained one. Even if training is thought to be specific to mode, intensity, and duration, there are some overlaps. For example, it has been found that strength training in some individuals contributes to a relatively large positive impact on health and endurance, effects previously associated primarily with aerobic exercise. The overload principle may, if applied too vigorously in relation to a person's individual adaptation ability, have detrimental effects, including reduced performance, injury, overtraining, and disease [10]. Training is a commodity that must be renewed; otherwise, you gradually lose achieved performance improvements [2], although some capacities, such as muscle memory, seem to persist for life.

General recommendations for health may be stated, but individual predispositions make general training schedules for specific performance effects unpredictable. All exercise training should be adjusted to individual purposes, goals, and circumstances.

Effects on Physical Health

The effects of physical activity and exercise are both acute (during and immediately after) and long-lasting. Effects remaining after a long period of regular physical activity have far-reaching consequences for health and are described below. For example, some muscle enzymes' activity can be quickly increased by physical exercise/training but just as quickly be lost when idle. Other changes remain for months or years even if training ends—for instance, increased number and size of muscle fibers and blood vessels [11]. Good health, therefore, requires physical activity to be performed with both progression and continuity. Most of the conducted physical exercise/training is a combination of both aerobic and muscle strengthening exercise, and it can be difficult to distinguish between their health effects. To describe ill-health, indicators of life expectancy, disease incidence (number), and prevalence (how often) are used. In describing the relationship between physical activity and falling ill with certain diseases, the dose–response relationship, the effect size (the risk reduction that is shown in studies), and the recommended type and dose of physical activity are considered. It shows the relative effects of regular physical activity on the risk of various diseases (US Department of Human Services, 2009). The greatest health gains are for people who move from completely sedentary to moderately active lifestyles, with health effects seen before measurable improvements in physical performance. Previously, most scientific studies collected data only on aerobic physical activity. However, resistance exercise also shows promising health (mental and physical) and disease-prevention effects [11].

Aerobic physical activity has been shown to benefit weight maintenance after prior weight loss, reduce the risk of metabolic syndrome, normalize blood lipids, and help with cancer/cancer-related side effects, while effects on chronic pain are not as clear [2]. Muscle-strengthening physical activity has, in contrast to aerobic exercise, been shown to reduce muscle atrophy [1], risk of falling [7], and osteoporosis [7] in the elderly. Among the elderly, both men and women adapt positively to strength training. Strength training also prevents obesity, enhances cognitive performance if done alongside aerobic exercise, counteracts the development of neurodegenerative diseases, reduces the risk of metabolic syndrome, counteracts cancer/cancer-related side effects, reduces pain and disability in joint diseases, and enhances bone density. The risk of falling increases markedly with age and is partly a result of reduced muscle mass, and reduced coordination and balance. A strong correlation between physical performance, reduced risk of falls, and enhanced quality of life is therefore, not surprisingly, found in older people. Deterioration in muscle strength, but not muscle mass, increases the risk of premature death but can be counteracted by exercise as a dose–response relationship describes the strength improvement in the elderly. Recommendations state high-intensity strength training (6–8 repetitions at 80% of 1-repetition maximum) as most effective [11]. Muscle strengthening physical activity for better health is recommended as a complement to aerobic physical activity. Amongst the elderly, vibration training can be an alternative to increase strength.

Effects on Mental Health

Mental illness is a global problem affecting millions of people worldwide [7]. Headache, stress, insomnia, fatigue, and anxiety are all measures of mental ill health. The term “ill health” constitutes a collection of several mental health problems and symptoms with various levels of seriousness. Studies have compared expected health benefits from regular physical activity for improvement of mental health with other treatments, for example, medication. Most recent studies show that physical activity and exercise used as a primary, or secondary, processing method have significant positive effects in preventing or alleviating depressive symptoms and have an antidepressant effect in people with neurological diseases. Training and exercise improve the quality of life and coping with stress and strengthen self-esteem and social skills. Training and exercise also lessen anxiety in people who are diagnosed with an anxiety- or stress-related disease [6], improve vocabulary learning, memory, and creative

thinking. The same Swedish data as used in Figure 1 show that between the years 2004–2007 and 2012–2015 anxiety, worry, and insomnia decreased but were not obviously correlated to the slightly increased level of physical activity in the population during the same period. Thus, in a multifactorial context, the importance of physical exercise alone cannot be demonstrated in this dataset. Some of the suggested physiological explanations for improved mental health with physical activity and exercise are greater perfusion and increased brain volume, increased volume of the hippocampus [10], and the anti-inflammatory effects of physical activity, reducing brain inflammation in neurological diseases. Physical exercise may also mediate resilience to stress-induced depression via skeletal muscle peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1 α), enhancing kynurenine conversion to kynurenine acid, which in turn protects the brain and reduces the risk for stress-induced depression. Further, increased release of growth factors, endorphins, and signaling molecules are other exercise-induced enhancers of mental health.

How Sport Affects Health

Sport's main purposes are to promote physical activity and improve motor skills for health and performance and psychosocial development. Participants also gain a chance to be part of a community, develop new social circles, and create social norms and attitudes. In healthy individuals, and patients with mental illness, sport participation has been shown to provide individuals with a sense of meaning, identity, and belonging. Whether the sport movement exists or not, training and competition including physical activity will happen. Sport's added values, in addition to the health benefits of physical activity, are therefore of interest. Some argue that it is doubtful, or at least not confirmed, that health development can come from sport, while others believe that healthy sport is something other than health, reviewed in depth by Coakley. In a sporting context, health is defined as subjective (e.g., one feels good), biological (e.g., not being sick), functional (e.g., to perform), and social (e.g., to collaborate). Holt argued that the environment for positive development in young people is distinctly different from an environment for performance, as the latter is based on being measured and assessed. That said, certain skills (goal setting, leadership, etc.) can be transferred from a sporting environment to other areas of life. The best way to transfer these abilities is, at the moment, unclear. Having the goal to win at all costs can be detrimental to health. This is especially true for children and adolescents, as early engagement in elite sports increases the risk of injury, promotes one-dimensional functional development, leads to overtraining, creates distorted social norms, risks psychosocial disorders, and has the risk of physical and psychological abuse. Of great importance, therefore, is sport's goal of healthy performance development, starting at an early age. For older people, a strong motivating factor to conduct physical activity is sports club membership. One can summarize these findings by stating sport's utility at the transition between different stages of the life; from youth to adulthood and from adulthood to old age. There, sports can be a resource for good physical and mental health [10].

Today, a higher proportion of the population, compared to 50 years ago, is engaged in organized sports, and to a lesser extent performs spontaneous sports, something that Angstrom showed in 2004 and is confirmed by data from The Swedish Sports Confederation (www.rf.se). Of the surveyed individuals in 2001, 50%–60% of children and young people said they were active in a sports club. The trend has continued showing similar progression to 2011, with up to 70% of school students playing sports in a club. Furthermore, the study shows that those active in sport clubs also spontaneously do more sports. Similar data from the years 2007–2018, compiled from open sources at The Swedish Sports Confederation, confirm the trend with an even higher share of youths participating in organized sports, compared to 1968 and 2001.

Taking part in sports can be an important motivator for physical activity for older people. With aging, both participation in sports and physical activity in everyday life decreases. At the same time, the number of people who are physically active both in leisure and in organized sports increases (The Public Health Agency of Sweden 2017; www.folkhalsomyndigheten.se). Consequently, among elderly people, a greater proportion of the physical activity occurs within the context of sport. Together, research shows that organized sports, in clubs or companies, are more important for people's overall physical activity than ever before. Groups that are usually less physically active can be motivated through sport—for example, elderly men in sport supporters' clubs, people in rural areas, migrants, and people with alternative physical and mental functions. No matter how you get your sporting interest, it is important to establish a physical foundation at an early age to live in good health when you get older. A greater sport

habitus at age 15 results in higher physical activity at 53 years of age. Early training and exposure to various forms of sports are therefore of great importance. Participation creates an identity, setting the stage for a high degree of physical activity later in life [12].

Sport's Effects on the Health of Children and Young People

The effects of participation in organized sports for children and young people are directly linked to physical activity, with long term secondary effects; an active lifestyle at a young age fosters a more active lifestyle as an adult. As many diseases that are positively affected by physical activity/exercise appear later in life, continued participation in sport as an adult will reduce morbidity and mortality. It must be emphasized that good physical and mental health of children and young people participating in sport requires knowledge and organization based on everyone's participation. Early specialization counteracts, in all regards, both health and performance development [13].

Conclusion

Physical activity can occur spontaneously (leisure/work/transport) or organized and be divided according to purpose: Physical exercise is aimed primarily at improving health and physical capacity. Physical training is aimed primarily at increasing the individual's maximum physical capacity and performance. Physical inactivity is described as the absence of body movement, when energy consumption approximates resting levels. People who do not meet recommendations for physical activity are considered physically inactive and are sometimes called "sedentary". Sport can be organized by age, sex, level of ambition, weight or other groupings. Sport can also be spontaneous and defined as a subset of exercises undertaken individually or as a part of a team, where participants have a defined goal. General recommendations for physical activity are found, not considering everyday activities. One can meet the daily recommendations for physical activity by brief, high-intensity exercise, and remaining physically inactive for the rest of the day, thereby creating a "polarization" of physical activity: Having a high dose of conscious physical training, despite having a low energy expenditure in normal life due to high volumes of sedentary time. Polarization of physical activity may lead to increased risk of poor health despite meeting the recommendations for physical activity. During most of our lives, energy expenditure is greater in normal daily life than in sport, physical training, and exercise, with the exceptions of children and the elderly, where planned physical activity is more important.

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