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DOES PHYSICAL ACTIVITY AT A YOUNG AGE REALLY MEAN A HEALTHIER ADULTHOOD AND OLD AGE?

Analysis

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ABSTRACT

Physical education in schools endeavours to develop life patterns through encouraging regular physical activity and sports in childhood and youth, so as to establish a life-long goal that will reflect in an active, healthy lifestyle and consequently in a higher quality of life also in adulthood and old age. This, however, also raises an important question: Are these goals in fact achieved?

The purpose of this paper is based on a review of available, particularly longitudinal, studies and aims at determining the extent of the impact of an active lifestyle and an appropriate level of physical fitness in youth on the health, physical activity and lifestyle in later stages of life.

Despite the great interest in academic research of the issue, this question has not yet obtained a completely clear answer. The overall conclusion of most significant longitudinal studies around the world is that a physically active lifestyle developed during childhood and adolescence generally transfers to adulthood; however, the links between practising sports / doing physical activity during childhood/adolescence and adulthood are low (r = 0.09 to 0.25). The relationship between the individual stages of life decreases with an increase of the age interval under observation. On the other hand, more advanced training programmes for young people have a greater impact on the physical activity and health status of the same people in later periods of life.

Many more extensive longitudinal studies will be required in order to clarify this issue. Nevertheless, a basic finding is clear: only regular and systematic physical activity both in youth and later periods can contribute to better fitness and better health.

Keywords: *physical activity, health, lifestyle, youth, adulthood*

ALI TELESNA AKTIVNOST V MLADOSTI RES POMENI BOLJ ZDRAVO ODRASLOST IN STAROST?

Analiza

POVZETEK

Med najpomembnejšimi cilji športne vzgoje je z redno telesno in športno dejavnostjo razviti take vzorce življenja otrok in mladine, da bodo dejavnost in kakovost življenja ter zdrav življenjski slog njihovo vodilo tudi v odraslosti in starosti. Ob tem pa se postavlja pomembno vprašanje: Ali te cilje v resnici tudi dosegamo?

Namen prispevka je na osnovi pregleda dostopnih opravljenih, zlasti longitudinalnih, študij ugotoviti, kakšen vpliv imata aktiven življenjski slog in ustrezna raven telesne pripravljenosti mladih na zdravje, telesno aktivnost in življenjski slog v kasnejših obdobjih življenja.

Kljub velikemu znanstvenemu interesu za proučevanje te problematike danes na to vprašanje še nimamo povsem jasnega odgovora. Splošna ugotovitev najpomembnejših longitudinalnih študij v svetu je, da se športno aktiven življenjski slog, razvit v otroštvu in mladostništvu, prenaša v odraslost, vendar so povezave med športno/telesno aktivnostjo v otroštvu/adolescenci in odraslem obdobju nizke (r = 0,09–0,25). Povezanost med posameznimi starostnimi obdobji se manjša s povečevanjem opazovanega starostnega intervala. Zahtevnejši vadbeni programi mladih pa imajo večji vpliv na telesno aktivnost in zdravje v kasnejših obdobjih življenja.

Za razjasnitev tega problema bo potrebno še več obsežnih longitudinalnih študij, a osnovno spoznanje je jasno: le redna in sistematična telesna aktivnost tako v mladosti kot kasnejših obdobjih lahko pripomore k boljši telesni pripravljenosti in boljšemu zdravju.

Ključne besede: *telesna aktivnost, zdravje, življenjski slog, mladostniki, odrasli*

INTRODUCTION

Physical activity holds an irreplaceable role in a person's lifecycle. It is an essential factor, essential for a normal biological, social and mental development and for the general health of young people; in mature years and old age, regular and suitably chosen physical activity or exercise preserves a person's vitality, it protects him/her against diseases and contributes to a higher quality of life.

Following the recommendations of the World Health Organization (WHO) (Roberts, Tynjala & Komkov, 2004) and the British Institute for Health Education - UKHEA (Biddle, Sallis & Cavill, 1998), young people should practise moderate to intense physical activity for at least 60 minutes per day.

The WHO report of 2004 (Young people's health in context – Health Behaviour in School-eged Children (HBSC) study: International report from the 2001/2002 survey; Mulvihill, Nemeth & Vereecken, 2004) shows that the recommended extent of physical activity is only obtained by one in every two 11-year-old boys, 41% of 13- year-old boys and only 33% of 15-year-old boys; with girls, these numbers amount to one in three 11-year-olds, one in four 13-year-olds and one in five 15-year-old girls. Their physical activity of girls decreases by about 50% between the ages of nine and fifteen. The situation only worsens in high school. Only 15% of girls remain adequately physically active.

Considering such data, it is not surprising that young people today are physically less able compared with young people just some decades ago – their level of fitness is generally worse. For instance, the results obtained in aerobic capacity tests (or more precisely, the results from a 600m running competition) undertaken by children and youth in Slovenia since 1990, have been continuously falling by 0.56% each year (Strel, Kovač, Jurak, Starc, Bučar-Pajek & Leskošek, 2007).

The significance of physical activity and corresponding physical fitness in children and young people would undoubtedly be lower if poor fitness and its common side-effect of an unhealthy body-mass index didn't lead to medical conditions and shorter lives. A combination of inactivity, an unhealthy diet and low physical capacity of children and youth leads to an unhealthy life and illness. Factors of metabolic syndrome (MS) and of cardio-vascular diseases, diabetes, etc. have already become pediatric problems. Children who are not sufficiently physically active already have a much greater chance of encountering problems with their cardiovascular condition in their teens (Eriksson, Taimela & Koivisto, 1997; Erikseen, 2001; McMurray, Bangdiwala, Harrell & Amorim, 2008). Already in childhood, a large amount of subcutaneous fat and poorer physical ability are associated with higher blood pressure, insulin resistance, poor blood lipid profile, poor left ventricular geometry and poor pumping function of the left ventricle (Thomas, Baker & Davies, 2003; Vaccaro & Mahon, 1989). Many researchers have reported that at least one MS factor is present in more than half of the children in the developed world (McGill, McMahan, Herderick, Malcom, Tracy & Strong, 2000; Huang, Ball & Franks, 2007).

The most important lever for the promotion of physical activity is physical education (PE). Therefore, PE plays a very important role also in terms of public health (Salis & McKenzie, 1991; Haywood, 1991; Pate, Corbin, Simons-Morton & Ross, 1987). One of the primary goals of physical education in schools is to develop life patterns in youngsters and children through encouraging regular physical activity and sports at an early age, so as to form life-long habits that will reflect in an active, healthy lifestyle and consequently in a higher quality of life also in adulthood and old age.

PURPOSE OF THE PAPER

In terms of assessment and evaluation of the effectiveness of physical education in achieving this objective, the following logical question is raised: do an active lifestyle and an appropriate level of fitness in young people have an impact on their health, physical activity and lifestyle in later periods?

This question has not yet been clearly and directly answered to this day. The only empirical evidence obtained so far consists in the following two facts:

a) Physical activity and physical ability in young people are associated with different parameters of their health condition (Terry Huang, Ball & Franks, 2007; Eriksson, Taima & Koivisto, 1997; Rizzo, Ruiz, Hurtig-Wennlöf, Ortega & Sjöström, 2007, Fox, 2004; Van Veldhoven et al., 2001, Welsh, Kemp & Roberts, 2005, Houston et al., 2002);

b) Physical activity and physical ability in adults are linked to their health condition (McMurray, Harrell & Amorim, 2008; Souza, Cardoso, Yasbek & Faintuch, 2004; Boreham & Riddoch, 2001).

Therefore, the purpose of this paper is to determine whether physical activity of children and young people has a direct impact on their physical activity and physical fitness and health in later periods of life and how strong this impact is, based on the analysis of the results of the available studies.

METHODOLOGICAL APPROACH

We tried to obtain an answer to this question on the basis of the following analyses of the results of academic research:

- analysis of the results of studies on the transmission of various health risk factors from childhood/adolescence to adulthood
- analysis of the effects of physical activity in childhood/adolescence on the lifestyle and health in adulthood,
- analysis of the impact of various programmes, content and complexity of physical activity in youth on the lifestyle and health in adulthood,
- analysis of the effects of hereditary and environmental influences on the lifestyle and health in adulthood.

Over 130 academic papers were collected for the purpose of the study. The analyses are based on longitudinal studies that have been conducted over the past two decades. We mainly selected large national longitudinal studies that were published in high profile and influential scientific journals.

PRESENTATION OF THE STUDIES AND THEIR FINDINGS

Analysis of the results of studies on the transmission of various health risk factors from childhood/adolescence to adulthood

Metabolic syndrome and related diseases. MS involves different risk factors for the development of many chronic diseases such as cardiovascular diseases (CVD), type 2 diabetes, liver or kidney conditions and certain cancers (Terry, Huang, Ball & Franks, 2007; Bitsori & Kafatos, 2005; Grundy, 2005). In medicine, MS is defined by the presence of three or more of these risk factors (Terry Huang, Ball & Franks, 2007). Individual factors are tightly related to each other and have a strong synergistic effect.

Individual MS factors differ in their natures during various periods of human life. Results of European and Canadian longitudinal studies (Andersen, Hasselstrom, Gronfeldt, Hansen & Karsten, 2004; Katzmarkzy, Perusse, Malina, Bergeron, Despres & Bouchard, 2001) indicate that the relationship between the presences of individual MS factors through different time periods is medium (r = 0.40 to 0.60). Most pronounced is the transfer of problems with excessive body weight, the amount of adipose tissue (r = 0.70), hypertension (r = 0.40-0.54) and reduced HDL-cholesterol (r = 0 0.56 to 0.58) from adolescence to early adulthood.

Osteoporosis. Osteoporosis is a metabolic bone disease characterized by the reduction in volumetric bone density and micro-architectural disorders of bone tissue leading to enhanced bone fragility and consequent increase in the risk of fracture (Ralston, 1997; Duraković, 2003). One out of three women and one in twelve men aged over 50 in the developed world suffer from osteoporosis (Biddle, Gorely, Marshall, Murdey & Cameron, 2004).

We now know that an increase in the maximum bone density achieved at a young age means a longer period of stronger, healthier bones (Zanker, Gannon, Cooke, Gee, Oldroyd & Truscott, 2003; Torstveit & Sundgot-Borgen, 2000). Childhood and adolescence are therefore periods when young people can do the most for the health of their bones in later stages of life with an appropriate diet and sufficient physical activity.

Physical exercise is especially important in the period of accelerated growth. Due to high levels of growth hormone and other factors, around a quarter of the final (adult) bone mass is accumulated (Bailey, 1997) during this period that lasts for about four years (± two years depending on the time of peak height velocity (PHV), which is normally at 12.5 years of age for girls and at 14 for boys (Rowland, 1996)).

The only two solutions recognised as relevant and important preventive (and curative) strategies in the fight to improve the health of people in their youth and later stages of life, are a suitable diet and sufficient physical activity in childhood, adolescence and of course, throughout all later stages of life.

Analysis of the effects of physical activity in childhood/adolescence on lifestyle and health in adulthood

Studies that looked at the long-term permanence of physical activity and physical fitness and at whether these are transmitted from childhood to adulthood are not great in number and show very different results. Some show a very positive influence – others only little or no influence at all. In some cases, it has even been shown that physical activity in childhood can have a negative impact on physical activity in later stages of life.

For greater clarity, I decided to present the results of different studies in three subsections, according to the extent of the effect that they acknowledge.

Effects of physical activity in youth have largely positive effects on physical activity and health in later periods of life. Numerous studies show highly positive effects of physical activity, physical fitness and health status in youth on the lifestyle and health status in later periods of life. Among these we find the Bogalusa Heart Study (Nicklas, Duvillard & Berenson, 2002), which included 1,169 people who were first tested at ages 5 and 14 years, and then again at the ages of 20 and 29.

Based on the measured values of concentrations of "bad" low-density cholesterol (LDL-C), children were classified into three groups: i) an acceptable risk of <2.84 mmol/l (<110 mg/dl); ii) on the risk margin 2.84 to 3.34 (110-129 mg/dl); iii) high risk> 3.35 (> 130 mg/dl).

The prevalence of obesity in adulthood was significantly higher in individuals who had been classified in the high-risk group in childhood (39%), compared to those from the acceptable risk group (24%). The study showed that the concentrations of lipids and lipoproteins present in the blood of an individual during childhood are well maintained also in early adulthood (high traceability). A modified level of low-density cholesterol (LDL-C) in childhood is maintained in adulthood, causing an increased incidence of dyslipidemia, obesity and high blood pressure.

Similar, very positive effects of physical fitness in youth on the lifestyle and health in later periods are also shown by Dennison, Strus, Mellitis and Charney (1988). A group of physically active 25-year-old American men had significantly better physical abilities at the age of 10-11 and in adolescence (between 15 and 18) compared to a group of physically inactive young men. The authors also found that boys who had been ranked below 20 percentile in their performance in running on 600 yards, were much more likely to become physically less active in early adulthood. This clearly shows that individuals who are significantly physically active in childhood are more likely to be physically active in adulthood as well.

The Swedish longitudinal study (Glenmark, Hedberg & Jansson, 1994) also shows that about 25-30% of the variance in the volume of physical activity in leisure time in 27-year-old adults is explained by the aerobic capacity (VO2max) of these people at 16 years of age. Physical capacity (aerobic endurance, muscle strength, physical activity and assessment in physical education) of 16-year-old adolescents can explain 82% of the variance in the time spent on physical activity in 27-year-old women and 47% of the variance in the time spent on physical activity in men of the same age.

A similar positive effect of physical activity and physical fitness in youth on health parameters during middle age is also shown in "*A 25-Year Follow-Up Study*" (Mikkelsson, Kaprio, Kautiainen, Nuppponen, Tikkanen & Kujala, 2004). The most important message of this study is that a high endurance for running (the result of running a distance of 2000 metres) at a young age resulted in a much lower risk of high blood pressure in adulthood.

Studies also show that an active sporting life at a young age does not automatically mean an active life and good health in later periods of life. This remains the key message today in a widely referential longitudinal Harvard study (Paffenbarger, Hyde, Hsieh & Wing, 1986), which researched the effect of physical exercise during student years on the presence of cardiovascular disease and on mortality in subsequent periods. The students were divided into three groups in relation to their physical activity: i) a group of individuals who were involved in competition sports and took part in regular training processes, ii) a group of individuals who were involved in a variety of sport and recreational activities at least five hours per week, iii) a group of individuals who were athletically active for less than five hours per week (often zero).

These groups did not differ from each other in terms of the incidence of cardiovascular disease later in life. The study showed that those subjects who were the most physically active as students but did not exercise regularly after college had the same probability of developing cardiovascular diseases as those students who had never been physically active. Also, the study showed that physical activity had the same health benefits for those subjects who only became physically active later in life as for those who had been active throughout the observation period.

The main message of the study is that the effects of physical exercise on cardiovascular and respiratory functions are short-term and that they wear off after physical activity is stopped. How quickly this happens is not clearly known.

Another highly referential study, *the Amsterdam longitudinal study* (Twisk, Kemper & Van Mechelen, 2002), revealed no significant relationship between physical activity and state of fitness in adolescence and risk factors for cardiovascular disease in adulthood.

The aim of the researchers was to determine the relationship between physical activity and aerobic capacity (VO2max) in young people during adolescence (between 13

and 16 years of age) and risk factors for cardiovascular disease in the same people at the age of 32. The measured factors included blood lipid levels (total cholesterol, high density cholesterol, the relationship between them), systolic and diastolic blood pressure, indicators of body fat and subcutaneous fat distribution (four body folds).

The extent of physical activity during adolescence was not associated with a good health status of the same people aged 32; and a negative correlation was found between VO2max at a young age and some parameters of health status (subcutaneous fat and total cholesterol in the blood) in adulthood. It has been shown that a reduction in physical activity during the period from adolescence to adulthood is associated with unhealthy levels of fat in the blood. The authors conclude that a reduced level of physical activity had a more negative impact on risk factors for cardiovascular disease than a moderate but constant physical activity measured in the period.

The results of the *Northeran Ireland Young Hearts Study* (Gallagher et al., 2002), Danish Youth and Sports Study (Hasselstrem, Hansen, Froberg & Andersen, 2002) and Leuven Longitudinal Study on Lifestyle, Fitness and Health (Lefevre et al., 2002) showed a low but statistically significant positive relationship between physical fitness in adolescence and some parameters of metabolic syndrome (the ratio of total cholesterol, high-density cholesterol, and the amount of subcutaneous fat and/or risk factors for cardiovascular disease (CVD) as a whole) in adulthood (between the ages of 22 and 40). Researchers have not been able to prove a link between the extent of physical activity in adolescence and risk factors for CVD in adulthood.

Danish researchers (Hasselstrem et al., 2002) also found that a change in aerobic capacity (VO2max) is the best predictor of risk factors for CVD (especially for men). Reduction in VO2max is accompanied by an increase in the number of risk factors for CVD, but these vary greatly between different groups of young people. Many young people who attended professional trade schools in adolescence later became physically inactive. On average, their VO2max decreased by 19 per cent, which is much more compared to only four per cent of reduction in VO2max observed in subjects who had attended grammar school.

The effects of exercise at an early age on the physical activity in adulthood can also be negative. Taylor, Blair, Cunnings, Wun and Malina (1999) found a negative effect of physical activity during childhood and adolescence on the extent of physical activity in adulthood.

Their study included 105 middle-aged men (aged 32-60). Based on questionnaires completed retrospectively, the authors assessed the physical activity and health status of the subjects in childhood and adolescence. The subjects were also subjected to a stress test on the treadmill. The results showed that the frequency of physical activity during childhood and adolescence was inversely proportional to the subjects' current physical activity (activity in adulthood). The authors conclude that excessive and vigorous physical activity during adolescence, especially when it is a result of forcing children to exercise by parents, can also have negative effects on the motivation for physical activity in later stages of life.

Analysis of the impact of various programmes, content and complexity of physical activity in youth on the lifestyle and health in adulthood

More demanding and comprehensive programmes are usually more successful in creating a healthy lifestyle. In presenting the results of some studies I want to answer the question 'What impact on physical activity and health in adulthood and old age do school physical education programmes and competitive sports programmes in childhood and adolescence have?'

The results of the *Canadian longitudinal research* (Trudeau, Laurencelle, Tremblay, Rajic, & Shephard, 1998) clearly confirm the importance of large-scale sporting activities in creating a lasting healthy and active lifestyle.

The purpose of the study was to determine the effect of a daily (five times per week) programme of physical education on physical activity and attitudes towards physical activity in adulthood (20 years later). They compared an experimental group (N = 147) who for six years, throughout their primary school years, had five hours of physical education per week (in the 1970s), and a control group (N = 720). The aim of the programme of the experimental group, which was implemented throughout the school years, was to maximise the activities of children during the hours of PE with a view to increasing their aerobic and muscular performance. Activities were carefully staged according to the motor development of children and included some athletic sports, the basics of many team sports, gymnastics, swimming, body expression and various outdoor activities. The PE programme for children in the control group was normal (40 minutes per week under the guidance of their local teacher).

The programme in which the experimental group was involved was proven to increase the total time spent doing physical activity and consequently increased the aerobic power and muscular endurance of the children. Twenty years later, those women who had participated in the experiment as young girls were more physically active; while significantly fewer of the men involved in the programme smoked (11.3% of smokers in the experimental group compared with 30.8% of smokers in the control group). However, the researchers did not find any significant differences between the experimental and control groups in their attitudes to physical exercise.

Another interesting finding confirming that physical activity during childhood and adolescence is an important factor of physical activity in adulthood is presented in the results of a study (Pihl, Matsin & Jürimäe, 2002) which claims that 60% of physical education teachers maintain an active, healthy lifestyle in old age, which is a much higher percentage compared to that of teachers of other subjects. It is interesting that as many as 70% of physical education teachers took part in competitive sports in their youth, compared with only 6% of teachers of other subjects.

The results of some other studies show that larger and more complex programmes for children and youths (school athletic programmes and competitive sports-oriented programmes, etc.) leave deeper and more lasting effects and thus have a greater impact on the activity in later stages of life. In the continuation, I present some supporting examples.

In the *CORDIS Study* (Kraut, Melamed, Gofer & Froom, 2003), which was based on a sample of 3,687 adult industrial workers aged 65-84, the authors researched the impact of organised sports activities at a young age to later physical activity in leisure time. It concluded that extra-curricular sports and various physical activities organised during school years (e.g. training in a sports club) had a significant impact on the level of physical activity in adulthood.

There have been other studies carried out that confirm the fact that participation in competitive sports during adolescence (10 to 19 years of age) is the most important or at least a very important predictor of physical activity in adulthood and mature years (Barnekow & Muijen, 2009; Folgeholm, Sarna & Kaprio, 1999, Glenmark et al., 1994; Telama, Yang, Laaksao & Viikari, 1997; Hirvensalo, Lintunen & Rantanen, 2000).

Finnish researchers (Kujala, Kaprio, Taima & Sarna, 1994) found significant differences between the average population and certain groups of former Finnish top athletes: i) athletes who had been involved in endurance sports (running and cross-country skiing), ii) athletes who had engaged in team sports (hockey, football, basketball), iii) athletes who had been involved in combat sports (boxing, judo). Athletes who had practised aerobic endurance disciplines were showing significantly less expressed risk factors for cardiovascular disease compared with people in the control group and with other athletes; they sought medical care less frequently and were significantly less likely to receive hospital care for heart disease and cardiovascular and respiratory diseases (Table 1). On the other hand, injuries and damage to the locomotor system (chronic damage to knees, hips and spine) were present in endurance athletes in a larger extent than what was the average for the control group. The concern for a healthy lifestyle (regular sporting activity, a healthy diet, lower alcohol and cigarettes consumption) also proved much higher in former endurance athletes than people in the control group (Folgeholm et al., 1994). The generally healthier lifestyle of former top endurance athletes was also reflected in significantly longer life expectancy (Sarna, Sahi, Koskenvuo & Kaprio, 1993) (Table 2).

Table 1: A comparison of the presence of risk factors for cardiovascular disease in athletes of various disciplines and the control group (Kujala, Kaprio, Sarna & Taimela, 1994; Folgeholm et al., 1994).

	ITM > 30	Type 2 diabetes	High blood pressure	Ischaemic heart disease
The control group	12.3	6.7	28.6	19.4
Athletes in total	11.6	4.9*	23.3*	12.7*
Endurance athletes	2.3*	1.7*	20*	9.1*
Runners in the long run	0.0	1.9*	13.6*	5.8*
Nordic skiers	5.6	1.4*	29.2	13.9*
Team sports players and athletes	6.6*	3.0*	22.4*	10.8*
Football	5.0*	2.5*	22.6	11.3*
Hockey	3.4	3.6	20.5	9.8
Basketball	4.5	0.0 *	14.7*	5.9
Athletes	5.6*	3.7*	24.6	12.0*
Athletes practising combat sports	22.8	9.0	26.0	16.9*
Boxing	17.8	11.8	27.2	15.4
Wrestling	23.0	8.5	29.1	19, 9
Weightlifting	28.4	10.4	25.4	22.4
Athletes-weight throwers	25.5	5.1	20.2	11.1*

Legend: BMI = body mass index

Table 2: Life span of athletes of various kinds (Sarna, Sahi, Koskenvuo & Kaprio, 1993).

	Lifetime (years)
Control group	69.9
Endurance athletes	
Long-distance runners	76.8
Nordic skiers	75.0
Sports games players and athletes	
Football	72.5
Hockey	75.7
Basketball	70.1
Athletics	74.5
Athletes practising combat sports	
Boxing	69.8
Wrestling	72.3
Weightlifting	70.0
Athletes-weight throwers	72.6

Research also shows (Sallis & McKenzie, 1991; Cohen, Brownewll & Felix, 1990) that certain sport and physical activity programmes have a more significant impact on the sporting habits and health of adults than others. Both Sallis and McKenzie (1991) note that adolescent activity in some life-long aerobic sports activities such as swimming, jogging and cross-country skiing, has a greater impact on sports and physical activity habits of adults than group sports.

Analysis of heritable and environmental influences on lifestyle and health in adulthood

The general health condition and a healthy lifestyle in adulthood also depend on genetic factors and on the effects of the family environment. A study (Simonen, Videman, Kaprio, Levälahti & Battié, 2003) assessed the physical activity of 117 pairs of identical twins from their 18th year of age. The most important influence on the attitude towards physical activity in adulthood was discovered in hereditary factors, combined with family lifestyle and followed by participation in competitive sports in adolescence (between the ages of 12 and 18).

Both factors together explained 69% of variance in individual differences in practising sports and recreational activities in adulthood; about one-third of the variance is explained by the authors with other factors, such as knowledge and understanding of healthy lifestyle factors, personality traits, etc.

DISCUSSION AND CONCLUSIONS

Perhaps the first and most important message of this paper is that, despite the great interest in the scientific study of the issue, the question whether an active lifestyle and associated good health that is developed during childhood and adolescence is transferred to adulthood and old age does not yet have a completely clear answer.

The results show that the links between sport/physical activity during childhood/adolescence and adulthood are low ($r = 0.09$ to 0.25) and that they decrease with increasing the range of the observation interval.

Given the basic rules of sports activities, which claim that only regular and appropriately challenging exercise can have a positive effect on physical fitness and health of individuals, this is logical and expected. It is also known that the biological effects of exercise (biochemical, physiological, neuromuscular and other) after cessation of exercise wear off relatively quickly. This was also very clearly demonstrated by the Harvard and Amsterdam studies (Paffenbarger, Hyde, Hsieh & Wing, 1986; Twisk, Kemper & Van Mechelen, 2002). Cumulative health effects of exercise, therefore, can only be expected with regular and systematic exercise throughout the entire lifetime. A greatly important role that activity at a young age plays is also in the formation of habits

and values that ensure that a healthy lifestyle developed in youth is continued in the later stages of life. People who go through extensive experiences in physical activity in their youth have a more positive attitude to sport in adulthood. This is also confirmed by the authors of several studies (Sarna, Sahi, Koskenvuo & Kaprio, 1993; Kujala, Kaprio, Sarna & Taima, 1994; Folgeholm et al., 1994), in which they show that former top endurance athletes in their third age are healthier than ordinary people, mainly due to a healthier and more active lifestyle, which they keep up even after the end of their professional careers.

Young people need to do more sports! The important conclusion of the analysis of research results is the recognition/validation of the expected fact: that a larger extent and frequency of physical activity and a systematic sports programme for children and youth undoubtedly mean a better physical performance and lower risk factors for the development of metabolic syndrome symptoms and later cardiovascular disease, osteoporosis, etc. By reducing physical activity, the risk of developing MS increases significantly (Kelishadi et al., 2006; Kelishadi et al., 2007; Raitakari, Porkka, Taima, Talama, Räsänen & Viikari, 1994). At the same time, it is important to consider the fact that inactivity and a low level of aerobic capacity are not only related to individual factors of MS, but are also strong predictors of developing MS in later periods. People with oxygen consumption (VO2max) of less than 29.1 ml/kg/min, have a nearly seven times greater chance of developing MS compared with those with a VO2max equal to or greater than 35.5 ml/kg/min (Lakka, Laaksonen, Lakka, Niskanen, Kumpusalo, Tuomilehto et al., 2003).

The complexity of the issue of determining and explaining the relationship between sport and physical activity in childhood/adolescence and adulthood is also largely methodological. There are two fundamental problems:

i) Difficulty of implementation of long-term longitudinal studies

Only with permanent monitoring of large numbers of children with active and inactive lifestyles throughout life (which is impossible) would we be able to come up with complete answers to the question. All other methodological approaches leave a certain degree of openness, which leads to a relatively high diversity or disunity in the results.

ii) Reliability of data on measured levels of physical activity of a person

Data on the extent and intensity of physical activity in different studies are obtained with different methods (questionnaires and/or interviews, measurement of heart rate, distance and intensity of the movement and pedometric/accelerometric measurements). Each has its drawbacks, which reduces the total objectivity of the obtained data. Even more pronounced than that is the question of the objectivity of the results comparison, which were obtained by different methods.

Therefore, for better illumination of this issue, we need more extensive longitudinal studies, which will be based on technologies with a more reliable manner of measurement of physical activity.

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