

The role of resignation from physical education classes in the context of prevention of civilization diseases

(Znaczenie zjawiska rezygnacji z zajęć wychowania fizycznego w kontekście profilaktyki chorób cywilizacyjnych)

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Abstract – Introduction: Childhood overweight and obesity is the cause of the global public health crisis. The mass phenomenon of resignation from physical education classes by children and youths Polish schools has been investigated for several years. Fourteen percent of students in Poland declare their unwillingness to participate in obligatory physical education classes. More than half of the European population above 15 years of age do not take up any physical activity.

The aim of this review is to compare the latest findings on the causes of the phenomenon under study and its health effects, as well as to present the importance of the interdisciplinary team in the early prevention of civilization diseases.

Methods: In order to collect the data, comprehensive review of the subject-related literature was done with the use of three relevant databases: Pubmed, EMBASE and Web of Science. The analysis took into consideration studies published between January 1st, 2004 and August 31st, 2014. The review included only those prospective studies, where confidence intervals were stated at 95% confidence level (CI). Some data concerning the scale of the problem, as well as the impact of reduced physical activity among children on the development of civilisation diseases in adulthood was revealed, too. The review also considered development of obesity, metabolic, and cardiovascular diseases.

Results and conclusions: Health behaviours within physical activity during adolescent years diverge from the generally accepted global recommendations. Only an interdisciplinary approach to the problem of resignation from physical education classes can bring about changes in attitudes and health behaviours among children and adolescents.

Key words - physical education, civilisation diseases prevention, children, obesity, cardiovascular diseases, metabolic diseases.

Streszczenie – Wstęp: Przyczyną światowego kryzysu zdrowia publicznego jest dziecięca nadwaga i otyłość. Od kilku lat w polskich szkołach bada się masowe zjawisko rezygnacji dzieci i młodzieży z zajęć wychowania fizycznego. 14% uczniów szkół polskich deklaruje niechęć do uczestnictwa w obowiązkowych

zajęciach wychowania fizycznego. Ponad połowa Europejczyków po 15 roku życia nie podejmuje aktywności fizycznej w ogóle.

Celem niniejszego przeglądu jest porównanie najnowszych badań dotyczących przyczyn badanego zjawiska, jego skutków zdrowotnych oraz przedstawienie znaczenia interdyscyplinarnego zespołu we wczesnej profilaktyce chorób cywilizacyjnych.

Metody: W celu zebrania danych, dokonano szczegółowej analizy artykułów o badanej tematyce w bazach Pubmed, EMBASE i Web of Science. Pod uwagę wzięto artykuły opublikowane między 2004 a 2014 rokiem. Do przeglądu zakwalifikowano tylko te badania prospektywne, w których zostało przyjęte 95% prawdopodobieństwo (CI) badanego zjawiska. Odnotowano także dane dotyczące skali badanego zjawiska, jak również wpływ obniżonej aktywności fizycznej u dzieci na rozwój chorób cywilizacyjnych w wieku dorosłym. Wzięto pod uwagę rozwój otyłości, chorób metabolicznych i chorób układu krążenia.

Wyniki i wnioski: Zachowania zdrowotne w zakresie aktywności fizycznej w okresie dorastania odbiegają od ogólnie przyjętych światowych rekomendacji. Tylko interdyscyplinarne podejście do problemu rezygnacji z zajęć wychowania fizycznego, umożliwi zmianę postaw i zachowań zdrowotnych dzieci i młodzieży.

Słowa kluczowe - zajęcia wychowania fizycznego, profilaktyka chorób cywilizacyjnych, dzieci, otyłość, choroby układu krążenia, choroby metaboliczne.

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I. INTRODUCTION

In the second half of the 20th century the trends related to causes of prevalence among children and adolescents changed. Thanks to hygiene improvement, prevention of infections and change of lifestyle and eating habits, civilisation diseases have gained significant importance. In recent years, overweight and obesity among children worldwide have increased.

According to one of the most recent definitions put forward by Caspersen, Powell and Christenson, physical activity can be described as every bodily movement of skeletal muscles which results in energy expenditure [1]. As early as the 16th century, the impact of physical effort on proper weight maintenance and better health condition became the subject of interest. Rapid development of science, technology and transport in the course of the recent years have unfortunately revealed many negative health-related phenomena among children and youths. They include, first and foremost, significant reduction of physical activity, unwillingness to take up exercising, and a sedentary way of life. They all lead to a range of serious and unfavourable physiological changes in the human body [2, 3, 4].

Over the last decade, the impact of null physical activity among children and its consequences were often enough the subject of numerous discussions [5, 6, 7, 8]. However, the majority of these reports do not comprehensively describe importance of physical education classes among children for the prevention of civilisation diseases in adult age. They also do not consider the formative role of physical education in school for the development of proper health-conscious attitudes.

Therefore, the aim of the review is to systemise the latest scientific reports on the importance of physical education classes within the context of interdisciplinary prevention of civilisation diseases.

II. METHODS

In order to collect the data, the search was performed in MEDLINE, EMBASE and Web of Science databases. The most recent prospective studies (cohort and case-control studies), as well as single reviews which examined the relation between physical activity and incidence of obesity,

metabolic and cardiovascular diseases among children were collected. The review included only those prospective studies, where confidence intervals were stated at 95% confidence level (CI). The analysis took into consideration the studies published between January 2004 and August 2014. The literature which formed the basis for the review was selected based on the key words, including physical education classes, physical activity, children, obesity, diabetes, cardiovascular diseases and others. Based on the preliminary analyses, 3,422 articles were selected in whole. The data was collected independently by two authors. After a preliminary selection based on the number of the aforementioned publications, 300 studies were chosen to serve as the subject of in-depth analysis. The final decision to include or exclude the examined study was made based on the detailed analysis of research methods, the size of the examined population, methods for evaluating physical activity at physical education classes and assessment methods for study findings. As a result, the final analysis, which formed the basis for the review, included 59 full-text articles.

III. MASS RESIGNATION FROM PHYSICAL EDUCATION CLASSES AND BROADLY-TAKEN PHYSICAL ACTIVITY AMONG YOUTHS

For several years, the mass phenomenon of conscious resignation from physical education classes has been examined in Polish schools. Active participation in young persons' development is more and more often superseded by short- and long-term PE excuse notes. The causes of this phenomenon vary. Sometimes it results from a chronic disease of a child, but definitely more often it is related to laziness, complexes, and lack of awareness of the consequences of once made decisions in the future. As studies reveal, unwillingness to participate in PE classes increases with age [9].

Lack of regular physical activity in youth affects health in adult age. This in turn brings its economic effects because, as revealed studies from Denmark, the lack of physical activity significantly raises the costs of medical healthcare and reduces GDP rate due to numerous long-term excuse notes [10]. It is estimated that in a c. 5.5 m population with the physical education reduced to minimum there is a need for around 3.1 m of additional days off due to health reasons [11]. Over the half of the Europeans aged 15+ do not take up any physical activity. According to The National Institute for Health and Welfare in Finland, around 10% of the children aged 12-14 are not physically active enough to maintain their proper development. In addition, 1/3 of the youth between 16 and 18 years of age spend only little more than 1.5 h per week on physical activity out of school [12]. The analysis of American studies revealed significant reduction of physical activity over the years.

A $3 \geq$ MET activity among adults dropped from 48% in 1960 to 20% in 2008, whereas physical stress decreased to

MET 2-2.9. The phenomenon bears serious negative impact on physical activity among children and youths [13].

The studies show that measuring the time spent at the computer or watching TV is a good factor describing the extent of lack of physical activity. On average, American youths spend over 3 hours a day watching TV with this time span extending gradually from 1999 to 2011. 6.9% of the youths in the US admit spending up to 3 hours watching TV. The number of the persons examined, who spend more than 3 hours per day at the computer, have increased from 22% in 2003 to 25% in 2009, and to 31% in 2011. 5.1% of respondents spend at the computer more than 5 hours a day [14].

The studies conducted in the Podlaskie province, Poland, have revealed that the percentage of students not participating in PE classes during one semester or through the whole school year was less than 1%. In comparison, based on the studies involving students from schools in Łódź it was stated that 18% of the excuse notes were issued by doctors, whereas 30% - by parents [9, 15]. According to the Supreme Chamber of Control, 19% of primary school, 24% lower secondary school and 36% secondary school students admit to occasional absence from physical education classes [16].

From among 1,054 students aged 11-15 from schools in Warsaw, as many as 30% of boys and 25% of girls spend more than 5 hours on the activities which do not involve physical activity, including watching TV. Interestingly enough, 92.8% of boys and 91.7% of girls have personally assessed their activity as high or moderate, whereas only 15.6% of the study group admitted that their activity is too low. The percentage of such people drops with age, though. Research findings have revealed that over 65% of examined children and adolescents from Warsaw do not undertake recommended amount of physical activity [17]. The results of questionnaire studies conducted in chosen schools across Poland have shown that 14% of students declare their unwillingness to participate in obligatory physical education classes. The reasons for avoiding such classes mentioned include inaccurately designed PE class curriculum, inability to choose the form of classes, or lack of an attractive programme on offer (31%), health reasons (35%), too difficult exercises (12%) and lack of interest in sport and physical activity (12%) [16].

IV. PHYSICAL EDUCATION CLASSES AND DEVELOPMENT OF OBESITY AND METABOLIC DISEASES

Childhood overweight and obesity can be described as an excess of body mass relative to the weight right for age and height. Puberty is the period during which the risk of obesity incidence is heightened. It is associated with the change of proportion between fat and muscle tissue in the human body. Girls get their fat tissue thickened, whereas in case of boys it becomes reduced in favour of muscle tissue

gain. Reduced physical activity among children and youths in school age negatively affects the scale of the problem.

Studies reveal that 13.3% of Polish adolescents aged 13-15 are overweight (14.9% of girls, and 11.6% of boys, $p < 0.01$). 4.5% of the persons examined are obese – 5.7% and 3.3% girls and boys, respectively ($p < 0.001$). The highest percentage of overweight and obese students occurs among 14 year olds, constituting 12% and 16%, respectively. 14-year-old students comprise 36% of overweight and obese persons in the group aged 13-15 [18].

Papers discussing obesity also include the data concerning the increase in obesity incidence depending on the place of domicile. Economic transformations and different stages of environmental urbanisation condition regional differences in the development of children and youths, also in terms of overweight and obesity incidence.

According to WHO, 38% of children in Europe are overweight or obese [19]. From the physiological perspective, obesity appears when the energy balance becomes disturbed, which means that the energy supplied through food intake exceeds the amount of energy value burnt off by the human body. A sedentary mode of living, and thus reduced physical activity, contribute to obesity [20]. The studies published in 2003 indicate that energy balance of our predecessors was 1:3 (burnt-off energy : supplied energy), whereas nowadays it is 1:7, which means that energy expenditure should be increased by 400 kcal by undertaking aerobic physical training lasting about 45-60 minutes per day. First steps in obesity treatment should be oriented towards increasing physical activity and a proper diet [21].

The decision to undertake physical activity is directly associated with the knowledge children and youths have about overweight, obesity and their effects. The questionnaire study included 233 children aged 11-15. Only 1% of the respondents revealed high level of obesity-related knowledge, 50% - moderate, and 33% - low. 61% of the study group demonstrated false knowledge about obesity claiming that it does not bring any health effects and is not a disease [22].

The Health Behaviour in School-aged Children (HBSC) questionnaire is a unique source of information on youth health and lifestyle, which has been used both in Europe and North America since 1982 [23]. Oblacińska et al. used this questionnaire to examine self-assessment of health and physical fitness among obese and non-obese youth. In her study, 85% of obese adolescents considered their health as good or very good, whereas 64% positively assessed their fitness. Every sixth overweight student assessed their health as so-so or poor, whereas every fourteenth considered their fitness as poor. A statistically significant difference was observed in perceiving their health condition (boys $p < 0.01$, girls $p < 0.001$) and physical fitness (boys $p < 0.001$, girls $p < 0.001$) between overweight adolescents and their peers with due weight. Obese adolescents significantly more often reported irritation, apathy, back pain or a headache. Obese boys were reported to become irritated ($p < 0.01$) and annoyed, as well as to have back pains more often than

their healthy-weight peers. Obese girls reported head ache ($p < 0.01$), apathy, stomach aches and back pains more often than other non-obese girls ($p < 0.05$) [18].

The studies show that every sixth student did not think about dieting. Over 1/3 of the adolescents admitted to being currently on diet, definitely more often girls (37%) than boys (28%) ($p < 0.05$), 2/3 of the respondents have tried dieting more than twice, and 40% have done it at least four times. Girls significantly oftener made numerous attempts to lose extra kilograms ($p < 0.001$), whereas boys have over three times oftener not tried it at all (9% vs. 28%, $p < 0.001$) [18]. The results of 2010 HBSC questionnaire edited by Mazur and Małkowska-Szkutnik [24] on children and youth health are presented in the tables below. The studies indicate that in the group of healthy-weight girls aged 11-15 almost half of them considers themselves too fat. Around 10% of 11- and 13-year olds, and 50% of 15-year olds report health problems [24].

One of the body mass and overweight indexes is the Body Mass Index, otherwise known as Quetelet index. However, according to the subject-related literature, contrary to popular belief, BMI index not always concurs with the lowering of physical activity. The research involving graduates of the School of Physical Education of Poznań and representatives of the authorities in Greater Poland revealed that the normal weight was common among the representatives, who favoured moderate physical activity. Strikingly, inappropriate BMI value and overweight were more typical of the graduates than the local authorities representatives. The graduates declared definitely more frequent involvement in physical activities, including 63% of persons – at high frequency. The study revealed that BMI is not the best index to measure the amount of fat tissue in physically active persons [25].

Interestingly enough, in the course of the meta-analysis it was stated that standard physical activity at school does not improve BMI in children, and the social policy, which recommends increasing physical activity at schools, does not contribute materially to the reduction of their obesity. In comparison, an increase in intensity of basic physical activity at schools minimally affects long-term changes in BMI. 3 out of 18 studies under analysis showed an increase in BMI in girls undertaking standard school activity [26]. Children with high BMI are highly possible to have this index raised in adult age. There is a high risk that children with high BMI, this index will be raised upon reaching adulthood [27]. Physical Education classes should not however recede into the background of school curricula. First and foremost, as research indicates, such physical activity contributes to undertaking physical effort more often later in adulthood. Secondly, PE classes also protect against poor motivation to lower body mass in case of the risk of heart failure or heart attack [27, 28]. It is important to ingrain in the social awareness the belief that it is right to undertake physical activity to keep up good health as long as possible. Wide-scaled promotion of the advantages of sport can lead to the improvement of general health in society.

According to other publications, physical activity among children and youths between 0 and 18 years of age does not contribute to lowering BMI in the population, and only its lowering by 0.15 kg/m^2 can have, to a modest but significant extent, impact on a permanent BMI change of the population [29]. There are no unequivocal proofs that reduced physical activity is the cause of any preconditions to obesity. However, if such preconditions appear, reduced physical activity may contribute to obesity [30].

The research clearly indicates an increase in the incidence of obesity among persons above 20 years of age [27]. Regular physical activity undertaken in adulthood causes a range of morphological changes, such as a decrease in concentration of triglycerides and C-reactive protein (CRP), or increase in HDL cholesterol concentration. Physical activity was also proved to positively affect liver functioning (ALAT and AspAT activity decrease) and reduce the risk of cardiovascular diseases prevalence [31].

In the group of 92 children aged 11-12 positive correlation was observed between high BMI and statistically significant reduction of physical activity among participants [32]. Children with excessive body fat show a statistically significant worse capability for making certain efforts with the majority of anaerobic processes. It turns out that due to the increased amount of adipose tissue the human body is unable to achieve the maximum level of energy typical of a given age, which was proved in the study involving 41 girls aged 9-10 [33].

Physical activities undertaken in early life has also considerable impact on the development of type II diabetes or metabolic syndrome in adult age. Available studies show that strength training of moderate intensity makes tissues more sensitive to insulin [34, 35].

V. CORELATION BETWEEN PHYSICAL ACTIVITY IN CHILDHOOD AND CARDIOVASCULAR DISEASES IN ADULT AGE

One of the main causes (apart from, among others, genes [36]) of chronic diseases in adulthood is lack of physical activity in early school age and youth [37]. Lack of regular physical activity during childhood leads to disorders in circulatory system functioning during adulthood [8, 38-48]. The consequence of failing to shape health-oriented attitudes in childhood is lack of physical activity in adult age. The studies by American Heart Association revealed that watching TV for around 2 hours per day is positively correlated [95% CI (1.03-1.23)] with the higher risk for cardiovascular diseases. 32.4% of American teenagers spent over 3 hours a day watching TV [43, 49, 50].

Studies conducted in 2010 by the National Youth Physical Activity and Nutrition Study in the USA showed that 15.3% of secondary school students met generally accepted requirements concerning aerobic physical activity per week, whereas 51% regularly did strength training [49]. Other American studies indicate a slight increase in the percentage of the youth attending Physical Education clas-

ses once per week (from 48.9% in 1991 to 51.8% in 2012), which is a positive phenomenon [51].

International studies involving 15,152 respondents in the study group show that lack of physical activity is responsible for 12.2% of instances of the heart attacks (MI) worldwide, with the consideration for other risk factors associated with cardiovascular diseases (CVD), such as: smoking, diabetes, high blood pressure, obesity, lipid profile and psycho-social factors [52].

Based on the INTERSTROKE study, conducted in 22 countries (including Poland) and involving 3,000 patients after stroke and properly qualified 3,000 healthy persons (control group) it transpires that regular physical activity reduces the risk of stroke by 31%. An article on this subject was published in Lancet journal [53]. A five-year long cohort study involving 656 patients with ischaemic heart disease (IHD) revealed that regular physical activity lowers the level of inflammatory biomarkers in blood. CRP, IL-6 and glucose levels in blood also dropped [54]. In comparison, a continuing high level of CRP in blood was strongly correlated with ischaemic blood vessels disease 1.63 (95% CI 1.51-1.76) and with ischaemic stroke 1.27 (95% CI 1.15-1.40) [55]. Even if at least one of the chronic diseases appeared in the examined population, regular moderate physical effort significantly reduced the risk of death (hazard ratio range: 0.65-0.75, $p < 0.05$) [56].

Physical effort affects autonomic nervous system, too. The study involving children with type I diabetes proved significant impact of 12-week physical training on heart rate variability (HRV). Parameters of the frequency analysis were also considered. After the effort, spectrum for very low frequencies (VLF) and low frequencies (LF) increased in comparison to the initial state ($p < 0.05$). In contrast, spectrum for high frequencies, which monitors functioning of the parasympathetic nervous system, did not show any significant changes [57]. Some risk factors for cardiovascular diseases, such as total cholesterol (TC) or HDL cholesterol fraction, insignificantly dropped ($p < 0.01$). However, neither triglyceride level (TG) nor HbA1C, which indicates the level of control over blood glucose, did not change materially ($p > 0.066$) after 12-week training [57].

VI. THE ROLE OF SCHOOL IN OBESITY PREVENTION: SUGGESTED STRATEGIES

Based on the discussions held so far it transpires that overweight and obesity significantly increase the risk of high blood pressure, ischaemic heart disease, metabolic heart diseases, osteoarticular system diseases, faulty posture, and secondary psycho-social disorders in adolescence and adulthood.

Social countermeasures against civilisation diseases development, as well as effective diagnostic methods and prevention of complications should be based on the holistic and interdisciplinary approach to the problem. Attempts to

prevent such diseases should be made already in the developmental age.

Knowledge of the factors affecting health and pro-health behaviours should have positive impact on the prevention of civilisation diseases. Health promotion among the youngest should be based on comprehensive education, and educational institutions should be driven by health-oriented policy. Its implementation is possible only by an interdisciplinary team of experts, whose attention should be directed both to students and their parents. The team should consist of teachers, educators, psychologists, physiotherapists, doctors and dieticians. Their close cooperation and execution of the accepted programme could positively change modifiable risk factors concerning civilisation diseases.

Prevention is based on knowledge. Unfortunately, the analysis of study findings concerning knowledge about civilisation diseases risk factors (including cardiovascular diseases) shows that Polish people have poor awareness of the problem. The knowledge of adult respondents is informal, fragmentary and incomplete. Parents do not realize how important PE classes are for their children's health in the future. It is yet another argument in favour of promoting healthy lifestyle at the grass roots.

Under the assumptions of the "ideal" programme, in every school there should be a team made up of all these experts.

This programme should have the following objectives:

- to carry out screening tests in 5-6 and 13-14 year-old children,
- to select a group of children from a risk group of civilisation diseases,
- to provide individual diet and training plans,
- to raise health-oriented awareness among children and youths,
- to organise briefings for parents/care-givers,
- to maintain positive effects of the made interventions.

Modifications should also be applied with regard to physical education curriculum. PE classes often boil down purely to group plays. They lack variety, while teaching methods and techniques are not adjusted to students' current needs, their age and sex. Students' breaking down by sex at PE classes in secondary schools is not a bad idea, but the possibilities of choosing the type of activity undertaken is limited.

PE curriculum should include swimming classes, elements of gymnastics, yoga or pilates for girls, and basics of strength and functional training for the boys who are keen on building up muscles, which, in case of lack of any rudimentary theoretical knowledge, may lead to injuries of the organ system.

It would be advisable to after-class (obligatory) meetings with physiotherapists, where students would have a chance to improve their motor co-ordination skills and learn proper values for the parameters and physiological indexes relevant for a given age. Periodical lectures run by physiotherapists or doctors (talks) could deal with risk factors for civilisation diseases. Demonstrating the potential destruc-

tion of the human body resulting from a possible disease would reduce the number of undesired behaviours among young people (such as smoking or drinking).

Schools do not provide education (except for general knowledge about biology) on physical development of the human body, hormone changes (in girls and boys) and their influence on morphological characteristics, commonly known as “physicality”. No basics of bromatology, the study of food, are provided, either. Unaware of their bodies’ needs, maturing children often make an attempt to change their appearance through diets or exercises, which may lead to psycho-social disorders.

The role of a psychologist is generally limited to meetings with individual students, while he or she could run intrapsychic and motivation training sessions for larger groups, spreading knowledge about emotional problems, their origins and consequences (often deriving from the disease and dependent on health condition). Such exercises would allow teenagers in particular to overcome their own limitations, better use inborn personality inclinations, allay doubts and prejudices, as well as to raise their self-esteem (especially important when struggling with overweight).

Human upbringing principally aims at shaping their attitudes, no matter whether this process is undertaken in school, home or workplace [58]. Educational institutions should therefore strive to shape right attitudes concerning psychological development, physical culture, motor skills, and widely understood health.

Scientists and researchers from Gdańsk made an attempt to execute a programme covering generally understood prevention of civilisation diseases (including obesity and cardiovascular diseases) among children. With the assistance of City Hall in Gdańsk, additional medical, pedagogical and environmental care was exercised with regard to school age children. The programme was planned to be implemented in two stages for the years 2011-2013 and 2014-2016 (pending) [59].

The activities undertaken in Gdańsk so far helped create a comprehensive support system directed towards overweight and obese children, both within the family – through complex educational interventions among parents, and in school, through introducing health-oriented school policies. In addition, schools should also pay attention to the contribution made by the interdisciplinary team to execute this programme.

The undertaken project was the first such a comprehensive programme in Poland oriented towards the problem of overweight and obesity among children and youth [59].

The first edition of the programme included 14,683 children aged 6, 9-11 and 14. 2,288 children and parents (15.58%) were subject to a specialist intervention. 820 parents took part in an educational programme. As part of the environmental support, 324 primary schools and junior high school teachers were trained. In addition, 990 teachers obtained the knowledge about diabetes in children. Over 2,400 third-grade students completed practical workshops on second breakfast preparation [59].

VII. CONCLUSIONS

In the light of the research presented above, it is crucial to treat elimination of overweight and obesity among children and youths as a complex problem, which is a main modifiable factor of civilisation diseases.

Prevention of civilisation diseases should be anchored in promoting and forming healthy lifestyle attitudes and health-oriented behaviours among young citizens. Prevention should be accompanied by diagnosis and therapy.

Pro-health behaviours should be understood as the conscious and purposeful undertaking of every form of activity aiming to protect and improve health.

School age children should undergo screening tests to identify non-modifiable health disorders (secondary hypertension, hormone disorders, diabetes) and participate in specialist educational programmes.

Fighting mass resignation from PE classes in school should be accompanied by operations of the interdisciplinary expert team. The change in the way of thinking and perceiving body mass as an illness among the society is a big challenge. It is a task which requires time, involvement, knowledge, and future-oriented approach to the problem and its consequences.

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