



PHYSICAL ACTIVITY OF FEMALE STUDENTS IN SECONDARY SCHOOLS IN THE CONTEXT OF PHYSICAL ACTIVITY RECOMMENDATIONS FULFILMENT

original paper

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ABSTRACT

Purpose. Increasing energy intake and decreasing movement performance are among the greatest population issues of mankind. Risk elimination consists in returning to physically active way of life. The aim of the paper was to analyse the physical activity of female in selected secondary schools in the Presov district region, Slovakia, from the point of view of physical activity recommendations fulfilment.

Methods. The research group consisted of 353 female students from 14 selected secondary schools in the Presov district region. The students were distributed in four groups according to age (15–18 years).

Results. More than half of the studied females did not perform movement activity of medium or high intensity. The highest percentage of success rate in the criteria fulfilment was achieved by females of all age categories in walking 5 times per week for the minimum of 30 minutes ($W 5 \times 30$). Only 44.3% of the students aged 15 years and up to 70.8% of those at the age of 18 met at least one criterion of the physical activity recommendations.

Conclusions. As for physical activity recommendations fulfilment, the most successful criterion was performing physical activity regardless of its intensity. Physical activity recommendations seem to be very hard to implement in this age category, especially those concerning intense physical activity.

Key words: physical activity intensity, IPAQ, adolescents, health

Introduction

From the historical point of view, mankind developed for thousands of years in relative lack of food but with a high presence of physical activity in life. It means that humans have adapted to lower energy intake and higher energy output. At present, the situation contrasts with the past and people, for the first time in their history, are not able to fully eliminate the drop-out of physical activity caused by changes in the manufacturing process and way of life [1]. Moreover, increasing energy intake at all age levels, especially in countries with higher living standards, as well as decreasing movement performance are among the obvious but mainly latent greatest population health issues.

Physical activity undertaken at recommended levels is associated with multiple health benefits and lowers the risk of numerous illnesses in people, irrespective of their age, gender, or locality [2]. On the other hand, physical inactivity is the fourth risk factor of premature morbidity worldwide, after hypertension, smoking, and high glucose levels [1]. Unfortunately, in most

European countries, the number of overweight and obese young people has more than doubled in the past 20 years [3]. Thus, overweight, as well as obesity have been found to impair the ability of adolescents to achieve the physical activity recommendations [4].

General recommendations created by the World Health Organization (WHO) [5] reveal that physical activity undertaken by adolescents should fulfil the criteria of type (aerobic, muscle and bone strengthening, balance improving), duration (at least 60 minutes), frequency (at least 3 times per week), intensity (from moderate to vigorous), and volume (determined by frequency and duration) [6, 7]. Population studies demonstrate that many adolescents do not meet the established recommendations for daily moderate to vigorous physical activity [8–10]. The worst news is that the amount of practised physical activity is continually decreasing and in the last two decades it has equalled up to 30% of the recommended values [1].

The recent task for science is not only to remind the new generation about the issue, but also to offer solutions. The best period to start finding and suggesting

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appropriate solutions is childhood and the process should continue through adolescence. The advantage of this step is the fact that apart from immediate health benefits, children and adolescents' values are created that will probably be followed also in adulthood [1, 11].

The amount of physical activity practised by the youth population in the last 25 years has shown linear decrease. A reverse effect is recorded with regard to the increasing youth obesity. This way of life is accompanied by retrogressive health condition of children and adolescents, their decreasing aerobic fitness, lower ability to regenerate after load, and high risk of civilisation diseases [12].

The minimum need of physical activity for a human being encloses the so called threshold value. It is the inevitable amount of physical activity needed for a healthy development of an organism. The threshold value changes (decreases) with increasing age of an individual. According to newer, reduced norms, it is required in youth age to maintain the minimal level consisting of 60 minutes of organized and 60 minutes of spontaneous daily physical activity [13]. The lowest level of physical activity is 30–60 minutes of medium or intensive load per day in and out of school [14]. A similar trend for recommended physical activity norms is observed for adolescents.

Not so long ago, health-oriented physical activity was considered as such that in the prevailing number of days per week, females achieved energy output of 9 kcal/kg · day⁻¹ and males 11 kcal/kg · day⁻¹. At present, experts seem more inclined to physical activity recommendations in which energy output equals minimally 6–8 kcal/kg · day⁻¹ [14]. This means minimally 60 minutes of physical activity with medium to high intensity per day. It should be emphasized that physical activity of medium intensity is characterized by medium effort (3–6 METS), and physical activity of high intensity is characterized by more challenging activity, with energy output increasing over the basal metabolism at least six times (6 METS).

Other aspects that should be taken into consideration are gender and age differences in meeting general recommendations for physical activity. Most research results confirm the lower probability of girls being physically active compared with boys [10, 15–18]. Another research showed that adolescent boys met the recommendations more frequently (1.1–11.3 times) than adolescent girls [19]. Finally, the association between age and achievement of physical activity recommendations is not clear; although, age was thought to be related to a decline in physical activity [20]. This is supported with studies [5, 8, 21] that described a declining tendency of moderate to vigorous physical activity during the preadolescent and adolescent years. Moreover, boys turned out more active than girls, and these differences in the level of moderate to vigorous physical activity remain constant as age increases [8, 21, 22].

The issue is addressed by more and more experts, which allows to define the way of risk elimination more clearly. Research performed not only in sports sciences but also in the social, biological, and – mainly – medical area indicates that one of the irreplaceable ways to change the situation consists in recovering the physically active lifestyle [2]. Prior to this step, the inevitable process is to assess the physical activity levels in different age categories, as well as to determine the changes in physical activity levels [10]. The variety of applied methods for determining the volume and intensity of physical activity in individual age categories have caused problems with comparing the achieved data on the national, as well as international level. Consequently, there are difficulties in generalizing recommendations.

The effort to create a universal standardized method was crowned by formulating the short and long version of the International Physical Activity Questionnaire (IPAQ) [11]. The number of studies using this method in the last decades enables their acceptable comparability based on reliability and validity criteria. However, there is a subjective evaluation of respondents during the questionnaire administration and it is quite common to overestimate the physical activity undertaken, which was confirmed in earlier studies in different countries [23, 24]. Therefore, it is ideal to combine the usage of questionnaires [25] and monitoring devices as pedometers, heart rate monitors, accelerometers, or GPS [10].

With these clearly defined factors, the question is what should be the minimal amount of physical activity that reveals its health benefit. What we need are serious analyses of movement regimes in all age categories. The aim of the paper was to analyse the physical activity of female students from selected secondary schools in the Presov district region, Slovakia, in the context of physical activity recommendations.

Material and methods

Participants

The research was performed among 353 female students from selected secondary schools per stratified random sampling: secondary vocational schools, business academy, and pedagogical secondary school of all 13 districts in the Presov region, which represents less than 3% of female secondary school population in the region. In all the selected schools, we randomly chose one class in each year in which we tested each female. The students were distributed in four groups according to age: 15 ($n = 97$), 16 ($n = 86$), 17 ($n = 105$), and 18 ($n = 65$) years.

Procedure

Physical activity volume data were obtained with the use of standardized IPAQ questionnaire, long version [11]. Questionnaires were filled in online during

teaching units through the INDARES Internet system. The administration was controlled in accordance with the manual and with 1 trained person per 10 students. Questionnaires were used to gain data about the volume of physical activity performed in a week in three areas: vigorous and medium physical activity and walking; a continual score in MET/minutes/week was applied.

On the basis of the presented data, we monitored physical activity recommendations fulfilment per week in accordance with the following criteria: performing vigorous physical activity minimally 3 times per week for 20 minutes ($V\ 3 \times 20$), performing medium physical activity minimally 5 times per week for 30 minutes ($M\ 5 \times 30$), continual walking minimally 5 times per week for 30 minutes ($W\ 5 \times 30$), and daily physical activity for 60 minutes ($Sum\ 7 \times 60$) [26].

Data analysis

The normality of the research data distribution was assessed with the Shapiro-Wilk test. For basic statistical description of data, mean (\bar{x}) from the measures of central tendency and standard error of mean (SEM) from the measures of variability were used, as well as the minimal and maximal value.

Significance differences of the performed physical activity levels were calculated between 15 and 16, 17, 18 years of age. We considered as priority to find out the difference between the entry and finishing of secondary school (that means, the difference that depicts

changes during the period of secondary school). Non-parametric Kruskal-Wallis analysis of variance (K-W ANOVA) was applied for evaluating differences between physical activity volumes in the observed age groups. Mann-Whitney test with Bonferroni correction of the p -value was used for multiple comparisons of mean between age groups. The rejection of the null hypothesis was assessed at the level of $p \leq 0.05$. Statistical analysis was carried out with the Statistica software, version 12.0 (StatSoft, Inc.; Tulsa, USA).

Results

Volume of physical activity

The Shapiro-Wilk test showed the non-normality of distribution of the obtained data. Despite of age and residence of living homogeneity of the monitored group, data were positively skewed.

As the results show, more than half of the studied females (53.82%) at the age of 15–18 years did not perform any physical activity of high or medium intensity during the monitored week. Their only activity was walking; however, this did not apply to all female students. In some cases, females did not practise any continual walking that would last at least 10 minutes in the whole week.

The level of the movement activity in the studied females can be evaluated as considerably heterogeneous, with major differences: the lowest number of MET/min-

Table 1. Basic statistical characteristics of physical activity volume undertaken by the studied 15–18-year-old girls

Age (years)	Volume of physical activity	\bar{x}	SEM	Min	Max
15	VMET	370.8	70.4	0.0	3960.0
	MMET	1099.1	114.2	0.0	4740.0
	WMET	1414.2	170.7	0.0	3960.0
	SUMMET	2884.2	252.2	0.0	4740.0
16	VMET	420.0	133.6	49.5	8349.0
	MMET	1170.9	129.7	82.5	13,329.0
	WMET	1835.5	172.4	0.0	7140.0
	SUMMET	3426.5	313.8	0.0	5460.0
17	VMET	290.9	71.1	66.0	8349.0
	MMET	868.2	81.0	196.0	13,783.0
	WMET	1356.9	125.5	0.0	3960.0
	SUMMET	2516.0	176.4	0.0	5115.0
18	VMET	386.3	106.4	0.0	6006.0
	MMET	1620.9	277.2	90.0	9195.0
	WMET	1732.5	217.3	0.0	4140.0
	SUMMET	3739.7	513.9	0.0	13,280.0

\bar{x} – average values, SEM – standard error of mean, Min – minimum values, Max – maximum values, VMET – MET/minutes/week of vigorous intensity physical activity, MMET – MET/minutes/week of medium intensity physical activity, WMET – MET/minutes/week spent on walking, SUMMET – MET/minutes/week of the performed physical activity

Table 2. Differences in physical activity volume in relation to age (Kruskal-Wallis analysis of variance with multiple comparisons of mean)

	Kruskal-Wallis analysis of variance			Multiple comparisons of mean		
	<i>H</i>	<i>df</i>	Sig.	Group	<i>U</i>	Sig.
VMET	1.957	3	0.581	15 vs. 16	1.2334	1.000
				15 vs. 17	0.9363	1.000
				15 vs. 18	0.5999	1.000
				16 vs. 17	0.3494	1.000
				16 vs. 18	0.5264	1.000
				17 vs. 18	0.2262	1.000
MMET	3.925	3	0.270	15 vs. 16	0.2847	1.000
				15 vs. 17	0.9870	1.000
				15 vs. 18	1.0219	1.000
				16 vs. 17	1.2456	1.000
				16 vs. 18	0.7401	1.000
				17 vs. 18	1.9185	0.330
WMET	7.909	3	0.048	15 vs. 16	2.4655	0.082
				15 vs. 17	0.3273	1.000
				15 vs. 18	1.5408	0.740
				16 vs. 17	2.1939	0.169
				16 vs. 18	0.7191	1.000
				17 vs. 18	1.2728	1.000
SUMMET	5.466	3	0.141	15 vs. 16	1.2820	1.000
				15 vs. 17	0.6964	1.000
				15 vs. 18	1.1734	1.000
				16 vs. 17	1.9799	0.286
				16 vs. 18	0.0109	1.000
				17 vs. 18	1.8131	0.418

H – statistical value of Kruskal-Wallis ANOVA, *df* – degree of freedom, Sig. – significance of differences, *U* – statistical value of Mann-Whitney U test, VMET – MET/minutes/week of vigorous intensity physical activity, MMET – MET/minutes/week of medium intensity physical activity, WMET – MET/minutes/week spent on walking, SUMMET – MET/minutes/week of the performed physical activity

utes/week spent on physical activity was 82.5, and the highest was up to 13,783 (Table 1). Comparably, in the female research groups, a tendency is observed of a gradual increase in the practised physical activity level together with increasing age.

Comparing females who were in their first and last studying years (15- and 18-year-olds) (Table 1), higher average values were observed in the last year group in all the following criteria: intensive physical activity (4.01%), medium physical activity (32.19%), walking (18.36%), and total practised physical activity (22.88%) during the whole week. The presented differences in performing physical activity were not statistically significant between any age categories (Table 2).

The analysis of physical activity recommendations fulfilment

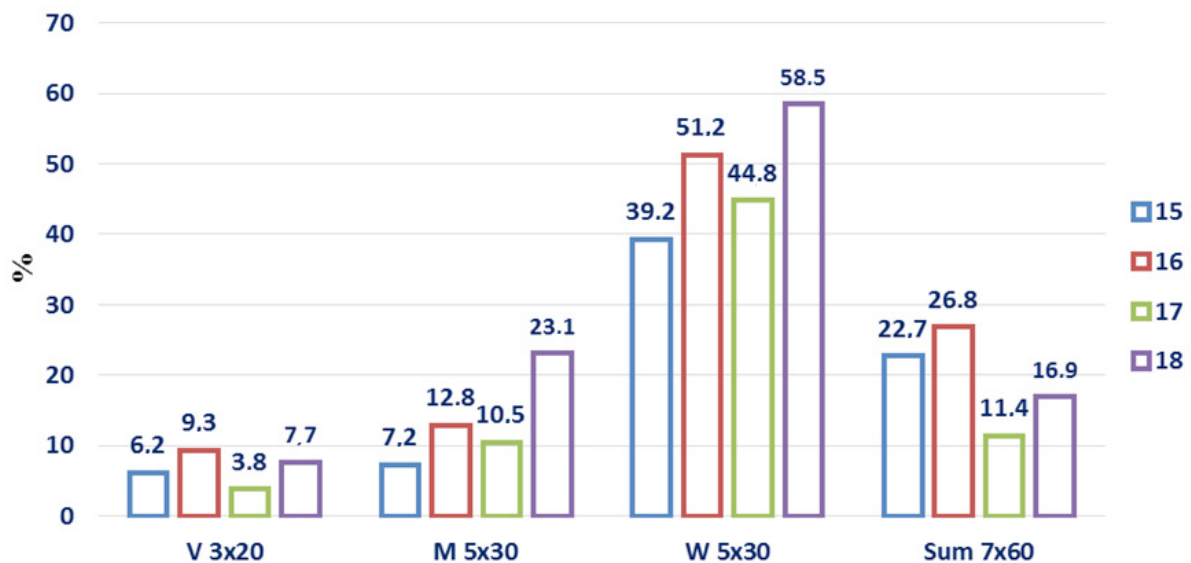
In the analysis of the fulfilment of health recommendations for performing physical activity in the aspect

of its volume and intensity, we found out in individual age categories (Figure 1) that the lowest percentage of the recommendations fulfilment was achieved in the criterion of V 3 × 20 (intensive physical activity minimally 20 minutes 3 times per week). On average, this recommendation was implemented only by 6.8% females in the whole studied group. On average, 13.4% of females fulfilled the recommendations for performing physical activity of medium intensity lasting 30 minutes minimally 5 times per week (M 5 × 30).

Among specific age categories, there were found differences in all criteria. Females in the second (V 3 × 20 and Sum 7 × 60) and last year of study (M 5 × 30 and W 5 × 30) achieved the best results in meeting the criteria.

The highest percentage of success rate in meeting a criterion was achieved by females of all age categories in walking 5 times per week minimally for 30 minutes (W 5 × 30). This criterion was fulfilled by 48.4% within the whole research group.

The last evaluated criterion in the context of health



V 3 × 20 – vigorous physical activity 3 times per week minimally for 20 minutes, M 5 × 30 – medium physical activity 5 times per week minimally for 30 minutes, W 5 × 30 – walking 5 times per week minimally for 30 minutes, Sum 7 × 60 – any physical activity performed 7 times per week minimally for 60 minutes

Figure 1. Physical activity recommendations fulfilment

recommendations fulfilment was performing physical activity regardless its intensity (Sum 7 × 60). Performing any activity lasting minimally for 60 minutes during every day in a week was considered as a fulfilled criterion. The average of 19.4% of all females met the requirement. The best results in the criterion were achieved by 16-year-old students (26.8%), and 17-year-olds obtained the worst results (11.4%).

There was a very low percentage of females who fulfilled the health recommendations. Only 44.3% of 15-year-old females met at least one of the criteria, in 18-year-olds the proportion was up to 70.8%. In total, we can conclude that out of the whole monitored research group, 193 females (54.7%) met minimally one criterion.

Discussion

The presented results of a physical activity study among secondary school students in the Presov district region, with the usage of the long version of IPAQ questionnaire, indicate low volume values of physical activity presented in MET/minutes/week. In comparison with the Polish population [27], we can conclude that our research group, in individual age categories, achieved similar and better results. The Polish females obtained 2219.2 MET/minutes/week on average and females from eastern part of Slovakia – 3739.73 MET/minutes/week. The total values achieved by 17-year-old Slovak females are comparable even with Polish males (2640.4) and in three age categories are even higher. It is also important to consider the number of physical education classes at school. While Slovak females have 2 hours of physical education at school [27], in the Polish research group the number equals from 2 to 5.

Interesting is the total duration of physical activity depending on age. The lowest values were achieved in the third year of study by 17-year-old female students and the highest values were observed in 18-year-olds.

Comparing with the Latvian population [28], our research group obtained much lower values. To achieve the level of Latvian youth (5000 MET), our research group is missing more than 1200 MET/minutes/week. In the physical activity, structure dominates in our, as well as in the Polish research group walking. On the other hand, Slovak females achieved higher values of MET/minutes/week in physical activity of medium intensity, while Polish females – in physical activity of high intensity.

As for the aspect of physical activity recommendations fulfilment, in all age categories we found a very low percentage of females (regardless of age) who reached the minimum threshold of vigorous (6.8% on average) and moderate physical activity (13.4%). It corresponds with other studies indicating that in the countries of the European Union, approximately 2/3 of adolescents do not attain the recommended level of physical activity [29, 30]. The same tendency is revealed in the HBSC study, where approximately 34% of the examined adolescents did not perform the recommended 60 minutes of moderate effort for 5 or more days weekly [25].

Among those who implemented the recommendations there were 40% of boys and 27% of girls [30, 31]. In our study, the values ranged from 7.2% to 23.1% of females within different age categories. Moreover, it should be emphasized that this percentage decreased with age, especially among girls [30, 31]. However, it was not confirmed in our study as the amount of physical activity undertaken by females rather increased in subsequent age categories. Despite health benefits resulting

from regular physical activity, the majority of youth in the developed countries, including Europe and the USA, are characterized by insufficient physical activity [30, 32]; this was confirmed in this research.

Adolescents who did not meet the requirement of 60 minutes per day on moderate to vigorous physical activity with at least 10–20 minutes per day on vigorous physical activity might be at a higher risk of having excess body fat than adolescents who implied the daily overall 60 minutes of moderate to vigorous physical activity [25]. This is the group at an elevated risk of disorders as well as diseases related with insufficient physical activity [33].

The best results concerning physical activity recommendations were achieved within the criterion of walking 5 times per week for the minimum of 30 minutes. This was obtained on average by 48.39% of females. It turns out that walking is highest represented criterion in both the aspect of physical activity recommendations fulfilment and the structure of physical activity presented in MET/minutes/week. As observed in another research [34], walkers have also a tendency to practice more vigorous and moderate intensity activities. It corresponds with our results, where the group of 18-year-old females, who reached the highest percentage rate of physical recommendation fulfilment, undertook the most volume of moderate and vigorous physical activity.

An insufficient level of physical activity noted among female adolescents suggests that it is necessary to pay greater attention to this social group while developing health programmes. The results of the presented studies indicate that actions for promoting various forms of physical activity among adolescents should be continued and intensified [34].

One of the limitations of the research is the application of a self-reported questionnaire without combining it with pedometer or accelerometer devices. The weakness of the self-reported method is that active adolescents tend to overestimate physical activity, whereas obese adolescents underestimate physical activity [35]. Certain studies [35, 36] call directly for longer monitoring with pedometers because this would enable students to better understand their individual physical activity levels and patterns, and to carry out self-assessments of physical activity.

There is lack of research in Slovakia that would focus on physical activity assessment in relation to recommendation fulfilment in all age categories, from pre-school children up to the senior population. The results of this study should contribute to a wider awareness of the issue and give inevitable feedback about the levels of physical activity performed by children and adolescents.

Conclusions

– More than half of female students did not undertake movement activity of medium or high intensity.

– The average amount of practised physical activity increased gradually with the increasing age, except for females at the age of 17.

– Regardless of age, the most preferable activity among secondary school female students was walking.

– Female students who were in their first year of study at a secondary school practiced less physical activity than those in their last year of study.

– From the point of view of physical activity recommendations, the most preferred criterion was performing any physical activity, regardless of its intensity (Sum 7×60).

– Physical activity recommendations seem to be very hard to implement in this age category, especially those concerning intense physical activity.

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