

Physical activity of male and female adolescents living in a town and a city in the context of public health recommendations

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Summary

Study aim: To assess the physical activity of male and female adolescents from Poland living in a town (Czechowice-Dziedzice) and in a city (Katowice).

Material and methods: The research involved 431 high school students aged 16-18 years (249 from Czechowice-Dziedzice and 182 from Katowice). Physical activity was measured by the short form of the International Physical Activity Questionnaire (IPAQ). The volume of the different levels of physical activity was calculated in units of MET min/wk.

Results: The total volume of weekly physical activity was higher among high school students living in a town (Czechowice-Dziedzice) than students living in a city (Katowice). Only 31.5% of the students met the criteria for recommended physical activity.

Conclusions: The level of physical activity varies by place of residence. Students living in towns are more physically active than youth living in cities. Most high school students (64%) included in the research can be considered to be insufficiently physically active.

Key words: Physical activity – IPAQ – Environmental factors – Health recommendations

Introduction

Long-term epidemiological studies have demonstrated the relationship between the deficiency of physical activity (hypokinesia) and premature mortality or the incidence of many diseases [15,27]. However, despite large amounts of newly presented scientific evidence about the benefits of regular physical activity, the awareness of the role of reasonable effort in both maintaining physical health and in preventing and treating lifestyle diseases remains insufficient. The low percentage of Poles who satisfy the recommended physical activity as suggested by the American College of Sports Medicine (ACSM), the American Heart Association (AHA), and the World Health Organization (WHO) [6,12] substantiate this conclusion.

Experts have recognized the decline in physical activity of children and adolescents as a growing problem [34]. Regular physical exercise plays a fundamental role in normal, balanced psychophysical development. Meanwhile, the younger generation frequently becomes a “victim” of technological progress. They spend more time at the computer, while their mobile phone replaces traditional ways of spending time with peers. These behaviours reduce the physical activity of children and adolescents to a minimum during their spare time. The result is an in-

creasing number of children and young people with postural defects and obesity. The latter, according to World Health Organization, has grown to the size of being considered a global epidemic [33].

Physical activity is determined by, among other factors, place of residence. Many authors highlight the greater levels of activity of rural and small towns residents, arguing that the higher level of physical activity is a result of, among other things, work performed on farms and gardens, as well as commuting – to get to school, the bus, shops – on foot or by bicycle, which is referred to as “active transport” [14] or “active commuting” [19].

Czechowice-Dziedzice, with a number of residents that is almost 10 times fewer than Katowice, can be considered a town. Within the town’s administrative boundaries are located administrative units (town councils) that lack high schools. Thus, over 50% of the students from Czechowice-Dziedzice commute to school by bus or train, or need to go to school on foot. In cities with well-developed public transportation systems, it is much easier to get to school. A significant share of the so-called “school transport” in the physical activity of children and adolescents has been confirmed in numerous scientific studies in countries with school commuting systems organized better than Poland’s. [8,14,30]. This allows for the

assumption that active forms of commuting to school (active commuting) play an important part in physical activity undertaken by young Polish people residing in villages and towns who attend secondary schools.

In research on the subject of physical activity, comparisons between the actual parameters of physical activity and the recommended parameters are rare. The lack of such comparisons allowed the research problem at the centre of this study to be defined. The aim of this study is thus to compare the parameters of physical activity of male and female adolescents aged 16-18 years who live in a town (Czechowice-Dziedzice) and in a city (Katowice) in the context of the amount of physical activity recommended to maintain health. The following research questions were formulated:

1. What is the level of high, moderate, and low physical activity among male and female adolescents who live in a town and in a city?
2. What is the total weekly physical activity of male and female adolescents in a town and a city?
3. What percentage of the researched students met the criteria for minimum and optimum recommended physical activity needed for a healthy life?

Material and Methods

The survey study included a total of 431 subjects. The research was conducted in 2009 among 182 high school students enrolled in Paderewski General Education Lyceum number 1 in Katowice (included 87 boys and 95 girls), and in 2010, among 249 students of the Staszic Technical and General Education School Complex of Czechowice-Dziedzice (143 boys and 106 girls). In the study, participating students included first- and second-year high school students, aged 16-18 years, who regularly attended physical education classes. The selection of schools was intentional. The lyceum in Katowice is located in the centre of the city, and the students were residents of the city. The school of Czechowice-Dziedzice was chosen from among three schools with lyceum-type classes, as its students were mostly from out of town. Participation in the study was voluntary.

In the assessment of physical activity, the short version of the international physical activity questionnaire (IPAQ) was used [1,3]. The collected information about physical activity was supplemented with the measurement of the subjects' body height and mass, and calculation of body mass index (BMI). Respondents completed the IPAQ alone in the presence of a trained interviewer, who explained all the emerging doubts about the interpretation of the questions contained in the questionnaire.

The level of weekly physical activity (measured in units METmin/wk), which was described as high, mod-

erate and low intensity, was determined by multiplying the number of days in which the activity was done in a week, the average length of the activity's duration in one day, and metabolic equivalent of the task (MET, metabolic equivalent of work = 1kcal/kg/h [11]). The MET value of 3.3 was adopted for low intensity effort (AF3), MET value 4 for moderate (AF2), and MET value 6 for high (AF1). In the latter case MET value 8 was assumed per IPAQ instruction. In this work, it was reduced to MET value 6 in accordance with a solution adopted by other authors [16,29] connected with the propensity of youth to overestimate high intensity efforts [3,25]. The total weekly physical activity of subjects was determined by summing its level in the aforementioned ranges of intensity (AF4).

The level of weekly physical activity of respondents was interpreted on the basis of selected criteria of physical activity recommended for children and adolescents from 5 to 18 years old. The latest standards of physical activity recommended for optimal health indicate a need to do daily moderate (4.0 MET) or vigorous (6.0 MET) physical activity (MVPA) with a cumulative daily duration of not less than 60 minutes [10,31,33]. A moderate to vigorous intensity of physical activity that lasts at least 30 minutes per day is considered a daily minimum for children and young people [17].

The statistical analysis of the collected results was performed using the Statistica 9.1 software and Microsoft Excel. The significance of differences in the mean results of physical activity in male and female adolescents from Czechowice-Dziedzice and Katowice was evaluated using Student's *t*-tests or the Mann-Whitney *U* test. The proportion of male and female adolescents who met the criteria for minimum and optimum desired physical activity to maintain health was calculated and compared using Chi-square test. The level of $\alpha = 0.05$ was considered significant.

Results

Analysis of the parameters of the respondents' somatic build indicates the diversity of gender and place of residence (Table 1). The female students from Katowice were on average shorter and heavier than their peers from Czechowice-Dziedzice, as was reflected in the higher ($p < 0.01$) values of their body mass index (BMI). The differences in somatic build among male individuals were minor. In most cases, the mean values and dispersion values of BMI results show that the body build of the studied adolescents was normal.

The analysis of physical activity of the compared groups of secondary school youth from Czechowice-Dziedzice and Katowice was limited to an assessment of frequency per week, as well as daily and weekly levels, as categorized in three ranges of effort intensity.

Table 1. Somatic characteristics (mean \pm SD) of male (M) and female (F) adolescents from a town (T) and a city (C)

Variable	FT (n=106)	MT (n=143)	FC (n=95)	MC (n=87)
Body height (cm)	166,3 \pm 5,7	177,8 \pm 6,9	163,8 \pm 5,6**	177,4 \pm 6,6
Body mass (kg)	56,9 \pm 8,7	70,3 \pm 11,5	57,9 \pm 10,0	72,2 \pm 12,9
Body Mass Index (kg/m ²)	20,6 \pm 2,7	22,1 \pm 2,8	21,5 \pm 3,4**	22,8 \pm 3,5

** Significantly ($p < 0.01$) different from FT group

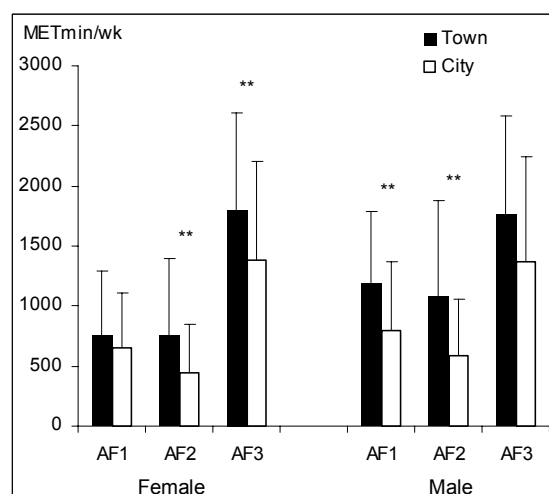
Table 2. Frequency and daily volume (mean \pm SD) of physical activity in male (M) and female adolescents (F) classified within 3 ranges of intensity

Intensity	FT (n=106)		MT (n=143)		FC (n=95)		MC (n=87)	
	Frequency of physical activity (days/week)							
AF 1	76	2,84 \pm 1,47	127	3,39 \pm 1,22	67	2,55 \pm 1,10	80	3,08 \pm 1,29
AF 2	98	3,41 \pm 1,95	137	4,01 \pm 1,81 [#]	76	3,19 \pm 1,64	74	3,19 \pm 1,80 [#]
AF 3	106	6,42 \pm 0,99	143	6,46 \pm 0,94	95	6,37 \pm 1,31	86	6,31 \pm 1,15
Daily volume of physical activity (min.)								
AF 1	76	44,7 \pm 19,1	127	59,4 \pm 25,0	67	45,4 \pm 22,3	80	42,9 \pm 20,3 ^{###}
AF 2	98	56,3 \pm 32,2	137	67,4 \pm 34,8	76	46,9 \pm 28,7*	74	47,5 \pm 23,9 ^{###}
AF 3	106	84,1 \pm 33,6	143	82,0 \pm 33,7	95	67,8 \pm 34,0***	86	63,9 \pm 37,1 ^{###}
AF 4	106	168,8 \pm 65,2	143	199,5 \pm 64,2	95	140,2 \pm 63,9***	86	143,1 \pm 51,9 [#]

Legend: T – Town; C – City; AF 1 – High physical activity; AF 2 – Moderate physical activity; AF 3 – Low physical activity; AF 4 – Total physical activity; Numbers in columns pertain to number of subjects meeting criteria for respective physical activity intensities; Significantly different from FT group: * $p < 0.05$; *** $p < 0.001$; Significantly different from MT group: [#] $p < 0.05$; ^{###} $p < 0.001$

The male and female secondary school students who lived in Czechowice-Dziedzice were, on average, more often physically active per week. Most days of the week, the surveyed students undertook only physical activity of low intensity, regardless of gender and place of residence (Table 2). The boys declared participation in physical activities of high and moderate intensity more often than the girls. Also, the average daily duration of physical activity in the evaluated ranges of intensity was higher for individuals from the town (Table 2).

The level of weekly physical activity in each of the evaluated ranges of intensity was higher for adolescents from Czechowice-Dziedzice. Statistically significant inter-group differences were found in all cases with the exception of high intensity activities of the girls from Czechowice-Dziedzice in relation to their peers from the city (Fig. 1). In all compared groups, low intensity activity had the largest share of the total volume of weekly physical activity, while moderate efforts had the smallest share. The boys declared greater amounts of activity of moderate and high intensity than the girls did; an inverse relationship was found for efforts of low intensity.

**Fig. 1.** Mean (\pm SD) weekly volume of physical activity of male and female adolescents; classified within 3 ranges of intensity

For explanation of symbols see Table 2; *** $p < 0.01$

Greater amounts of activity of students from Czechowice-Dziedzice in certain ranges of intensity were reflected in total volume of weekly physical activity (Fig. 2).

The secondary school students from Katowice presented a significantly lower level of weekly physical activity. A particularly significant difference, on average 1271 METmin/wk, was observed between the boys, while between the girls it was smaller, 629 METmin/wk. In both cases, these differences proved to be statistically significant ($p < 0.01$; Fig. 2).

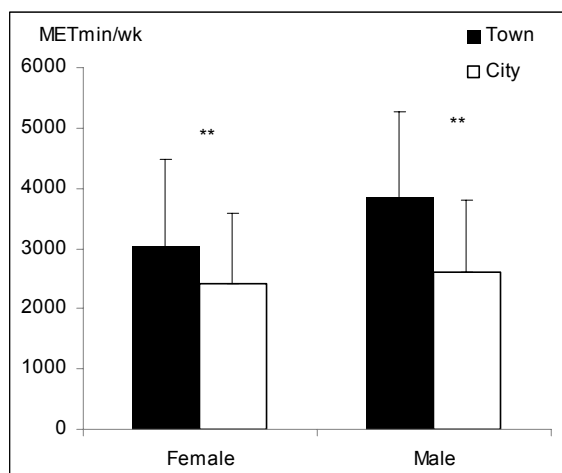


Fig. 2. Mean (\pm SD) total volume of weekly physical activity of male and female adolescents

*** $p < 0.01$

The current standards of physical activity recommended for health emphasise that to keep or improve their health, children and adolescents must do exercise of moderate or high intensity. In our study, a significant proportion of the girls did not meet this recommendation. The volume of their total weekly physical activity was a result of undertaking mainly efforts of low intensity. A much larger share of efforts of moderate and high intensity was observed for the boys (Fig. 1).

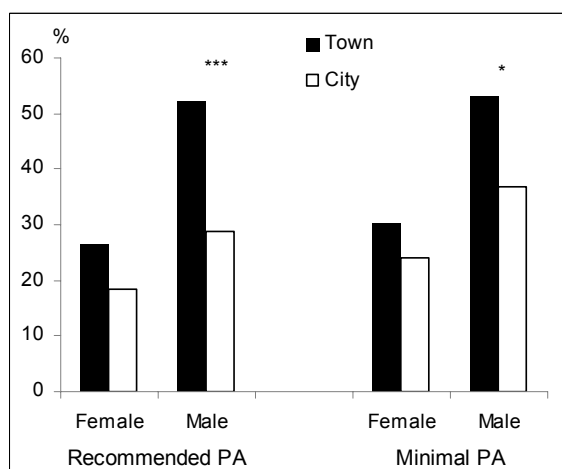


Fig. 3. Percentages of the male and female adolescents meeting recommended [10,31,33] and minimal [17] physical activity (PA) standards

*** $p < 0.01$

The assessment of physical activity parameters of the surveyed subjects indicates a significantly higher proportion of sufficiently active male adolescents among these living in a town (Fig. 3). Undertaking daily physical effort of intensity ≥ 4 MET was observed in 41.6% of the students from Czechowice-Dziedzice (53.1% boys, 30.2% girls) and 30.4% of the students from Katowice (36.8% boys, 24.0% girls). Yet only for 39.4% of respondents from Czechowice-Dziedzice and 23.0% from Katowice, however, the cumulative duration per day was not less than 60 minutes.

Discussion

The recommendations on necessary physical activity for children and young people are much stricter than for adults due to a developing organism's greater need for movement activities. Numerous publications highlight the positive impact of movement activities on the physical, mental, and social development of the young generation. The same publications also warn of the decline in participation of youth in extracurricular physical activities [7]. The results of the last report of the Health Behaviour in School-Aged Children (HBSC, 2010) are particularly alarming. According to the authors, only 10.3% of students aged 16-18 years (17.9% male students, 4.2% female students) undertook efforts of moderate or high intensity for at least an hour on a daily basis. In other studies of a nationwide sample of Polish youth, 65% of the evaluated respondents did not present the recommended level of physical activity [5]. According to Stankiewicz *et al.* [28], 30.7% of these young people declared daily physical efforts. Such an unsatisfactory result was confirmed by the high school students from Czechowice-Dziedzice and Katowice. It was found that only 36% of the studied adolescents reached the minimal physical activity levels recommended for health, while only 31.5% reached the optimal physical activity levels recommended for health. It should be stressed that it was the claimed physical activity of the young people that was analysed (surveys); hence, the actual level was probably even lower, because research results show the tendency of youth to overestimate their physical efforts. It applies especially to physical activity of high intensity [3,4,25]. Biernat *et al.* [4] point out that discrepancies between the actual level of physical activity and the declared level could be prevented by the proper training of interviewers. In light of the experience of the authors of this paper, even such an essential measure may be ineffective in surveys of the physical activity of youth. Increasingly lower levels of fitness and physical efficiency of today's adolescents quite often make students regard their efforts of moderate

intensity as being highly intensive. However, it does not mean that their caloric expenditure exceeds 6 kcal/kg/h (6 MET).

Many researchers highlight the sexual dimorphism in physical activity that shows boys undertake recommended physical efforts of moderate and high intensity more often than girls, and this is reflected in the boys' higher total volume [21,22]. In our study we also reported the higher volumes of moderate and intensive efforts of the boys. As a result, and similar to the opinions of other authors [9,18,23], a higher percentage of male secondary school students met the recommendations for physical activity assumed to have healthy effects.

One of the crucial factors differentiating participation of children and adolescents in physical activities is their place of residence [20,13]. This was also reflected in the results of this study, according to which the percentage of both male and female adolescents who fulfilled the criteria of minimal and optimal physical efforts recommended for health was much larger in Czechowice-Dziedzice than Katowice. The lower levels of physical activity of residents of urban areas has also been addressed by Bergman *et al.* [2], Sandercock *et al.* [26] and Wojtyła-Buciora and Marcinkowski [32].

In light of the high percentages of insufficiently physically active adolescents observed in this research, the results of other studies on teenagers' self-evaluation of physical activity levels seem interesting. In research by Stankiewicz *et al.* [28], in which 69.3% of adolescents did not attain recommended physical activity, only 10% of the respondents considered themselves insufficiently physically active. In another study, the percentage of respondents unsatisfied with their physical activity level was 20% [32]. This shows the low awareness of young people regarding the need of an organism for physical effort, and indicates the need for development of healthy behaviour among students, especially the habit of regular physical activity.

To summarise the above results of the study, it should be noted that secondary school students living in a town (Czechowice-Dziedzice) presented higher levels of physical activity than their peers living in a city (Katowice) in all ranges of effort intensity. The physical activity of boys was characterised by the prevalence of efforts of high and moderate intensity. Girls dominated the physical activity forms of low intensity efforts. Thus it confirmed the results of many previous observations conducted in Poland and abroad.

The most important cognitive conclusion of this research is a finding that in light of the latest recommended standards of physical activity for children and adolescents aged 5-18 years, 36.0% of secondary school students from

Czechowice-Dziedzice and Katowice reached the recommended minimal level of physical activity, while 31.5% reached the optimal level. This indicates a justified and urgent need for intensification of actions intended to promote healthy lifestyles, with a particular emphasis on physical activity and its continuous monitoring among all children, young people, and adults. A key role in this process is played by scholastic physical education, in which the main objective should be to prepare a student for a life of physical activity. Some countries promote the idea contained in the slogan "lifetime sports", which assumes that a purpose of scholastic physical education is to help students find the movement forms (sports) that they will do throughout their lives.

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