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ORIGINAL RESEARCH

Selected parameters characterizing physical activity behavior in pupils of the second grade of elementary school in the Ústí Region, Czech Republic

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Abstract

Background: By the application of pedometers and subjective evaluation techniques, one can obtain information about the importance of physical activities (PA) in the lifestyles of adolescents. The conduct of PA in the Ústí Region, which is a structurally affected region within the Czech Republic, may be specifically impinged upon. **Objective:** The aim of this study is to establish indicators of adolescent participation in PA during school days and weekends and to evaluate them from the point of view of recommended criteria for health. We compare our findings with other studies and draw attention to the role of school movement programs. **Methods:** Physical activity was concurrently and objectively monitored by the Yamax SW-700 and SW-800 pedometer for a period of seven consecutive days. An identification and recording sheet were used for the registration of results. A total of 285 boys and 276 girls from elementary schools in the Ústí Region participated in the survey. Pedometers were applied during normal school attendance. Kruskal-Wallis and Mann-Whitney tests were used to assess differences between days of the week in boys and girls. A daily step count (SC) was compared with the recommended criteria for health. The daily recommendation amounted to ≥ 13,000/11,000 SC for 12-year-old children and ≥ 10,000 SC for 13–15-year-old adolescents. **Results:** The daily SC values for boys were 10,702 ± 4,474, and for girls the lower 9,841 ± 3,722 (p = .02, r = .10). Weekend days were accompanied by a decrease in values in boys compared to school days (p < .001, r = .20) and girls (p < .001, r = .17). 43.2% of boys and 35.9% of girls meet the recommended health criteria. PA participation time is higher in boys than in girls during school days (p < .001, r = .25) compared to (p < .001, r = .22). The importance of school movement programs becomes evident. **Conclusions:** Boys achieve higher daily values than girls in all monitored indicators. The lowest SC levels are those reached by the oldest group of adolescents during weekends.

Keywords: physical activity, physical education, step counts, youth lifestyle

Introduction

In adolescents, we consider the conduct of physical activities (PA) to be a suitable way to shape a life-long complex of physical literacy (Whitehead, 2001). At the same time, appropriate physical behavior is a good starting point for shaping and maintaining the quality of life until adulthood. Although it is necessary to strive to evaluate physical behavior as a whole in the form of a 24-hour evaluation of energy output according to current models of movement behavior and non-movement behavior (Tremblay et al., 2017), physical activities play a pivotal role in these models (Saunders et al., 2016). Practice confirms the role of physical activities in the prevention of the development and increase of civilization's diseases, as they help to balance the ratio of energy intake to output. In their application, it is desirable to reach the level that is beneficial to health and brings the body the desired benefits. The limitation of physical activities in one's everyday life becomes one of the signs of the gradual acceptance of an unhealthy lifestyle. The consequences of this, in the form of obesity and other diseases of civilization, are evident in the relevant characteristics of the Czech population (de Gouw et al., 2010; Hamřík et al., 2017), where it increasingly affects the lives of younger generations, including adolescents (Mitáš et al., 2020; Rubín et al., 2018). Many adolescents, like their parents, cannot detect these threats or ignore them. Moreover, although many of these mistakes are often manifested even at preschool age, they may not be perceived as something painful. In the age of compulsory elementary school attendance, many pupils rely, for the increase in their expression of abilities and skills, on the advantages of natural ontogenetic development. This potential is then quickly exhausted as long as it is not supported by a sufficient application of physical activities (Bláha & Cihlář, 2019). Within the recommended criteria for physical activity, PA may currently be considered at least minimally effective for maintaining health (Corbin et al., 2004; Tudor-Locke, Craig, Beets, et al., 2011; Tudor-Locke, Craig, Brown, et al., 2011). These characteristics may be looked for

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in the determination of the time and intensity of a load, the frequency of repetition, in the energy expenditure converted from other indicators (energy expenditure – kcal; heart rate, and counts) or by other means.

Among other characteristics that are currently valid, it is possible, in specific circumstances, to respect the recommendation that can be explained as a form of monitored locomotion, or more specifically, steps taken. Although the evaluation of the number of steps one takes encounters methodological limits (John et al., 2018), this indicator has become a clear guide for determining the level of application of (selected) physical activities in a wide range of populations and numerous comparative and correlation analyses (Craig et al., 2013; De Bourdeaudhuij et al., 2003; Lubans & Morgan, 2009; Miguel-Berges et al., 2018; Mitre et al., 2009; Sigmund et al., 2016; Sigmundová et al., 2011; Tudor-Locke et al., 2009) and also serves as a means for judging the load level in a variety of professions or sports activities. The set evaluation process has also been proven in a number of health-oriented and interventionist programs (Bravata et al., 2007; Craig et al., 2002; De Cocker et al., 2009; Dishman et al., 2009; Mitre et al., 2009). A link may also be seen here to the assessment of BMI levels and the activities of pedestrians (Tudor-Locke et al., 2009). Similarly, a link may be established between favorable PA values established by the pedometer and cardiorespiratory fitness values (Cao et al., 2009). The recommended criteria by means of completed steps during units of time are stated by many authors, for example, Colley et al. (2012); Frömel et al. (1999); Sigmund & Sigmundová (2011); Tudor-Locke, Craig, Beets, et al. (2011), and Tudor-Locke and Bassett (2004).

Although the use of user-friendly bracelets, watches, and accelerometers is now preferred, the use of pedometers can be respected for accuracy (Šimůnek et al., 2016) and for the possibility of comparison with older studies. These are all based on the achievement of daily recommended criteria in regard to the age and assumed health of the assessed persons. In the case of younger aged pupils (6–12 years), one can consider values of 12,000 steps for girls and 15,000 steps for boys (Tudor-Locke et al., 2004). According to the approach of the authors, the recommended criteria in adolescents can be considered met if girls reach 11,000 steps in a predominant number of days in the week and boys reach 13,000 steps (Sigmund & Sigmundová, 2011), and in other cases, lower criteria can be considered (Sigmund & Sigmundová, 2021a; Sigmundová & Sigmund, 2015). A more challenging view is obvious in the general recommendation of the application of 12,000 steps in children and youth aged 16 to 19 years old during a moderately intense load, which is thus associated with adequate sensitivity (Colley et al., 2012). Current recommendations hover above 13,000/11,000 steps per day (≥ 13,000/11,000 steps/day for 5–12-year-old boys/girls) and ≥ 10,000 steps/day for 12–16-year-old adolescents (Tudor-Locke, Craig, Beets, et al., 2011) and adults (Tudor-Locke, Craig, Brown, et al., 2011). The studies carried out thus allow for the capture of developmental trends in the application of "locomotion oriented" physical activities in adolescent sets at international and purely local levels.

The Czech Republic has undergone quite large socio-economic changes in recent decades which have also been significantly imprinted on adolescent lifestyles. In general, we are observing an increased level of sedentary behavior as well as a deterioration in fitness indicators. The field of education has not even been able to respond optimally to these changes. Although Framework educational programs, in their areas of the Human and Health, care about health by means of the cultivation of clearly defined physical activities, it seems that instruction in these subjects is insufficient for the current needs of society. The reduced application of physical activity is thus also reflected in activities that can be evaluated with pedometers or accelerometers. In the research of Frömel et al. (1999), the values for Czech girls and boys were still above the recommended daily value (the daily average for girls was 11,666 steps and for boys was 13,786 steps). The study by Vašíčková et al. (2013) shows an average for Polish adolescent girls of 12,356 steps during school days and 12,567 steps per day at weekends. For boys, these figures hover around 12,006 during school days and 11,014 at weekends. This is consistent with the view that the wearing of a pedometer by girls is accompanied by a higher PA (Ho et al., 2013). Over the last decade, successive reductions in these indicators have been observed, as documented in a one-off study (Bláha, 2019; Bláha & Cihlář, 2019; Rubín et al., 2018), as well as in long-term continuous monitoring (Mitáš et al., 2020). In a nationwide study, Mitáš et al. (2020) showed a decrease in the average daily values in older adolescents between 2010–2011 and 2016–2017 in girls (n = 1,129) from 11,905 to 10,729 and in boys (n = 779) from 12,422 to 10,295 steps. A number of studies confirm lower values during weekend days compared to weekdays, with Sunday being considered the least active day for walking. It can also be seen that in recent years, according to some studies, girls have started to equal or even surpass boys in the number of locomotion values achieved (Mitáš et al., 2020; Řepka et al., 2020; Rubín et al., 2018; Sigmund & Sigmundová, 2021b). This would mean that boys are becoming more distant from the recommended values, while girls oscillate around those values. We were interested in whether we could confirm these trends in the Ústí Region, which in a number of characteristics surpasses other regions in the fact that it is a structurally affected region. In our study, we wanted to answer questions about whether the indicators of locomotion activities in children at the 2nd level of elementary schools in the Ústí Region met the recommended health criteria. The question was also how different the indicators we found were from the conclusions found in other studies.

The goal of this study was therefore to determine selected indicators of the physical activities of pupils in the 2nd level of elementary schools in the region through a weekly application of a pedometer and to evaluate these indicators from the perspective of the recommended health-oriented criteria. A secondary objective was also to present the time characteristics of participation in physical activities and to evaluate them in relation to the reported number of steps and physical indicators of the pupils.

Methods

Study design and participants

The implementation of this survey took place at schools in the Ústí Region and resulted in a stratified selection; the survey was then conducted during acceptable climatic conditions and when pupils would be settled into a certain movement routine during the year 2019. Pupils whose routine was affected by the COVID-19 pandemic in early 2020 were not included in the survey. We chose the period from September 15 to November 15 during the autumn and from March 15 to June 15 during the spring to carry out the survey. We chose this period as neutral in terms of climatic conditions and also suitable due to the organizational structure of the school year and thus research planning. The selected period also covers the data collection period for other similar studies in the Czech Republic (Bláha & Cihlář, 2019; Rubín et al., 2018).

The selection of schools was subject to parameters relating to how the population in the region has been settled. We considered the representation of schools in larger cities and agglomerations in industrial areas (over 30,000 inhabitants), smaller municipalities of an industrial character (under 10,000 inhabitants), industrial zones, and the representation of municipalities in agricultural areas. The variable nature of the settlement in the region and its geographical organization was thus respected. The main problems of the region are the considerable extent of industrial production, the resulting ecological burden caused by this, and the increased migration of the population where education and qualifications usually fall short of the usual level to be found in the Czech Republic (Czech Statistical Office, 2021). These circumstances are also the source of social problems found in the region, the perception of reduced quality of life (Petrovič & Murgáš, 2020), and are also reflected in the sphere of education and the participation of adolescents in physical activity. The characteristics of the selected groups are illustrated in Table 1. After discarding incomplete documentation, we evaluated the data obtained from 561 participants (age 13.04 ± 1.16 years, body mass index 20.79 ± 3.93 kg/m^2). The number of participants reached values suitable for evaluation by objective measurement techniques (n = 500).

Table 1 Basic characteristics of selected groups

		Body mass index (kg/m^2)		Calendar age (years)	
Age (years)	*n*	*M*	*SD*	*M*	*SD*
Boys					
≤ 12	89	20.17	4.15	11.76	0.43
13	82	22.15	4.80	13.00	0.00
14	74	21.21	4.00	14.00	0.00
≥ 15	40	21.78	4.15	15.08	0.27
Total	285	21.23	4.36	13.17	1.18
Girls					
≤ 12	101	19.52	3.01	11.73	0.45
13	87	20.68	3.84	13.00	0.00
14	62	20.86	2.96	14.00	0.00
≥ 15	26	20.49	2.83	15.08	0.39
Total	276	20.28	3.30	12.96	1.14

Procedures

The actual implementation of the research was preceded by a presentation of the problem and the design of the research to the administrations of the schools. On this occasion, the measuring techniques themselves were submitted for testing and assessment. We noted the specifics of the individual schools in regard to the teaching Physical Education and the provision of other movement programs and met with parents and pupils to discuss the rules for cooperation in the research survey. We supported the precision of the survey by involving teachers of subjects for which the application of the techniques used for the further education of their pupils and their education in the requirements for a healthy lifestyle could be evaluated. The teachers received training in the proposed research procedures and in the use of evaluation and recording techniques. At the same time, possible problems were presented in consultation (the consent of parents and pupils to participate in the research, the loss of a device, the social status of families, the absence of selected data, GDPR rules, etc.).

Teachers, and subsequently pupils, were provided with recording sheets containing a request and communication to parents as to the purposes of the research and the possibilities of the pupil's involvement in the research. Pupils were subsequently informed of the conduct of the research, received pedometers, and were instructed to use them. According to the specific instructions of the teachers, the pupils underwent a short period (3–5 days) of pedometer testing. At the instruction of the teacher, pupils started the application of measuring and evaluation techniques together according to their classes. The wearing of pedometers took place according to organizational possibilities for several days; for our needs, we recorded data for one week (always both days of the weekend and 5 days of school attendance). The pupils recorded the obtained values in record sheets. They also entered data on the time of participation in physical activities in the school facility and the time of participation in physical activities in their free time. Only the activities with a duration longer than 10 minutes were entered and the data was specified for the day. Teachers immediately collected the recording sheets and pedometers, checked the quality of the completed data, and helped with the administration of the surveys.

Measurements

To determine the amount of PA in days, YAMAX Digiwalker SW-700 and SW-800 pedometers were used (YAMAX Corporation, Tokyo, Japan). The number of steps – more precisely, sufficiently strong vertical oscillations – is the most accurately measured value for them. For both the distance and the energy output, the error rate increases, and this must be considered when interpreting the results. YAMAX pedometers demonstrate considerable measurement accuracy in practice (Šimůnek et al., 2016). The data concerning the number of steps (but also jumps and changes in body position) obtained from pedometers were not adjusted in any way. Extremely low (less than 500) and high (more than 32,000) step counts per day were

eliminated. The pedometers had new batteries and were calibrated (5% tolerance).

Data analysis

We relied on 13,000 steps/day for boys and 11,000 steps/day for girls (Sigmund & Sigmundová, 2011) to determine compliance with health criteria. However, we also considered a milder view of other authors who consider lower values for the population we address – in adolescents over 12 years of age, we respected the level of 10,000 steps (Tudor-Locke, Craig, Beets, et al., 2011; Tudor-Locke, Craig, Brown, et al., 2011).

Using the Shapiro-Wilk test, the normality of the data was rejected. For this reason, we used non-parametric procedures for statistical processing. Non-parametric analysis of variance (Kruskal-Wallis) was used to determine whether there were significant differences in the amount of physical activity between independent groups (e.g., between school grades). Statistical significance was pre-determined as $p < .05$. For a post-hoc analysis, the Mann-Whitney test was used, and the effect size was interpreted as follows (Pallant, 2013): small effect $r > .1$, medium effect $r > .3$, large effect $r > .5$. The Wilcoxon test was used to assess within-group differences. Whether there was a dependency between variables was determined by using the Spearman correlation coefficient and the determination coefficient. Statistical analysis was performed in the R programming language (Version 3.5.2; https://www.R-project.org), used in the IDE RStudio (Version 1.1.463; https://www.rstudio.com).

Ethical statements

This study was approved by the Ethical Committee of the Faculty of Education of Jan Evangelista Purkyně University in Ústí nad Labem (no. 1/2019/01). The school administrations, parents, and participants confirmed their agreement to participate in the research by providing written consent.

Results

Average step count

The resulting values are largely based on the expectation that boys would show higher volumes of locomotion activities than girls. Table 2 shows that boys outperform girls not only in daily averages but also during school days as well as on weekends. The difference between boys and girls when using median values (Mann-Whitney test) is manifested on school days ($p = .02$, $r = .10$), however, during weekend days it falls short of statistical significance ($p = .19$, $r = .06$). School days always appear to be more physically active in both boys ($p < .001$, $r = .20$) and girls ($p < .001$, $r = .17$), compared to weekend days (Wilcoxon test). As Table 2 documents, both weekend days for boys and girls are among the weakest days of the week. In terms of median values, Sunday values have the lowest level. While the difference between average and median values for boys during school days ($M_{SDB} = 10{,}985$; $Mdn_{SDB} = 10{,}605$) does not vary greatly, it doubles during weekend days (9,994 steps vs 9,218 steps). For girls, the median during school days is only slightly lower than the average ($M_{SDG} = 10{,}061$, $Mdn_{SDG} = 9{,}828$). The difference between these variables occurs only during weekend days (9,291 vs 8,604). Higher values of standard deviations for boys on both school days and weekend days ($SD_{SDB} = 4{,}451$, $SD_{WB} = 5{,}673$) indicates a considerable imbalance in their participation in locomotion activities. In girls, a similar imbalance can be found on weekend days ($SD_{WG} = 5{,}180$).

View from the perspective of age

We were also tracing trends in reporting locomotive activities with increasing age of adolescents. For pupils, fluctuations in values are observed with increasing age, followed by a decrease in total reported values, i.e., during weekdays and weekends. This trend is most noticeable for the oldest groups of boys and girls. The whole monitored group of pupils ≥ 15 years of age ($n = 66$) thus shows a decrease in all monitored indicators compared to all other years ($p < .001$).

View from the perspective of days

The volume of steps taken by both boys and girls over weekdays is variable, though median values are below average values (girls do not even get past the 10,000-step threshold). The values of both averages and medians for both sexes will fall more significantly during the weekend days, while the values of standard deviations will increase significantly. In terms of average values, Sunday seems to be the most problematic.

The level of the prevailing volumes of steps completed can be seen as one of the criteria for meeting health recommendations. We subjected our groups to more demanding but also to milder criteria (Table 3). The data obtained show that 26.7% of boys meet the required health recommendations according to the more demanding criteria, but when we consider 10,000 steps to be the limit for adolescents over the age of 12, this number increases to 43.2%. For girls, this number increased from 31.9% to 35.9% according to the set criteria.

With the time characteristics of participation in physical activities, we tried to draw indicators of locomotion activities. Table 4 lists the time values of the total reported PA under school and leisure programs. It is clear from these data that school days are shown to be more active in both boys and girls (Wilcoxon test $z_B = 5.64$, $p < .001$, $r = .25$; $z_G = 4.84$, $p < .001$, $r = .22$), but the values of standard deviations ($SD_B = 63.86$, $SD_G = 68.52$) and in

Table 2 Reported locomotion activity during days of the week

	Boys (n = 285)			Girls (n = 276)		
Day in week	*M*	*SD*	*Mdn*	*M*	*SD*	*Mdn*
SC_1	10,702	4,474	10,053	9,841	3,722	9,402
SC_{SD}	10,985	4,451	10,605	10,061	3,621	9,828
SC_W	9,994	5,673	9,218	9,291	5,180	8,604

Note. SC_1 = step counts of individual on one day of the week; SC_{SD} = step counts of individual in the course of a school day; SC_W = step counts of individual in the course of a weekend day.

particular the predominance of zero participation in PA among the number of pupils with reported participation during weekend days show how little time pupils spend on physical activities during weekends. Differences in PA time volumes are minimal between boys and girls on school days and weekends. Kruskal-Wallis test results showed no deviations between sets of boys by age, nor in daily values, whether this be on school days or weekends. However, there were differences in daily values in girls (ϕ^2 = 9.73, p = .02, η^2 = .02). A follow-up post-hoc analysis showed differences between the oldest girls (≥ 15 years) versus two younger age sets (≤ 12 years and 13 years) in the volume of the time of day devoted to PA (all ps <.01) and weekdays (p = .02, p = .01). The post-hoc analysis also confirmed a decrease in the daily amount of time devoted to PA between the youngest (≤ 12 years) and the oldest (≥ 15 years) groups of all adolescents (p = .04).

The daily volumes of PA time fluctuate throughout the week (Figure 1). Sunday is the most problematic day for both boys and girls, as average values decrease significantly (in minutes: M_B = 35.96, M_G = 35.38). The biggest differences in values within both sets of boys and girls are evident on Saturday (SD_B = 81.49, SD_G = 85.52), but the difference between sets of boys and girls in average values is negligible (M_B = 47.32 min, M_G = 48.74 min).

Throughout the PA monitoring, we tried to identify the amount of time devoted to physical activities within school movement programs (especially in subject Physical Education) and the physical activities performed by the pupil in his/her free time. The usual teaching hour is 45 minutes, for methodological reasons we set the duration to 35 minutes (organization, transitions, changing clothes). Although the group of boys showed higher values at the time of participation in these programs (M_B = 16 min), the Mann-Whitney tests did not confirm statistically significant differences (z_B = 0.64, p = .53, r = .03).

Kruskal-Wallis test results in girls (ϕ^2 = 22.27, p < .001, η^2 = .07) imply a difference in participation in programs according to the age of the girls. The subsequent post-hoc analysis showed a significant decrease in participation in these programs compared to girls 13 years old and under 12 years of age, and it shows already in a group of 14-year-old girls (p = .01, p = .04), and even more in 15-year-olds (all ps <.001). In boys, such a decrease was observed when comparing the oldest boys with 13-year-olds (p = .05). The days where school programs were most prevalent include Tuesdays, Thursdays, and Fridays.

The total amount of time devoted to PA must be supplemented by leisure PA, in other words, activities conducted in the pupils' free time. Wilcoxon test results do not indicate that boys and girls also devote time to PA between school days and weekends at other times (z_B = .08, p = .93, r < .001; z_G = .10, p = .92, r < .001). We also do not find differences in these monitored parameters between boys and girls (z_{SD} = .29, p = .77, r = .01; z_W = .36, p = .72, r = .02). The time spent in leisure PA is variable and it is

Table 3 Proportion of group members meeting more demanding and milder recommended health criteria

	Age (years)				
Variable	≤ 12	13	14	≥ 15	Total
Boys					
n	89	82	74	40	285
Criterion A	26 (29.21%)	23 (28.05%)	21 (28.38%)	6 (15.00%)	76 (26.67%)
Criterion B	26 (29.21%)	45 (54.88%)	43 (58.11%)	9 (22.50%)	123 (43.16%)
Girls					
n	101	87	62	26	276
Criterion A	31 (30.69%)	33 (37.93%)	19 (30.65%)	5 (19.23%)	88 (31.88%)
Criterion B	31 (30.69%)	39 (44.83%)	21 (33.87%)	8 (30.77%)	99 (35.87%)

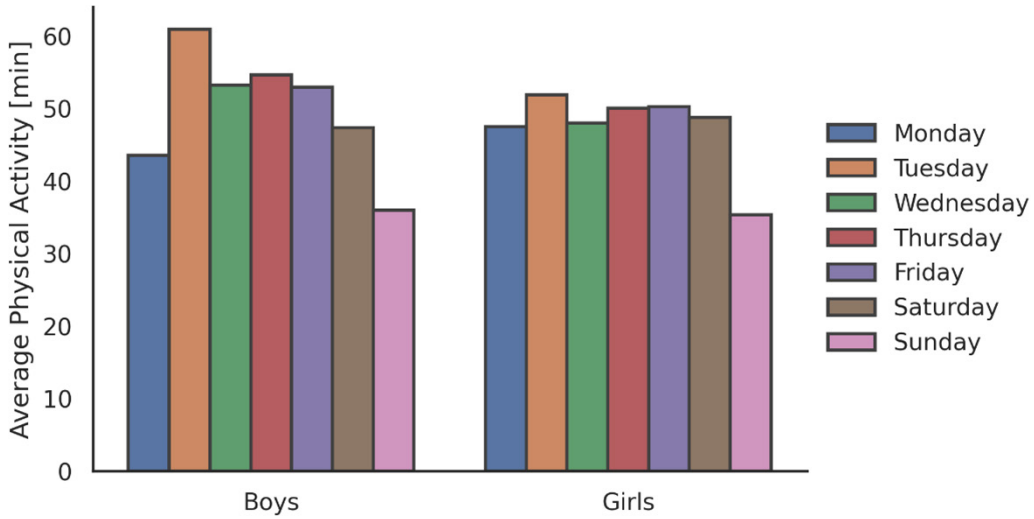
Note. Criterion A = fulfilled recommendation, reached 11,000 steps/day for girls and 13,000 steps/day for boys; Criterion B = fulfilled recommendation, reached 11,000 steps/day for girls or 13,000 steps/day for boys at an age up to 12 years, reached 10,000 steps/day for boys or girls older than 12 years.

Table 4 Time (in minutes) devoted to PA

	Length of all PA		Length of leisure time PA		Duration of school movement programs	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Boys					16.14	8.65
PA_1	49.83	43.76	38.30	43.08		
PA_{SD}	53.06	45.66	36.91	44.33		
PA_W	41.66	63.86	41.66	63.86		
Girls					14.59	6.20
PA_1	47.39	41.20	36.98	41.00		
PA_{SD}	49.54	39.69	34.95	39.13		
PA_W	42.08	68.52	42.08	68.52		

Note. PA = physical activities. PA_1 = length of individual participation in PA on one day of the week; PA_{SD} = length of individual participation in PA during school day; PA_W = length of individual participation in PA during a weekend day.

Figure 1 Reported period of participation in physical activities during days of the week



difficult to capture possible trends from the point of view of groups according to age composition. Only the subsequent post-hoc analysis indicates a decrease in the daily participation time for these activities in the oldest group of girls compared to a set of 13-year-old girls (p = .04). The group of 13-year-old girls surpasses the oldest age group and also the set of 14-year-old girls in the time volume of weekend leisure PA (p < .05).

A significant proportion of the pupil population shows no PA outside the school environment. In our group, we identified a total of 114 boys (43.35%) and 109 girls (43.78%), who devoted time to extracurricular PA. These physically active individuals, within the framework of extracurricular movement programs, show higher PA time volumes during weekend days than on school days (z_B = 5.71, p <.001, r = .38; z_G = 5.26, p < .001, r = .36). However, at the time of participation in these activities, we do not see a difference between boys and girls whether this be during school days (z_{SD} = .18, p = .86, r = .01) or weekend days (z_W = .28, p = .78, r = .02).

Discussion

The presented study summarizes the values of the reported number of daily steps, as well as PA participation periods performed both in the school environment and in extracurricular leisure activities. The default data was a good basis for performing the corresponding statistical operations. The usual debates about the decrease in the participation of children and adolescents in physical activities have been based not only on the findings of other studies but also on daily contact with Physical Education teachers and other educators as well as parents. We were mainly guided in conducting this study by the motive to find objective data on reported physical activities with regard to the specifics of the region and to comment on possible observed trends in the past (Bláha, 2019). Therefore, we were not surprised by the lack of high values found in both boys (10,702 steps/day) and girls (9,841 steps/day). These average daily values oscillate around 10,000 steps/day, which would correspond to the recommended health values for the older adolescent group or the adult population (Tudor-Locke, Craig, Beets, et al., 2011; Tudor-Locke, Craig, Brown, et al., 2011). However, the values given in Table 2 imply circumstances that should be highlighted. Median values for all indicators are significantly lower than the averages, and high standard deviation values also indicate that many boys and girls are already below the levels recommended for the adult population. The increased average values can thus be attributed to the physically active members among all of the pupils. They are most likely the ones who apply structured physical activities in clubs and groups, and this even on weekend days. While by the age of 14 the values achieved oscillate in boys at 11,000 steps/day and girls at 10,000, there is a noticeable decrease in older adolescents. Adolescents thus experience a decrease in participation in PA even before entering secondary school, and these trends are likely to increase in the future.

The groups of boys and girls we monitored do not reach the stricter health recommendations of 11,000 steps for girls and 13,000 steps for boys (Sigmund & Sigmundová, 2011). However, they are able to manage (with difficulty) the milder threshold of the recommended health criteria set for adolescents and adults (Tudor-Locke, Craig, Beets, et al., 2011; Tudor-Locke, Craig, Brown, et al., 2011). Boys hover at this limit (M_B = 10,701 ± 4,474; Mdn_B = 10,053), while girls are already below the 10,000 steps per day (M_G = 9,841 ± 3,722; Mdn_G = 9,402). Given the composition of the groups (younger pupils are included), it would be appropriate to expect (a more pronounced) overcoming of these values. The resulting values remain far behind the data found in the past by Frömel et al. (1999), which lists 11,666 steps/day for girls and 13,786 for boys. It can also be inferred from other more extensive studies conducted that the data we collected related to the Ústí Region are rather among the weaker sort. At the same time, the results show that boys are generally more active in walking than

girls. In daily average values, girls outperform by 861 steps, in median value this is 651 steps (p = .02, r = .10). Higher values than for groups in the Ústí Region, and at the same time a higher volume of steps in boys than in girls, are also confirmed by the conclusions of other studies. For instance, according to Nováková Lokvencová et al. (2011) significantly higher step count (SC) during school days (M_{SDB} = 12,621 ± 3,922, M_{SDG} = 12,222 ± 3,352) and weekends (M_{WB} = 10,842 ± 4,775; M_{WG} = 10,438 ± 4,770) than for Ústí Region groups (M_{SDB} = 10,985 ± 4,451, M_{SDG} = 10,061 ± 3,621, M_{WB} = 9,994 ± 5,673; M_{WGUL} = 9,291 ± 5,180). Rubín et al. also shows higher SC values than we do (2018). This applies to SC per week (M_B = 11,772 ± 3,948, M_G = 11,753 ± 3,671), school days (M_{SDB} = 12,029 ± 4,008, M_{SDG} = 12,057 ± 3,788) and weekend days (M_{WB} = 10,061 ± 5,141, M_{WG} = 9,896 ± 4,863). Interesting comparisons may also be made to a study monitoring the promotion of school-related physical behavior (Frömel et al., 2020), which also presents higher values during school days than our groups do. From an environment similar to ours the conclusions of the study Sigmund and Sigmundová (2021a) as well as Vašíčková et al. (2013) may be presented, which was implemented among the same age groups of Polish adolescents. The girls in this study reached 12,356 ± 2,838 steps during school days, and during weekends 12,567 ± 3,511 steps. The boys reached 12,006 ± 2,924 steps during school days and 11,014 ± 3,511 steps during weekends. Thus, even these values are significantly higher than in our groups. The current comparison with younger pupils is also shown by the study by Řepka et al. (2020), which lists values above 13,500 steps for both boys (n = 52) and girls (n = 52) for school days, while these are lower for weekend days. Interestingly, in this case, girls show higher volumes of steps than boys during weekdays and weekends. In accordance with the study by Mitáš et al. (2020), we can confirm the decreasing trend of reporting locomotion activities in adolescents. This study, conducted in older adolescents (ages 18.60–18.67 years) for the period 2016–2017, reported an average daily step count of 10,729 girls and boys 10,295. In an effort to capture similar trends in the region, we obtained similar values in previous studies (Bláha & Cihlář, 2019), and found that the volumes of reported steps of girls were lower compared to boys. The boys in this study (n = 347) reached an average daily count of 10,549 ± 4,527 steps, 11,153 ± 4,854 during school days, and 9,040 ± 5,552 steps during weekends. The girls in our sets (n = 292) reached 9,972 ± 3,962 steps, 10,431 ± 4,115 and 8,824 ± 5,091 steps in these indicators. The data collected from 2019–2020 thus confirm a similarly reported participation in locomotion activities from the previous years. Like our results, other studies confirm a reduced volume of reported locomotion activities during weekends. The question of why the obtained values of locomotive activities in this group are lower than in the above-mentioned studies is difficult to answer satisfactorily. Numerous specifics of the region can be reflected in the results, such as the level of education and structure of the population, the level of income, sports facilities, the nature of the built-up area, the offer of sports facilities and clubs, and many others. However, these variables and their potential impact will need to be further investigated and refined.

The volume of steps completed served to evaluate the fulfillment of recommended health criteria. Different boundaries are used for assessment in Czech studies, where the authors' perspectives, the time of implementation of the studies, and the nature of the groups are decisive for their determination. The more demanding assessment criteria we have adopted can be, for example, found in the Rubín et al. (2018) study, which has depended on the opinion of Czech authors (Sigmund & Sigmundová, 2011; Sigmundová & Sigmund, 2015). According to Rubín et al. (2018) conclusions, 32% of boy adolescents and 56% of girl adolescents meet these criteria. The values we found are significantly lower, especially for girls (27% of boys and 32% of girls fulfill the recommendations), which logically increases when more moderate criteria are adopted. However, we believe that the values we have found are correct and correspond to the habits and conditions of adolescents in the Ústí Region, as similar data have also been confirmed by previous studies.

The reported time devoted to physical activities was intended to provide insights into how adolescents are perceived in their physical activities in the school environment and those conducted outside of school. We conducted a questionnaire in order to ascertain the role of subject Physical Education, other physical activities, or other physical programs provided by the school in a week-long movement routine play in pupils' lives. We deliberately did not set a period of time for one class as we are aware of possible complications and shortcomings associated with its implementation. Even so, it was possible to conclude that movement programs carried out in school conditions generally make up a significant part of all daily PA. For some adolescents, subject Physical Education at school is their only reported participation in PA. In our groups, we found that more than 54% of boys and girls do not perform any physical activities during school days! How debatable then can be the excuses which absent pupils from the subject of PE in school, as well as the many demanded increases in Physical Education hours. In regard to the data obtained, it can be concluded that subject Physical Education plays a serious role to the extent possible – it provides a limited opportunity to participate in PA for all, regardless of the assumptions of the participants. The leisure-time conduct of PA is conducted in the Ústí Region by a limited group of boys and girls, but it can be stated that a large part of them have grown to appreciate PA, and they are certainly focused on improving their performance-oriented fitness. However, the methodology of the investigation implemented by us did not allow us to precisely account for structured leisure-time physical activities (Gába et al., 2018, 2019), so their specification is difficult. To our surprise, however, the differences in expected values in reporting PA time between boys and girls, as well as between school days and weekend days, did not transpire. The high SD values in the steps/day indicators and the time of participation in PA in both boys and girls, especially on weekend days, indicate a significant

imbalance among the members of the groups and show that, in addition to the physically active part of the population, we have a number of very passive adolescents in respect to movement activities. After all, "no involvement in PA" was the most commonly stated response of both girls and boys. From the perspective of time, Saturday provides the largest space of time in which to implement PA individually, in the family, or in a club environment, but it is unused. Sunday then appears to be a day of physical rest; PA is reported at the lowest degree. It is clear that adolescents are not being persuaded of the need to make up for the lack of PA on school days during their days off. The reasons for this lack of involvement in adolescents are most likely primarily the fault of their families and due to educational gaps. But a solution might easily be found in the next offer of sports clubs, clubs during weekends, or the offer of sporting fields and grounds and, overall, the creation of a suitable environment for the conduct of these activities. During the days of schooling, one can see the advantages associated with transport to school, the movement of pupils in the school environment, the teaching of subject Physical Education, and in active adolescents, the activities of clubs and sporting groups. Even in these cases, certain limitations can be found in the responsibility of parents for creating an optimal movement routine for their children, which often encounters shortcomings in the economic background of families, the education of parents, the location, and amenities of the environment. Unfortunately, some negative trends can also be anticipated in the context of the effects of the pandemic in 2020–2021.

Strengths and limitations

One of the advantages of this survey is the evaluation of relevant data for a relatively large set, the basic characteristics of which are limited by the location and age of participants, and the duration of data collection under a definite degree of control by researchers. The data collection sites were carefully selected, and the collaborators and participants were motivated. We managed to obtain the required data by combining two research techniques. The use of pedometers was met by curiosity in many children not only because of their novelty but also because of possible comparisons that could be made with other available techniques, especially phones. Pedometers were often used in the course of teaching subjects Health Education or Physical Education, which made it possible to convey information about the use of this technique and arguments for its use. The use of pedometers is generally cited as a limitation of the study for methodological reasons, but also due to the lack of user comfort. These issues were already solved when potential participants were addressed.

The study did not include individuals who refused to participate in the research by themselves or were refused by their parents. The most commonly mentioned reason for refusal was their unwillingness to carry out the necessary actions related to the research. This was often supported by the parents' refusal to share information about their children. Although we guaranteed anonymity and also the absence of any claims for compensation for damaged material, we were also given these reasons for non-participation. We perceived that the relative frequency of rejections differed according to the location and type of school. The success of the work with participants and the quality of the data obtained also reflected the authority and interest of the teacher himself or herself.

The second applied research technique was the questionnaire together with the recording sheet. Completing it correctly was a necessary condition for inclusion in the research. The possibilities of using this technique are primarily limited by subjectivity when data is entered onto the recording sheets. The scope of the questionnaire and the wording of some questions may have caused problems. Some sheets had to be discarded due to incompleteness.

Within the presented items, we see positive signs in the coverage of data on locomotion activities throughout the week, that is, both on school days and on weekend days. This gave us data that could be used to evaluate compliance with health criteria and to build our investigation on studies that mention these conclusions (Mitáš et al., 2020; Rubín et al., 2018; Sigmund & Sigmundová, 2021b). Linking step data to questionnaire entries has proved to be an advantage for the further refinement of data and in the search for selected correlates. It turns out that a suitable method would be to modify some items so that they could be better linked to structured and unstructured leisure activities. Items relating to the recording of data for school movement programs have proved to be a strength of this study. This would allow for feedback as to the importance of school subject Physical Education, especially where leisure PA is lacking. It is clear that further arguments could be found in this study to support the application of PA within the school environment, as this allows the creation of social links and the use of the advantages of targeted but unstructured teaching.

Conclusions

The average values of reported physical activities in the form of daily steps are usually below the recommended health-oriented level for our groups of children at the second stage in elementary schools. Only 27% of boys and 32% of girls meet the stricter recommendations of health criteria. The median and standard deviation values for the reported locomotion indicate a significant imbalance among the groups. This is manifested in the fact that in addition to physically active individuals, individuals with inactive behavior and sedentary lifestyles are largely represented in the groups. The reported volumes of steps for our groups are below the level of comparative studies carried out in the Czech Republic among groups of a similar age. During weekend days, there was a decrease in completed physical activities detected by the pedometer. The decrease is at the level of statistical significance, and Sunday appears to be the least active day of the week for our groups. Boys show higher locomotion values than girls. The time of participation in PA is also extremely variable and confirms significant inter-individual differences among boys and among girls. There is a great importance of teaching subject Physical Education

because for a considerable part of this population it is the only opportunity to participate in PA.

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Conflict of interest

The authors report no conflict of interest.

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