



# Physical activity of children and adolescents from the Czech Republic, Hungary, Poland, and Slovakia: A systematic review

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## Abstract

**Introduction and objective.** Systematic monitoring of physical activity of young populations from different regions may be useful for making international comparisons, better understanding trends in physical activity and designing public health interventions to increase physical activity. Thus, the aim of the study was to comprehensively review studies examining the level of physical activity of children and adolescents from the Visegrád countries, and indicate the percentage of children and adolescents meeting the recommended level of physical activity.

**Materials and method.** A systematic search of the published literature was conducted. Included were reports with original research that consisted of the proportion of children and adolescents who met physical activity recommendations or guidelines. To provide a current picture of physical activity of children and adolescents, the review was restricted to studies published between January 2015 – November 2018.

**Results.** Moderate-to-vigorous physical activity recommendations were met by between 7.5% – 69.4% of children and adolescents. Vigorous physical activity recommendations were met by between 33.6% – 64.5% of children and adolescents. Daily recommendations for the number of steps taken were fulfilled by between 11.6% – 69.0% of children and adolescents. Differences between age categories, genders and countries were observed.

**Conclusions.** Public health interventions to increase physical activity are required to decrease insufficient levels of physical activity in children and adolescents, especially in girls. The review also highlights the need for studies with representative random samples that use validated measurement methods.

## Key words

health, exercise, recommendations, Visegrád

## INTRODUCTION

The health benefits of being physically active are broadly recognised. For children and adolescents, physical activity at the appropriate level improves the cardiovascular system and the quality of bones, in addition to aiding weight management and reducing symptoms of depression [1, 2, 3]. Physical inactivity leads to energy imbalance and can increase the risk of becoming overweight or obese [4, 5] and developing factors in cardiovascular diseases, such as high blood pressure, insulin resistance and glucose intolerance [1].

The World Health Organization (WHO) [6] recommends that children and adolescents aged 5–17 should perform at least 60 minutes of moderate-to-vigorous intensity physical activity (MVPA) daily. However, globally, over 80% of those aged 11–17 do not comply with physical activity recommendations [7]. In addition, the results of the Health Behaviour in School-aged Children (HBSC) survey showed that, in Europe, only 23.1% of boys and 14.0% of girls aged 13–15 years met the WHO recommendations for daily physical activity [8]. Vigorous physical activity (VPA) may

be especially beneficial for children and youths [9]. Based on a review of studies, Owens et al. [10] concluded that higher levels of VPA among youths were associated with improved blood lipid profiles, were beneficial for blood pressure, increased the aerobic capacity of youths, and improved body composition. The WHO [5] recommends that children and adolescents should participate in vigorous-intensity activities at least 3 times per week. Unfortunately, it appears that a too small percentage of children and adolescents engage in VPA on a daily basis [11, 12].

The time children and adolescents spend watching television or using electronic media has resulted in more sedentary time and less physical activity. According to the WHO European Childhood Obesity Surveillance [13], which studied 18 countries, 22% – 52% of children spend at least 2 hours every weekday watching television programmes or using electronic media; on weekend days, the figure ranges from 52% – 91%. Children's sedentary habits may be maintained through to adolescence and adulthood. This is concerning because physical inactivity is among four risk factors – along with hypertension, smoking, and high glucose levels – associated with premature morbidity worldwide [14].

Poland, the Czech Republic, Slovakia, and Hungary form an alliance of four Central European states called the Visegrád Group. These countries share historical and political

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roots and monitored indicators (e.g. health standards) in these countries may develop similarly [15]. In the Visegrád countries, the percentage of gross domestic product (% GDP) for health ranges from 4.6 in Poland to 7.4 in the Czech Republic and Slovakia; % GDP for education ranges from 3.8 in Slovakia to 5.0 in Poland; and the %GDP for sport ranges from 0.2 in Slovakia to 1.1 in Hungary [16].

Despite low indicators in selected sectors of the national economies of the Visegrád countries, the levels of physical activity of the young generation are higher than in most Asian, African and Latin American countries, but lower than youth from countries such as Ireland, the USA, Greenland and Bangladesh [7]. The physical activity levels of children and adolescents may be improved by participation in organized forms of physical activity [17], including physical education lessons. According to the WHO [16], students participate in a different number of mandatory physical education classes per week: in Poland – 3–4 hours, in the Czech Republic – 2 hours, in Slovakia – 3 hours, and in Hungary – 5 hours. Additionally, in the Czech Republic, many schools have voluntarily included 1–4 extra hours of physical activity per week. Thus, the education systems in the Visegrád countries offer opportunities for physical activity for children and adolescents.

## OBJECTIVES

Monitoring the physical activity of the younger population in developing socio-economic environments, taking into account relevant factors [18, 19], may help make international comparisons, better understand physical activity trends and design public health intervention to increase physical activity. Thus, the aim of the study is to comprehensively review studies examining the levels of physical activity of children and adolescents in the Visegrád countries, and indicate the percentage of children and adolescents meeting the recommended level of physical activity.

## MATERIALS AND METHOD

**Search strategy.** The comparative literature analysis method adopted by the authors is often used in the research of physical activity in children and adolescents [20, 21, 22]. The guidelines followed were those outlined as the preferred reporting items for systematic reviews to ensure transparent reporting [23]. The literature analysed was identified by searching electronic databases.

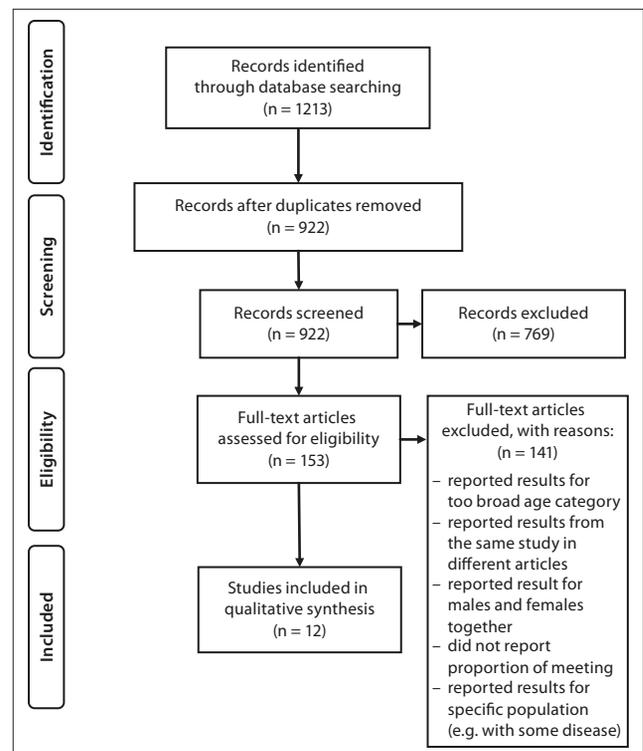
Electronic searches of computerised databases were performed according to a protocol agreed to by all co-authors. Four databases were searched: SportDiscus with Full Text, MEDLINE and Health Source: Nursing/Academic Edition via EBSCO, SCOPUS and Web of Science. A literature search for papers was carried out using keyword combinations (Tab. 1). If an abstract was not available, the first 1,500 characters of the HTML full text of the article were searched. On the Web of Science database, topic and title field were used. The search was conducted on 25 November 2018.

Papers were reviewed if they met the following criteria: original research published in English; no book chapters or conference proceedings; physical activity was reported for children and adolescents aged 5–18 years; the sample included

**Table 1.** Search terms used for study identification

Facets	Search terms
Physical activity	Exercise OR exercises OR physical activity OR physical activities
Children/adolescents	Child OR children OR adolescent OR adolescents OR teenager OR teenagers OR youth
Countries	Poland OR Polish OR Czech Republic OR Czech OR Hungary OR Hungarian OR Slovakia OR Slovak

healthy populations from some combination of Poland, the Czech Republic, Slovakia, and Hungary; published between January 2015 – November 2018. Papers were excluded from the review if the results included subjects under 5-years-old (e.g. 3–10-years-old) or subjects above the age of 18 years (e.g. 15–20-years-old) without division into the age categories pertaining to this study. Neither unpublished studies nor 'grey' literature was analysed. The literature identification process is shown in Fig. 1.



**Figure 1.** Flow diagram for the identification, screening, eligibility, and inclusion of studies

**Data extraction.** The search was conducted by a library curator with systematic-review expertise. Articles were extracted and imported into EndNote software. Duplicate articles were removed using Endnote. The titles and abstracts of potentially relevant articles were analysed by two reviewers (AK and JT). The full texts of papers passing initial screening were then obtained. Then MK-Z with JB and MM with HE-K analysed full texts of copies of the papers independently. If an article was included by one reviewer and not the other, the article was sent to a third reviewer for further review. From the initial list, the following elements were extracted and recorded: author(s) and year of publication; participants (sample size, gender, age and country); measurement method; criteria for physical activity recommendations; and

percentage of sufficient active subjects. Extracted information was discussed and papers presenting the same research results were excluded, resulting in the final selection of papers.

## RESULTS

A total of 12 articles were included in the analysis (Tab. 2). The articles contained the results of six studies from the Czech Republic ( $n = 22,237$ ), five from Poland ( $n = 2,474$ ) and one each from Hungary ( $n = 975$ ) and Slovakia ( $n = 8,042$ ). In total, 33,728 children and adolescents were studied (8 of the 12 studies included representative research samples). The analysed studies were carried out in various years, sometimes at the turn of two years. In some studies, there is no information on the year of the research. Therefore, it was not possible to determine what percentage of the surveyed children and adolescents constitute the population of each country.

Most research was carried out during an HBSC study which provided information about the health, well-being, social environment and health behaviour of 11-, 13- and 15-year-old boys and girls. In the presented review, physical activity in HBSC studies was measured by an item asking adolescents about the number of days over the past week that they were physically active for a total of at least 60 min per day.

**Meeting physical activity recommendations.** Recommendations for MVPA were met by 7.5% – 69.4% and for VPA by 33.6% – 64.5% of children and adolescents. The daily recommendation of 12,000 steps was met by 11.6% – 69.0% of children and adolescents, while 39.8% to 53.3% completed 11,500 steps per day.

**Gender differences in physical activity.** Recommendations for MVPA were met by 14.6% – 40.5% of boys and 7.5% – 25.2% of girls. The VPA recommendations were met by 39.4% – 64.5% of boys and 30.2% – 51.3% of girls. The daily recommendation of 12,000 steps was met by 69.0% of boys and 11.6% – 51.4% of girls, while 50.5% – 53.3% of boys and 39.8% – 48.3% of girls completed 11,500 steps per day.

**Physical activity across age groups.** The daily recommendation of 11,500 steps was met by 39.8% – 53.3% of children aged 5–7, while 51.4% – 69.0% completed 12,000 steps per day. Recommendations for MVPA were met by 8.0% – 29.5% of 7–12.49-year-old children; 7.5% to 69.4% of those aged 12.5–18 years fulfilled the criteria. Recommendations for VPA were achieved by 34.4% – 39.4% of 10.5–12.49-year-old children and 30.2% – 64.5% of 12.5–16.49-year-old adolescents.

**Physical activity across countries.** Recommendations for MVPA were met by 8.0% – 32.3% of children and adolescents from the Czech Republic, 8.5% – 14.6% of adolescents from Hungary, 7.5% – 69.4% of children and adolescents from Poland, and 25.1% of children and adolescents from Slovakia. Recommendations for VPA were met by 33.4% – 45.9% of adolescents from the Czech Republic and 51.3% – 64.5% of adolescents from Poland. The daily recommendation of 11,500 steps was met by 39.8% – 53.3% of children from the Czech Republic; 11.6% – 69.0% of children and adolescents from Poland completed 12,000 steps per day.

## DISCUSSION

The review aimed to examine the levels of physical activity of children and adolescents from the Visegrád countries and indicate the percentage of children and adolescents meeting the recommended levels of physical activity. In the studies analysed, different percentages of respondents met the recommended level of physical activity. Recommendations of MVPA were met by 7.5% – 69.4% of the total sample, VPA recommendations were met by 33.6% – 64.5% of the total sample, and daily recommendations for the number of steps were met by 11.6% – 69.0% of the total sample. The range of results obtained was very wide and caused difficulties for clearly estimating the levels of physical activity of children and adolescents. The selection of children and adolescents for research could have an impact on this. From among the 12 analysed articles, eight could be qualified as representative samples and only five as national representative samples. In the studies where the criterion of representativeness was not met, compared to studies with representative samples, there was a higher percentage of children and adolescents fulfilling the recommendation of physical activity. In addition, there continues to be an absence of research on this issue, particularly regarding children and adolescents from Hungary and Slovakia.

It turned out that a higher percentage of boys reached the recommended level of physical activity compared to girls. Guthold et al. [7] evaluated trends in insufficient physical activity among adolescents and showed that high percentages of girls completed insufficient physical activity in Hungary (85.8%), Poland (84.2%), the Czech Republic (82.0%) and Slovakia (77.8%). The authors of 10 out of 12 articles indicated that, in general, a twice as low percentage of girls than boys met the recommended MVPA. Tabak et al. [33] and Gába et al. [26] demonstrated even greater differences (7.5% girls compared to 22.8% boys; 8.0% girls compared to 22.0% boys). As for the recommended VPA and the recommendations for the number of steps, although the gender differences were smaller, the percentages were still higher for boys. The lower levels of girls' physical activity corroborate the findings of earlier studies [7, 34]; furthermore, this result can be considered consistent with general research on the physical activity of girls [28].

Significant differences in the levels of physical activity for children and adolescents depending on their age category were observed. The results were consistent with other studies [35, 36] and indicated that the older the children, the lower the level of MVPA. This could be seen most clearly in the 14–18-year-old bracket, where the rate ranged from 7.5% – 22.8%. The recommended level of MVPA was observed in only one out of five adolescents aged 15 [27]. A study by Frömel et al. [11] contradicted this, and taking into account gender and country of origin, determined that the recommended level of MVPA was met by every fifth girl from the Czech Republic and every fourth girl from Poland. Considering the age of the children and adolescents, as in previous studies [37], the results of the papers analysed were not consistent in terms of the recommended level of physical activity. Moreover, they were not complete, as it was impossible to determine the actual level of physical activity undertaken by children aged 8–10-years-old. This may be related to the physical and motor development of children of this age, who show a significant need for physical activity during this period [38].

**Table 2.** Physical activity (PA) of children and adolescents from the Visegrád countries

Author(s), year of publication	Participants (sample size, gender, age and country)	Measurement method	Criteria for recommendation of physical activity	% of sufficiently active subjects
Brindova et al. [24]	8,042 children and adolescents (3,910 boys, 4,132 girls) aged 11–15, national representative sample Slovakia	HBSC study: self-reported MVPA, number of days physically active at least 60 minutes, last 7 days	At least 60 minutes per day of MVPA	25.1%
Czajka et al. [25]	221 children (116 boys, 105 girls) aged 6–7, regional sample Poland	HJ-113 pedometer (Omron, Japan), step counts, 7 consecutive days	12,000 steps per day	69.0% boys, 51.4% girls
Frömel et al. [11]	1,117 adolescents (449 boys, 668 girls) aged 15, regional sample the Czech Republic 729 adolescents (296 boys, 433 girls) aged 15, regional sample Poland	IPAQ (long form), last 7 days	VPA (at least 20 minutes on 3 or more days per week) MVPA (at least 60 minutes every day)	Czech Republic VPA: 45.9% boys, 33.4% girls MVPA: 32.3% boys, 20.1% girls Poland VPA: 64.5% boys, 51.3% girls MVPA: 40.5% boys, 25.2% girls
Gába et al. [26]	365 children (156 boys, 209 girls) aged 7–12, regional representative sample the Czech Republic	Accelerometer ActiGraph (ActiGraph, LLC., FL, USA), number of days physically active at least 60 minutes for at least 4 days including 1 weekend day	At least 60 minutes per day of MVPA	22.0% boys, 8.0% girls
Kalman et al. [27]	4,385 children (2,126 boys, 2,259 girls) aged 11, 13, 15, national representative sample Czech Republic	HBSC study: self-reported MVPA, number of days physically active at least 60 minutes, last 7 days	At least 60 minutes per day of MVPA	aged 11: 28.0% boys, 23.3% girls aged 13: 29.5% boys, 19.0% girls aged 15: 24.8% boys, 14.3% girls
Kantanista et al. [28]	175 girls aged 12–13, 15–16, 17–18, regional sample Poland	Yamax Digi-Walker SW 701 pedometer, step counts, 7 consecutive days	12,000 steps per day	aged 12–13: 15.6% girls aged 15–16: 11.6% girls aged 17–18: 18.0% girls
Kokko et al. [29]	10,426 children and adolescents aged 11, 13, 15, national representative sample Czech Republic	HBSC study: self-reported MVPA, number of days physically active at least 60 minutes, last 7 days	At least 60 minutes per day of MVPA	overall: 21.0% aged 11: 26.0% aged 13: 21.0% aged 15: 17.0% 24.0% boys, 18.0% girls
McMahon et al. [30]	975 adolescents (416 boys, 559 girls) aged 15, national representative sample Hungary	Modified version of the PACE + (Patient-Centred Assessment and Counselling for Exercise Plus Nutrition), number of days physically active at least 60 minutes, last 2 weeks	At least 60 minutes per day of MVPA	14.6% boys, 8.5% girls
Schwarzfischer et al. [31]	62 children aged 11, regional sample Poland	SenseWear Armband 2 (SWA), Part of the European CHOP trial (Childhood Obesity Project), at least 3 consecutive days	At least 60 minutes per day of MVPA	69.4% overall
Sigmund et al. [12]	5,750 children and adolescents (2,803 boys, 2,947 girls) aged 10.5–16.5 national representative sample Czech Republic	HBSC study: self-reported MVPA and VPA, last 7 days	At least 60 minutes of MVPA per day, At least 30 minutes and at least 4 days per week VPA	MVPA overall: 25.6% boys, 19.2% girls aged 10.5–12.49: 29.5% boys, 24.2% girls aged 12.5–14.49: 27.2% boys, 20.1% girls aged 14.5–16.49: 20.4% boys, 13.6% girls VPA overall: 42.0% boys, 33.6% girls aged 10.5–12.49: 39.4% boys, 34.4% girls aged 12.5–14.49: 42.6% boys, 36.2% girls aged 14.5–16.49: 44.4% boys, 30.2% girls
Sigmundová et al. [32]	194 children (106 boys, 88 girls) aged 5, regional representative sample Czech Republic	Yamax Digiwalker SW-200 pedometer, step counts, 7 consecutive days (at least 4 weekdays and 2 weekend days)	11,500 steps per day	Weekdays: 50.5% boys, 48.3% girls Weekends: 53.3% boys, 39.8% girls
Tabak et al. [33]	1,287 adolescents (579 boys, 708 girls) aged 14–18, national representative sample Poland	HBSC study: self-reported MVPA, number of days physically active at least 60 minutes, last 7 days	At least 60 minutes per day of MVPA	22.8% boys, 7.5% girls

This was confirmed by Balaban [39], who showed that among Czech children aged 8–11 years there was a low-to-medium correlation between MVPA and locomotor skills.

Regarding demographic data – the number of citizens in the Visegrád countries aged 0–14 and 15–18 [40] – the largest research sample consisting of children and adolescents was analysed in the Czech Republic. Exploring this topic was important because Czech results can form a valuable part of the argument concerning the physical activity of children and adolescents from the Visegrád countries, in addition to motivating researchers from Poland, Slovakia, and Hungary. The results of this study confirmed that there was no clear country-based pattern to meeting physical activity recommendations and percentages differed (by several points) depending on the research methodology and population size. However, the ranges followed global trends showing that only about 20% of adolescents meet physical activity recommendations, and that the prevalence of sufficient activity is higher among boys in comparison to girls [7].

This review found that the recommended levels of physical activity differed depending on the country of origin of the children and adolescents. The recommended MVPA level was achieved by 69.4% of the examined 11-year-old children from Poland [31]. This result is 48.4 points higher than the statistic for Czech children and adolescents [29] and 44.3 points higher than adolescents from Slovakia [24]. These findings are fundamentally different from those of Guthold et al. [7], which may be a result of the selection of the research sample [31]. Generally, the largest percentage of children and adolescents meeting the recommended MVPA was found in Slovakia, followed by Poland and then the Czech Republic [16]; the lowest percentage was observed in children and adolescents from Hungary. It should be noted that young people have the opportunity to take additional hours of physical activity classes in Slovakian and Czech schools [16]; therefore it seems that physical activity undertaken voluntarily can increase the overall level physical activity of children and adolescents.

Whether physical activity was measured using objective or subjective methods may have had a consequence on the results obtained. Subjective measures include physical activity diaries, observation, and recall questionnaires, and are considered practical, low cost, and easy to use [41]. However, subjective measures present limitations in poorer reliability and validity, participant recall bias, and interpretation of questions [42]. In physical activity assessment, objective methods include measures that directly assess frequency, intensity, time and type. The number of steps, minutes of activity, intensity of activity, and bouts of activity can be measured [43]. Commonly used tools include accelerometers, pedometers, and heart rate monitors, as well as indirect calorimetry and direct observation.

In the studies analysed, electronic tools were used five times (two different accelerometers and three different pedometers). Physical activity monitors do not accurately assess movements that require extra effort, such as walking uphill or carrying loads. In the case of accelerometers, accuracy measures were greatest when detecting sedentary behaviour and lowest when detecting light physical activity. Accuracy is generally higher when the accelerometer is placed on the hip compared to the wrist [44]. Pedometers allow evaluation of the number of steps but not the intensity of

physical activity [45]. Also, the SenseWear Armband used in the study of Schwarzfisher et al. [31] could be a useful tool for determining levels of energy expenditure at low intensities rather than high intensities [46]. Self-reported measures were used seven times and all included in the review studies were cross-sectional.

The limitations of the results obtained in this review arise from different researchers using different types of measurement methods (objective and subjective), different sample sizes and different guidelines or recommendations. This makes it impossible to reliably compare the prevalence of physical activity in different countries. As this review was restricted to published studies in English using selected databases, publication bias may be present.

## CONCLUSIONS

Despite recommendations for physical activity by international and local bodies, physical inactivity is an increasing global health burden. In the Visegrád countries, a large proportion of children and adolescents did not meet the physical activity recommendations. National and local authorities and schools in the Visegrád countries should implement strategies to increase the level of physical activity, especially in girls. Compared to boys, fewer girls met physical activity recommendations.

This review highlights the need for further studies with representative random samples that use validated measurement methods to eliminate significant discrepancies in the results and ultimately obtain reliable data on the levels of physical activity of children and adolescents. In the studies, VPA should be measured more often because according to literature VPA may be more beneficial for health outcomes than MVPA.

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