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Pol. J. Sport Tourism **2024**, *31(4), 9-15*
DOI: 10.2478/pjst-2024-0022

Original research papers

EVALUATION OF THE RELIABILITY OF A PHYSICAL ACTIVITY QUESTIONNAIRE PROPOSAL FOR GIRLS AGED 8-11 WITH POSTURAL DISORDERS

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Abstract
Introduction. Regular physical activity (PA) protects both the mental and physical health of individuals across all age groups. Documented health benefits for children include improved physical fitness and endurance, reduced risk of cardiovascular and metabolic diseases, lower likelihood of depression and obesity, enhanced bone density, improved cognitive functioning, and better posture. A review of the literature did not identify any questionnaire that had been translated and adapted to Polish conditions in order to assess PA in children aged 8-11. Therefore, a Physical Activity Questionnaire was developed. The aim of this study was to evaluate its reliability for a group of girls aged 8-11 with postural disorders. ***Material and Methods.*** The study group consisted of 32 female students aged 8-11 with postural disorders in the transverse plane. The Physical Activity Questionnaire includes three questions that were developed based on the PAQ-A (Physical Activity Questionnaire for Adolescents) and HBSC. The selected questions were adapted to the assessed age group. The validation of the questionnaire was conducted using the test-retest method. ***Results.*** The reliability of individual items in the questionnaire was assessed using the ICC/KAPPA coefficient, depending on the type of variable. It was found that most items (except for items 3.7 and 3.18) demonstrated good reliability. This also applies to the questionnaire as a whole (ICC = 0.85; $p < 0.001$). Sufficient repeatability across successive tests was confirmed. ***Conclusions.*** The Physical Activity Questionnaire is a relatively reliable tool for determining the level of physical activity in girls aged 8-11 with postural disorders.

Key words: physical activity, validation, postural disorders, pediatrics

Introduction

Regular physical activity (PA) protects both mental and physical health across all age groups. Documented health benefits for children include improved physical fitness and endurance, reduced risk of cardiovascular and metabolic diseases, lower likelihood of depression and obesity, increased bone density, and enhanced cognitive functioning [1, 2, 3]. Research by Sidlauskiene et al. conducted in a group of children aged 11-14 demonstrated that a low level of physical activity correlates with poorer body posturographic parameters [4].

The global decline in physical activity levels among populations in most countries has led to efforts aimed at promoting physical activity on a large scale [1, 5]. The 2020 WHO report revealed that 81% of children aged 11-17 fail to meet the recommended minimum level of physical activity [6]. The HBSC (Health Behaviour in School-aged Children) report indicated that only 17.2% of Polish children aged 11-15 meet the recommendation of 60 minutes of MVPA (moderate-to-vigorous physical activity) per day [7]. Similar findings were presented in the Global Matrix 4.0 Project Report (2022), which established that only 16.8% of children and adolescents in Poland are moderately or vigorously active for at least 60 minutes daily, seven days a week [8].

Numerous sources indicate that the pandemic period contributed to a decrease in physical activity levels among young people [9, 10]. Studies assessing the short-term effects of COVID-19 suggest that children were less active during that time [11]. A study conducted in 2020 revealed that 68.3% to 77.9% of Polish parents reported a decline in their children's leisure-time physical activity during the pandemic [12]. However, researchers also found that physical activity of children and adolescents in Poland had already been declining before the COVID-19 pandemic [7, 12].

Parallel to efforts aimed at increasing physical activity levels among young people, a process of monitoring and evaluation is being conducted using appropriate research methods. These methods are traditionally divided into subjective and objective approaches, each with its strengths and weaknesses. Objective methods include accelerometers, pedometers, and observation, while subjective methods encompass diaries and survey questionnaires [3].

Survey questionnaires are an effective research tool for monitoring larger groups. Their lower cost and ability to gather information about specific physical activities are additional

advantages of this method [13]. Biddle et al. in their analysis of the literature, identified 20 tools for assessing physical activity in children and adolescents. Among the top five were: PAQ-C (Physical Activity Questionnaire for Older Children), PAQ-A (Physical Activity Questionnaire for Adolescents), YRBS (Youth Risk Behaviour Surveillance Survey), Teen Health Survey, A-PA-RQ (Adolescent Physical Activity Recall Questionnaire), HBSC (Health Behaviour in School Aged Children), CLASS (Children's Leisure Activities Study Survey), School Health Action, Planning and Evaluation System (SHAPES) Physical Activity Questionnaire and Finnish Twin Cohort Study [14].

A review of the literature did not identify a survey questionnaire that had been translated and culturally adapted to Polish conditions for assessing physical activity (PA) in children aged 8-11. As a result, a Physical Activity Questionnaire was developed. In this age group, the questionnaire can be used as a guided description. According to scientific reports, self-administered questionnaires are not recommended for children under the age of 10 due to their insufficiently developed cognitive processes [3].

The Physical Activity Questionnaire consists of three questions developed based on the PAQ-A (Physical Activity Questionnaire for Adolescents) and the HBSC (Health Behaviour in School-aged Children) [7, 15].

The PAQ-A ranked among the top three out of 20 physical activity questionnaires evaluated by experts [14]. It is designed for assessing children aged 14-19. The questionnaire was validated and adapted to Polish conditions in 2019, with its validity and reliability assessed as satisfactory [15].

In turn, the HBSC survey includes children aged 11-15 and ranked in the top five among the 20 physical activity questionnaires evaluated by experts [14]. This is an international study on the health behaviors of school-aged youth, conducted in Poland since 1989 [7].

The aim of this study was to evaluate the reliability and validity of the questions in the Physical Activity Questionnaire for a group of girls aged 8-11 with postural disorders.

Material and Methods

The study was conducted with the approval of the Senate Ethics Committee for Scientific Research at Józef Piłsudski University of Physical Education in Warsaw (SKE 01-38/2022) and following the principles of the Declaration of Helsinki. It took place at an elementary school as part of a research project. The study group consisted of 32 female students aged 8-11 living in a medium-sized town (with a population of 20,000 –100,000 residents) (Tab. 1). All participants resided in the Lubelskie region. The study involved girls whose parents or legal guardians provided written consent for participation in the aforementioned research project.

Table 1. Characteristics of the study group (n = 32)

	Mass	Height	BMI	Age
Mean	40.76	1.45	19.19	9.88
Median	39.10	1.45	19.25	10.00
Std. Deviation	10.64	0.06	3.68	0.34
Shapiro-Wilk W statistic	0.96	0.97	0.97	0.39***

*** – $p < 0.001$.

The following inclusion criteria were adopted:
- Gender: female;
- Age: 8-11 years;
- Ability to complete the survey independently;
- Consent from a parents or legal guardian for participation in the study;
- Girls who, in the last 7 days, experienced no limitations in their normal, usual physical activity;
- Physically active individuals within the last two years;
- Postural defect with ATR (Angle of Trunk Rotation) of 3°-6°.

The exclusion criteria were as follows:
- Gender: male;
- Age below or above the range of 8-11 years;
- Inability to complete the survey independently;
- Lack of legal guardian's consent for participation in the study;
- Girls who, in the last 7 days, were unable to engage in their normal, usual physical activity due to reasons beyond their control (e.g., illness).

The validation of the questionnaire was performed using the test-retest method in a paper-based format as an auditory survey. The study participants were gathered in a single room. Before the session began, they were provided with verbal instructions on how to complete the questionnaire and given time to respond to the questions. The respondents were allowed to ask questions during the survey. The group was divided in such a way that a maximum of 8 participants were present in the room at a time. There were no individuals requiring a personalized approach within the group. The completed questionnaires were collected directly by the survey administrator immediately after completion. The procedure was conducted twice among the same participants. Each participant completed the same questionnaire twice in one day with an 8-hour interval between sessions [16]. The analysis included questionnaires from individuals who, in the past 7 days, had no limitations in engaging in their normal, usual physical activity.

The Physical Activity Questionnaire consists of 3 questions developed based on two questionnaires: the PAQ-A and HBSC. These questionnaires were selected as they are the only ones validated for Polish conditions and are designed for children and adolescents [7, 15]. Furthermore, both have been highly rated in research studies [14, 17, 18, 19]. However, neither questionnaire is specifically designed for the age group under study. Consequently, questions were selected from the above-mentioned questionnaires and adapted to suit the assessed age group. Additionally, question 3 required modification to align with the needs of the study population.

Questions 1 and 2 were sourced from the Polish version of the HBSC questionnaire.

Question 1, using the MVPA (Moderate-to-Vigorous Physical Activity) tool, assesses daily moderate physical activity. This question also allows for an easy determination of whether the activity level meets WHO recommendations [20]. In the study, respondents were asked:

"In the past 7 days, on how many days did you spend at least 60 minutes per day being physically active (summing up all daily activities)?". Participants marked their answers on a horizontal visual scale ranging from 0 to 7 days (0-7 points). Reporting fewer than 7 days indicated non-compliance with WHO requirements [1].

Question 2, using the VPA (Vigorous Physical Activity) tool, evaluates vigorous physical activity. VPA measures activities that result in high energy expenditure (> 6 METs), characterized by rapid breathing and an increased heart rate, as might

occur during running, team sports, fast cycling, or swimming. Participants in the study were asked:

"How often, during your free time OUTSIDE OF SCHOOL, do you usually engage in vigorous physical activity, meaning you 'run out of breath' and sweat?". The possible answers included seven options, rated from 0 to 6 points: daily (6 points), 4-6 times a week (5 points), 2-3 times a week (4 points), once a week (3 points), once a month (2 points), less than once a month (1 point), never (0 points). According to WHO recommendations, the target level of vigorous physical activity for the selected group of children is at least 3 times per week [1].

Question 3 was adapted from the Polish version of the PAQ--A and is used to assess children's participation in various types of physical activity. Respondents in the study were asked: "Have you engaged in any of the following activities in the past 7 days (last week)? If yes, how many times per week?". This question provided five response options: 0; 1-2; 3-4; 5-6; 7, scored on a scale of 0 to 5, where "1" indicated a low level of physical activity and "5" pointed to a high level. The final score was calculated as the average of the total points obtained. A higher score indicated a higher level of physical activity [21]. The responses included 20 out of 30 sports and recreational activities featured in the original PAQ-A version. These activities were: rope jumping, rollerblading, playing tag, power walking, cycling, jogging/running, aerobics, swimming, playing rounders/baseball, dancing, rugby/American football, badminton, skateboarding, soccer, volleyball, basketball, gymnastics, handball, table tennis, martial arts/combat sports. The list of activities was tailored to simplify the question for the age group and excluded seasonal activities that could not be performed during the winter season.

The following evaluation framework was adopted to assess the reliability of the questionnaire based on PAQ-A and HBSC:
1. Reliability assessment of question 1 from HBSC.
2. Reliability assessment of question 2 from HBSC.
3. Reliability assessment of individual questions from PAQ-A.
4. Reliability assessment of the sum of questions 1 and 2 from HBSC.
5. Reliability assessment of the sum of questions from PAQ-A.
6. Reliability assessment of the sum of questions from HBSC.

Depending on the scale of the variables, the KAPPA or ICC coefficient was used [22, 23, 24]. Additionally, the distributions of the sums of responses from the HBSC and PAQ-A questionnaires were analyzed. Reliability coefficients were calculated for each individual item and their sums (separately for HBSC and PAQ-A). The reliability of the sum of responses from both questionnaires was graphically presented using the Bland-Altman plot.

The criteria for reliability levels were as follows: low reliability: ICC < 0.50, moderate reliability: ICC 0.50-0.75, good reliability: ICC 0.75-0.90, and excellent reliability: ICC > 0.90 [25]. Statistical significance was set at $p < 0.05$.

Results

It was found that individual items (except for items 3.7 and 3.18) demonstrated good reliability. This also applied to the questionnaire as a whole, which achieved an ICC of 0.85 ($p < 0.001$) (Tab. 2).

Table 2. The reliability of the Physical Activity Questionnaire in the context of test-retest for individual items and the entire questionnaire.

Moderately high repeatability was demonstrated in consecutive studies, as indicated by the Bland-Altman plot. Most differences fell within the range of 1.96×SD (Fig. 1). Furthermore, the distribution of response differences in both examinations was similar and did not deviate from a normal distribution (Fig. 2). The normality of the response distribution was verified using the Anderson-Darling test ($A = 0.63$; $A = 0.65$; $p > 0.05$) (Fig. 3-4).

Table 2. The reliability of the Physical Activity Questionnaire in the context of test-retest for individual items and the entire questionnaire

QUESTIONNAIRE QUESTIONS	KAPPA/ ICC*	95%CI	P
1. past 7 days – physical activity for at least 60 mins	0.79	0.61-0.9	<0,001
2. vigorous physical activity outside of school	0.85	0.71-1	<0.001
3.1 rope jumping	0.81	0.63-1	<0.001
3.2 rollerblading	0.94	0.86-1	<0.001
3.3 playing tag	0.66	0.49-0.83	<0.001
3.4 power walking	0.57	0.35- 0.8	<0.001
3.5 cycling	0.88	0.73-1	<0.001
3.6 running	0.57	0.36-0.78	<0.001
3.7 aerobics	0.18	-0.25-0.62	>0.05
3.8 swimming	0.84	0.66-1	<0.001
3.9 playing rounders	0.44	0.13-0.75	<0.01
3.10 dancing	0.55	0.32-0.79	<0.001
3.11 rugby/American football	0.84	0.54-1	<0.001
3.12 badminton	0.54	0.15-0.94	<0.01
3.13 skateboarding	0.78	0.57-0.98	<0.001
3.14 soccer	0.42	0.15-0.69	<0.01
3.15 volleyball	0.43	0.19-0.66	<0.001
3.16 basketball	0.55	0.33-0.77	<0.001
3.17 gymnastics	0.57	0.33-0.82	<0.001
3.18 handball	0.34	0.02-0.66	>0.05
3.19 table tennis	0.53	0.29-0.78	<0.001
3.20 combat sports/martial arts	0.72	0.52-0.92	<0.001
TOTAL	0.85*	0.7-0.92	<0.001

The correlation coefficients indicate a relatively strong correlation between question 1 from the HBSC and the sum of items from the PAQ-A questionnaire. However, for question 2 from the HBSC, the correlation is negative. This may suggest that the responses from the PAQ-A questionnaire do not confirm sufficient intensity of effort regarding the declared and undertaken forms of physical activity by the participants. Combining questions 1 and 2 from the HBSC results in a statistically insignificant correlation between the sum of these questions and the sum of all items of the PAQ-A questionnaire (Tab. 3).

Discussion

The steadily declining level of physical activity worldwide, including in Poland, requires reliable tools for monitoring it. Measurement is crucial for developing policies aimed at promoting physical activity among children.

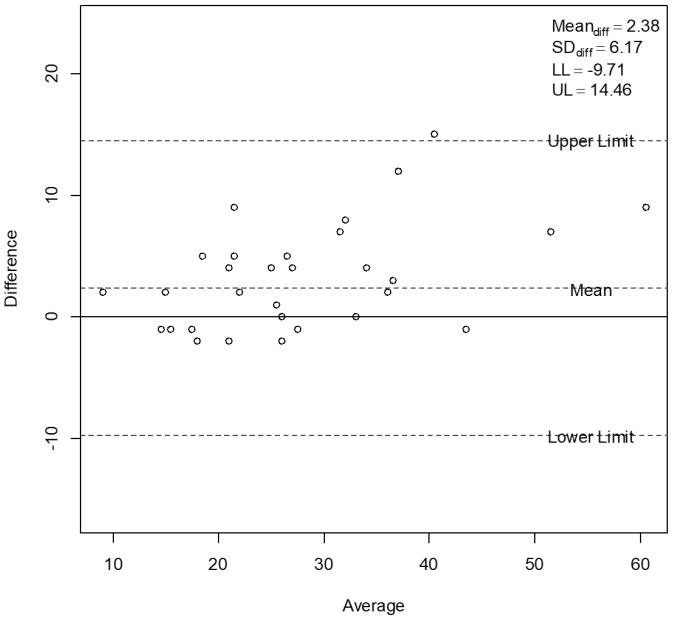

Figure 1. Bland-Altman plot for the Physical Activity Questionnaire

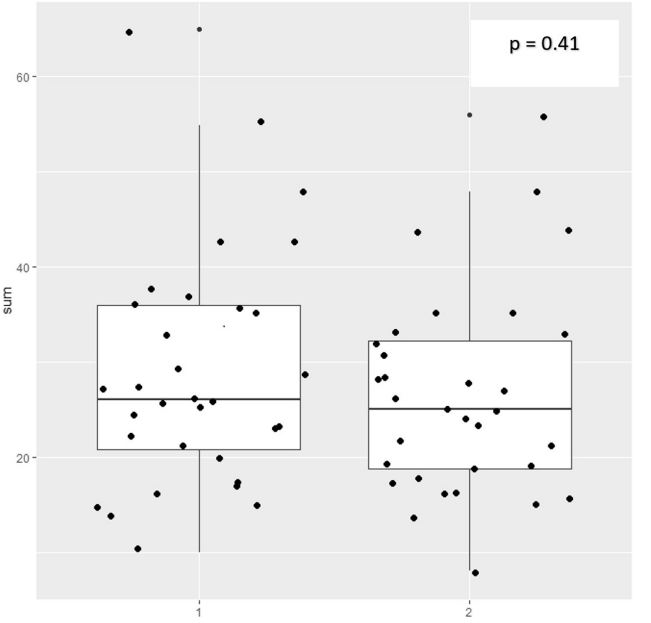

Figure 2. The sum of responses in the first and second examination

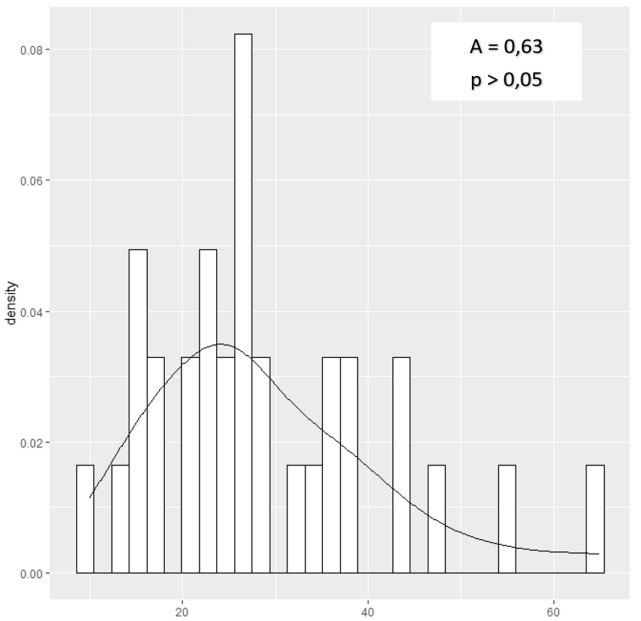

Figure 3. The distribution of sums in the first examination

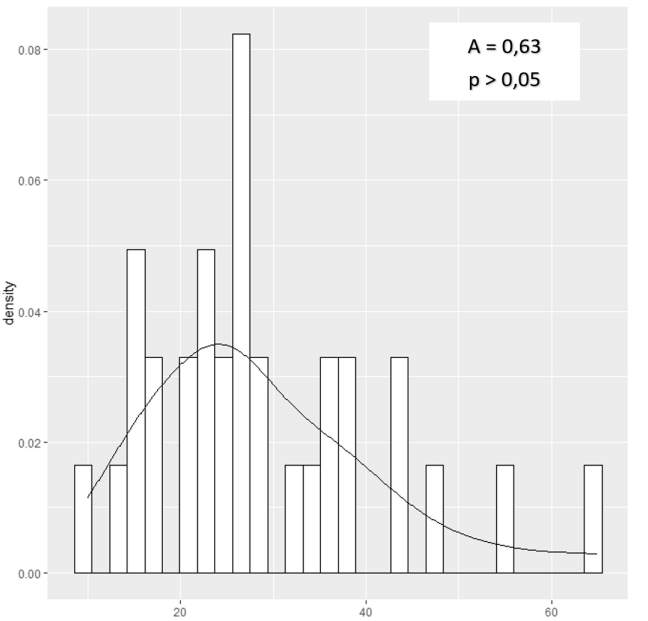

Figure 4. The distribution of sums in the second examination

Table 3. Characteristics of the study group (n = 32)

statistic / item	P1		P2	
	Spearman's Rho	p	Spearman's Rho	p
Q1-sum PAQ-A	0.47	>0.01	0.48	<0.01
Q2-sum PAQ-A	-0.4	>0.05	-0.47	<0.01
Q1 and Q2-sum PAQ-A	0.26	<0.05	0.15	>0.05

According to the 2021 report from the Public Health Committee (Polish Academy of Sciences), Poland ranked 31st out of 49 countries in terms of vigorous physical activity (VPA). The study focused on second-grade primary school students who were part of the international HBSC (Health Behaviour in School-aged Children) survey [26]. Additionally, the international COSI (European Childhood Obesity Surveillance Initiative) study conducted in Poland in 2016-2017 revealed that nearly one-third of 8-year-olds were overweight or obese. It was found that these children were more likely not to meet the WHO recommendations for minimum physical activity compared to those without excess body weight [27]. Furthermore, international research on obesity, such as ISCOLE (The International Study of Childhood Obesity, Lifestyle and the Environ-

ment), showed that about 90% of childhood obesity is associated with physical activity (MVPA and VPA), watching television, and short sleep duration [28].

For children, it is important that the tools used for research are non-invasive and easy to handle. One such tool is the survey questionnaire [13]. A review conducted by Biddle et al. in 2011 identified 20 tools for measuring physical activity in children and adolescents. According to expert evaluations, the top three included: PAQ-C and PAQ-A, the Youth Risk Behavior Surveillance System (YRBS), and the Adolescent Health Survey. The HBSC questionnaire, in turn, ranked within the top five in this ranking [14]. Among all the aforementioned tools, only one is designed for the 8-12 age group, which is PAQ-C, but it has not been validated for Polish conditions.

In Poland, several approved questionnaires are available for assessing the level of physical activity among children and adolescents, including IPAQ, PAQ-A, and HBSC [7, 15, 29]. Polish children over the age of 11 have often been evaluated using these tools. Research findings for this group have consistently shown a low level of physical activity. Children below this age in Poland have been assessed in terms of motor fitness using the FUS tool (Fundamental Motor Skills in Sport). Numerous studies have demonstrated the relationship and mutual influence of motor skills and physical activity in fostering an active lifestyle [30, 31]. Therefore, this part of the paper also addresses motor fitness.

The report by Molik et al. from 2022 revealed that 90% of children aged 7-15 demonstrated an unsatisfactory level of motor competence [32]. Very similar results were obtained by Makaruk et al., who used the same tool on a group of children aged 7-10 [33, 34]. Additionally, research conducted over the past 30 years by the National Center for Physical Fitness Research (NCBKF) at the University of Physical Education in Warsaw indicates a continuing decline in the physical fitness of Polish children and adolescents aged 7-19 [35].

Dąbrowska et al. evaluated physical activity of children aged 7-15 using a shortened version of IPAQ. Their results confirmed that the study group did not meet the minimum physical activity levels recommended by the World Health Organization [36].

All of the aforementioned studies confirm that individuals in our study group (8-12 years old) require interventions aimed at fostering active lifestyle habits. One such intervention is the regular assessment using effective tools. The Physical Activity Questionnaire was evaluated as sufficiently reliable (ICC = 0.85; $p < 0.001$). However, weak points of the prepared questionnaire were identified, particularly items 3.7 (aerobics; ICC = 0.18; $p > 0.05$) and 3.18 (handball; ICC = 0.34; $p > 0.05$), which demonstrated low reliability. Any research tool, especially one adapted to different cultural contexts, may contain elements that are less clear for various socio-cultural groups. Validation is conducted to identify potential weak points in diagnostic reliability. Every measurement tool, including physical activity questionnaires, has its strengths and limitations. Socio-economic and demographic factors, as well as measurement errors (misinterpretation or deliberate changes due to social expectations), are factors that can influence the final results of such studies [37, 38]. Furthermore, children aged 8-11 may experience incomplete understanding of questions/answers or misinterpretation [39]. Despite two questions with low response reliability, the overall questionnaire achieved a good reliability score (ICC = 0.85; $p < 0.001$), supporting the conclusion that the developed and described questionnaire is sufficiently reliable.

The first question of the Physical Activity Questionnaire is designed to assess moderate physical activity according to WHO recommendations. It has been utilized in international HBSC studies and originates from a pediatric screening test [20]. This question was also included and evaluated in Polish conditions by Nałęcz et al. Similar to our study (ICC = 0.79), high reliability was achieved in that evaluation as well (ICC > 0.99). Their study also established high overall reliability for PAQ-A (ICC > 0.98) [17]. The validation of this questionnaire for Polish conditions was conducted by Wyszyńska et al. in 2019 [18]. At that time, the reliability and validity of the tool were rated as satisfactory. This questionnaire has also been highly rated in international studies [18, 19].

A frequently used questionnaire for assessing physical activity in children aged 8-14 is PAQ-C. The reliability of this questionnaire has been confirmed in international studies [18, 40]. Unfortunately, it has not been validated for Polish conditions. The first question in both the PAQ-C and PAQ-A questionnaires concerns the frequency of engaging in various physical or recreational activities over the past seven days. The structure of this question differs between the two questionnaires only in the number of activities included. This question is also included in our version of the questionnaire.

A questionnaire validated in Poland for the age group falling within our studied age range is the short version of IPAQ. It was published in 2024, and the study was conducted in 2022 [32]. The validation of the Physical Activity Questionnaire was carried out in 2023. Therefore, it was not possible to use this version of the questionnaire. Additionally, the group we studied is more narrowly defined. This includes not only age but also gender and the presence of postural disorders. The study group consisted of females with postural disorders. Scientific reports clearly indicate that physical activity provides numerous health benefits, including the prevention of postural defects. Studies show that postural disorders in children are a significant problem and frequently occur in school-aged children [41]. Percy et al. described the positive impact of physical activity on bone density and muscular fitness in children, which in turn contribute to better posture [42]. Sallis et al. and Biddle et al. already wrote in the 1990s about the positive effects of physical activity on the muscular and skeletal systems [43, 44]. Moreover, there are studies where researchers directly concluded that low levels of physical activity are associated with postural disorders in children [4, 45, 46].

The age and gender of the studied girls are not random. According to Fijałkowska's report, the level of physical activity among school-aged children decreases with age. Additionally, it is lower in girls compared to boys. Moreover, the report noted that particularly unfavorable changes in physical activity levels are observed in girls aged 11 [47].

The results of the OLAF study conducted on Polish children indicate that the greatest body length gains in girls begin to appear at the age of 9 years and 6 months. The highest annual height increase occurs between 10 years and 8 months and 11 years and 8 months [48]. Similar data is reported by Masaaki Chazono et al., who found that the peak height velocity (PHV) occurs at 11 and 11.9 years of age [49]. These are periods of increased risk for the onset of scoliosis as well as its progression [50].

Conclusions

The presented Physical Activity Questionnaire is a reliable tool for determining the level of physical activity in girls aged 8-11 with postural disorders. This study confirmed the sufficient reliability of the first Polish questionnaire as a measurement tool for assessing physical activity in both healthy children and

those with postural disorders in the 8-11 age range. It should be considered whether the final version of the questionnaire should include question 2. Additionally, the reasons for the low reliability of responses to the question related to vigorous physical activity should be analyzed. Furthermore, two items in question 3 of the HBSC questionnaire require further investigation into the reasons for their low reliability. The survey results indicated that, like many diagnostic tools, the presented questionnaire also has certain limitations.

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Submitted: December 11, 2024
Accepted: January 10, 2025