ORIGINAL ARTICLE

Annals of Agricultural and Environmental Medicine
www.aaem.pl

Organized physical activity of secondary school students and university sports science students

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of the article

Groffik D, Frömel K, Ziemba M, Mitáš J, Seniow-Chmiel S. Organized physical activity of secondary school students and university sports science students. Ann Agric Environ Med. doi: 10.26444/aaem/150011

Abstract

Introduction and Objective. Organized physical activity (OPA) is an important part of adolescents' physical activity (PA). The aim of the study is to determine differences between secondary school students and sports science students at the university participation in OPA, and to recommend a strategy to increase the active participation of adolescents in OP, and improve the education of sports specialists.

Materials and method. The study was carried out continuously during 2010–2020 at 71 secondary schools in the Silesian region and at the Academy of Physical Education in Katowice, Poland. A total of 3,510 students participated in the study (2,199 secondary school students and 1,311 sports science students). To determine participation in OPA, the Physical Activity Preference Questionnaire was used, and to determine the level of weekly PA, the International Physical Activity Questionnaire was used.

Results. The largest representation in the OPA was in school (21.1%) and university (30.7%) boys in soccer, and in school (13.7%) and university (33.4%) girls in volleyball. Schoolboys participating in OPA ≥5 lessons had statistically significantly more school PA, recreation PA, vigorous and total PA than boys not participating in OPA. University boys and girls were alike in vigorous PA. School (3.35 times) and university (1.73 times) boys and school (3.93 times) and university (5.08 times) girls were more likely to meet the PA recommendations.

Conclusions. Active participation in the OPA of school and university boys and girls is significantly associated with a higher level of weekly PA, and likelihood to meet the PA recommendations. The greatest attention should focused on promotion of the participation in OPA in non-participating school boys and girls, as well as non-participating students at universities, as part of their professional training.

Key words

physical activity, healthy lifestyle, students, recommendation

INTRODUCTION

Organized physical activity (OPA) has many benefits not only for children and young people, but also for adults. The choice of OPA is dependent on individual preferences of physical activity (PA). Joy of movement is one of the main attributes of any free-time activity [1]. OPA has more benefits in student development than self-organized PA [2] and supports lifelong PA [3].

Unfortunately, most studies indicate that children and adolescents in Europe [4], especially in Central Europe,do not meet the recommendations for PA [5, 6, 7, 8]. Decreasing levels of PA are observed especially in adolescence. Adolescents are less physically active on weekends compared to school days, and reduced PA has been demonstrated in both boys and girls [9, 10, 11]. Health benefits related to the participation of students in sport and physical recreation have been extensively documented [12, 13, 14, 15]. With OPA, we can balance this decrease on non-school days [16, 17]. OPA has a positive influence on children's self-perception [18], produces better learning outcomes [19] and improves school behaviour [20, 21, 22]. OPA is associated with less inattention/hyperactivity and acting without thinking [23], and reduces screen time – especially in small screens [17]. Participating in OPA positively influences the development of motor function [24], body composition during growth and maturing [25, 26], and cardiorespiratory fitness [27].

Adolescents' participation in OPA is associated with a higher level of moderate to vigorous PA (MVPA) and vigorous PA (VPA) [28], as well as meeting the MVPA recommendations [29], especially among girls [30]. There are significant gender differences in OPA participation, differences related to preferred forms of PA [15, 31, 32, 33] and the importance of OPA for total PA. Studies show that PA preferences differ not only between boys and girls, but also change more frequently among girls than boys [33]. From a study conducted on adolescents aged 11 – 19 years [32], it appears that swimming was the most popular sport in both genders; however, the order of other most popular choices in boys were martial arts, and team sports (e.g. floorball and football). Girls preferred dancing as the most popular activity after swimming. Team sports were less popular than among boys. Half of the interviewed boys and girls played sports with a frequency of two to four sessions per week [32]. Girls were less active than boys and OPA programmes for girls significantly increased their daily PA [34]. Differences in OPA were related to the developmental period of adolescents [16], especially in girls [26].

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Received: 2021.12.04; accepted: 2022.05.11; first published: 05.07.2022

Another period of PA decrease appears during university studies [35]. Garcia Puelo et al. [36] characterize 68.9% of university students as physically inactive, according to the results of the IPAQ. A significant finding was that 92% of physically active students performed PA for health reasons. Demirer and Erol [37] also stated that 20.4% of university students are physically inactive and 57% are low physically active. In an international comparison, Russian university students proved to be more physically active than students in some African countries, Turkey, Iran and Ukraine, but they had a significantly lower overall PA level than university students in Western European countries [38]. A higher level of PA of university students of the Visegrad group compared to students in Ukraine was also noted [39].

Due to the specifics of professional training, the level of PA in sports science students is less researched [40]. The expected results are usually confirmed; for example, for Polish sports science students, Zuzda, Latosiewicz and Augustyńska [41] report that they meet the WHO recommendations for PA. The level of PA in male sports science students was higher than in women and they participated more in vigorous activities [42].

The increase of PA in adolescents, including the reduction of the negative impact of a pandemic on their lifestyle, is significantly dependent on the improvement of the professional training of sports specialists. Sports science students should have a deeper connection between the education of sports specialists and practice.

OBJECTIVE

The aim of the study was to determine differences between secondary school students and sports science students at university in the participation in OPA, and to recommend a strategy to increase the active participation of adolescents in OPA and improve the education of sports specialists.

MATERIALS AND METHOD

Participants and setting. In total, 71 secondary schools in the Silesian region and the Academy of Physical Education in Katowice, south-west Poland, participated in the study. Schools were selected based on their long-term cooperation with the Academy of Physical Education and after the consent of the school management. Thestudy at the Academy of Physical Education was carried out each year according to the study.

A total of 2,199 secondary school students (hereinafter referred to as 'school') and 1,311 sport science students participated in the research in the Academy of Physical Education (hereinafter referred to as 'university') (Tab. 1).

The study took place in the same school settings, in a computer laboratory, under the guidance of an identical research team. The web application 'International Database for Research and Educational Support' (Indares) (www.indares.com) was used to obtain and record research data. The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethical Committee of The Jerzy Kukuczka Academy of Physical Educatio, in Katowice (Reg. No. 2/2008).

Measurements. To determine the level of weekly PA, the 'International Physical Activity Questionnaire – long form' (IPAQ-LF) for adolescents was used [43, 44]. The Polish version was subject to the required translation procedure according to the 'EORTC Quality of Life Group' [45, and empirically verified in international comparative studies [14, 46]. The results of the IPAQ-LF were processed in accordance with the manual, but with the following changes: the MET-min of vigorous PA (VPA) were multiplied by 6 (in original by 8), the maximum MET-min per week was limited to 16,000 MET-min, and the maximum average daily sum of PA, transportation PA, sitting, and passive commuting was set at 960 minutes. 505 respondents were excluded for not meeting these criteria.

Recommendations for weekly PA were adapted according to the Healthy People 2030 [47], Physical Activity Guidelines for Americans [48], and recommendations for segments of school days [49]. Due to the known limitations of the IPAQ-LF questionnaire, the most demanding recommendations were set, namely, a combination of at least 5 or more days of at least 60 minutes moderate to vigorous PA (MVPA) per we, and at least 3 or more days of at least 20 minutes VPA per week (5×60 MVPA + 3×20 VPA).

For the participation of boys and girls in OPA, the Physical Activity Preferences Questionnaire (PAPQ) was used, which has long been used in school practice to obtain an overview of the preferred and realized PA of adolescents. Respondents to the questionnaire select preferred types of PA, and also state if they participate in organized types of PA and how often per week. According to the number of lessons of participation in the OPA, 4 specific groups were determined: 0 lessons (non-participants in the OPA), 1–2 lessons, 3–4 lessons and ≥ 5 lessons. The questionnaires were completed during one 45-minute teaching lesson in the web application Indares (www.indares.com). Respondents were instructed to complete the IPAQ-LF first, and then the PAPQ questionnaire.

Data analysis. Statistica version 13 (StatSoft, Prague, Czech Republic) and SPSS version 25 (IBM, Armonk, NY: IBM Corp.) software were used for the statistical analysis.

Descriptive characteristics were used to overview the participation of respondents in OPA and the Kruskal-Wallis

Table 1. Sample characteristics

Gender	Institution	n	Age (years)		Weight (kg)		Height (cm)		BMI (kg·m^{-2})		Organized PA	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*No (%)*	*Yes (%)*
Boys	Secondary	984	16.30	0.79	67.69	12.53	176.86	7.54	21.58	3.39	28.5	71.5
	University	665	23.84	1.62	78.10	9.98	180.26	6.73	23.98	2.28	25.0	75.0
Girls	Secondary	1215	16.32	0.73	56.96	8.78	165.74	6.15	20.71	2.83	34.8	65.2
	University	646	23.17	1.61	59.89	7.73	167.55	6.22	21.31	2.29	33.4	66.6

BMI – Body Mass Index; *M* – mean; *SD* – standard deviation; PA – physical activity

ANOVA was used to determine the structure of weekly PA according to participation in OPA. Cross tables were used to assess the meeting the PA recommendations of differently participating groups of participants in OPA, and for the odds of meeting the PA recommendations, binary logistic regression analyzes with the enter method (all independent variables are entered into the equation at the same time) was used. For determining the practical significance the η^2 and r effect size coefficients were used, and interpreted as follows: small effect $0.01 \leq \eta^2 < 0.06$ ($0.1 \leq r < 0.2$), medium effect $0.06 \leq \eta^2 < 0.14$ ($0.2 \leq r < 0.6$), and large effect $\eta^2 \geq 0.14$ ($r \geq 0.6$). Statistical significance was set at $p < 0.05$.

Participation of boys and girls in OPA. School and university boys participate in the OPA most in soccer and girls in volleyball (Tab. 2). It is noteworthy that school and university boys not participating in the OPA would prefer to realize soccer, and similarly, girls would prefer to realize volleyball. The biggest difference in participation between school and university boys and girls was found in gymnastics. Schoolboys participated in gymnastics as the fourth most realized activity, whereas for schoolgirls, it was rank three; however, university boys and girls only rarely participated in gymnastics.

Structure of weekly physical activity of boys and girls according to participation in OPA. Schoolboys participating in OPA ≥5 lessons had statistically significantly more school PA ($p < 0.001$), recreation PA ($p < 0.001$), vigorous PA ($p < 0.001$), moderate PA ($p = 0.024$) and total PA ($p < 0.001$) than schoolboys non-participating in OPA (Tab. 3). There was a statistically significant difference between the participation

Table 2. Participation of boys and girls in type of organized physical activity (PA).

Boys						Girls					
School			*University*			*School*			*University*		
Type of PA	n	%	Type of PA	N	%	Type of PA	n	%	Type of PA	n	%
Soccer	208	21.1	Soccer	204	30.7	Volleyball	166	13.7	Volleyball	216	33.5
Volleyball	62	6.3	Volleyball	41	6.2	Basketball	77	6.3	Aerobics	58	9.0
Basketball	45	4.6	Swimming	30	4.5	Gymnastics	68	5.6	Swimming	49	7.6
Gymnastics	35	3.6	Basketball	26	3.9	Dance	52	4.3	Aerobics	40	6.2
Swimming	32	3.3	Field and track (running)	19	2.9	Field and track (running)	32	2.6	Field and track (running)	30	4.6
Badminton	26	2.6	Bodybuilding	14	2.1	Swimming	28	2.3	Soccer	24	3.7
Field and track (running)	25	2.5	Handball	13	1.9	Badminton	27	2.2	Fitness exercises	23	3.6
Fitness exercises	25	2.5	Kick-box (thai-box)	12	1.8	Handball	26	2.1	Basketball	20	3.1
Karate	21	2.1	Badminton	11	1.7	Riding	26	2.1	Badminton	19	2.9
Bodybuilding	21	2.1	Judo	11	1.6	Soccer	23	1.9	Exercise in the water	13	2.0

Table 3. Structure of weekly physical activity (MET-min·week^{-1}) in boys according to participation in organized physical activity

Physical activity (MET-min·week^{-1}) and Sitting (min·day^{-1})	Number of lessons of organized physical activity per week								H	p	η^2
	0 lessons		1–2 lessons		3–4 lessons						
	S n=280	U n=166	S n=195	U n=73	S n=201	U n=123	S n=308	U n=303			
	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)			
School	**976 (3351)**	2939 (5723)	1440 (3226)	3908 (4892)	1400 (3158)	3348 (4800)	**2435 (5012)**	3250 (5133)	109.19[a]	<0.001	0.062**
Transport	693 (1854)	929 (2046)	900 (1848)	924 (1397)	693 (1947)	990 (2202)	957 (2257)	792 (1518)	19.10	0.246	0.007
Home	360 (915)	308 (800)	270 (955)	420 (810)	400 (1025)	280 (795)	360 (1043)	420 (1110)	4.39	0.7341	0.012*
Recreation	**416 (1151)**	964 (1671)	720 (1703)	666 (1524)	693 (1767)	1346 (1787)	**1800 (3087)**	1442 (2374)	117.33 [a]	<0.001	0.067**
Vigorous	**345 (1470)**	**1440 (2160)**	780 (2160)	1800 (2820)	1440 (2760)	1980 (2760)	**2460 (3690)**	**2490 (3090)**	201.98 [a,b]	<0.001	0.119**
Moderate	**1259 (2660)**	1588 (2880)	1745 (2770)	1620 (2900)	1610 (3150)	1580 (2420)	**1970 (3255)**	2095 (2760)	19.68[a]	0.006	0.008
Walking	1320 (2954)	2351 (3333)	1139 (2327)	2772 (3350)	990 (1865)	3003 (3218)	1667 (3440)	2112 (2805)	89.35	<0.001	0.050*
Total	**3940 (5752)**	6551 (6695)	4894 (6422)	7452 (6296)	5052 (6111)	7319 (6031)	**7395 (7373)**	7527 (6321)	114.57 [a]	<0.001	0.066**
Sitting	396 (234)	266 (133)	351 (231)	223 (154)	377 (236)	231 (137)	351 (231)	214 (163)	249.62	<0.001	0.148***

S – secondary school; U – university; Mdn – median; IQR – interquartile range; H – Kruskal-Wallis test; η^2 – effect size coefficient; p – significance level, *small effect size; **medium effect size; ***large effect size; significant difference between groups [a]/ secondary school 0 lessons and ≥5 lessons, [b]/ university 0 lessons and girls ≥5 lessons

Table 4. Structure of weekly physical activity (MET-min·week^{-1}) in girls according to participation in organized physical activity.

Physical activity (MET-min·week-1) and Sitting (min·day-1)	Number of lessons of organized physical activity per week								H	p	η2
	0 lessons		1–2 lessons		3–4 lessons		≥5 lessons				
	S n=423	U n=216	S n=325	U n=143	S n=302	U n=112	S n=165	U n=303			
	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)			
School	**853 (2451)**	**1782 (3562)**	1212 (2780)	1998 (3576)	1250 (3020)	3075 (3906)	**2355 (4080)**	**3696 (4727)**	109.37 [a,b]	<0.001	0.055*
Transport	693 (1535)	1328 (1923)	848 (1518)	1080 (1964)	774 (1848)	1076 (2075)	660 (2025)	852 (1749)	19.14	0.008	0.007
Home	360 (780)	718 (1115)	375 (835)	630 (995)	446 (840)	728 (1123)	540 (1050)	540 (1210)	55.01	<0.001	0.026*
Recreation	**407 (1232)**	**800 (1612)**	693 (1452)	825 (1665)	729 (1561)	1368 (1754)	**1182 (3214)**	**1615 (2655)**	122.41 [a,b]	<0.001	0.062**
Vigorous	**150 (990)**	**540 (1770)**	720 (1980)	720 (2040)	840 (2160)	1440 (1500)	**2160 (3960)**	**2880 (2940)**	253.57 [a,b]	<0.001	0.133**
Moderate	900 (1810)	1815 (2495)	1285 (2180)	1550 (2305)	1285 (2340)	2040 (2899)	1260 (2605)	2040 (2290)	72.75	<0.001	0.035*
Walking	1502 (2772)	2772 (3011)	1584 (2541)	2574 (3663)	1683 (2756)	2912 (3556)	2013 (3119)	2475 (3069)	68.56	<0.001	0.033*
Total	**3741 (5133)**	**6323 (5927)**	4536 (5554)	5820 (5856)	4476 (6423)	6901 (6384)	**6668 (7490)**	**7984 (5517)**	152.46 [a,b]	<0.001	0.078**
Sitting	**399 (231)**	**270 (191)**	369 (213)	279 (171)	386 (206)	261 (183)	**326 (214)**	**214 (154)**	253.32 [a,b]	<0.001	0.133**

S – secondary school; U – university; Mdn – median; IQR – interquartile range; H – Kruskal-Wallis test; η^2 – effect size coefficient; p – significance level, *small effect size; **medium effect size; significant difference between groups [a]/ secondary school students 0 lessons and ≥5 lessons, [b]/ university sports science students 0 lessons and girls ≥5 lessons

and non-participation of university boys only in vigorous PA (p<0.001). University boys with a participation in OPA ≥5 lessons showed the lowest number of minutes of sitting (Mdn=214 min/day).

Schoolgirls participating in OPA ≥5 lessons have statistically significantly more school PA (p<0.001), recreation PA (p<0.001), vigorous PA (p<0.001), and total PA (p<0.001) than girls non-participating in OPA (Tab. 4) Similarly, university girls participating in OPA ≥5 lessons had statistically significantly more school PA (p<0.001), recreation PA (p<0.001), vigorous PA (p<0.001), and total PA (p<0.001) than girls non-participating in OPA. A greater match was therefore registered between school and university girls, compared to boys. School (p<0.001) and university (p=0.005) girls participating in OPA ≥5 lessons per week reported a statistically significantly lower sitting than non-participants in OPA.

Meeting the PA recommendations of boys and girls in secondary school and university according to participation in OPA. Participants in OPA with ≥5 lessons met the PA recommendations (combination 5 times 60 min MVPA and 3 times 20 min of VPA) statistically significantly more often compared to those non-participating in OPA. School boys (χ^2=42.45, p<0.001; r=0.193), university boys (χ^2=7.83; p=0.005; r=0.099), school girls (χ^2=48.39; p<0.001; r=0.170) and university girls (χ^2=56.77; p<0.001; r=0.258).

Likelihood of meeting PA recommendations in boys and girls according to participation in organized physical activity and other moderators. School and university boys participating in OPA ≥ 5 lessons are more likely to meet PA recommendations than boys non-participating in OPA (Tab. 5). These likelihoods are not reduced by control

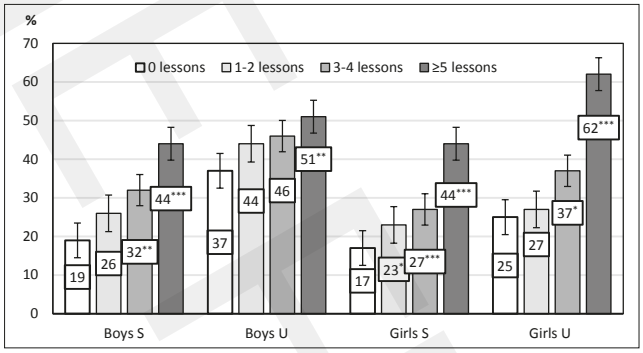

Figure 1. Meeting PA recommendations (combination of 5 times 60 min moderate to vigorous PA, and 3 times 20 min of vigorous PA) according to the participation of adolescents in organized physical activity (S-secondary school, U – university). Significant difference between groups (0 lessons and ≥5 lessons OPA); * p<0.05 ** p<0.01; *** p<0.001

variables BMI, smoking, size of place of residence, type of housing, ownership of a dog and bicycle, the possibility of using a car or cottage. In university boys, statistically significant associations was found between meeting the PA recommendations and the availability of a cottage (p=0.030) and smoking (p=0.006).

School (OR=3.93, CI=2.64–5.86; p<0.001) and university girls (OR=5.08, CI=3.29–7.85; p<0.001), participating in OPA ≥5 lessons were most likely to meet the PA recommendations (Tab. 6). These likelihoods did not reduce the control variables. University girls, were found between meeting of PA recommendations and living in a flat (p=0.026) and the availability of a cottage (p=0.016).

Table 5. Odds ratio for meeting the weekly physical activity recommendation (5x60 min MVPA+3x20 min VPA) according to participation of school and university boys in organized physical activity (OPA)

Variables	School boys				University boys			
	Model 1		*Model 2*		*Model 1*		*Model 2*	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
OPA – 0 lessons (ref. cat.)								
OPA – 1–2 lessons	**1.482 (0.958–2.292)**	**0.077**	**1.291 (0.732–2.278)**	**0.378**	**1.309 (0.748–2.290)**	**0.345**	**1.291 (0.732–2.278)**	**0.378**
OPA – 3–4 lessons	**1.955 (1.285–2.975)**	**0.002**	**1.388 (0.858–2.247)**	**0.182**	**1.449 (0.902–2.327)**	**0.125**	**1.388 (0.858–2.247)**	**0.182**
OPA – ≥ 5 lessons	**3.353 (2.311–4.866)**	**0.005**	**1.723 (1.158–2.563)**	**0.007**	**1.734 (1.178–2.552)**	**0.005**	**1.723 (1.158–2.563)**	**0.007**
BMI (ref. cat.: ≥ 25) < 25			0.925 (0.606–1.413)	0.720			0.930 (0.656–1.319)	0.685
Smoking (ref. cat.: Yes) No			0.879 (0.560–1.378)	0.573			2.299 (1.276–4.144)	0.006
City (ref. cat: < 1,000) 1,000–29,999 30,000–100,000 > 100,000			0.854 (0.525–1.391) 0.651 (0.417–1.016) 0.899 (0.640–1.263)	 0.527 0.059 0.539			0.690 (0.372–1.277) 0.612 (0.331–1.133) 0.869 (0.476–1.588)	 0.237 0.118 0.649
Home (ref. cat.: House) Flat			0.839 (0.603–1.529)	0.297			0.825 (0.559–1.529)	0.331
Dog (ref. cat.: Yes) No			0.990 (0.738–1.330)	0.949			0.822 (0577–1.169)	0.275
Bicycle (ref. cat.: No) Yes			0.684 (0.400–1.170)	0.166			0.872 (0.592–1.283)	0.486
Car (ref. cat.: No) Yes			0.892 (0.670–1.186)	0.430			0.884 (0.600–1.303)	0.533
Cottage (ref. cat.: No) Yes			0.985 (0.680–1.426)	0.935			1.663 (1.050–2.541)	0.030

PA – physical activity; OR – odds ratio; CI – confidence interval; p – significance level; Model 1 – agreement between meeting of PA and participation in organized PA; Model 2 – adjusted for BMI, city, home, ownership of dog, availability of car, availability of cottage and smoking

Table 6. Odds ratio for meeting the weekly physical activity recommendation (5x60 min MVPA+3x20 min VPA) according to participation of school and university girls in organized physical activity (OPA)

Variables	School girls				University girls			
	Model 1		*Model 2*		*Model 1*		*Model 2*	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
OPA – 0 hours (ref. cat.)								
OPA – 1–2 lessons	**1.487 (1.035–2.138)**	**0.032**	**1.427 (0.990–2.059)**	**0.057**	**1.113 (0.686–1.805)**	**0.664**	**1.109 (0.680–1.811)**	**0.678**
OPA – 3–4 lessons	**1.848 (1.290–2.648)**	**0.001**	**1.820 (1.266–2.618)**	**0.001**	**1.776 (1.084–2.910)**	**0.023**	**1.839 (1.110–3.048)**	**0.018**
OPA – ≥ 5 lessons	**3.934 (2.639–5.864)**	**<0.001**	**3.772 (2.515–5.657)**	**<0.001**	**5.079 (3.287–7.850)**	**<0.001**	**5.549 (3.546–8.684)**	**<0.001**
BMI (ref. cat.: ≥ 25) < 25			1.564 (0.887–2.757)	0.122			0.878 (0.440–1.752)	0.712
Smoking (ref. cat.: Yes) No			0.975 (0.580–1.639)	0.924			0.944 (0.516–1.729)	0.852
City (ref. cat: < 1,000) 1,000–29,999 30,000–100,000 > 100,000			1.578 (0.924–2.694) 2.179 (1.314–3.613) 2.090 (1.269–3.442)	 0.095 0.003 0.004			0.866 (0.446–1.684) 1.175 (0.679–2.032) 1.082 (0.716–1.634)	0.672 0.564 0.708
Home (ref. cat.: House) Flat			1.131 (0.836–1.529)	0.426			1.629 (1.060–2.503)	0.026
Ownership of a dog (ref. cat.: Yes) No			0.960 (0.728–1.267)	0.827			0.960 (0.663–1.389)	0.827
Bicycle (ref. cat.: No) Yes			1.129 (0.716–1.780)	0.602			0.833 (0.527–1.318)	0.435
Car (ref. cat.: No.) Yes			0.762 (0.579–1.002)	0.051			0.890 (0.603–1.312)	0.555
Cottage (ref. cat.: No) Yes			1.078 (0.748–1.553)	0.687			1.897 (1.169–3.079)	0.010

PA – physical activity; OR – odds ratio; CI – confidence interval; p – significance level; Model 1 – agreement between meeting of PA and participation in organized PA; Model 2 – Adjusted for BMI, city, home, ownership of dog, availability of car, availability of cottage and smoking.

DISCUSSION

The most important finding of the study is confirmation of the positive effects of active participation in OPA in both school and university boys and girls on the level of their weekly PA. Schoolboys and schoolgirls participating in OPA ≥5 lessons realized statistically significantly more school PA, recreation PA, vigorous PA, and total PA, than non-participants. Furthermore, both genders from school and university participating in OPA ≥ 5 lessons are more likely to meet the PA recommendations than those non-participating in OPA. The fact that participation in OPA increased overall PA and improved body characteristics has been confirmed by many studies in children [50] and adolescents [51].

In Serbia, it was found that girls who are actively engaged in basketball training indicated higher aerobic capacity and maintained normal values of body fat and BMI, compared to those not participating in OPA [26]. This mainly applied to the association between participation in OPA and VPA [7]. Students participating in OPA 3–5 lessons were more likely to meet weekly PA recommendation (5×60 min MVPA and 3×20 min VPA). Similar results were found in a study [13] where weekly VPA recommendation was met by 61% of adolescents participating in 3 or more lessons of OPA per week, 29% of adolescents with 1–2 lessons of OPA per week, and only by 24% of adolescents not participating in OPA. Adolescence who participated in OPA showed a better level of physical mobility, positive changes in psycho-social and behavioural aspects [23, 52, 53], and improvement in sensorimotor coordination than those not participated in OPA or who did not exercise at all [21].

The involvement of hitherto non-participating adolescents in OPA after school requires respect for the diverse interests and activities of adolescents and efforts to link them with a suitable type of OPA [54]. Recognition of PA preferences is therefore important for increasing participation in OPA and increasing PA in children and adolescents. Girls prefer swimming and dancing, boys prefer swimming, martial arts and team sports [32, 55]. Based on previous research, it was also found that Polish adolescents significantly prefer team sports and participation in team sports in the context of OPA [33]. School and university boys are more active in vigorous PA than girls, which is in agreement with sport participation in sports science students from other countries [56, 57]. The fact that boys non-participating in OPA would prefer to play soccer and girls volleyball raises the question of why these expectations are not met. One of the reasons may be the predominance of opportunities to participate in the OPA for more physically efficient and performance-oriented youth than the options offered in the OPA for the less physically fit, recreational PA-oriented or sports-avoiding youth. Participation in team sports is strongly associated with improving mental health [58].

Research has also shown that university students who are not active have lower psychological well-being scores compared to very active university students [57]. There is a need to improve cooperation between schools, sports clubs, and leisure institutions that focus on OPA, as well as to provide the settings for equal access of all adolescents to regular participation in PA. It should also be respected that 63% of adolescents in Polish schools participate in PE mainly for 'fun–pleasure–entertainment' [59]. Discrepancies in the use of gymnastic activities in OPA in school boys and girls compared to university students point to the preservation of traditional forms of OPA, but often in conflict with the preferences and wishes of contemporary adolescents [60]. The fact that 4 in every 5 adolescents do not experience the enjoyment or social, physical, and mental health benefits of regular PA is caused especially by the inability to participate in OPA, which is largely dependent on socio-economic and political decisions [61].

The likelihood of boys and girls participating in OPA to meet the PA recommendations are not influenced by additional personal, demographic and socio-economic moderators (except for the availability of cottages which might indicate a higher socio-economic status). The need to support the participation in the OPA of children and adolescents from families with low socio-economic status has long been required [62] and moreover, in the post-pandemic period, the underestimation of this support can have fundamental health and educational consequences. Renewing habits of regular PA, which is provided mainly by school PE and OPA, will not be easy for children and young people with a non-motivating and economically supportive family background.

Fulfillment of the recommendations for PA 5x60 min MVPA and at the same time 3x20 min VPA shows a significant contribution of OPA to increasing VPA. Fulfillment of the most publicized recommendation at least 60 minutes of PA a day, including muscle and bone strengthening activities at least 3 days a week [47, 63] in adolescents is significantly dependent on the state and school OPA system and professional readiness of sports specialists.

Strengths and limitations of the study. The strength of the study is in addressing the associations between participation in OPA, weekly PA and meeting the recommendations for PA between school and university boys and girls, as well as the 11-year continuous monitoring of associations between the level of PA and participation in OPA. The limitation of the study is an intentionally selected set of secondary schools, and only the subjective data on weekly PA.

CONCLUSIONS

Active participation in OPA by boys and girls in secondary schools and university sports science students is significantly associatds with higher weekly PA and meeting the PA recommendations. The most positive effects of participation in OPA in vigorous PA were found in terms of gender in girls. Approximately a quarter of boys and a third of girls (school and university) did not participate in OPA, thus it is highly desirable to focus more on these adolescents, and in professional training for non-participating university sports science students. Sports science students should become more familiar with the specifics of adolescents' participation in OPA in different demographic, environmental and socio-economic settings. However, positive changes should be supported by effective State health and school policy that will respect socio-economic status and behavioural changes in adolescents.

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