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Associations between organized sports participation and objectively measured physical activity, sedentary time and weight status in youth

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Abstract

Objectives—The purpose of this study was to examine whether participation in organized sports is related to achieving physical activity recommendations, body mass index (BMI), objectively measured PA intensity and time spent sedentary.

Design—Cross-sectional study.

Methods—The sample comprised 973 children and adolescents (427 boys, 546 girls) aged 10-18 years (Mage=14.1±2.4). Organized sport was self-reported. Physical activity and time spent in moderate and vigorous intensity PA (MVPA) and sedentary time was assessed with accelerometers.

Results—More boys (51.3%) than girls (28.3%) reported to be involved in organized sports participation ($p<0.001$). Those who were engaged in organized sports were more likely to achieve physical activity guidelines (OR=1.64, 95% CI: 1.14-2.35, $p<0.01$), spent more time in MPA (OR=1.01, 95% CI: 1.01-1.02, $p<0.01$), VPA (OR=1.09, 95% CI: 1.05-1.13, $p<0.001$), and MVPA (OR=1.01, 95% CI: 1.01-1.02, $p<0.001$) than those who did not participate in organized sports. No associations between organised sport participation and time spent sedentary or BMI was observed.

Conclusions—Engagement in organized sports is related to higher levels of objectively measured MPA, VPA and achieving the recommended levels of MVPA in youth; however participation in sports appears unrelated to time spent sedentary and BMI. Our results suggest that promoting organised sport may increase physical activity of at least moderate intensity in young people.

Keywords

accelerometer; sport; BMI; Portugal; cross-sectional

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The study was carried out in Faculty of Human Kinetics, University of Lisbon, Estrada da Costa, 1499-002 Cruz Quebrada, Portugal

Introduction

Despite the well-established physical, social and mental health benefits of physical activity (PA),¹ a substantial proportion of children and adolescents are not active enough to benefit their health,^{2,3} and PA levels declines during the transition from childhood to adolescence, especially among girls.⁴

Studies have shown that organized sports participation is more stable over time,^{5,6} and it has been suggested that organized sports have an important role in preventing and reducing childhood obesity,⁷ and contribute to children and adolescents attaining PA recommendations.⁶ A clearer understanding of the relationships between context specific PA (e.g. sport participation), with overall PA, likelihood of achieving PA guidelines, and sedentary time may contribute to the development of more accurate preventive strategies to increase children' and adolescents' engagement in PA.

Participation in sports may also result in increasing time spent sedentary. Such possible increment of sedentary time has been hypothesized to occur because PA and sedentary time may act as gateway behaviours. Change in one behaviour may lead to a change in other behaviours.⁸ However, evidence from experimental studies using objective measures⁹ and observational studies using objective¹⁰ and self-report measures¹¹ of physical activity and sedentary time indicate that the association between sedentary and active behaviours may be asymmetrical; suggesting that both behaviours may co-exist. Therefore, the aim of this study was to examine whether participation in organized sports contributed to achieving PA recommendations, time spent in MVPA and sedentary and to body mass index (BMI). To address these research questions, we measured PA and sedentary time objectively in a large population based sample of Portuguese youth in combination with self-reported data on organized sports participation.

Methods

Data were collected from a representative sample of 2506 Portuguese children and adolescents aged 10-18 years ($M_{age}=14.1\pm 2.4$), from a cross-sectional study aimed to examine associations between PA, physical fitness, and overweight prevalence. For the present study 973 participants (427 boys, 546 girls) providing data on objectively measured PA and weekly participation in organized sports were included. Written informed legal guardian and children and adolescents consent was obtained for each component of the study by the child's legal guardian and by all participants. The study was approved by the Institutional Review Board of the Faculty of Human Kinetics, University of Lisbon.

Participants' height was measured barefoot to the nearest 0.5 cm, using a portable stadiometer. Weight was measured in light clothing to the nearest 0.1 kg on an electronic scale (Omron HBF-500 Body Composition Monitor). BMI was calculated from the ratio weight/height². Participants were then classified into normal weight or overweight/obese based on age and sex specific cut off points proposed by the International Obesity Task Force.¹²

Participants were asked whether they practiced any organized physical activities. Organized sport was defined as sport activities guided by a coach or other adult, such as playing football or basketball in a club team. Responses were dichotomous (yes or no). The test-retest reliability was carried out within a one-week interval across 100 participants. Using intraclass correlation coefficient (ICC), the reliability was high ICC=0.95.

PA and sedentary time were measured with the accelerometer GT1M Actigraph (Pensacola, FL, USA). Participants were given an information sheet providing instructions to wear the accelerometer on the hip secured by an elastic waist belt, during all waking hours except while bathing or doing other water-based activities. Prior to data collection accelerometers were tested to check abnormal functions and battery capacity. The devices were initialized as described by the manufacturer. Sequences of consecutive zeros for periods with 60 minutes were identified and were defined as missing data. At least three days of recording (two weekdays and one weekend day) with a minimum of 600 minutes wear time was required for inclusion in analysis. Activity levels were expressed in terms of overall PA (counts/min). Activity counts were summed for each hour that the accelerometer was worn between 7:00 AM and 24:00 PM to provide a representative image of daily activity. Time (min/d) spent in different sub-components of PA were calculated using the following intensity thresholds; <100 for sedentary time, 100 to 2019 for light PA (LPA), 2020 to 5998 for moderate PA (MPA), and 5999 for vigorous PA (VPA). Participants were classified as meeting PA guidelines if they accumulated 60 min/day in MVPA.¹³

Descriptive statistics are presented as mean and standard deviation or percentages. Data were tested for normality. Mann-Whitney U-test and Chi-square test were used to compare differences between boys and girls in organized sport participation, BMI, achievement of PA guidelines, time spent in sedentary behaviours and PA intensity. ANCOVA and Chi-square test were performed to assess differences between those who reported participating in organized sports with those who did not participate in organized sports for achieving PA guidelines, time in sedentary behaviours, and PA intensity. Firstly, analyses were performed using age-groups (10-12 years, 13-15 years, and 16-18 years). However, results were not different among age-groups. Therefore, analyses were conducted with the entire sample, adjusting for age. Binary logistic regression analysis was used to estimate the relationship between organized sports participation and achieving PA guidelines, BMI, PA intensity and time spent sedentary. Overall analyses were adjusted for age and sex, and thereafter analyses were run separately for sex, because boys and girls have different patterns of organized sport participation.⁴ Data analysis was performed using SPSS version 22. The level of significance was set at 0.05.

Results

The descriptive data of organized sports participation and characteristics of participants are presented in table 1. Slightly more than one third of participants participated in organized sports. Significantly more boys (51.3%) than girls (28.3%) reported to be involved in organized sports participation ($\chi^2(1)=61.599$, $p<0.001$). Similarly, the percentage of boys (28.3%) meeting PA guidelines of at least 60 minutes MVPA per day was significantly higher than girls (7.7%) ($\chi^2(1)=73.230$, $p<0.001$). Most participants were normal weight

(76.8%), but almost 20% of the boys and 25.8% of the girls were classified as overweight/obese ($\chi^2(1)=4.706$, $p=0.030$). Time spent sedentary was on average 561.3 ± 103.0 min/day and the majority of time devoted to PA was of light intensity PA (LPA) (249.5 ± 103.8 min/day). Girls spent significantly more time sedentary than boys ($U=98831.500$, $p<0.001$). In contrast, boys spent more time than girls in LPA, MPA and VPA.

The relationships between organized sport participation and achieving PA guidelines, BMI, sedentary time and PA intensity are presented in table 2. Boys who reported to practice organized sports were more likely to achieve the recommended levels of PA ($\chi^2(1)=5.526$, $p=0.019$), but this difference was not observed in girls ($\chi^2(1)=1.010$, $p=0.315$). Boys and girls who reported being involved in organized sport spent significantly more time in MPA, VPA and MVPA than those who did not report any participation in organized sport.

Results of the binary logistic regression analysis for the relationship between organized sport participation with achieving PA guidelines, BMI, sedentary time, PA intensity are shown in table 3. For the total sample, those who were engaged in organized sport were more likely to achieve PA guidelines ($p=0.008$), spent more time in MPA ($p=0.002$), VPA ($p<0.001$), and MVPA ($p<0.001$) than those who did not participate in organized sport. In boys, there was a 84% increased odds of achieving PA guidelines for those who participated in organized sport ($p=0.007$) compared with those who did not; and being involved in organized sport increased the likelihood of spent more time in MPA ($p=0.016$), VPA ($p=0.003$), and MVPA ($p=0.007$). In girls, participation in organized sport was related to higher amounts of time spent in MPA ($p=0.021$), VPA ($p<0.001$), and MVPA ($p=0.007$). Participation in organized sports did not reduce significantly the odds of being classified as overweight/obese nor time spent sedentary.

Discussion

The results from the present study suggested that children and adolescents who participated in organized sport were more active than those who did not participate. Organized sport appears to contribute to the proportion of youth meeting PA recommendations. Furthermore, being involved in organized sport increased time spent in MPA, VPA and MVPA. However, participation in organised sport did not reduce the odds of being classified as overweight or obese nor the time spent sedentary.

Consistent with previous studies, more boys than girls were involved in organized sport, 14,15 achieved PA recommendations of 60 min/day in MVPA,² and spent more time in PA across different levels of intensity.¹⁶ Gender differences might be related to different expected social role for boys and girls, and because boys are usually more involved in sports activities and girls engaged more in social leisure and individual artistic activities.¹⁷ Although the number of Portuguese adolescents officially involved in organized sport has increased in the last years,¹⁸ only about half of the boys and one quarter of girls reported to participate in organised sports. There are a variety of factors associated with participation in organized sport. Studies have suggested that social support from parents and friends,¹⁹ socioeconomic status,²⁰ and costs associated with sport participation²¹ are important factors that may explained the lower number of children and adolescents involved.

Considering that organized sport has a positive effect on the tracking of PA from childhood to adulthood in both boys and girls,⁵ strategies to promote organized sport may contribute to prevent the decline in PA during adolescence.²

No significant relationship was observed between organized sport participation and BMI status (defined as normal-weight vs- overweight/obese). In fact, several studies have showed that there are no relationship between sports participation and weight status.^{14,22} However, others have suggested that at younger age participation in organized sport reduced the risk of obesity regardless of the type of activity performed.²³ Furthermore, high intensity PA and sport participation may influence cardiorespiratory fitness which appears to have a favourable impact on BMI and other metabolic risk factors.^{24,25} The lack of observed associations between organized sport and weight status in some cases is plausible, because some organized sport are predominantly performed at low or moderate intensity.²⁶ The intensity of the activities is particularly important, because it seems that the magnitude of association is stronger for VPA than LPA and MPA in association with adiposity measured in young people.²⁷

Consistent with previous observations, children and adolescents that were involved in organized sport spent significantly more daily time in MPA, VPA, and MVPA, mainly the girls, being consistent with the literature.^{26,28} These results reinforce the importance of organized sport, because time spent in MVPA has health, fitness and behaviours benefits, such as increased bone mineral density, improved aerobic fitness, muscular strength, endurance and a more favourable cardiovascular risk factor profile.^{1,29} Interestingly, time spent sedentary was not related to organized sport participation. It appears that organized sport and high amounts of sedentary time may coexist, has and each of these behaviours differ in their correlate and determinants structure.^{11,15}

The results from this study should be interpreted keeping some limitations in mind. First, participation in organized sport was self-reported. Although response reliability was high, any self-report is subject to bias. We also did not determine the type of organized sport. We only considered the weekly practice of PA which involved competition, coaching or training sessions, and that were organized by adults. Further, the cross-sectional design of the study preclude any inference about causality and we cannot rule out our results are explained by residual confounding due to unmeasured confounders. The main strengths of this study were the relatively large and population based sample, and the use of objective assessment of free living PA and sedentary time.

Conclusion

This study suggested that engagement in organized sport was related with time spend in high intensity PA. In boys, participation in organized sport was related with attaining PA recommendation levels, although this was not observed in girls. There was no relationship between organized sport and BMI, and time spent sedentary.

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Practical implications

- Organized sport participation contribute to achieve daily PA guidelines, especially among boys, which is related with physical, social and mental health benefits.
- Children and adolescents that were involved in organized sport spent significantly more daily time in MPA, VPA, and MVPA.
- Time spent sedentary was not related to organized sport participation. Organized sport and high amounts of sedentary time may coexist.
- As recommended, getting involved in organized sports during childhood is important to keep involvement as a teenager and pursuing PA as an adult. Therefore, promoting organized sports among youth people may contribute to public health in long term.

Table 1
Descriptive characteristics of participants by gender.

	Total (n=973)		Boys (n=427)		Girls (n=546)		p
	n	%	n	%	n	%	
Organized sport ^a							<0.001
No	608	62.5	208	48.7	400	73.3	
Yes	365	37.5	219	51.3	146	26.7	
BMI ^a							0.030
Normal weight	747	76.8	342	80.1	405	74.2	
Overweight	226	23.2	85	19.9	141	25.8	
PA guidelines ^a							<0.001
Not accomplished	810	83.2	306	71.7	504	92.3	
Accomplished	163	16.8	121	28.3	42	7.7	
Sedentary time (min/day) ^b	561.3±103.0		545.6±112.5		573.6±93.50		<0.001
Total PA (min/day) ^b							
LPA	249.5±103.8		257.0±108.6		243.7±99.5		0.051
MPA	32.5±21.0		39.7±23.2		26.8±17.0		<0.001
VPA	3.1±4.3		4.4±5.5		2.1±2.6		<0.001
MVPA	35.6±24.0		44.1±27.2		28.9±18.7		<0.001

PA, physical activity; LPA, light physical activity; MPA, moderate physical activity; VPA, vigorous physical activity; MVPA, moderate to vigorous physical activity.

^aTested by Chi-square.

^bTestes by Mann-Whitney test.

Table 2
Characteristics of children and adolescents by participation or not in organized sport.

	Organized sport participation														
	Total					Boys					Girls				
	No	Yes	p	No	Yes	p	No	Yes	p	No	Yes	p			
PA guidelines (%) ^a			<0.001			0.019						0.315			
Not accomplished	87.5	76.2		76.9	66.7		93.0	90.4							
Accomplished	12.5	23.8		23.1	33.3		7.0	9.6							
BMI (%) ^a			0.065			0.398						0.322			
Normal weight	74.8	80.0		78.4	81.7		73.0	77.4							
Overweight	25.2	20.0		21.6	18.3		27.0	22.6							
Sedentary time (M±SD min/day) ^a	563.4±105.8	557.9±98.6	0.304	544.3±118.0	550.2±124.4	0.979	573.8±107.0	567.8±82.5	0.830						
PA intensity (M±SD min/day) ^b	251.7±109.3	245.6±93.8	0.451	259.2±114.1	254.9±103.4	0.917	247.8±106.6	232.4±75.6	0.098						
LPA	30.0±20.2	36.6±21.6	<0.001	37.9±22.8	41.3±23.5	0.015	25.9±17.3	29.6±16.1	0.020						
MPA	2.5±3.5	4.1±5.3	<0.001	3.9±4.8	5.0±6.2	0.002	1.8±2.3	2.8±3.1	<0.001						
VPA	32.5±22.6	40.7±25.4	<0.001	41.8±26.3	46.3±28.0	0.006	27.7±18.7	32.4±18.1	0.007						
MVPA															

PA, physical activity; LPA, light physical activity; MPA, moderate physical activity; VPA, vigorous physical activity; MVPA, moderate to vigorous physical activity.

^aTested by Chi-square.

^bTested by ANCOVA. Analyses were adjusted for age.

Table 3
Binary logistic regression representing the relationship between being involved in organized sport with accomplished PA guidelines, BMI, sedentary time, PA intensity.

	<u>Total^a</u>	<u>Boys^b</u>	<u>Girls^b</u>
	<u>OR (95% CI)</u>	<u>OR (95% CI)</u>	<u>OR (95% CI)</u>
PA guidelines			
Not accomplishing	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Accomplishing	1.64 (1.14-2.35)**	1.84 (1.18-2.86)**	1.41 (0.72-2.75)
BMI			
Normal weight	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Overweight/Obese	0.81 (0.58-1.12)	0.81 (0.50-1.30)	0.78 (0.49-1.22)
Sedentary time			
LPA	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
MPA	1.01 (1.01-1.02)**	1.01 (1.00-1.02)*	1.01 (1.00-1.03)*
VPA	1.09 (1.05-1.13)***	1.07 (1.02-1.11)**	1.19 (1.09-1.29)***
MVPA	1.01 (1.01-1.02)***	1.01 (1.00-1.02)**	1.02 (1.00-1.03)**

PA, physical activity; LPA, light physical activity; MPA, moderate physical activity; VPA, vigorous physical activity; MVPA, moderate to vigorous physical activity.

^aAnalyses were adjusted for age and sex.

^bAnalyses were adjusted for age.

*p<0.05, **p<0.01, ***p<0.001