ORIGINAL RESEARCH

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After-school leisure time: physical activity and estimated caloric expenditure in schoolchildren from southeast Spain

El periodo de ocio extraescolar: actividad física y gasto energético estimado en escolares del sureste español

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| Abstract |

Introduction: The after-school period is commonly used by schoolchildren to do physical activities; however, the level of moderate-to-vigorous physical activity (MVPA) and caloric expenditure achieved during that period of time is unknown.

Objective: To analyze the physical activity levels and the estimated caloric expenditure during the after-school period.

Materials and methods: 408 schoolchildren enrolled in the Spanish education system and aged between 11 and 12 years were included in the study, of whom 205 were females (11,21±0,41) and 203 males (11,20±0,40). This is a descriptive, relational and cross-sectional study. Schoolchildren reported their physical activity by means of the Previous Day Physical Activity Recall (PDPAR) instrument. Physical activity was analyzed through the average minutes involved in MVPA (>3METs) and the caloric expenditure taken from the MET levels.

Results: The results showed a higher average of MVPA ($p<0.05$) and caloric expenditure ($p<0.001$) in males than in females.

Conclusions: The average MVPA minutes estimated by schoolchildren meet the recommendations of daily physical activity established by the World Health Organization (WHO). Special attention is required for the female gender and the beginning of adolescence.

Keywords: Physical Activity; Health; Children (MeSH).

| Resumen |

Introducción. Por lo general, el periodo de ocio extraescolar es empleado por los escolares para realizar actividades físicas; sin embargo, se desconoce el nivel de actividad física de moderada a vigorosa intensidad (AFMV) y de gasto calórico registrados en ese periodo.

Objetivo. Analizar los niveles de actividad física y gasto energético estimado durante el periodo de ocio extraescolar.

Materiales y métodos. Participaron 408 escolares, con un rango de edad entre 11 y 12 años, siendo 205 niñas (11.21±0.41) y 203 niños (11.20±0.40) del sistema educativo español. Se siguió un diseño de tipo descriptivo relacional y de carácter transversal. Los escolares registraron la actividad física con el instrumento Previous Day Physical Activity Recall y su análisis se hizo a través del promedio de minutos realizando AFMV (>3 MET) y el gasto calórico extraído de los niveles de MET.

Resultados. Se encontraron medias superiores para los hombres respecto a las mujeres, tanto en los minutos de AFMV ($p<0.05$) como en el gasto calórico ($p<0.001$) registrado.

Conclusiones. El promedio de minutos de AFMV estimada por los escolares estudiados cumple con los valores diarios recomendados por la Organización Mundial de la Salud. Se debe prestar especial atención al género femenino y a la entrada a la adolescencia.

Palabras clave: Actividad física; Salud; Consumo de energía; Niños (DeCS).

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Introduction

The World Health Organization (WHO) recommends that all young people aged between 5 and 17 perform minimum 60 minutes of moderate-to-vigorous physical activity (MVPA) per day, that is, above three MET. (1) A subjective way to estimate physical activity intensity is the metabolic equivalent of task (MET), which is defined as the ratio of energy expenditure to a resting rate.

A study conducted to find which are the appropriate recommendations to avoid adiposity in Spanish schoolchildren revealed that 60 minutes of MVPA are adequate for the Spanish context; however, a high dose of vigorous physical activity is also necessary for a more optimal health condition. (2)

During the International Conference on Physical Activity and Obesity in Children, it was stated that a low level of physical activity translates into a higher risk of developing obesity, while a high level of physical activity leads to a lower risk. (3) In young Europeans aged between 10 and 12 years, De Bourdeaudhuij *et al.* (4) found that those who spent more time in MVPA and less time in sedentary activities had a better body weight status. (4)

An increase in weekly energy expenditure through physical activity in the after-school leisure period is essential to prevent overweight and the risk of childhood obesity. (5) In this sense, special attention should be paid to the level of physical activity after the school day is over, since some authors suggest that, during this period, young people carry out most of their activities. (6-8)

A study with European schoolchildren aged 10 to 12 years indicated that the level of physical activity inside schools was scarce and was mainly focused on sedentary activities. (9) Similarly, other studies on physical activity have reported that the level of activity in schoolchildren is higher during the week compared to the weekend. (10-12)

On the other hand, the international literature states that physical activity levels notably decrease when children go from primary education to high school. (13-15) In studies with primary school children (aged 6 to 12 years), physical activity levels seem to be acceptable and, in some cases, comply with the established recommendations. (8,16-18); however, in studies with schoolchildren aged 12 years and older, physical activity levels are lower than recommended, especially in the female gender. (17,19,20) In all the studies reviewed on young people, physical activity is significantly higher in men than in women. (21,22)

In epidemiological studies related to physical activity level in the subjects, MVPA episodes have been observed in numerous occasions, since it is considered that movement below 3 MET is of little relevance. MET, as unit of measurement of energy expenditure, has been used by several studies in Spanish adolescents, obtaining different results depending on the instrument and the population studied. (23-25) This article is part of a more extensive research where an international instrument for the valuation of physical activity and caloric expenditure in MET was validated in a self-reported way by the subjects. (26)

With this in mind, the objectives of this study are to assess the level of physical activity after school and the estimated caloric expenditure using MET, and to determine compliance with WHO guidelines in sixth grade students.

Materials and methods

Design and participants

The sample consisted of 408 sixth grade students, aged between 11 and 12 years, 205 girls (11.21±0.41 years) and 203 boys (11.20±0.40 years), from eight schools (public and state-subsidized private schools) of the Region of Murcia in the Spanish southeast. Sampling was non-probabilistic and chosen non-randomly for convenience. Students with cardiovascular diseases were excluded. The design of this study was descriptive, relational and cross-sectional.

Instruments

The Previous Day Physical Activity Recall (PDPAR), adapted to the Spanish culture, was used for measuring after-school physical activity. (26) For this version, semantic, idiomatic and conceptual patterns of the different items were adapted, obtaining a content validity index (CVI) between 0.8 and 1 for all items. The instrument consists of 19 periods of 30 minutes between 2:00 pm and 11:00 pm; the subject had to remember and mark the main activity performed the day before during each time interval. Once the questionnaires were completed, the responses of the participants regarding MET intensities were compared with the MET activity-intensity sheet. (27,28) This form translates the responses of the subjects into a MET number according to the studies carried out by the authors and the compendium of intensities in physical activities.

The results obtained in this study after applying the instrument are presented in three ways: first, as the average daily time used for MVPA; second, as the MET average resulting from physical activity; and third, as the estimation of the caloric expenditure resulting from the MET level established in kcal/day, in relation to the average obtained from the three weekly measurements of after-school leisure period. To calculate daily calories, regarding each activity indicated by the participant, the standardized formula number of MET in the activity x 3.5 x weight (kg)/200 was applied. With this, the estimated daily kilocalories of the after-school leisure period were obtained. (29)

Process

An action protocol was established in the schools to take measurements for three consecutive days during the week (Tuesday, Wednesday and Thursday). During those three days, the students had to answer a physical activity questionnaire (PDPAR) every day.

The evaluators received training before starting with the process to get acquainted with the instrument; then, the study was carried out. The PDPAR was explained in the first session by the evaluator, using the application tool and a digital presentation to expose the characteristics of the questionnaire prior to the beginning of the implementation by schoolchildren; during the remaining sessions, once the exercise was understood, the tool was applied autonomously.

The research was carried out in accordance with the ethical standards of the Declaration of Helsinki (revision of 2008) (30) and following the recommendations of Good Clinical Practice Directive of the EEC. (31) In turn, the management team of the schools and the legal guardians of the participants authorized their participation in the study.

Statistical analysis

Frequency tables were made with basic descriptive statistics to estimate the mean, dispersion and distribution of the data to find the characteristics of the sample. In addition, an inferential statistical analysis was performed using the chi-square statistical association test to observe physical activity levels per time intervals. Similarly, a t-Student test was carried out to estimate differences by sex in the average of minutes of daily physical activity in the after-school leisure period. The statistical analyzes were performed using the SPSS program version 19.0 (Chicago, USA) and the level of significance was set at p=0.05.

Results

Table 1 shows the average minutes invested in MVPA by the subjects studied. It can be seen how boys had a higher average [84 minutes, standard error (SE): 3.47] than girls (63 minutes, SE: 3.01). Moreover, the daily average MET shows higher levels in boys than in girls (48 MET, SE: 0.79 vs. 41 MET, SE: 0.65). Regarding the estimated average of calories during the after-school period, the same trend can be observed with respect to boys (981 kcal/day, SE: 0.79) and girls (766 kcal/ day, SE: 0.65).

Table 2 shows significant differences between the results obtained from both sexes for the MVPA and MET ($p<0.05$) and in the total calories obtained ($p<0.001$). Thus, the t-Student test indicates differences of 20.82 minutes of MVPA, 6.73 MET and 215 kcal/day in favor of the male gender.

Table 1. Average minutes of moderate-to-vigorous physical activity, MET and estimated calories by sex.

Sex	MVPA *			MET			Calories †		
	Mean	SD	SE	Mean	SD	SE	Mean	SD	SE
Male	84.67	49.49	3.47	48.42	11.39	0.79	981.43	643.28	45.14
Female	63.85	43.16	3.01	41.68	9.39	0.65	766.19	370.52	25.87

MVPA: moderate-to-vigorous physical activity; MET: metabolic equivalent of task; SE: standard error; SD: standard deviation.
* Average of minutes obtained from three measurements and representative of the after-school period in a day.
† Average of calories obtained from three measurements and representative of the after-school period in a day expressed in kcal/day.
Source: Own elaboration based on the data obtained in the study.

Table 2. T-Student and Levene's test for independent samples correlating the minutes of moderate-to-vigorous physical activity, MET and the estimated calories by sex.

Correlation of variables	Levene's test for equality of variances		Student's t-test for equality of means						
	f	sig	t	df	Sig. (bil)	Dif. means	Dif. SE	CI95%	
								Lo	Up
MVPA *	3.60	0.050	4.52	397.55	0.000	20.82	4.59	11.78	29.86
MET	4.11	0.43	6.51	390.38	0.000	6.73	1.03	4.70	8.77
Calories †	21.25	0.000	4.13	322.10	0.000	215.23	52.04	112.85	317.62

f: F-test; sig: significance; t: t-test; df: degree of freedom; Sig (bil): bilateral significance; Dif. means: difference of means; Dif. SE: difference in standard error; CI: confidence interval; Lo: lower limit; Up: upper limit.
* MVPA: mean MVPA minutes obtained from the three measurements and representative of after-school period in a day.
† Mean calories obtained from the three measurements and representative of the after-school period in a day expressed in kcal/day.
Source: Own elaboration based on the data obtained in the study.

The chi-square test detected significant differences in the MVPA level ($\chi2=19.276$; $p<0.005$) of the participants analyzed. The classification (Table 3) shows that 8.1% of the subjects lack this type of activity. The girls perform more physical activity in the interval from 0 to 30 minutes (63.6% vs. 36.4%) and 30 to 60 minutes (61.6% vs. 38.4%), while boys perform more physical activity of over 60 minutes compared to girls (59.7% vs. 40.3%).

Table 3. Classification in minutes of moderate-to-vigorous physical activity performed by sex.

Classification according to the MVPA		Sex		Total
		Male	Female	
No MVPA	Count	13	20	33
	% of Classification	39.4	60.6	100.0
	% Total	3.2	4.9	8.1
	Corrected residuals	-1.2	1.2	
0-30 minutes	Count	20	35	55
	% of Classification	36.4	63.6	100.0
	% Total	4.9	8.6	13.5
	Corrected residuals	-2.1	2.1	
30-60 minutes	Count	38	61	99
	% of Classification	38.4	61.6	100.0
	% Total	9.3	15.0	24.3
	Corrected residuals	-2.6	2.6	

Continues.

Classification according to the MVPA		Sex		Total
		Male	Female	
>60 minutes	Count	132	89	221
	% of Classification	59.7	40.3	100.0
	% Total	32.4	21.8	54.2
	Corrected residuals	4.4	-4.4	
Total	Count	203	205	408
	% of Classification	49.8	50.2	100.0
	% Total	49.8	50.2	100.0
$\chi 2$= 19,276; p< 0.005				

MVPA: moderate-to-vigorous physical activity; $\chi 2$: chi-square distribution.
Source: Own elaboration based on the data obtained in the study.

Discussion

This study analyzed the level of physical activity, MET and estimated calories in schoolchildren from the region of Murcia during the after-school leisure period. The average results point that both boys and girls reach the levels of physical activity recommended by the WHO. Likewise, the estimated caloric expenditure seems to have a relative agreement in the maintenance of an adequate energy balance in the studied sample.

The mean MVPA minutes were 84 minutes for males and 64 minutes for females, exceeding 60 minutes per day. (1) The findings of the study coincide with a longitudinal study with a sample of 2 185 young people from Denmark, Portugal, Estonia and Norway, followed since age 9 until age 15. In this population, 97.4% of the boys and 97.6% of the girls complied with the minimum recommendations of the WHO at the age of 9. However, when the data were analyzed for the age of 15, a decrease in these compliance percentages was found, with 81.9% of men and 62% of women. (17)

In another cross-sectional study carried out with 503 Portuguese young people aged between 6 and 18 years, the level of habitual physical activity was analyzed to establish if they met the WHO recommendations. The oldest participants had a lower number of MVPA episodes than younger participants: until age 14, the average of daily physical activity minutes was 79 minutes for girls and 144 minutes for boys; after that age, there was a decrease to 44 and 56 minutes, respectively. The authors concluded that participants aged 6 to 15 years complied with the WHO recommendations. (20) The results of this study coincide with those findings, since both boys and girls with those interval ages achieved the daily physical activity recommendations.

It is necessary to remember that the average values of this study comprise the whole sample in a global way, without making a classification by time intervals. When doing this classification, it was found that 8% of the participants did not perform any type of MVPA in the after-school leisure period, while 13.5% performed between 0 and 30 minutes, 24% between 30 and 60 minutes and 54% 60 minutes or more. The latter accumulated plenty of minutes of physical activity, which makes the averages for the entire sample higher.

In the European study IDEFICS (16), 7 684 young people aged between 2 and 11 years were evaluated in Cyprus, Italy, Hungary, Belgium, Spain, Estonia, Germany and Sweden. Regarding the sample of Spanish people selected for the study, and following the recommendations of the WHO, 30.4% of boys and 12.3% of girls complied with these guidelines. Girls outnumbered boys in the 0 to 30 minutes interval (38.2% vs. 21.5%) and in the 30 to 60 minutes interval (49.5% vs. 48.2%). These results are similar to those found in our study, in the sense that girls outnumber boys in the 0 to 30 minutes (26.8% vs. 16.2%) and 30 to 60 minutes intervals (29.7% vs. 18.7%), with boys outnumbering girls (65% vs. 43.4%) in the MVPA performed over 60 minutes, as recommended by the WHO. However, the percentages of this study are substantially higher, especially in the category of more than 60 minutes (65% and 43.4% vs. 30.4% and 12.3%). This may be caused by multiple factors, mainly because in the IDEFICS study the averages include all subjects aged between 2 and 11 years; this study included a sample with an average age of 11.21 years and, as described by the authors of the study themselves, physical activity increased with age within the ranges studied.

Going back to the study carried out in Spain, it was found that only 35% of a sample of 438 schoolchildren aged 9 fulfilled the recommendations of physical activity in the community of Madrid. (32) After analyzing the results of this study, from that perspective, 54% of the total of the sample comply with the recommendations of the WHO, which is similar to the findings of other authors (18) and is above the data of the community of Madrid.

In another study recently conducted in the Region of Murcia (21), 1 055 young people between 3 and 18 years of age were analyzed, finding that they did not comply with the minimum MVPA recommendations and that 77% of them were inactive according to the Physician-based Assessment and Counseling for Exercise (PACE) questionnaire implemented in that study. These data differ from our findings, perhaps because of the wide range of age and the type of instrument used.

Regarding MET levels and kcal/day found in the present investigation, 48 MET and 981 kcal/day were observed in boys and 41 MET and 766 kcal/day in girls. In a sample of 323 adolescents between 12 and 16 years of age from the Valencian community who used MET as reference value and were assessed through a self-report physical activity questionnaire, mean daily values of 44.68 MET for men and 38.77 MET for women were observed. (24)

Another study conducted in adolescents aged between 12 and 18 years from the province of Teruel found an average energy expenditure of 40.1 MET in males and 37.2 MET in females. (23) A different study with Aragonese adolescents found an average of 39.70 MET in males and 37.51 MET in females. (25)

As it can be seen, the results of MET levels in the study are higher than what other studies have described, which may be caused by several reasons; first, the measuring instruments are different, although they were equated in terms of energy expenditure, and second, the way of quantifying was different in terms of questions asked and time intervals. Another reason may be that the populations of most studies reviewed were older than 12 years, whereas our sample is younger. At this point, it is necessary to remember what has been described about the decrease in energy expenditure as age increases. (24)

When the means of caloric expenditure are analyzed for the after-school leisure period, males show higher values because their level of physical activity is higher than in females. In the average classification established by the consensus document on energy requirement (33), it is observed that the total daily energy expenditure in males is around 2 316 kcal/day. Considering that the established basal metabolic rate of energy expenditure is 1 321 kcal/day plus the average caloric expenditure of the children included in this study (981 kcal/day), and that the possible physical activity carried out during the school day was not included, the average values of the sample seem to coincide with the physical activity necessary to satisfy the requirements in said classification.

With regard to women, the document of the Food and Agriculture Organization of the United Nations (33) establishes an average total energy expenditure of 2 123 kcal/day for the age group between 11 and 12 years, the basal metabolic expenditure being 1 217 kcal/day. Thus, observing the values shown by the girls in the present study (766 kcal/day) and knowing that they are limited to the after-school leisure period, the figures seem to be slightly lower than the estimates proposed in said classification.

This study has some limitations. On the one hand, physical activity has been measured with a self-report instrument, which can cause an overestimation of physical activity (34); however, this type of instruments are useful for evaluating activity type and mode and its determinants, which may be more complex to evaluate objectively. (35) On the other hand, it must be borne in mind that the school hours (9:00-14:00 h) were not considered in the present study, and more schoolchildren may comply with the WHO recommendations; however, some studies indicate that physical activity is considerably lower inside the school than outside. (11)

Conclusions

The findings of this study suggest that schoolchildren in the Region of Murcia perform physical after-school activities on a regular basis during the last year of the primary stage, which seems to be combined with an adequate energy balance, based on the estimated energy expenditure extracted from the physical activities they perform. The values in MVPA minutes established by the WHO are met in the total average of subjects; however, only 54% of the sample exceeds 60 minutes per day. Policies to promote physical activity should focus on maintaining physical activity levels during the transition to secondary education, where a more noticeable decrease in physical activity levels has been described, especially in the female gender.

Conflicts of interest

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