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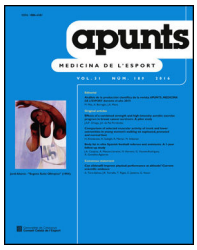

ORIGINAL

Physical fitness in Catalan children in relation to parental tobacco use and other associated factors

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PALABRAS CLAVE
Condición física;
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Abstract
Introduction: Physical fitness level in children and adolescents is determined, partly, by the specific social and cultural context of each country. There is a lack of information about physical fitness level of Catalan children and its relation with parental socioeconomic and education level and anthropometric parameters. The aim of this study is to assess the physical fitness level of Catalan children and to examine the association with family environment and parental anthropometric characteristics and smoking.
Methods and Materials: This is an observational, cross-sectional, descriptive and analytic study of 8- and 9-year-old schoolchildren. Physical fitness level was assessed with ''ALPHA-FITNESS battery'' and familiar environment and progenitors' characteristics with ALADINO family questionnaire. Differences between group means were assessed using Student's t test and analysis of variance (ANOVA) and relation between variables by Pearson correlation coefficient.
Results: 269 children participated, 146 male (54.2%). Higher parental education level is associated to a better cardiorespiratory condition in their offspring. Those children whose fathers have higher education have a lower waist perimeter and lower body mass index. Children whose parents are not regular smokers have a better physical fitness. A positive correlation between body mass indexes of parents and children is observed, while a negative correlation between the maternal body mass index and both the musculoskeletal and cardiorespiratory conditions of the children is found.
Conclusion: Children's physical fitness is related with education level, body mass index and smoking pattern of their parents.

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KEYWORDS
Physical fitness;
Children;
Parental determinants

Nivell de condició física en infants catalans relacionat amb l'hàbit tabàquic dels progenitors i d'altres factors associats

RESUMEN
Introducción: El nivel de condición física de la población infantil está determinado, en parte, por el contexto sociocultural específico de cada país. Hay una carencia de datos sobre el nivel de condición física de los niños catalanes y la relación de esta con las características del entorno familiar y de los progenitores. El objetivo del trabajo es medir el nivel de condición física de niños catalanes y su relación con el entorno familiar y las características antropométricas y tabaquismo de los progenitores.
Materiales y métodos: Estudio observacional transversal descriptivo y analítico de escolares de 8 y 9 años. El nivel de condición física se evaluó mediante la ''Batería ALPHA-FITNESS'' y las características del entorno familiar y de los progenitores con el cuestionario del estudio ALADINO. Las medias se compararon con la t de Student y el análisis de la varianza (ANOVA) y la relación entre variables con el coeficiente de correlación de Pearson.
Resultados: Participaron 269 niños/as, 146 niños (54,2%). A mayor nivel de estudios de los progenitores, mayor condición cardiorespiratoria de los niños/as, mientras que el nivel de estudios del padre está inversamente relacionado con el perímetro de cintura y el índice de masa corporal. Los niños/as con padres no fumadores habituales tienen mejor condición física. Se observa una correlación positiva entre el índice de masa corporal de los progenitores y el de los niños/as, y negativa entre el índice de masa corporal de la madre y la condición musculoesquelética y cardiorespiratoria de los hijos/as.
Conclusión: El nivel de condición física de los niños/as está relacionado con el nivel educativo, el índice de masa corporal y el hábito tabáquico de los dos progenitores.

Introduction

Physical condition (PC) can be defined as an integrated measure of the body functions involved in performing daily physical activity (PA). Evaluating PC includes assessment of the musculoskeletal and cardiorespiratory systems, and of body composition, which participate in performing PA. The relationship observed between these measures and morbidity and mortality from cardiovascular pathology makes PC an excellent health marker.[1–3]

The PC level is partially determined by genetic endowment, as well as by environmental factors and the individual's surroundings.[4] In children and adolescents, relationships have been observed between PC and PA,[5–7] the socioeconomic and educational level of the family,[8–10] and parental weight.[10] Published data coincide in that moderate-vigorous PA has the best effect on PC,[5,11,12] while physical inactivity only affects PC negatively when it replaces this moderate-vigorous PA.[13,14] In contrast, the results published in different countries on the link between family's socioeconomic and educational level and children's PC show contradictory data. While in the Madeira Growth Study[9] a high socioeconomic level is linked to a greater percentage of body fat and worse results in tests of cardiorespiratory and musculoskeletal condition, in the AVENA study[8] (carried out with Spanish adolescents), a high socioeconomic level is shown to be related to a higher level of PC and less obesity.

As for parental weight, a higher body mass index (BMI) for the mother is linked to worse long-jump test results and a more limited cardiorespiratory condition in European children, while in the case of the father's BMI, this inverse relationship is seen for the long-jump test.[10] Likewise, the ALADINO study, carried out with Spanish individuals, describes a positive relationship between parental weight and that of their children.[15] In spite of the known harmful effects that tobacco use has on health, the relationship between parental smoking and PC has rarely been studied. Pavic et al.[16] notes that passive exposure to tobacco smoke in children has a negative impact on their lung function and cardiorespiratory condition and increases their BMI values. This might be explained by the fact that lung function and physical growth decrease in children exposed to tobacco smoke, so worse results in all the components of PC would be expected. Even so, no studies linking parental tobacco use with their children's musculoskeletal condition have been found.

It is a fact that the social and cultural context is specific for each country, that the data published on PC in Spanish children are limited and that, in addition, no studies carried out with Catalan children have been found that link their PC levels and their settings. Given all this, the objective of this study was to measure the PC level in the Catalan child population and study its relationships with the family setting, the level of the parents' studies and the gross family income, and with parental weight and tobacco use.

Methods

This was an observational cross-sectional descriptive and analytical study on the population of 8- and 9-year-old children attending public and semi-public schools, in the municipalities of Sant Celoni, Santa Maria de Palautordera, Sant Esteve de Palautordera, Vilalba Sassera, Montseny, Gualba and Campins in the Baix Montseny region (Barcelona, Spain). Criteria for inclusion in the study were being enrolled in the 3rd course of primary level and having been born in 2005, as well as not having any condition or chronic injury that would prevent participation in physical education classes. The field work was performed during the 2nd semester of the 2013/2014 academic year.

Procedure

The directors and teachers at the educational centres were notified of the objectives of the study. Once consent had been obtained from these individuals, a date for giving the information sessions for the parents and legal guardians of possible participants was set. After these sessions, teachers at each centre gave the parents and legal guardians the questionnaires and the informed consent form. To participate in the study, these documents had to be returned to the centre, duly completed and signed by the parents or legal guardians.

Physical condition

Each participant's age and sex were requested, and participant PC was measured using the ALPHA-Fitness Battery,[17] validated in Spanish schoolchildren. This battery includes measures of morphological condition (weight, height and waist circumference), as well as musculoskeletal condition (lower body explosive strength (LBES) and upper body isometric strength [UBIS]) and cardiorespiratory condition (20-meter shuttle run test [20mSRT]), which are measured in the sequence mentioned. For the PC measures, the children wore sports clothing (t-shirt and shorts) and sports footwear.

Musculoskeletal condition

To measure LBES, the test of ''standing long jump'' was used: The child, with both feet placed outside the starting line, had to bend his/her knees while swinging the arms from behind to in front; with a strong push, the child would then jump forwards as far as possible, using his/her arms to help, and would fall to the ground with the feet together without losing balance. Each child performed the test twice, with the best result obtained being the one counted. To assess UBIS, the manual strength test was carried out with a Takei TKK 5001 analogue handgrip dynamometer. The child had to press the dynamometer little by little, continuously, for at least 2 s. The test was performed twice (alternately with the 2 hands) with the optimum adjustment based on hand measurement (calculated previously using the reference data table).

Cardiorespiratory condition

Cardiorespiratory condition was established using the 20-meter shuttle run test (20mSRT). This test was carried out on a track marked with 2 lines at a distance of 20 m from each other, with a tape recorder and an audio tape indicating the rhythm of the race. The child would stand behind one of the lines, facing the other one. He/she would begin to run when the first whistle was heard, and had to do so in time with the rhythm set by the music. Each 20-meter length was considered a period. The initial test speed was 8.5 km/h, and the speed was increased by 0.5 km/h every minute. Each speed increase was considered a stage. When the child was unable to reach the line before the whistle blew, the last period completed was recorded. The cardiorespiratory capacity corresponded to the stage of the last period completed.

Morphological condition

Morphological condition factors were measured following the International Society for the Advancement of Kinanthropometry (ISAK) provisions, recommendations and techniques.[18] The child, barefoot, would take position in the standard position: standing, with his/her arms extended along the side of the body in a relaxed position. At least 2 measurements were taken, with a third being taken when the difference between the first 2 was more than 5%. The result recorded was the mean between the 2 or 3 measurements taken. Weight was established using a Seca 813 digital scale (precision 100 g); the child would stand in the middle of the scale, without holding on to anything, with his/her weight uniformly distributed over both feet. Height was measured using a Seca 217 portable measuring rod (precision 1 mm): the child would stand with both feet together and with his/her buttocks and upper back in contact with the measuring rod, and his/her head in the Frankfurt plane; the corresponding measurement was taken at the upper part of the skull. The BMI was calculated dividing the weight expressed in kg by the height expressed in meters squared (BMI = weight (Kg)/ height $(m)^2$). The BMI values were then classified based on the Word Health Organisation criteria: a child's weight was considered to be underweight for values less than −2 standard deviations (SDs); normal weight, for values between −2SD and 1SD; overweight, for values between 1SD and 2SD; and obese, for values above 2SD.[19] Waist circumference (WC) was established using a non-extensible Lufkin W606PM steel measuring tape (7-mm wide; precision, 1 mm); the circumference corresponded with the measurement at the umbilical level, taken at the end of a normal exhalation.

Associated variables

The evaluation of the associated variables of interest was performed with the family questionnaire from the ALADINO study; these variables were classified according to the criteria of that study.[20]

Characteristics of the family setting

Parental educational level was classified based on the highest level of studies attained: primary school, secondary school or university studies. The gross annual family income was classified into 3 levels: less than €18,000, between €18,000 and €30,000, and more than €30,000.

Lifestyle

The children's lifestyle variables were classified according to the criteria of the Public Health Agency of Catalonia.[21] The number of days a week that the child participated in extracurricular sports activities was established, categorising the variable as 2 or fewer days a week and 3 days or more a week. The fact that a child spent 2 or more hours a day in front of a screen, watching television or playing computer games for entertainment was considered sedentary free time; and as active free time, when the child spent 1 or more hours a day playing outdoors. Children were classified as having an active lifestyle if they participated in extracurricular sports activities 3 or more days a week, spent fewer than 2 h a day in front of a screen for entertainment, and played outside for 1 or more hours a day.

Characteristics of the parents

To assess parental weight, their BMI values were calculated with their self-declared weight and height data. Parents' tobacco use was classified into 3 groups: neither of the parents was a habitual smoker; one of the parents was a habitual smoker; and both parents were habitual smokers.

Statistical analysis

Results are expressed as frequencies and percentages (%) for the qualitative variables, and means and SD for the quantitative variables. Medians were compared using Student's t-test; the analysis of variance (ANOVA) was based on the number of groups to compare; and the relationship between quantitative variables used the Pearson correlation coefficient. Statistical significance was set to $P < .05$ and the data were processed with the statistical package ''IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.''

Ethics

Informed consent was obtained from the parents or the legal guardians of the participants. The study was approved by the Commission for Research and Ethics of the Blanquerna Faculty of Health Sciences/Universitat Ramon Llull (Barcelona, Spain).

Results

Description of the study population

In this study, 13 of the 15 educational centres in the area participated (86.7%), 12public schools and 1 semi-public school. Informed consent was obtained for 269 children (participation rate of 75.8%). Table 1 shows the participants' characteristics. It can be seen that the boys obtain better PC results in the tests for musculoskeletal and cardiorespiratory condition and present significantly better WC values than the girls. As for weight, 35.2% of the children were classified as overweight (17.8% overweight and 17.4% obese); obesity is more prevalent in boys (22.7%) than in girls (11.1%). More mothers have university studies than fathers (44.3% and 35.1%, respectively), although the differences are not statistically significant ($P = .096$). With respect to lifestyle, the percentage of boys that participate in extracurricular sports activities 3 or more days a week is statistically higher than that of the girls (43.4% and 19.4%, respectively). In reference to the hours a day spent on screen time for entertainment and spent playing outdoors, there are no statistically significant differences by sex. In contrast, the percentage of boys that have an active lifestyle is significantly higher than that of the girls: 20.2% and 6.4%, respectively. The self-declared parental weight and height data shows that the mean BMI is 26.1 kg/m^2 for the fathers, and 23 kg/m^2 for the mothers. Somewhat more than half the families indicate that neither of the parents is a smoker.

No relationship is observed between the hours that the children spend on screen time for entertainment and the days a week that they spend participating in sports activities (Table 2). However, even though the differences are not statistically significant, the children that spend more hours a day playing outdoors spend fewer hours in front of screens.

Physical condition and characteristics of the family setting

The analysis of PC and the family setting (Table 3) shows that a higher level of the fathers' studies is linked to better results in the children's cardiorespiratory condition; likewise, the higher the fathers' educational level, the lower the children's WC and BMI values. As for the mothers' educational level, there is a statistically significant relationship with cardiorespiratory condition, but not with the rest of the PC components. A higher gross family income level is linked to greater LBES and lower UBIS values.

Physical condition and lifestyle

The children that participate in extracurricular sports activities 3 or more days a week and have an active lifestyle obtain better results in LBES and cardiorespiratory condition that those that participate 2 days or less (Table 4). No relationship with the rest of the PC components is seen; likewise, no differences are observed in any of the PC variables in relation to sedentary and active free time.

Table 1 Characteristics of the study population.

Characteristics	Boys		Girls		P	Total	
	n	Mean (SD)	n	Mean (SD)		n	Mean (SD)
Age (years)	145	8.9 (0.3)	124	8.9 (0.3)		269	8.9 (0.3)
Musculoskeletal condition							
LBES (cm)	141	121.8 (18.6)	114	114.6 (18.3)	.002	255	118.6 (18.7)
UBIS (kg)	141	13.4 (2.6)	117	12.7 (2.5)	.031	258	13.1 (2.6)
Cardiorespiratory condition							
20mSRT (stages)	127	3.2 (1.4)	106	2.2 (1.0)	<.001	233	2.8 (1.3)
Morphological condition							
Weight (kg)	141	32.3 (6.8)	117	31.4 (6.7)	.315	258	31.9 (6.8)
Height (cm)	141	134.4 (5.4)	117	133.3 (6.2)	.114	258	133.9 (5.8)
BMI (kg/m^2)	141	17.8 (3.0)	117	17.6 (2.7)	.560	258	17.7 (2.9)
WC (cm)	141	58.7 (6.4)	116	56.9 (6.3)	.022	257	57.9 (6.4)
Weight (%)							
Underweight	4	2.8	0	0.0		4	1.6
Normal weight	80	56.7	83	70.9	.016	163	63.2
Overweight	25	17.7	21	17.9		46	17.8
Obese	32	22.7	13	11.1		45	17.4
Educational level of the father (%)							
Primary school	26	19.4	26	22.4		52	20.8
Secondary school	65	48.5	44	37.9	.239	109	43.6
University studies	43	32.1	46	39.7		89	35.1
Educational level of the mother (%)							
Primary school	26	19.0	24	20.7		50	19.8
Secondary school	55	40.1	36	31.0	.313	91	36.0
University studies	56	40.9	56	48.3		112	44.3
Annual gross family income (%)							
< €18,000	37	25.5	23	43.9		60	24.2
€18,000 - €30,000	37	25.5	23	28.0	.413	60	24.2
> €30,000	39	26.9	36	28.0		75	30.7
Weekly frequency of extracurricular activities (%)							
Not enrolled	33	23.1	48	38.7		81	30.3
≤2 days	34	23.8	44	35.5	<.001	78	29.2
≥3 days	62	43.4	24	19.4		86	32.2
Hours a day of screen time for entertainment (%)							
≥2 Hours[a]	73	51.0	64	52.0	.873	137	51.5
<2 Hours[b]	70	49.0	59	48.0		129	48.5
Hours a day of outdoor activities (%)							
<1 hour[c]	23	17.2	31	26.1	.085	54	21.3
≥1 hour[d]	111	82.8	88	73.9		199	78.7
Lifestyle (%)							
No active	95	79.8	103	93.6	.002	198	86.5
Active	24	20.2	7	6.4		31	13.5
Father's BMI (kg/m^2)	131	26.9 (3.0)	118	26.2 (3.5)	.595	249	26.1 (3.2)
Mother's BMI (kg/m^2)	136	22.8 (3.3)	120	23.2 (3.3)	.268	256	23.0 (3.3)
Parents' tobacco use (%)							
Neither of them	74	51.7	68	54.8	.614	142	53.2
Yes, one or both	69	48.3	56	45.2		125	46.8

20mSRT: 20-meter shuttle run test; BMI: body mass index; LBES: lower body explosive strength; SD: standard deviation; UBIS: upper body isometric strength; WC: waist circumference.

[a] Two or more hours a dayeither on weekdays and weekends.

[b] Less than 2 hours a day either on weekdays and/or weekends.

[c] Less than an hour a day either on weekdays and/or weekends of outdoor activities.

[d] An hour or more a day of outdoor activities either on weekdays and weekends.

Table 2 Relationship between sedentary free time and sports activities and active free time.

	Hours a day of screen time for entertainment			
	≥ 2h[a]	<2h[b]	Total	*P*
Weekly frequency of extracurricular sports activities				
<2 days	77	81	158	.920
≥3 days	42	43	85	
TOTAL	119	124	243	
Hours a day of outdoor activities				
<1 h[c]	32	22	54	.057
≥1 h[d]	88	109	197	
TOTAL	120	131	251	

[a] Two or more hours a day either on weekdays and weekends.
[b] Less than 2 hours a day either on weekdays and/or weekends.
[c] Less than an hour a day of outdoor activities either on weekdays and/or weekends.
[d] An hour or more a day of outdoor activities either on weekdays and weekends.

Physical condition and parental characteristics

The children whose parents are both non-smokers have better results in the LBES tests and in cardiorespiratory condition, and lower values in the WC and BMI measures (Table 5). The analysis of the correlation between PC and parental BMI reveals than increased BMI, both for the father and for the mother, is linked to an increase in the children's WC and BMI values; in addition, a negative correlation between maternal BMI and child LBES and cardiorespiratory condition results can be observed (Table 6).

Discussion

Description of the study population

In this study, the boys show better results in the musculoskeletal and cardiorespiratory condition tests than the girls, as well as higher PC values. Although the differences in BMI are not statistically significant, the percentage of boys with obesity is higher than that of the girls. The differences observed between boys and girls with respect to musculoskeletal and cardiorespiratory condition results (which are also seen in other studies)[22,23] might be due to the anatomical and physiological differences between sexes.[24] However, as has been observed in our study, boys spend more time participating in sports activities than girls; consequently, the differences observed could also be explained by the fact that boys are more active than girls.[25]

The levels of musculoskeletal condition, LBES and UBIS, along with the cardiorespiratory condition, of the children in Baix Montseny are much the same as the values published as the European standards of reference obtained in the framework of the ''Identification and prevention of dietary- and lifestyle-induced health effects in children and infants'' (IDEFICS) study.[10,22] Comparing the weight of the study children with the data published by the Spanish government, it can be seen that the percentages of children classified as overweight and obese in Baix Montseny (17.8% and 17.4%, respectively) are lower than those observed for Spanish 8-year-old children (where 24% are overweight and 18.6%, obese) and among Spanish 9-year-olds (25% being overweight and 21.2% presenting obesity).[26] In contrast, comparing the data obtained with those of the Catalan population reveals that the data are very similar: 16.3% and 17% of the Catalan children aged between 6 and 9 years were categorized as overweight and obese, respectively, in 2014.[27] It should also be pointed out that, just as occurs in Spain and in Cataluña in general,[28,29] in Baix Montseny obesity is more prevalent in boys (22.7%) than in girls (11.1%).

Physical condition and characteristics of the family setting

In this study, the father's educational level (more than the mother's) is seen to be linked to a better level of PC in the children. Specifically, the higher the level of studies of the father, the better the cardiorespiratory condition and the lower the WC and BMI values for the children; however, in the case of the mother, only a positive relationship between the maternal educational level and the children's LBES values is seen. These results partially contrast with those obtained in the AVENA study (carried out with Spanish adolescents), in which the educational level of the two parents is directly linked to better LBES and cardiorespiratory capacity (the latter factor only for the girls); and an inverse relationship is observed between the boys' body fat content and the maternal educational level, although not in the case of the girls.[8] Likewise, the results of the ALADINO study show that there are more children with obesity among the parents with primary or secondary studies, and that there are more children with an appropriate weight among parents having university studies.[26]

In general, parental educational level is linked to family income level in our study, and gives an idea of the family's socioeconomic status. However, a link is observed only between the gross family income level and LBES and UBIS, but not with the rest of the components of PC; this could be explained by the homogeneity of the study population.

Table 3 Physical condition and family setting.

	LBES (cm)			UBIS (kg)			20mSRT (stages)			PC (cm)			BMI (kg/m^2)		
	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*
Father's educational level															
Primary school	48	115.7 (17.3)		49	13.4 (2.5)		45	2.5 (1.3)		48	59.6 (6.8)		49	18.2 (3.2)	
Secondary school	106	117.8 (20.1)	.052	106	13.4 (2.6)	.105	98	2.6 (1.3)	.016	106	58.7 (6.3)	<.001	106	18.1 (2.9)	<.001
University studies	84	123.1 (16.7)		86	12.6 (2.5)		76	3.1 (1.3)		86	55.5 (5.0)		86	16.7 (2.8)	
Mother's educational level															
Primary school	47	114.6 (17.9)		47	13.1 (2.7)		45	2.3 (1.2)		46	58.3 (6.8)		47	17.9 (3.3)	
Secondary school	88	119.1 (18.5)	.200	89	13.3 (2.3)	.813	79	2.7 (1.3)	.008	89	58.4 (6.1)	.309	89	17.8 (2.7)	.406
University studies	106	120.5 (19.1)		108	13.0 (2.7)		97	3.1 (1.4)		108	57.1 (6.3)		108	17.4 (2.8)	
Gross annual income															
< €18,000	55	113.7 (19.2)		55	13.5 (2.4)		51	2.6 (1.3)		55	59.3 (7.6)		55	17.9 (3.4)	
€18,000 - €30,000	59	120.3 (19.2)	.040	59	13.5 (2.8)	.021	55	2.7 (1.3)	.269	59	58.6 (6.3)	.082	59	18.0 (3.0)	.276
> €30,000	73	121.9 (17.6)		74	12.4 (2.6)		68	3.0 (1.3)		74	56.8 (6.0)		74	17.2 (2.6)	

20mSRT: 20-meter shuttle run test; BMI: body mass index; LBES: lower body explosive strength; SD: standard deviation; UBIS: upper body isometric strength; WC: waist circumference.

Table 4 Physical condition and lifestyle.

	LBES (cm)			UBIS (kg)			20mSRT stages)			PC (cm)			BMI (kg/m^2)		
	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*
Extracurricular sports activities															
≤2 days	150	116.1 (18.0)	.002	153	12.9 (2.5)	.093	136	2.5 (1.3)	.002	152	57.7 (6.1)	.952	153	17.6 (2.8)	.826
≥3 days	83	123.9 (19.3)		83	13.5 (2.6)		78	3.1 (1.4)		83	57.8 (6.7)		83	17.5 (3.0)	
Sedentary free time															
≥2 Hours[a]	121	118.6 (19.3)	.997	122	13.1 (2.7)	.750	107	2.8 (1.4)	.932	122	58.6 (6.6)	.117	122	17.8 (3.0)	.479
<2 Hours[b]	132	118.6 (18.4)		134	13.0 (2.4)		124	2.7 (1.3)		133	57.3 (6.2)		134	17.5 (2.8)	
Active free time															
<1 hour[c]	50	116.8 (21.0)	.533	51	12.5 (2.6)	.060	40	2.7 (1.4)	.999	50	58.4 (6.8)	.566	51	17.7 (3.0)	.971
≥1 hour[d]	190	118.6 (18.3)		192	13.2 (2.5)		178	2.7 (1.3)		192	57.8 (6.4)		192	17.7 (2.9)	
Lifestyle															
Inactive	190	117.3 (18.5)	.011	193	13.0 (2.5)	.945	29	2.6 (1. 3)	.017	192	57.8 (6.3)	.573	193	17.7 (2.9)	.346
Active	29	126.9 (20.4)		29	13.1 (2.6)		171	3.3 (1.2)		29	57.1 (6.7)		29	17.1 (3.0)	

20mSRT: 20-meter shuttle run test; BMI: body mass index; LBES: lower body explosive strength; SD: standard deviation; UBIS: upper body isometric strength; WC: waist circumference.

[a] Two or more hours a day either on weekdays and weekends.

[b] Less than 2 hours a day either on weekdays and/or weekends.

[c] Less than an hour a day either on weekdays and/or weekends of outdoor activities.

[d] An hour or more a day either on weekdays and weekends of outdoor activities.

Table 5 Physical condition and parental tobacco use.

	LBES (cm)			UBIS (kg)			20mSRT (stages)			PC (cm)			BMI (kg/m^2)		
	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*	n	Mean (SD)	*P*
Tobacco use															
No. Neither of them	136	121.3 (18.4)		138	13.1 (2.5)		122	2.9 (1.3)		138	56.9 (5.9)		138	17.3 (2.7)	
Yes. One or both	117	115.3 (18.7)	.011	118	13.1 (2.6)	.868	109	2.5 (1.3)	.018	117	59.1 (6.7)	.006	118	18.1 (3.1)	.026

20mSRT: 20-meter shuttle run test; BMI: body mass index; LBES: lower body explosive strength; UBIS: upper body isometric strength; WC: waist circumference.

Physical condition and lifestyle

Better results in the tests of LBES and cardiorespiratory condition are obtained by children that participate in extracurricular sports activities 3 or more days a week, and by those that have an active lifestyle (the ones that participate in extracurricular sports activities 3 or more days a week, spend less than 2 h a day on screen time for entertainment and play outdoors for an hour or more a day). In contrast, no link has been found with weight, WC and BMI. These results could be explained by what has been seen in other studies, where performing moderate-vigorous intensity PA is related to better cardiorespiratory and musculoskeletal condition.[5,10,12] However, the role of PA in preventing excess weight is subject to debate. While some studies seem to indicate that performing moderate-vigorous or vigorous PA appears to be a factor that protects against overweight and obesity,[11,28,29] others suggest that excess weight might be the cause of a low PA level among children.[30] No relationship has been observed between sedentary free time and PC either; these results coincide with those of other studies, in which the relationship between physical inactivity and worse PC is not significant.[14,31] In fact, the studies indicate that physical inactivity has a negative impact on PC solely when it replaces PA.[13,14] In our study, an inverse relationship is seen between the time spent in front of a screen for entertainment and the time participating in outdoor activities, although no relationship is observed between screen time and participating in sports activities. Even though the relationship is not statistically significant, the results suggest that encouraging outdoor activities might reduce children's screen time for entertainment, which could help to improve their PC.

Physical condition and parental characteristics

Our results demonstrate that parental tobacco use is linked to a lower PC, more limited cardiorespiratory condition and LBES, and higher WC and BMI values. Results of studies indicate that passive exposure to tobacco smoke in children increases the risk of overweight and obesity.[15,16,32] However, in spite of the well-known negative effect that tobacco use has on both the individuals that smoke and the people around them, we have found only 1 study that links children's passive exposure to tobacco smoke to worse lung function and cardiorespiratory condition in the children.[16]

The BMIs calculated from the parents' self-declared height and weight reveal a negative correlation between the maternal BMI and child LBES and cardiorespiratory condition, and a positive correlation between the parents' BMIs and the WC and BMI values of their children. These results are similar to those involving European children, in which there is also a negative relationship between maternal BMI and child LBES and cardiorespiratory condition, as well as to the ALADINO study results showing a positive link between parental and child weights.[15,26]

This study has a few limitations that should be considered. As the study design is cross-sectional, it is not possible to establish causal associations. In addition, the restricted geographical area in which the study took place makes it difficult to extrapolate the results. The PA levels have been

Table 6 Physical condition and parental weight.

		LBES (cm)	UBIS (kg)	20mSRT (stages)	WC (cm)	BMI (kg/m^2)	
Paternal BMI (kg/m^2)	*r	-.126	.111	.163	.185	−.132
	P	.054	.088	.012	.004	.054
	n	236	238	237	238	213
Maternal BMI (kg/m^2)	*r	-.171	−.046	.211	.244	−.189
	P	.008	.475	.001	.000	.005
	n	242	245	244	245	221

*r: Pearson's correlation coefficient.
20mSRT: 20-meter shuttle run test; BMI: body mass index; LBES: lower body explosive strength; UBIS: upper body isometric strength; WC: waist circumference.

determined on the basis of qualitative criteria, without taking quantitative measurements; the parental height and weight data are self-declared, which might lead to interpretation errors because people generally underestimate their weights.[33] Study strengths are that the children's PC has been evaluated using the ALPHA-Fitness Battery validated using a population of Spanish schoolchildren, and that the children's morphological condition has been determined according to the ISAK criteria.

In conclusion, the PC levels of the children included in the study are similar to those of European children. Their PC is more closely linked to the father's educational level than to the mother's, and is related to participation in PA outside of school time and to parental BMI and tobacco use.

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