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DOES BODY MASS INDEX MODERATE THE RELATIONSHIP BETWEEN PARENTAL SUPPORT, FITNESS, AND PHYSICAL ACTIVITY PRACTICE IN ADOLESCENTS?

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Abstract

The present study aimed to determine whether the relationship between parental support and level of physical fitness and the amount of physical activity (PA) is moderated by the body mass index (BMI) of adolescents. A total of 748 pairs, which consisted of a parent and his/her adolescent child (13-17 year olds), took part in this study. Self-report measures related to parent support, weekly frequency of moderate-to-vigorous physical activity (MVPA) and enjoyment with PA, such as objective physical fitness (aerobic capacity, speed, and long broad jump) were used. Moderation regression analyses with PROCESS were used. Results showed that BMI moderated the relationship between instrumental support and aerobic capacity, as well as, between guided support and long broad jump. Additionally, parental support (instrumental and emotional) contributed to the explanation of the highest percentage of variance in the variables of weekly frequency of MVPA and enjoyment with PA. It is concluded that parental support can contribute to the improvement of the physical fitness and weekly MVPA of adolescents.

KEY WORDS: *body mass index, parental support, fitness and physical activity.*

Resumen

El presente estudio pretendió conocer si la relación entre apoyo parental y el nivel de condición física y cantidad de actividad física (AF), estaba moderada por el índice de masa corporal (IMC) de los adolescentes. Un total de 748 diadas padres-hijos adolescentes (13-17 años de edad) participaron en este estudio. Medidas de autoinforme relacionadas con el apoyo parental, frecuencia semanal de AF y la diversión asociada a dicha práctica, así como medidas de condición física objetiva (capacidad aeróbica, velocidad y salto de longitud horizontal) fueron empleadas. Se llevó a cabo un análisis de regresión moderada empleando PROCESS. Los resultados mostraron que el IMC moderó la relación entre apoyo

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instrumental y capacidad aeróbica, así como la relación entre apoyo guiado y longitud de salto horizontal. Adicionalmente, el apoyo parental (instrumental y emocional) explicaba el mayor porcentaje de varianza en las variables frecuencia semanal y diversión asociada a la práctica de AF. Se concluye que el apoyo parental puede contribuir a mejorar la condición física e incrementar la práctica de AF de los hijos adolescentes.
Palabras clave: *índice de masa corporal, apoyo parental, condición física y actividad física.*

Introduction

Physical fitness and physical activity (PA) are important for physical and mental health during childhood and adolescence (Charlton et al., 2014; González-Cutre & Sicilia, 2012; Ho, Louie, Chow, Wong, & Ip, 2015). Fitness also has been positively related with self-esteem and perceived sports competence (Smith et al., 2014). Moreover, regular PA in youth is positively associated with children and adolescents perceived physical competence (Inchley, Kirby, & Currie, 2011) and the enjoyment associated with these activities (Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009). Despite this, evidence shows that fitness and PA has been declining over recent decades (Charlton et al., 2014; Jago et al., 2011; Tomkinson, Olds, Kang, & Kim, 2007).

Family environment also has an influence on adolescents´ physical and psychological health (García-Mendoza, Parra, & Sánchez-Queija, 2017; Laird, Fawkner, Kelly, McNamee, & Niven, 2016; Martínez-López, López-Leiva, Moral-García, & De la Torre-Cruz, 2014; Rhee et al., 2016). For example, parents influence on their children's PA by tangible support (by purchasing their equipment, driving them to the sports facilities, resource provision) intangible support (encouragement, praise, advice on the importance of being physically active) and direct modelling (Fredricks & Eccles, 2005; Morrissey, Wenthe, Letuchy, Levy, & Janz, 2012; Wright, Wilson, Griffin, & Evans, 2010).

The mechanisms of parental influence on the PA of children are an issue that is still debated. For instance, physically active parents who value fitness and enjoy PA practice are more likely to have a positive influence on the frequency of PA in their children (Cheng, Mendonça, & de Farias-Júnior, 2014). In fact, responsiveness -praise, moral support, involve children in making decisions- and parental structuring -planning of family activities, enrollment in organized activities, provision of necessary equipment- have been positively related to the fun, perceived competence, self-efficacy, motivation and frequency of PA practice of children and adolescents (Davison et al., 2013; Dowda et al., 2011).

Likewise, support offered by parents seems to be mediated by the body weight of parents and children (Brunet et al., 2014; Rhee et al., 2016). De Bourdeaudhuij et al. (2005) found that family support towards the practice of PA was lower in overweight adolescents than in their normal weight peers. In a similar line, Trost, Kerr, Ward, and Pate (2001) examined different correlations of PA in preadolescent with obesity and normal weight. Results revealed that only the paternal modeling differed for both groups. Likewise, Davison and Schmalz (2006), explored the possible interaction between perceived parental support and the odds to be sedentary in a group of adolescents. Their findings reflected the existence of differences in self-reported PA in the condition low parental support (less activity in the risk group), an activity that was comparable in both groups when perceived parental support was high. As is clear from previous research, BMI of children and adolescents seems to influence the support that parents offer towards the practice of PA of their children (Laird et al., 2016; Schoeppe et al., 2016; Stearns et al., 2016).

However, few studies have been developed to examine the extent to which different forms of parental support -informational, emotional or instrumental- are related to the physical fitness of children and adolescents (Davison, Downs, & Birch, 2006; Ellis, Lieberman, & Dummer, 2014). Knowing this relationship can be useful to suggest to mothers and fathers guidelines that mitigate the risks associated to health and promoting improvements in physical fitness of their adolescent children (Brunet et al., 2014). To our knowledge, this type of relations has not been researched using self-reported parental and adolescents´ measures and objective measures in adolescents.

Based on the above, this study aimed to know if the support expressed by mothers and fathers towards the practice of PA predicts the physical fitness (aerobic capacity, speed and broad jump) and PA (MVPA and enjoyment with PA) of their children, beyond personal variables such as age and BMI. Additionally, we examined whether the BMI of adolescents moderates the relationship between the different forms of parental support, physical fitness and the practice of PA of boys and girls.

Method

Participants

A total of 748 parent-adolescent pairs took part in this study (fathers, *n*= 376, 50.3%). Adolescents (53.1% girls) ages ranged between 13 and 17 (*M*= 14.43, *SD*= 1.24). Parental information was obtained through a questionnaire (see Table 1). 5.8% of young people in this study had a nationality no Spanish. Over 50% of mothers and fathers had an educational level of bachelor or higher. Children's information was collected through a combined method of objective measures of physical fitness and self-reported responses. Data collection was developed during the spring of 2014 -third academic term-.

Instruments

MEASURES FOR PARENTS

a) *Ad-hoc Socio-demographic Questionnaire.* A questionnaire was developed for parents to report data on their age, weight, height, weekly frequency of PA practice, educational level, employment status.
b) *Parental Influence on Physical Activity Scale - Parent Version* (Jago, Fox, Page, Brockman, & Thompson, 2009). This scale consists of 14 items in four

dimensions (general support, current PA, past PA, and guided support) related to the weekly frequency with which parents (with their children or on their own) undertake PA-related activities. Parents were asked to indicate their degree of agreement with each statement according to a 4-point Likert scale (1= total agreement; 4= total disagreement). A process of translation-back translation was used for the presentation of the scale in Spanish language. At the beginning, a Spanish translator with extensive experience in English language, translated the original version in English to Spanish. After that, the translator and the researchers made some small adjustments in the new version of the items in order to not alter their original meaning. Finally, the process of back-translation was carried out by an English language native with extensive knowledge of the Spanish language in order to identify possible discrepancies when comparing the two English versions. Disagreements were resolved through a small discussion group of researchers and two independent translators. In the study by Jago et al. (2009), the 14 ítems reported the 67.5% of variance of scores obtained and showed an adequate internal consistency of .75. The general factor of "support" reported of 23.2% of variance (α= .83), while the factor "current PA" reported the 19.4% of variance in the scores obtained (α= .84). At the same time, the factors "past PA" and "guided support" reported of 12.5%, with internal consistency values of α= .80 y α= .82, respectively.

MEASURES FOR ADOLESCENTS

c) *SECA 214 Stadiometer*. An Elegant type-B ASIMED digital weighing machine and a portable SECA 214 stadiometer were used to register weight and height values of participants who were barefoot and wore light clothes. The body mass index (BMI) value was computerized by means of Quetelet's equation: BMI= mass (kg)/height (m^2). Values BMI were transformed in *z*-scores according to the International Obesity Taskforce criteria (Cole, Bellizzi, Flegal, & Dietz, 2000) and the specific cutoffs for each sex and age proposed by Cole and Lobstein (2012). In girls, the 73.7, 20.4 and 5.7% were normal weight, overweight and obese respectively. In boys, were the 80.1, 14.4 and 5.5%, respectively.

d) *20-Metre Shuttle Run Test* (Leger, Mercier, Gadoury, & Lambert, 1988). Aerobic capacity was evaluated by means of the 20-metre shuttle run test. Speed was measured with the 4 × 10 metre shuttle run test, while broad jump (leg explosive strength) was assessed by means of the broad jump test. These three tests were completed using ALPHA (Assessing Levels of Physical Activity and fitness at population level) protocols. Procedure and test reliability was indicated by Ortega et al. (2011).

e) *Moderate to Vigorous Physical Activity Scale* (MVPA; Prochaska, Sallis, & Long, 2001). The MVPA measures the number of days (from zero to seven) in both the last week and a standard week in which participants completed at least 60 min of moderate to vigorous PA. The value obtained is equivalent to the number of days of weekly practice when both items are averaged. MVPA scale was performed again to 44 participants one week later. Results showed a high intra-class correlation (ICC= .812, 95% CI: .789-.829). The validity results were verified by calculating the correlation index between the self-report measure and the accelerometers values. The value of Pearson's correlation was .40.

f) *Physical Activity Enjoyment Scale* (PACES; Motl et al., 2001). It consists of 16 items, each of which is introduced by the phrase: "When I am active...." It is meant to assess PA enjoyment by means of favourable expressions - "It is stimulating" - and unfavourable expressions - "It is boring". Responses are made according to a 5-point Likert scale (1= complete disagreement, 5= full agreement). The final value is obtained by averaging the responses to all items after inversion of the values assigned to unfavourable items. The highest score is equivalent to greater PA enjoyment. Internal consistency was .92 for the sample under study.

Procedure

We contacted with 20 compulsory education Centers in the autonomous community of Andalusia (Spain). Twelve of them showed interest to collaborate in the study. A random sampling of dyads the -parents-children- was carried out in proportion to the number of students enrolled, to get a similar percentage of participants of each school. A written description of the nature and purpose of this research was made available to the participating parents and guardians, children, and school headmasters and PE teachers. Parents or legal guardians signed an informed consent for their children could participate in this research. Parents decided who of them answered the questionnaire about support and modeling offer to their children. This procedure has been used in previous studies (Stearns et al., 2016). The return rate was 48% (372 mothers, 49.8%, and 376 fathers, 50.2%). The parental questionnaire contained a code (the child's course, group and position in an alphabetical list) to relate the parents' data with the children's responses. The questionnaires (administered in Spanish language), anthropometric measurements, and physical fitness values were measured during PE classes under the researchers' supervision. The study protocol was approved by the Ethics Committee of the University of Jaen. Research design was in accordance with the Spanish legal framework for clinical research on humans (Royal Decree 223/2004 on clinical trials), personal data protection legislation (Organic Law 15/1999), and the standards of the Declaration of Brazil (2013 version).

Data analysis

Initially, the factor structure of the Parental Influence on Physical Activity Scale was examined, in order to verify that our data reproduced the original structure obtained by Jago et al. (2009). A factor load of .40 or higher was established as a criterion to retain an item within the considered factor.

Values are shown as means and standard deviation. Differences between boys and girls were analysed using the Student's *t*-test for independent samples. The Pearson correlation coefficient was used to examine the bivariate association between variables. To examine whether the different dimensions of parental support were related to the fitness and PA practice in adolescents and if this relationship was moderated by the participant's BMI, regression tests were used. After centering the moderator variable BMI, interactions between different types of support (instrumental, emotional, present practice, past practice, and guided support) and BMI were calculated as a previous step.

The different predictor variables were introduced in the regression analysis with the procedure of successive steps. In the first step, adolescents' age and BMI were introduced. Parent past and current PA practice were included (with modelling purposes) in the second step. The three parental support measures (instrumental support, emotional support, and guided support) were included in the third step. Finally, the interaction between each dimension of parental support and BMI of adolescents was included in the last block. After that, all dependent measures were subjected to different moderated multiple regressions, incorporating as predictor variables the specific kind of support, BMI, interaction specific support x BMI. Data analyses were completed with the statistical software package SPSS v. 21.0 for MS Windows (IBM Corp. Released, 2012) and PROCESS (Hayes, 2013). Significance was set at .05 for all analyses.

Results

Factor analysis of the Parental Influence on Physical Activity Scale

An exploratory factor analysis (EFA) with varimax rotation revealed the existence of five factors whose values exceeded 1 (Table 2). The general parental support factor in the original version of the scale was divided into two dimensions: *instrumental support* (journeys and payment of fees; 36.9%, α= .89) and *emotional support* (encouragement; 13.47%, α= .76) for PA practice. The third factor, called *current PA* (11.45%, α= .85), showed the degree to which parents perceive themselves as physically active throughout the week. The fourth factor, called *past PA* (8.56%, α= .84), showed the degree to which parents had been physically active in the past relative to the present. The fifth factor, known as *guided support* (8.09%, α= .87), showed to what extent parents set household rules that encourage PA practice.

Descriptive and correlation analyses

Table 1 and 3 show mean values and standard deviations by gender for all variables considered in parents and children. Parents who answered the questionnaire had different age, weight status, height and BMI (p< .001). Scores were higher in males than females.

After Bonferroni correction (.05/15= .003), boys obtained significantly higher scores than girls in physical fitness measures, as well as MVPA, as well as MVPA and enjoyment. Moreover, significant differences were found in favor of boys in instrumental parenting support and emotional parenting support (p< .001).

Table 1
Mean values, standard deviations (age, height, weight and weekly physical activity), and frequency distribution for different parent socio-demographic variables

Parent socio-demographic variables	Overall (*n*= 748)	Mother (*n*= 372)	Father (*n*= 376)	*t*(747)	*p*
Age (years)	45.68 (5.05)	44.26 (4.90)	47.10 (4.80)	-7.95	< .001
Height (cm)	167.61 (8.09)	162.61 (5.70)	172.90 (6.91)	-20.75	< .001
Weight (kg)	75.04 (15.29)	65.96 (11.11)	84.12 (13.42)	-18.89	< .001
Body mass index (BMI) (kg/m^2)	26.16 (4.15)	24.88 (3.97)	27.44 (3.93)	-8.47	< .001
Weekly physical activity (60 minutes/day)[a]	2.23 (2.14)	2.12 (2.05)	2.33 (2.18)	-1.304	.84
Educational level				$\chi^2_{(3)}$	*p*
< Primary Education		6 (1.6%)	10 (2.7%)	5.11	.25
Primary Education		137 (32.0%)	138 (37.1%)		
High School/Technical certificate		130 (35.1%)	149 (40.1%)		
University		96 (26.2%)	75 (20.2%)		

Note: [a]number of days a week with at least 60 minutes of practice.

The Pearson coefficients, mean values, standard deviations, and reliability of all measurement scales are shown in Table 4. Positive correlations and statistically significant were found between parent instrumental support and physical fitness and self-reported measures (*r*= .468 for the largest, all *p*< .01). Parent emotional support obtained similar correlation results (*r*= .347 for the largest, all *p*< .01). Parental current PA was positive and statistically related to adolescent aerobic capacity (*r*= .397, *p*< .01) and self-reported measures by children (*r*= .204, *p*< .01 for MVPA and *r*= .134, *p*< .01 for enjoyment). Moreover, guided support was positive and statistically related to MVPA (*r*= .124, *p*< .01).

Table 2
Items and factor loads obtained in the dimensions of the parental influence on Physical Activity Scale (Parents Version)

Items	IS	ES	CPA	PPA	GS
1. I pay for my children to do some physical activity over the weekend (e.g., swimming or soccer)	**.86**	.13	.09	.03	.10
2. I drive my children to sports clubs over the weekend	**.85**	.06	.31	.11	.07
3. I take and collect my children where they do sports or physical activity over the weekend	**.85**	.22	.12	.06	.08
4. I pay for my children to do some physical activity in the weekdays (e.g., swimming or soccer)	**.73**	.09	.30	.12	.07
5. I encourage my children to be physically active in the weekdays	.20	**.88**	.15	.07	.06
6. I encourage my children to be physically active over the weekend	.17	**.84**	.15	.03	.06
7. I do physical activity with my children in the weekdays	.17	.15	**.84**	-.01	.13
8. I do physical activity with my children over the weekend	.27	.10	**.80**	.11	.08
9. I do a considerable amount of physical activity in the weekdays	.20	.04	**.78**	.16	.12
10. I do a considerable amount of physical activity over the weekend	.13	.12	**.74**	-.02	.15
11. I used to do a considerable amount of physical activity in the weekdays, but I do not any more	.12	.05	.07	**.92**	.10
12. I used to do a considerable amount of physical activity over the weekend, but I do not any more	.08	.04	.07	**.91**	.12
13. I set rules so I do some physical activity in the weekdays (e.g., being home at a set time, not going to some places, etc.)	.13	.06	.19	.10	**.91**
14. I set rules so I do some physical activity over the weekend (e.g., being home at a set time, not going to some places, etc.)	.10	.06	.19	.14	**.90**

Note: IS= instrumental support; ES= emotional support; CPA= current physical activity; PPA= past physical activity; GS= guided support. The values in bold within the same column are located in each one of the five factors.

Regression tests for moderation in fitness measures

Results in aerobic capacity revealed that age, BMI and instrumental parental support explained the 25.9% of variance in observed scores [R= .509, R^{2}= .259; F(7, 740)= 36.99, p= .001]. Thus, when age (β= .528, p< .001) and the instrumental parental support (β= .759, p< .001) were higher, such as the BMI was lower (β= -.787, p< .001), better results in aerobic capacity test. Additionally, interaction instrumental support x BMI contributed to increase in .05% the percentage of variance explained in the aerobic capacity of adolescents, ΔR^{2}= .005,

$\Delta F(1, 739) = 5.27$, $p = .022$, $\beta = -.181$, $t(739) = -2.11$, $p < .05$ (see table 5). The number of bootstrap samples for bias corrected bootstrap confidence intervals was 5000. In addition, the level of confidence for all confidence intervals in output was 95%.

Table 3

Results of Student's *t*-test for independent samples and statistical significance of the considered variables according to gender

Children socio-demographic variables	Overall (*n*= 748) *M* (*DT*)	Girls (*n*= 397) *M* (*DT*)	Boys (*n*= 351) *M* (*DT*)	*t*(747)	*p*
Age[a]	14.43 (1.24)	14.24 (1.17)	14.60 (1.27)	-4.00	< .001
Weight[a]	60.21 (13.44)	55.40 (10.03)	63.85 (14.99)	-8.69	< .001
Height[b]	164.77 (8.62)	159.73 (6.27)	167.96 (8.70)	-14.68	< .001
Body mass index[a]	22.10 (4.20)	21.63 (3.90)	22.48 (4.39)	-2.76	.007
Aerobic capacity[a]	5.08 (2.46)	3.88 (1.74)	6.15 (2.52)	-14.19	< .001
Agility/speed[a]	3.31 (.34)	3.12 (.25)	3.48 (.32)	-17.26	< .001
Leg explosive strength[a]	152.67 (31.34)	134.09 (22.07)	169.11 (29.08)	-18.55	< .001
MVPA[b]	3.41 (1.79)	2.88 (1.70)	3.86 (1.73)	-7.63	< .001
PA enjoyment[b]	3.97 (.64)	3.86 (.65)	4.06 (.61)	-4.34	< .001
Instrumental support[c]	2.62 (.96)	2.44 (.94)	2.79 (.94)	-5.07	< .001
Emotional support[c]	3.33 (.70)	3.25 (.73)	3.40 (.66)	-2.84	< .001
Current physical activity[c]	2.21 (.80)	2.17 (.77)	2.24 (.81)	-1.31	.19
Past physical activity[c]	2.15 (.93)	2.16 (.93)	2.14 (.92)	.23	.82
Guided support[c]	2.42 (.97)	2.39 (.96)	2.44 (.98)	-.60	.55

Notes: MVPA= Moderate-to-vigorous physical activity; PA= physical activity; [a]Objective measures of physical fitness in adolescents; [b]MVPA (0-7) and children's scores (1-5); [c]Parental support and PA (1-4).

To understand the nature of this interaction, simple slopes were calculated using the mean of the moderator variable as well as a standard deviation above and below the average (Figure 1). Examination of these variables revealed a positive relationship between instrumental parental support and aerobic capacity for each category of BMI: below average, $\beta = .939$, $t(739) = 7.359$, $p < .001$, average: $\beta = .759$, $t(739) = 8.273$, $p < .001$, and above average: $\beta = .578$, $t(739) = 4.69$, $p < .001$ of BMI. This relationship was higher when adolescents showed a lower BMI with regard to the sample study mean.

Table 4

Mean values, standard deviations, reliability and correlation index between different measures (*n*= 748).

Variables	1	2	3	4	5			8	9	10	11	12
Adolescent age	1	.005	.033	-.022	-.053	-.029	-.080*	.284**	.277**	.374**	-.036	.015
Adolescent BMI (z-scores)		1	-.08	.033	-.051	.019	-.008	-.311**	.204**	- .238**	-.061	-.076*
Instrumental support[a]			1	.404**	.468**	.130**	.303**	.286**	.286**	.238**	.333**	.242**
Emotional support[a]				1	.347**	.056	.170**	.115**	.137**	.122**	.278**	.220**
Current PA[a]					1	-.070	.397**	.083*	.072	.070	.204**	.134**
Past PA[a]						1	.196**	-.030	-.032	-.038	-.023	-.037
Guided support[a]							1	.036	.026	-.013	.124**	.036
Aerobic capacity[b]								1	.602**	.659**	.302**	.192**
Speed[b]									1	.748**	.243**	.226**
Broad jump[b]										1	.241**	.224**
MVPA[b]											1	.415**
PA enjoyment[b]												1
M	14.43	0	2.62	3.33	2.21	2.15	2.42	5.06	3.31	152.70	3.41	3.97
SD	1.23	1.00	.96	.70	.80	.		2.45	.34	31.	1.79	.64
Cronbach alpha	--	--	.89	.76	.85	.		--	--	--	--	.92

Notes: BMI= body mass index; PA= physical activity; MVPA= moderate-to-vigorous physical activity. [a]Information provided by parents; [b]information obtained from children. *$p< .05$; **$p< .01$.

Table 5
Percentage of variance explained, change increment and statistical significance of the hierarchical multiple regression analysis for the different criteria variables

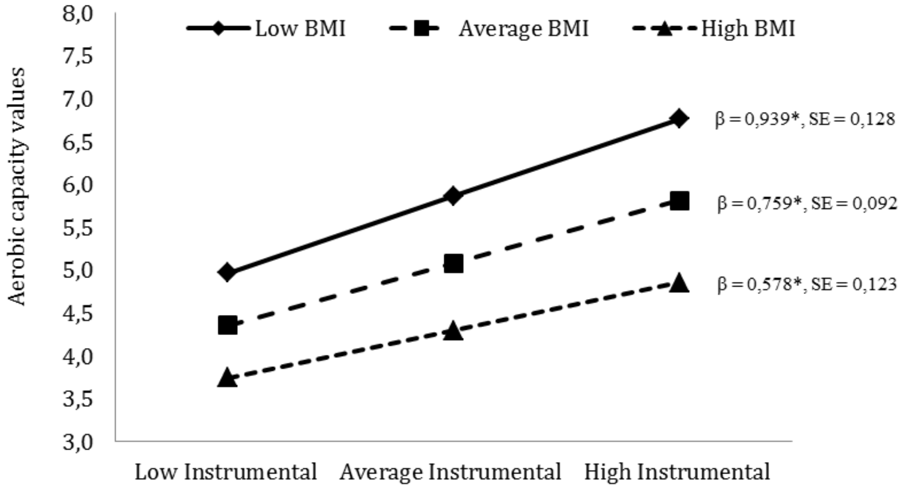
Criteria variables	R^2	$\triangle R^2$	*F*	*p*
Aerobic capacity				
Model 1	.178	.178	*F*(2,745)= 80.53	< .001
Model 2	.185	.007	*F*(2,743)= 3.31	.036
Model 3	.259	.074	*F*(3,740)= 24.68	< .001
Model 4	.264	.005	*F*(1,739)= 5.27	.022
Speed				
Model 1	.119	.119	*F*(2,742)= 50.30	< .001
Model 2	.126	.007	*F*(2,740)= 2.80	.06
Model 3	.206	.080	*F*(3,737)= 24.59	< .001
Model 4	.206	.000	*F*(1,736)= .51	.43
Broad jump				
Model 1	.198	.198	*F*(2,745)= 91.70	< .001
Model 2	.205	.007	*F*(2,743)= 3.30	.038
Model 3	.256	.052	*F*(3,740)= 17.18	< .001
Model 4	.268	.012	*F*(1,739)= 11.75	< .005
MVPA				
Model 1	.005	.005	*F*(2,745)= 1.87	.31
Model 2	.046	.041	*F*(2,743)= 16.05	< .001
Model 3	.146	.100	*F*(3,740)= 28.78	< .001
Model 4	.146	.000	*F*(1,739)= .12	.64
Enjoy PA				
Model 1	.006	.006	*F*(2,745)= 2.24	.11
Model 2	.025	.019	*F*(2,743)= 7.38	< .005
Model 3	.089	.063	*F*(3,740)= 17.11	< .001
Model 4	.146	.000	*F*(1,739)= .05	.62

Notes: Model 1 includes as predictors the age and BMI; Model 2 includes the above variables, as well as parental current PA and past parental PA; Model 3 includes the above variables, and instrumental, emotional and guided support; Model 4 includes the term of the interaction support x BMI; MVPA= moderate-to-vigorous physical activity; PA= physical activity.

When speed was the criteria variable, the inclusion of predictors in the first three steps reported the 21% of variance observed in participants' speed [*R*= .45, R^2= .206, *F*(7, 737)= 24.59, *p*< .001). In this case, age (β= .073, *p*< .001) and the instrumental parental support and BMI respectively acted as positive (β= .105, *p*< .001), and negative (β= -.071, *p*< .001) predictors of speed, respectively. None interaction between parental support and BMI was statistically significant.

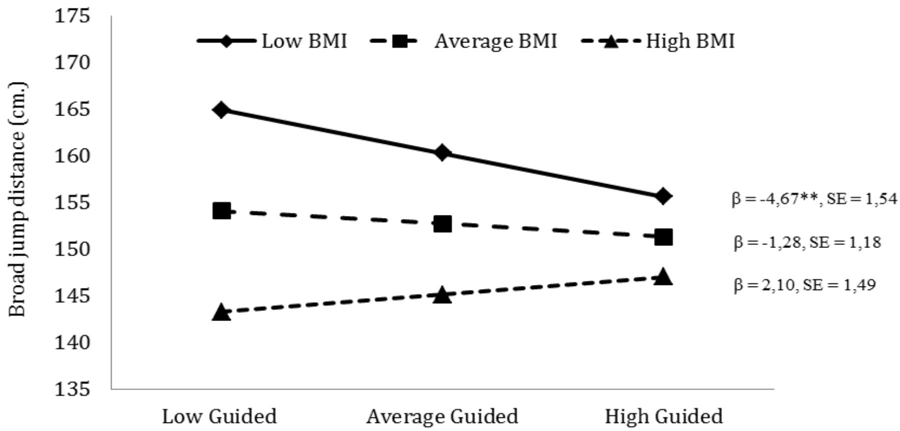
For broad jump, the inclusion of age and BMI along with the different dimensions of parental social support resulted in a model that explained the 25.6% of the variance in the scores obtained [*R*= .506, R^2= .256, *F*(7, 740)= 22.54, *p*< .001). Age (β= 9.36, *p*< .001), parent instrumental support (β= 7.48, *p*< .001) and parent emotional support (β= 3.21, *p*< .05) were statistically significant predictors. Thereby, better results were obtained in this test with higher age, instrumental support and emotional. Additionally, the interaction guided support by BMI, $F(1, 735)= 10.32$, $p= .001$, increased a 1.2% the percentage of variance explained in broad jump, $\Delta R^{2}= .012$, $\Delta F(1, 739)= 12.94$, $p< .001$, $\beta= 3.361$, $t(739)= 3.60$, $p< .001$. The number of bootstrap samples for bias corrected bootstrap confidence intervals was 5000. In addition, the level of confidence for all confidence intervals in output was 95%.

Figure 1
Moderating effect of body mass index in the relationship between parental instrumental support and aerobic capacity



Notes: BMI= body mass index. *$p< .005$.

Figure 2
Moderating effect of body mass index in the relationship between guided support and broad jump



Notes: BMI= body mass index. *$p< .005$.

To understand the nature of this interaction, the simple slopes were calculated (Figure 2). It was observed that among young people with lower BMI values than the average, the relationship between guided support and broad jump was negative and statistically significant, β= -4.67, $t(728)= 3.035$, $p= .002$.

Regression tests for moderation in physical activity measures

Analysis did not reveal a moderate effect of BMI in the relationship between parental support and PA. However, instrumental and emotional parental support consistently predicted the self-report measures of PA practice. Specifically, for MVPA measure, the model predicted 14,6% of the variance in the scores obtained [$R= .384$, $R^2= .146$, $F(7, 740)= 18.05$, $p< .001$]. In this case, parental instrumental support (β= .489, $p< .001$) and parental emotional support (β= .424, $p< .001$) respectively, were statistically significant predictors (see table 5). None interaction kind of support x BMI was statistically significant.

Finally, the prediction model of PA enjoyment explained 8.9% [$R= .298$, $R^2= .089$, $F(7, 740)= 10.27$, $p< .001$)] of the variance. The statistically significant predictors were BMI (β= -.034, $p< .05$), parent instrumental support (β= .130, $p< .001$), and parent emotional support (β= .139, $p< .001$). None interaction kind of support x BMI was statistically significant.

Discussion

This study examined if parental support to PA predicts physical fitness (aerobic capacity, speed and broad jump), and PA (MVPA and enjoyment with PA) of their children, beyond personal variables as age and BMI. Besides, it was analyzed if the effect of parental support on physical fitness and PA was different according to the values of BMI. Results reveal that BMI moderates the relationship between instrumental parental support and aerobic capacity, and the relationship between guided support and broad jump. In the first case, the examination of simple slopes indicates that the effect of instrumental support on adolescent aerobic capacity is consistently positive independently of BMI. However, the slope is more pronounced among adolescents who have a lower BMI value. Thus, the effect of instrumental support on aerobic capacity seems to be greater among participants who have a lower BMI.

On the other hand, effect of guided support on broad jump was different according to BMI of adolescents (negative for low values and positive for high values of BMI). Nevertheless, only the negative relationship between guided support and broad jump was significantly moderated by BMI of adolescent. Therefore, a greater structuring of the family context for participation in sports PA was associated with worse results in the broad jump test, particularly in those adolescents with lower BMI.

Our results are similar to Nock et al. (2016). In their study, with an overweight and obese adolescents, the familiar dimensions of cohesion and expressiveness predicted the recovery time of the base heart rate after performing a submaximal effort test. The greater family emotional cohesiveness and expressivity were associated with a shorter cardiac recovery time. In a similar line, Peterhans, Worth, and Woll (2013), studied the relationship between family behavioral factors associated with health (daily PA and time invested in sports clubs) and the aerobic capacity of a group of German adolescents. The results showed that these factors explained the 4.1% and 2.1% of the variance in boys´ and girls' aerobic capacity, respectively.

On the other hand, instrumental support proved to be a consistent predictor of young adolescent fitness beyond the personal variables of age and BMI. This results coincides with Davison, Cutting, and Birch (2003), who observed that maternal instrumental support was associated with higher PA levels and aerobic capacity in adolescents. One possible explanation may be that parents who provide their children more aids to PA practice, enjoy at the same time of greater social status. Recently, Finger, Mensink, Bauzer, Lampert, and Tylleskär (2014) found in a group of German adolescents that the highest rates of aerobic fitness were reached by boys and girls belonging to families with a higher socioeconomic status. Supporting this idea, Charlton et al. (2014), concluded that the economic difficulty of the area of residence along with the non-achievement of the educational objectives from disadvantaged households, was associated with worse indices of physical fitness (20 metre multi stage) in British children and adolescents. These results indicate that the problem is not only the cost associated to PA practice, in addition, the displacement is another one, because the sport centers are usually located in prosperous or wealthy residential areas. Therefore, it is necessary to identify what are the factors associated to low physical fitness level during adolescence because its importance like critical marker of health in early age stages (Stearns et al., 2016).

Our data on self-reported PA practice reveal that both instrumental and emotional support positively predict MVPA and enjoyment reporting a percentage of variance greater than 14.0% in MVPA and enjoy with PA. These data are similar to results obtained by Heitzler, Martins, Duke, and Huhman (2006) who concluded that parents' beliefs in PA and instrumental support (e.g., journeys to practice facilities) are related to the adolescents' participation in organised PA and sports events. In the same way, Verloigne et al. (2014) concluded that parental instrumental support (payment of installments, provision of mean of transport) was positively associated with the quantity of PA -assessed by accelerometry- performed by adolescents during weekdays.

The observed association between parental emotional support and the weekly PA practice, enjoyment coincides with previous studies (Robbins, Stommel, & Hamel, 2008; Sabiston & Crocker, 2008). In this regard, Robbins et al. (2008), obtained that perception of higher parental emotional support -encourage and observe PA along with being congratulated and praised for this practice- predicted the number of weekly hours that boys and girls performed along with their own positive perception as physically active young people who hope to remain actives during adulthood.

A current meta-analysis carried out by Yao and Rhodes (2015), examined the impact that specific actions of parental support had on the practice of PA -assesed by self-reports and accelerometry- of children and adolescents. Support and parental motivation (aspects of a more emotional nature) had a moderate effect on this PA practice. However, Siceloff, Wilson, and Van Horn (2014), did not find this relationship in a group of adolescents belonging to marginalized communities. This result could be explained by the reciprocal relationship between parents' expectations and adolescents' results. Greater instrumental and emotional support may be related to a favourable family attitude towards PA, as well as greater confidence in adolescents' physical abilities. Likewise, the achievement of the expected results would corroborate parents' expectations, thus leading to increased parent social support (both tangible and emotional). These results are similar to those found by Taverno-Ross, Dowda, Beets, and Pate (2013). In their study physically active adolescent girls (with frequent participation in single and team sports out of school) felt greater parental support for the development of these activities.

Although parental support has a positive effect on the attitudes and PA practice in children and adolescents, there are also reasons to believe that certain parental behaviors have negative implications. As pointed out by Heitzler et al. (2006), greater demands by physically active parents occasionally have a more deterrent rather than encouraging effect on PA practice. These demands are coupled with higher anxiety levels, which lead to negative feelings and even PA abandonment. In this sense, Davison and Deane (2010) concluded that girls who were encouraged by their parents to be physically active with the aim of reducing their body weight, expressed a decrease in the enjoyment with PA together with a greater concern regarding weight. Also, this support did not translate into changes in the PA frequency.

Some strengths of this study include its large sample size, the collection of information from two independent sources (parents and children), and the use of objective (fitness tests) and subjective (questionnaires) measures. On the other hand, this study also has some limitations. First, its cross-sectional nature hinders the analysis of causal associations between parental support, physical fitness, PA frequency, and intention to being physically active. Second, limitations result from the use of self-reported measures. Third, there are several other aspects of parental support that were not measured in this study (i.e.: parents´ perception about the value of sport and the competence of their child in the sport context).

As suggested by Morrissey et al. (2012), educational and public health spheres should emphasise the importance of family support in the promotion of healthy behaviours in children and adolescents. It is therefore important to stress the need to design family-focussed interventions aimed at promoting PA among youth. As Davison et al. (2013) point out, these interventions should emphasize the importance of different forms of family support (provide the necessary equipment, enroll them in associations or sports clubs, sharing decisions about the most convenient type of activity or praising the participation of children and adolescents). This relevance is even greater among parents with limited means (economic, who are not working or have time constraints) to provide instrumental support (Charlton et al., 2014). Some strategies to facilitate this support include sharing vehicles on journeys to sport facilities, organising social activities for parents while their children get exercise, suggesting PA and sports activities be shared by all family members, and even helping parents to think creatively about possible ways to increase the PA of their adolescent children (Jackson et al., 2013; Verloigne et al., 2014).

It is concluded that BMI of adolescents moderates the effect that some forms of parental support (instrumental and guided support) have on some physical fitness measures (aerobic capacity and broad jump), but it doesn´t happen in MVPA and enjoyment with PA. Specifically, the effect of instrumental support on adolescent aerobic capacity is positive for any BMI value, although this effect is greater when BMI scores are below their mean value. On the other hand, when guided support parental is higher, the performance obtained in broad jump test is lower, particularly in those adolescents who present a lower BMI. Likewise, emotional and instrumental parental support contribute to the explanation of the higher percentage of variance in scores observed in MVPA and enjoyment with PA. An important line for future research should focus on getting to know whether parent-expressed and child-perceived support are the best predictors of physical fitness, weekly frequency of PA practice, and enjoyment of PA and sports activities. The findings of this study highlight the need to broaden our understanding of the personal and social factors that promote fitness and PA among adolescents.

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