Perceived physical fitness mediates the relationship between parental support and physical activity enjoyment in overweight and obese adolescents (words: 3987)

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Abstract

The relationship between parental support and physical activity enjoyment appears to be mediated by individual-level factors. The aim of this study was to examine whether the relationship between perceived parental support and physical activity enjoyment is mediated by overweight and obese adolescents' physical fitness, both subjectively and objectively assessed. One-hundred and sixty-three participants (mean age = 14.30 years, 55.8% boys) with an average body mass index of 28.97 kg / m^2 took part in this study. Participants completed a questionnaire of parental influence regarding physical activity, a questionnaire of physical self-perception and several fitness tests (cardiorespiratory fitness, lower limbs muscular strength and flexibility) using the ALPHA-fitness battery. The results showed that relationship between perceived parental support and physical activity enjoyment is mediated by the overweight and obese adolescents' perceived cardiorespiratory fitness and flexibility. We suggest to create educational guidelines for parents to increase the support and improve overweight and obese students' positive perceived physical competence, in order to achieve a greater adherence to physical activity and greater physical activity enjoyment.

Keywords: social support, obesity, adolescents' health, physical activity

Introduction

The increasing prevalence of overweight and obesity among youth stands as a major issue in the public health system of developed countries [1]. Overweight children and adolescents are more likely to become obese adults [2], and to have cardiovascular and respiratory diseases [3] and psychological conditions associated with low well-being and quality of life [4-5]. Different studies have shown that overweight and obese children and adolescents perform less physical activity daily and enjoy less with its practice than their normal-weight peers [6-8]. This may be due to the intimidation, discomfort or embarrassment that they experience during physical activity practice. They also achieve lower results in most physical fitness tests compared to their normal-weight peers [9].

It has also been reported that overweight can be viewed as the cause rather than as the effect of lacking activity and low fitness [10]. According to Pahkala et al. [11], overweight and obesity make some activities associated with physical activity less attractive (e.g. running, jumping and flipping). This negative view makes overweight individuals less likely to undertake physical activity. Still, physical activity and the affective reaction produced by its practice (enjoyment or fun) is not associated with body weight alone. According to the ecological model [12], environmental variables, such as the availability of recreational areas [13], social variables, such as parental support [14-15], and cognitive variables, such as physical self-concept and perceived competence [16-17], can also be determining factors of the frequency of practice and its associated fun.

Physical activity enjoyment is defined as the subjective experience characterized by the pleasure and enthusiasm involved in its practice [18]. Parents, as the main agents of socialization, play a leading role in promoting children and adolescents' physical activity, as well

as in the affective reaction linked to its practice [19]. Special attention has been given to parental social support, defined as the set of actions, both tangible (transport, fee payment) and intangible (encouragement, advice) performed by parents to increase the physical activity of their children [20-21]. Previous research provides evidence of the relationship between parental support and physical activity enjoyment. For example, Silva, Lott, Mota & Welk [22] showed that the involvement and stimuli that children attributed to their parents maintained a positive relationship with the perceived enjoyment and self-efficacy toward the practice of physical activity in a sample of Portuguese adolescents. Recently, Shen et al. [23] showed that beliefs about parental support predicted the fun associated with school physical activity in a concurrent way and over time.

According to the Expectation-Value Model [24-26], the degree of parental support may vary depending on the parents' belief system. Among these beliefs are the ability they attribute to their children for the performance of physical activity, the importance or value they attach to their practice and the expectations they place on the minor about their possible success in this particular domain [25-26]. Several studies found that positive physical self-concept was associated with greater self-reported physical activity and physical activity enjoyment [27-30].

A smaller number of studies have aimed to examine the possible relationships between parental support and the physical fitness level of their children. De la Torre-Cruz, Ruiz-Ariza, Suárez-Manzano and Martínez-López [31] showed that the instrumental parental support positively predicted fitness in adolescents. In the specific case of adolescents who are overweight and obese, Nock et al. [32] concluded that a greater degree of family cohesion was associated with a shorter time interval of recovery of the basal heart rate (indicative of a better physical fitness) after performing a submaximal test. In this regard, MacDonald et al. [33] found that

cardiorespiratory fitness, muscular strength in the upper limbs and flexibility positively predicted the predilection for the performance of physical activity.

As was indicated above, the perceived parental support is directly associated with the children and adolescents' amount of physical activity and physical activity enjoyment [14, 19-20]. It has recently been shown that this relationship is mediated by a number of individual-level variables (perceived self-efficacy or physical self-concept), and that the influence of perceived support on the practice of physical activity is partly indirect [23, 34].

Previous research has explored the effect of individual-level variables on the relationship between parental support and physical activity and enjoyment with the practice [14,23], but rarely in overweight and obese youths. Additionally, and to the best of our knowledge, fitness has not been researched as a mediating variable, although the best results in physical fitness tests are associated with greater predilection for the practice of physical activity [33]. This paper aimed to examine whether subjectively- and objectively-assessed physical fitness mediates the relationship between perceived parental support and enjoyment of physical activity in a group of overweight and obese adolescents. The starting hypothesis is that, in addition to the direct relationship between perceived parental support and enjoyment of physical activity, both perceived and actual physical fitness may be mediators in this relationship.

Method

Participants

The paper researches data from 1.328 secondary education students at eight schools, both public (n = 6) and private (n = 2), in various towns in a province in southern Spain (Andalusia). In this cross-sectional research only participants with a body mass index (BMI) equal to or greater than the 85th percentile were considered, according to the specific cut-offs for each sex

and age [35]. The sample was obtained for convenience (educational centres that agreed to participate in the study). The inclusion criteria were: Population adolescent between 12 to 16 years old, suitable for physical activity. Boys and girls with any physical or psychological problem to the participation in Physical Education classes, were excluded. The resulting population was thus reduced to 199 students, out of which only 163 (81.9%) scored in all the tests relevant for this paper. Our statistical analysis relies on the latter. The participants' average age was 14.30 ± 1.22 years (range: 12–16), and their average BMI was 28.97 ± 2.53 kg / m^2.

Instruments

Anthropometric and physical fitness measures.

Body Mass Index. An Elegant type-B ASIMED digital weighing machine and a portable SECA 214 stadiometer were used to register the participants' weight and height, barefoot and in light clothes. The BMI value was computerised by means of Quetelet's equation: BMI = mass (kg)/height (m^2).

Physical fitness measures. These tests were done using ALPHA (Assessing Levels of Physical Activity and Fitness at population level) protocols. The procedure and test reliability were indicated by Ortega et al. [37]. Cardiorespiratory fitness was measured with the 20-meter shuttle-run test, which is done in a large group at the end of the session. The score is the number of paliers completed. The participants must run between two lines 20 m away, at the rhythm of the sound signal. The test ends when the subject stops due to fatigue, or when it does not reach the corresponding line in two repeated times. Participants must be constantly encouraged during the assessment [36]. The muscular strength of the lower extremities was assessed with the standing long jump test. It is performed with the feet behind the line, with an opening of legs approximately the width of the shoulders. The distance in centimetres is recorded [37]. The

flexibility of the thighs and the lumbar area of the back was measured with the sit-and-reach test. It is performed with sitting on the floor with legs stretched out straight ahead. The soles of the feet are placed flat against the sit and reach box. Both knees should be locked and pressed flat to the floor. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. Participants must hold that position for two seconds. The score is recorded to the nearest centimeter or half inch as the distance reached by the hand [37].

Self-report measures.

Parental Influence on Physical Activity Scale—children's version [38]. The Parental Influence on Physical Activity Scale consists of 14 items in four dimensions related to the weekly frequency with which parents (with their children or on their own) undertake physical activity-related activities. The participants were asked to report their degree of agreement with each statement according to a four-point Likert scale (1 = total agreement; 4 = total disagreement).

In this study, only the general parental support factor was used. This factor consists of six items with information on the degree of support towards physical activity that children attribute to their parents [e. g.: "The adult(s) I live with on a weekend day pay for me to take part in physical activity (for example, paying for swimming or to attend football club)"]. An average score was obtained from the six items, where higher values show greater perceived parental support. The internal consistency index obtained was $\alpha = .89$.

Self-Description Questionnaire—short form [39]**.** This questionnaire consists of 40 items designed to assess nine components of physical self-concept and two additional

dimensions: general physical self-concept and global self-esteem. This paper uses the factors of cardiorespiratory fitness ('I can be physically active for a long time without feeling tired'), muscular strength ('I am a physically strong person') and flexibility ('I have good body flexibility'). The participants reply to each item with the extent to which the statements match the image that they have of themselves, according to a six-point Likert scale (1 = totally false; 6 = totally true). A higher score signals a more positive perception of themselves as regards physical fitness. The internal consistency values obtained were $\alpha = .87$ for cardiorespiratory fitness, $\alpha = .81$ for strength and $\alpha = .92$ for flexibility.

Physical Activity Enjoyment Scale (PACES). This paper used the Spanish version [40] of the scale by Motl, Dishman, Saunders, Dowda, Felton and Pate [41]. It consists of 16 items, each of which is introduced by the sequence 'When I am active...'. The scale is meant to assess physical activity enjoyment by means of favourable and unfavourable expressions, e.g. 'It is stimulating' and 'It is boring', respectively. Responses are according to a five-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 given to unfavourable items. The highest score signals greater enjoyment of physical activity. The internal consistency obtained was $\alpha = .92$ for the sample under study.

Procedure

The participants´ data were obtained with a procedure that combined objective assessment of physical fitness with self-reported information. The nature and objectives of this study were presented in writing to the management of the high schools, the physical education teachers and the parents and legal guardians of the students involved. The parents or legal guardians signed an informed consent form to allow their children to participate.

Data recording took place in the hours allocated to physical education classes. The self-report measures were completed in regular classrooms prior to the objective fitness tests. Physical fitness was measured on the sports courts of each school. A number of stations were set up for youth to complete in groups of five students.

This piece of research was approved by the Bioethics Committee of the University of XXXX [omitted to protect its ID]. The design complies with Spanish regulations for clinical research in humans (Law 14/2007, 3 July, Biomedical Research), with the regulations for private data protection (Organic Law 15/1999) and with the principles of the Declaration of Helsinki (2013 version, Brazil).

Statistical Analysis

Descriptive analyses (mean and standard deviation) were made of the variables of the study. The reliability of the self-report measures, viewed in terms of internal consistency, was obtained using the Cronbach's alpha statistic. The relationship between the variables was examined with the Pearson correlation index. The macro PROCESS [42] of SPSS was used to test a mediational model with two parallel mediators where a relationship between both is admitted such that neither is under the causal influence of the other [43].

Three mediational models were examined to test the direct and/or indirect effect of an independent variable on a dependent one through two mediators (one objective, the other self-perceived). The independent variable was perceived parental support. The dependent variable was enjoyment of physical activity. The mediating variables were cardiorespiratory fitness, muscular strength and flexibility, measured both objectively with Alpha Fitness battery tests, and subjectively by measurements of perceived cardiorespiratory fitness, muscular strength and flexibility according to the scale by Marsh et al. [39]. The SPSS macro allowed 10.000 bootstrap

samples of the data with replacement to calculate the bias-corrected bootstrap point estimate for the size and significance of the indirect effect. All data were analysed using SPSS version 21.0 (IBM, Inc., SPSS, Chicago, Illinois). Statistical significance was set at $p < .05$.

Results

Table 1 shows the mean values, standard deviations, t-test values and statistical significance for all variables regarding to sex (values for all self-reported variables were higher than the midpoint of their measurement scales). Boys showed higher weight and high than girls. In addition, boys showed a higher objectively and subjectively lower limb muscular strength and cardiorespiratory fitness. Mean values in perceived flexibility were higher in girls. Differences by sex were not found in perceived parental support and physical activity enjoyment.

Insert table 1 approximately here

Weak and moderate statistically significant positive correlations were obtained between the scores of the physical fitness tests and the measurements of self-perceived physical fitness (lower value for cardiorespiratory fitness, $r = .27$, $p < .01$ and higher value for flexibility, $r = .47$, $p < .01$). Parental social support also showed statistically significant positive correlations with all the variables ($r = .16$, $p < .05$ for the lowest values, namely lower limb muscular strength and perceived flexibility), except for the value of objectively measured flexibility. Finally, physical activity enjoyment showed statistically significant positive correlations with all the self-reported measures ($r = .26$, $p < .01$ for the lowest value, namely self-perceived flexibility) as well as with objectively measured flexibility ($r = .18$, $p < .05$).

Insert table 2 approximately here

The results obtained after mediational analysis with 10.000 samples (Tables 3–5) reveal an indirect effect of perceived parental support on physical activity enjoyment. This effect is mediated by perceived cardiorespiratory fitness, a_1b_1 = .544 (.235) = .128 [.061 - .224]. Table 3 shows that participants who perceived more parental support for physical activity felt a higher cardiorespiratory fitness. This perception is associated with higher physical activity enjoyment compared to peers who perceived a lower degree of parental support. Thus, two cases that differ by 1 as regards social parental support differ by an estimated .128 in physical activity enjoyment brought by perceived cardiorespiratory fitness.

Insert table 3 approximately here

Another indirect effect of perceived parental support on physical activity enjoyment was also found. This effect was mediated by perceived muscular strength, a_1b_1 = .425 (.155) = .066 [.022 - .143]. Table 4 shows that participants who perceived more general parental support towards physical activity attributed greater muscular strength to themselves, and this perception was associated with greater physical activity enjoyment compared to their peers who perceived less parental support. Again, two cases that differ by 1 regarding social support attributed to parents differ by an estimated .066 in physical activity enjoyment brought by perceived muscular strength. In addition to this indirect effect, a direct effect between parental support and enjoyment was also found, c' = .147, p = .045, regardless of the influence mediating variables may have.

Insert table 4 approximately here

The last analyses revealed an indirect effect of parental support on physical activity enjoyment. This effect was mediated by perceived flexibility, a_1b_1 = .285 (.093) = .027 [.003 - .078]. Table 5 shows that participants who perceived more parental support experienced greater physical activity enjoyment brought by higher perceived flexibility compared to their peers who reported less parental support. Thus, two cases that differ by 1 as regards the social support attributed to parents differ by an estimated .027 in the physical activity enjoyment brought by the perceived degree of flexibility. Beyond the mediating effect, a direct effect of perceived parental support was found on physical activity enjoyment: c' = .186, p = .009.

Insert table 5 approximately here

All the previous analyses showed an indirect effect of perceived parental support through self-reported measures of physical fitness on enjoyment with physical activity. Thus, an additional analysis was chosen in which only the scores observed in perceived cardiorespiratory fitness, perceived muscular strength and perceived flexibility were included as mediating variables. The aim was to determine whether all of them or only some of them, given the correlation between their values, continued to mediate independently and statistically significantly in the relationship between parental support and physical activity enjoyment. The results showed that perceived cardiorespiratory fitness, a_1b_1 = .544 (.205) = .111 [.050 - .205], and perceived flexibility, a_3b_3 =

.285 (.078) = .022 [.002 - .066], acted as independent mediators between the perceived parental support and the enjoyment with physical activity.

Discussion

This paper aimed to examine whether subjectively- and objectively-assessed physical fitness mediates the relationship between perceived parental support and enjoyment of physical activity in a group of overweight and obese adolescents. The results reveal that perceived parental support is directly related to enjoyment of physical activity. This finding is in line with others that report that parental provision of opportunities, experiences and stimuli is associated with their children's greater frequency, motivation and physical activity enjoyment [20-24, 35].

They also show that this relationship is partially mediated by the participants' perceived cardiorespiratory fitness and flexibility, and that is it not mediated by objectively-assessed physical fitness. Our findings reveal that two cases that differ by one unit on perceived parental support are estimated to differ by .111 and .022 units in their enjoyment of physical activity through perceived cardiorespiratory fitness and flexibility, with those more supported having higher enjoyment. Thus, the youths who attributed greater parental support to their parents also perceived higher cardiorespiratory fitness and flexibility in themselves, which, in turn, increased their physical activity enjoyment. Although the perceived physical strength was initially a significant mediating variable, it ceased to be so when all the predictors of attributed competence were introduced simultaneously in a later analysis. One possible explanation lies in the fact that young people with overweight and obesity carry out accurate evaluations of their muscular strength, since all the components examined are the most inherent characteristics of their body constitution. On the contrary, due also to their physical complexion, they can underestimate their cardiorespiratory fitness and flexibility. If parental support translates into a more positive

assessment of these parameters, the differences in capacity in relation to their normal-weight peers could be reduced and, consequently, they could enjoy more participation in group activities.

To our knowledge, only the study conducted by Shen et al. [23] has examined the mediating role of perceived physical competence in the relationship between parental support and physical activity enjoyment. The authors concluded that parental support increased the enjoyment of school physical activity, albeit only in girls who attributed to themselves a low competence attributed to the practice of physical activity, a result that did not occur neither among their male peers nor among those who attributed a high degree of parental support.

The initial direct relationship between parental support and physical self-concept has been described in previous works. Harter [44] noted that self-evaluations of children and adolescents are affected by interactions with significant adults, particularly parents. Greater parental support and capacity beliefs related to the achievement of children can lead to more favourable self-images in the child [45], particularly if such support and expectations are interpreted in terms of opportunities for participation in physical-sporting activities [46]. Likewise, as Grolnick, Friendly and Bellas [47] indicate, the greatest support could be interpreted by overweight and obese youths as a parental action that combines balanced structuring (parents increase the opportunities to be physically active, since they believe that doing so will be a benefit for their children) and independence (autonomy for the child to decide how to do it, encouraging control of his or her own actions and the feeling of perceived competence).

On the other hand, the positive relationship observed between physical self-concept and physical activity enjoyment coincides with the findings of Cairney et al. [16] and Lohbeck et al.

[17]. Lohbeck et al. [17] found that both cardiorespiratory and perceived flexibility predicted physical activity enjoyment in a group of primary school children. The relationship between competence and physical activity enjoyment was also observed by Cairney et al. [16]. In their longitudinal study, boys and girls with high attributed competence had more enjoy with physical activity. Moreover, a differential effect in terms of the sex of the participant was observed in the low-capacity group, which decreased the fun over time in the girls, remaining stable in their male peers.

None of the parameters of objectively-assessed physical fitness mediated the relationship between perceived parental support and physical activity enjoyment. This result is contrary to that obtained recently by MacDonald et al. [33], who found that predilection for physical activity, was predicted by cardiorespiratory fitness, handgrip strength and flexibility in primary school students. As possible explanations of this controversy are the body structure and differential age of the participants. It is likely that the youngest children, not mostly obese, link the good results in physical fitness tests with skill, which turns physical activity into a favourite practice that allows the comparison, in successive occasions, between their own competence and that of their peers. On the contrary, cognitive maturity and the greater number of experiences lived by adolescents with overweight and obesity make them aware that their body structure places them at a disadvantage in this type of test [33].

The main contribution of this paper, and one that fills a gap in the literature, lies in testing whether perceived physical fitness, objectively-assessed physical fitness, or both at the same time mediate the relationship under study in a sample of overweight and obese adolescents. The findings suggest that the relationship between parental support and physical activity enjoyment is mediated by perceived positive physical self-image, not by the results obtained from objective

tests of physical fitness. This may be because physical activity enjoyment is brought by perceived competence, not by achievement. Overweight youth may be aware that parental support does not result in improved physical fitness due to their body type: the results obtained from the physical fitness tests will be, as a rule, lower than those of their normal-weight counterparts. Thus, the psychological rather than the strictly physical component may play a mediating role in the relationship between parental support and physical activity enjoyment. In addition, the type of parental support should be better based on increasing adolescents´ feelings of competence to a greater extent instead of trying to improve their physical fitness level.

While this paper relies on major strengths like the large sample size of overweight and obese adolescents and the subjective and objective assessment of mediating variables, it also has limitations. Firstly, the dependent variable used is a self-report measure; more precise measures, such as accelerometer-assessed ones, could be used in further research. Secondly, the use of similar scale formats may increase the possibility that some of the covariation observed among the constructs examined may be the result of the consistency in the scale properties rather than the content of the items. Harman´s single-factor test showed an explained variance value of 28.8%. Therefore, common method bias was not observed. Thirdly, all the data used for this piece of research was supplied by the participants: admittedly, children's judgment of social parental support correlates more highly with variables associated with the practice of physical activity [48] although the parents' view of their support is also relevant and worth researching. Finally, this is a cross-sectional piece of research and, therefore, causal relationships cannot be viewed.

Conclusion

Self-perceived cardiorespiratory fitness and flexibility act as mediating intra-personal variables in the relationship between self-perceived parental support and physical activity enjoyment in overweight youth. Thus, the positive and subjective assessment of physical capacity increases physical activity enjoyment in the overweight adolescents who receive greater parental support to undertake physical activity. It can therefore be suggested that interventions aim to offer guidelines for parents to increase their support and to further improve overweight and obese students' positive perceived physical competence, in order to achieve a greater adherence to physical activity and greater physical activity enjoyment. For example, educational centres could promote parent schools, where physical education specialists show some active strategies.

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