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THE IMPACT OF PHYSICAL ACTIVITY ON QUALITY OF LIFE AND SELF-CONCEPT IN OVERWEIGHT BOYS

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The data analysed in this dissertation are the result of a partnership between the FADEUP and the Faculty of Psychology and Educational Sciences of the University of Porto (FPCEUP).

During the academic year 2013/2014 I have participated in participant recruitment.

This thesis represents a preliminary analysis of the data related with psychological variables.

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Resumo

A obesidade infantil aumentou dramaticamente a nível mundial nas últimas duas décadas, sendo a promoção da atividade física (AF) é uma estratégia central para combater esta. Contudo, os fatores psicológicos que prevêem a perda de peso na obesidade infantil não estão bem estabelecidos, assim como o impacto de diferentes tipos de AF nessas crianças.

O presente estudo focou-se na compreensão do impacto de dois tipos de AF (desporto *vs.* AF tradicional) na qualidade de vida (QV), autoconceito, autoestima e perda de peso em rapazes dos 8 aos 12 anos com excesso de peso (EP). Também a identificação de fatores psicológicos que prevêem a perda de peso constituiu um objectivo.

Sessenta rapazes com o IMC ≥ percentil 85 foram divididos em três grupos: grupo do futebol (GF), o grupo da AF tradicional (GT) e o grupo de control (GC). Os resultados demonstraram que a AF tem impacto na QV psicossocial, QV global, competência física e massa gorda, tendo o desporto em particular um impacto sobre o aumento da competência social e a diminuição do IMC. Assim, a prática de AF, independentemente do seu tipo, é um fator essencial para a saúde psicossocial dos rapazes com EP.

A aparência física, a conduta comportamental e a autoestima global não foram influênciadas pela prática de AF. A QV física e psicossocial demonstraram-se preditores significativos da perda de peso em rapazes com EP.

Em suma, os fatores psicossociais são cruciais na prevenção e tratamento desta condição clínica, uma vez que influenciam e são influenciados por esta.

Palavras-Chave: Atividade física, desporto, crianças com excess de peso, benefícios psicossociais, perda de peso

Abstract

The child obesity increased dramatically worldwide in the last two decades, and the promotion of physical activity (PA) is a central strategy against it. However, there are no well-established psychological factors that predict weight loss in child obesity, as well as the impact of different types of PA in these children.

The current study focused on understanding the impact of two different types of PA (participation in sport *vs*. traditional PA) in the Quality of life (QoL), Self-concept, Self-esteem, and weight loss in boys with overweight (OW) aged from 8 to 12 years old. As an additional goal we identify some psychological factors that predict weight loss.

Sixty boys with a BMI ≥ 85th percentile were assigned into three groups: the soccer group (SG), the traditional physical activity group (TG) and the control group (CG). The results showed that PA in general has impact on psychosocial QoL, global QoL, athletic competence and fat mass, and that the participation in sport, in particular, has impact on the increase of social competence and the decrease of BMI. Therefore, the practice of PA, regardless of the PA type, is an essential factor in the psychosocial health of OW boys.

The physical appearance, behavioural conduct and the global self-worth were not influenced by the practice of PA. The physical and psychosocial QoL were significant predictors of weight loss in OW boys.

Concluding, the psychosocial factors are crucial to prevent and treat this clinical condition, since they influence and are influenced by this condition.

Keywords: physical activity, sports' participation, overweight children, psychosocial benefits, weight loss

Introduction

The concept of "bigger is better" concerning children's weight was accepted by society for a long time, prevailing the idea that a fat child was a healthy one (Onis, Blossner, & Borghi, 2010). Such concept may have been a major contributor to the increase of child obesity in the last two decades (Vale et al., 2013), crossing every socioeconomic level, ethnicities and continents (Antunes & Moreira, 2011). At a global scale, between 1990 and 2010 there was a 60% relative increase in child overweight and obesity, of which a total of 11.7% in developed countries and 6.1% in underdeveloped countries account for the increase in the last year of this period (Onis, et al., 2010). In Portugal, the rate of obesity in children between 6 and 8 years old in 2008 was 8,9%, 14.6% and 15.3%, according to the criteria of the International Obesity Task Force (IOFT), Centers of Disease Control and Prevention (CDC) and the World Health Organization (WHO), respectively (Rito et al., 2012). Regardless of these numbers, the expression of overweight and obesity in our country is notorious since early ages (3-6 years old), showing high rates of prevalence: 37.2% in girls and 29.6% in boys, indicating a higher risk for girls (Vale et al., 2011). Nonetheless, the risk associated with gender is controversial in the literature, varying according to the age group and geographic distribution (Rito et al., 2012).

Associated with sedentary habits, child obesity shows a greater prevalence in countries where the daily routines have less physical activity (PA) (Lissner et al., 2012). Indeed, Lissner et al. (2012) confirmed this association by observing the daily habits of overweight children (2-9 years old). The same pattern was reported by Moreira (2007), who argued that the upward trend in obesity was related with the hours of TV watching in children aged between 7 and 9 years.

The National Observatory of Physical Activity and Sport (2011) revealed that, between 2006 and 2009, only 31% of the Portuguese boys and 10.4% of the Portuguese girls, aged between 10 and 17 years old, were considered physically active. As expected, this study also showed that the percentage of sedentary activity was superior when considering the same age group (66.7% in girls and 63% in boys). These results reinforce the notion that the recommendations for physical activities are not being followed in Portugal by the majority of the youth population. The current recommendations for PA, defined at a European level, propose that children between 6 and 17 years old should perform at least one hour of PA daily, of moderate to vigorous PA (MVPA) of aerobic

nature (Oja, Bull, Fogelholm, & Martin, 2010). The pre-school age group seems to comply more with the recommendations, even though the association between low MVPA and obesity is still observed, mainly in girls. (Vale et al., 2013).

In this sense, PA is a crucial aspect in order to prevent and deal with child obesity. The benefits of PA are extended to various dimensions, from physical to psychosocial (Blair, 2009). Regarding children and adolescents with normal weight, there are numerous advantages reported in the literature, namely to the cardiovascular system, blood pressure, adiposity, lipid and lipoprotein metabolism, anxious and depressive symptomatology and academic performance (Strong et al., 2005). Moreover, particularly in the case of children with overweight (OW children) and/or obesity (OB children), in addition to the PA benefits previously mentioned, there are also other specific benefits regarding the body mass index (BMI) and the total and/or abdominal fat when performing aerobic and/or resistance exercises, as stated in the systematic review of Janssen and LeBlanc (2010).

Therefore, promoting PA is a central strategy against obesity in pediatric age. Indeed, its impact is noteworthy in health, both in the short and long term. In the short term, due to the limitations imposed by obesity, the realization of daily tasks could be lightened with the practice of PA (Gulsah, Can, & Gozaydin, 2011). On the other hand, health condition is a relevant risk factor in the clinical profile in adult age. As such, in the long term, PA may contribute to the prevention of OW or OB clinical profile in adults. This is an important factor because children with BMI in the 95th percentile, when compared with children with BMI in the 75th percentile, showed greater probability of manifesting these clinical profiles (Guo, Wu, Chumlea, & Roche, 2002).

In addition, PA is not only crucial to promote children's health and treat obesity, but it also impacts the general psychosocial level (Blair, 2009; Martínez-López, Fernández, Sánchez, & Granados, 2009), as assumed in the "Health through Sport Model" that was build based on the systematic review of Eime, Young, Charity and Payne (2013), in children with normal weight (NW children). Among other variables, the impact of PA occurs at the levels of quality of life (QoL), self-concept and self-esteem.

Regarding the general QoL, literature on NW children suggests that more active children presented a higher QoL, when compared with more sedentary peers (Martínez-López et al., 2009). Boys tended to present higher QoL than girls (Martínez-López et al., 2009). In children aged between 8 and 12 years old, there seem to be some differences between genders: less active girls reported more anxiety and sleeping problems, difficulties in interpersonal relationship and concentration, whereas boys showed physical and peer

relationship difficulties, when compared to their more physically active peers (Gulsah et al., 2011).

The impact of PA on QoL in OW and OB children (OW/OB children) shows notorious benefits when considering the psychosocial context, in a similar way to NW children in the age group between 8 and 11 years old (Lin, Su, & Ma, 2012; Poeta, Duarte, Giuliano, & Mota, 2013). The authors found better results in QoL, as well as a substantial reduction in BMI, in OW/OB children that participated in PA, particularly in the physical, emotional, social and psychosocial domains (Poeta, Duarte, Giuliano, & Mota, 2013). There seems to be a reduced impact of overweight in QoL for physically active children (Martínez-López et al., 2009; Sánchez-López, et al., 2009). However, this finding is not yet consistently reported for all age groups. The impact of PA in children's QoL was not found in OW/OB children aged between 10 to 12 years old, by Hartmann, Zahner, Puhse, Puder and Kriemler (2010).

Concerning self-concept, a great number of studies in this field only focused on the impact of PA in the physical self-concept, not considering other domains included in this variable (e.g., cognitive, behavioural, social). Most of the studies on this variable are correlational and not experimental, analysing only the association between these variables. With NW children and adolescents, a recent systematic study (Babic et al., 2014) found a consistent association between PA and physical self-concept. However, in a particular age group of 10 to 11 years Crust et al. (2014) did not find a relationship between AF and the physical self-concept. In the case of OW/ OB children, the association between PA and the physical self-concept is also observed in the age group of 8 to 12 years old (Goldfield et al., 2007; Seabra et al., 2014). Moreover, Faulkner, Carson and Stone (2014) also found this relationship with MVPA, in OW/OB 11 year-old children.

Regarding the influence of PA on self-esteem, some authors found no relationship between PA and global self-esteem in OW/OB children aged between 8 and 12 years old (Goldfield, et al., 2007; Faulkner, et al., 2014), while others found a positive relationship between these variables (Martínez-López, et al., 2009; Seabra, et al., 2014). Despite the scarcity of the studies about this relationship, the global self-esteem is one of the most affected dimensions in OW/OB children and adolescents when compared with their normal-weight peers, as discussed in a systematic review by Griffiths, Parsons and Hill (2010) and other authors (Chen, Welk, & Joen-Matre, 2014; Danielsen et al., 2012).

Taking into account the previous mentioned results, the current study focuses on understanding the impact of PA in the psychological variables in OW or OB boys aged

between 8 and 12 years old, namely (1) QoL, due to the fact that in the literature the influence of PA is not always verified for this variable in this specific age group, and because it is one of the most affected dimensions in OW and/or OB children; (2) Self-concept, in order to understand the impact of PA in the various dimensions of this concept, since much of the literature is restricted to the dimension of physical competence; and (3) Global self-esteem, because it is considered one of the most affected dimensions in obesity (Tremblay et al., 2011) and can work as a motivational barrier to the practice of PA (Nieman & LeBlanc, 2012). In addition to these facts, the psychological factors that predict weight loss in child obesity are still not well-established.

We addressed some methodological limitations in previous studies that may explain the divergent results. One limitation is the absence of conceptualization and differentiation between PA types. PA is a broad term used to describe several types of PA and it is possible that some specificities of the PA type might be the basis of some inconsistencies in results. In addition, it is pertinent to clarify if there is, or not, a distinct impact of different types of PA in OB. There are also a reduced number of experimental studies in literature, when compared with the correlational ones, and most of them did not use a control group with the same clinical condition (OW and / or OB children). For this reason, this study sought to integrate a control group composed of OW or OB child not engaging in formal sport activities during the research period.

Taking this into account, we sought to conceptualise and include different types of PA – participation in a sport vs. traditional activity -, to analyse the impact of PA in weight reduction. The group participating in sport underwent soccer training since it is a popular, affordable, globally practiced sport which involves high impact activities that stimulate the muscular-skeletal system (Krustrup et al., 2010). This type of PA corresponds to the concept defined by Caspersen, Powell and Christenson (1985): "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective" (p.126). In what concerns the traditional activity group, it only incorporates the concept of physical education defined by the Department of Education and Early Childhood Development (2009): "a sequential, developmentally appropriate educational experience that engages students in learning and understanding movement activities that are personally and socially meaningful, with the goal of promoting healthy living" (p. 8).

This study was implemented in children between 8 to 12 years old based on previous data in literature that reported a decrease in the compliance with the recommendations concerning PA in this age group.

Method

1. Participants

Sixty OW boys recruited from two schools and an obesity clinic outpatient associated with a hospital in Porto, Portugal, participated in this study. Eligibility for recruitment and participation in study required children to be 8 to 12 years old (M = 10.41, SD = 1.42) and to have a BMI ≥ 85th percentile for age and gender (CDC/NDHS, 2000). The exclusion criteria were children using medication or diagnosed with medical conditions that would limit their ability to perform physical activity and children who were involved in exercise programs developed by third parties, in nutrition and/or weight loss programs (up to one year period prior to the study).

2. Measures

2.1. Anthropometry and Body Composition

Children's body mass and height were collected using standardized procedures. The body mass was measured by means of a physician's digital scale (Tanita®, BC-418MA, Tanita Corporation of America, Arlington Heights, Illinois, USA), and height was collected using a fixed stadiometer (Holtain Ltd., Crosswell, UK).

The overweight (85^{th} percentile ≤ BMI< 95^{th}) and obese (BMI ≥ 95^{th}) conditions of children were defined by calculating the BMI (kg/m^2) and according to BMI cut-offs of CDC/NDHS (2000).

2.2. Quality of Life

This variable was measured using the *Pediatric Quality of Life Inventory 4.0* (PedsQL) (Varni, Seid, & Kurtin, 2001; Portuguese version by Lima, Guerra, & Lemos, 2003). It is a 20-item self-report scale with four subscales: Physical Functioning,

Emotional Functioning, Social Functioning and School Functioning. Participants indicated their agreement with each item, on a 5-point scale, from 0 (never) to 4 (always). Items are reverse scored and linearly transformed to a 0-100 scale. Three scores are then calculated based on this formula: sum of the items over the number of items answered. The Physical Functioning subscale makes up the Physical Health Summary Score (Cronbach's α = .87), and the other three subscales compose the Psychosocial Health Summary Score (Cronbach's α = .90). A Global Quality of Life Score was also computed by averaging participants' responses in all four subscales (Cronbach's α = .92) (Varni, 2008). Higher scores are indicative of better quality of life.

2.3. Self-concept

The Portuguese version (Faria, & Fontaine, 1995) of the *Self Perception Profile for Children* (SPPC; Harter, 1984) was used. For each of the 36 items, participants chose, from two statements, the one they felt more related to and then indicated whether it was "really true for me" or "sort of true for me". The scores were calculated based on the sum of the items over the number of items answered, for each subscale. The SPPC addressed five specifics domains: Scholastic Competence (Cronbach's α =.62), Social Competence (Cronbach's α =.42), Athletic Competence (Cronbach's α =.55) and Physical Appearance (Cronbach's α =.64), Behavioural Conduct (Cronbach's α =.58), as well as a separate Global Self-Worth subscale (Cronbach's α =.64).

2.4. Physical Activity (PA)

At the beginning of the program, all participants used GT3X accelerometers (Actigraph, Pensacola, Florida, USA) for seven consecutive days. All participants collected data with ≥ 500 min of valid data per day over the period of five consecutive days. The accelerometer is programmed to evaluate mean minutes of MVPA intensity per day in order to estimate the average volume and intensity of PA in each participant, in accordance with age specifications (Evenson, Cattellier, Gill, Ondrak, & McMurray, 2008). The cut-point for MVPA in children and adolescents was defined as ≥ 2296 count per minute.

3. Procedure

This study was developed by the Faculty of Sport of the University of Porto (FADEUP) and was funded by the UEFA Research Grant Programme. The Faculty of Psychology and Educational Sciences (FPCEUP) was involved as a participating institution. The study received ethical approval from relevant boards: the research committee of the FADEUP and hospital authorities. All children and their legal representatives received information sheets about the study protocol and written consent was provided by legal representatives.

After completing the baseline measures, participants were randomly assigned into three groups: the soccer group (SG; *N*=23), the traditional physical activity group (TG; *N*=17) and the control group (CG; *N*=20). Changing between the intervention groups was allowed depending on availability of each child to be present in the respective training.

The soccer intervention program consisted of a five-month period of 90 minute PA sessions after school. All sessions were oriented by two physical education teachers, and arranged in three parts: 10-20 min of warm-up, 40-60 min of technical drills and small-sided games, and 10 min of cool-down.

The traditional intervention program was multidimensional, designed to develop aerobic endurance, strength, flexibility, coordination, balance, and to develop enjoyment and body awareness. All sessions were arranged in three parts: 10-20 min of warm-up, 40-60 min of different kinds of activities such as walking, running, gymnastics, and exercises to improve coordination, flexibility, and strength training, and a 10 min cool-down.

The soccer and traditional interventions were carried out at the facilities of the FADEUP three days a week.

The CG was formed by children who didn't show any interest in participating in any of the above mentioned groups. Also, the CG children's physical activities were limited to 2 sessions per week, 45-90 min each, included in the compulsory physical education curriculum at school.

4. Statistical Procedures

In order to analyse the data, we used the IBM SPSS Statistics® program (Statistical Package for Social Sciences) version 20, for Windows. The reliability of each measure was

assessed using the Cronbach's alpha coefficient. To test the assumption of normality, we used the Kolmogorov-Smirnov test (KS; with Lilliefors Significance Correction) and the following criteria: absolute skewness (Sk) and kurtosis (K) values lower than 3.0 and 8.0, respectively (Kline, 2005). Based on these criteria, the assumption of normality was met for the total sample. Preliminary analyses were conducted to examine the differences between the three groups (SG, TG and CG) at baseline, applying a one-way analysis of variance (ANOVA). Effect size was calculated using partial eta-squared (η^2) and the guidelines proposed by Cohen (1988) were applied for interpreting this value: small (≥ .01), medium (≥ .06), or large (≥ .14).

A mixed between-within subjects ANOVA was conducted to assess the impact of PA intervention (Groups: SC, TG, CG) on participants' BMI, fat mass, QoL, and self-concept, in two time periods (pre-intervention - T1 - and – post-intervention – T2).

For the second aim of the study, we started to explore the relationship (and possible multicollinearity) between the changes observed among the two assessment times in psychological variables and weight, using Pearson correlation coefficients (*r*). Then we performed a linear regression analysis to evaluate the predictive ability of a set of independent variables on weight loss. The independent variables that composed the model were chosen based on significant relationship with the dependent variable and theoretical relevance.

It should be noted that the mean percentage of fat mass loss was calculated based on the different values collected in both T1 and T2 observations. Similarly, in the matrix of correlations and linear regression model, the psychological variables assume the values of the difference between T2 and T1, and the weight loss was calculated based on the difference of the results in BMI in T2 and T1 assessment.

For all procedures and statistical analysis we used a 95% confidence interval.

Results

1. Sample Characteristics

At the baseline (pre-intervention assessment) the three groups were homogeneous in what concerns age, weight, height, BMI, percentage of body fat, MVPA and psychosocial variables (Table 1).

Table 1. Characteristics of all participants in baseline.

	Soccer Group *M* (*SD*)	Traditional PA Group *M* (*SD*)	Control Group *M* (*SD*)	*F*	*df*	*p*
Age (years)	10.47 (1.52)	10.75 (1.23)	10.05 (1.44)	1.15	2,59	.324
Weight (kg)	52.44 (13.59)	55.78 (9.80)	59.92 (20.15)	1.28	2,59	.286
Height (cm)	1.48 (0.12)	1.48 (0.09)	1.49 (0.13)	0.11	2,59	.899
BMI (kg/m^2)	23.75 (2.77)	24.86 (3.37)	26.21 (4.47)	2.53	2,59	.089
Body Fat (%)	18.26 (7.33)	21.55 (6.68)	22.17 (11.47)	1.21	2,58	.305
MVPA (min/day)	112.61 (50.95)	105.11 (51.86)	103.69 (53.52)	0.18	2,59	.834
PedsQL						
Physical QoL	72.10 (23.28)	68.38 (18.46)	66.67 (27.60)	0.29	2,58	.746
Psychosocial QoL	68.29 (22.15)	71.55 (20.322)	70.13 (19.17)	0.12	2,58	.883
Global QoL	69.58 (21.51)	70.96 (16.89)	69.46 (20.20)	0.03	2,58	.969
SPPC						
Scholastic Competence	16.18 (3.80)	16.81 (5.68)	17.74 (4.79)	0.48	2,51	.620
Social Competence	18.50 (3.20)	16.44 (3.52)	17.42 (3.64)	1.51	2,52	.231
Athletic Competence	16.61 (3.35)	14.56 (4.70)	15.95 (3.58)	1.22	2,52	.305
Physical Appearance	15.22 (3.56)	13.37 (4.99)	14.63 (4.00)	0.85	2,52	.433
Behavioural Conduct	16.67 (2.72)	17.13 (3.61)	17.47 (3.90)	0.25	2,52	.777
Global Self-Worth	17.22 (3.34)	16.88 (3.63)	17.74 (4.07)	0.24	2,52	.786

2. Impact of Physical Activity on the psychological variables, anthropometry and body composition

To test the impact of the PA on psychological variables, anthropometry and body composition, and body composition, a mixed ANOVA was performed, with the factor "Groups" as between-subjects and the factor "Time" as within-subjects. Results are shown in Tables 2 and 3.

2.1. Quality of Life

The Group effect was not significant for *QoL* (total score and dimensions), however, a substantial main effect for Time was found in physical functioning (T1: *M* = 68.75, *SD* = 23.50; T2: *M* = 77.68, *SD* = 19.45), psychosocial functioning (T1: *M* = 69.29, *SD* = 20.47; T2: *M* = 75.51, *SD* = 18.46) and global QoL (T1: *M* = 69.41, *SD* = 19.64; T2: *M* = 76.18, *SD* = 17.76). These results allow us to conclude that there was an increase of the levels of physical QoL, psychosocial QoL and global QoL between T1 and T2, regardless of the group to which participants belonged.

No significant effect Group x Time interaction was found. However, it should be noted that the variance explained by the interaction of these two effects (effect size) is moderate in what concerns to psychosocial QoL and total score. In order to identify the groups that had a significant change between T1 and T2 is these variables (within-group changes) we applied Students' two-tailed paired t-test. Considering psychosocial QoL, there were a significant increases for both SG, $t(22) = -2.166$, $p = .041$, $\eta^2_p = .176$, and TG, $t(16) = -2.372$, $p = .031$, $\eta^2_p = .260$, between T1 and T2, but not in CG, $t(15) = -.664$, $p = .517$, $\eta^2_p = .029$. In global QoL, the results were similar: there significant increases for both SG ($t[22] = -2.106$; $p = .047$, $\eta^2_p = .168$) and TG ($t[16] = -2.578$; $p = .020$, $\eta^2_p = .293$) between T1 and T2, but not in CG, $t(15) = .024$, $p = .981$, $\eta^2_p = .000$.

2.2. Self-concept

Regarding the *scholastic competence*, a substantial main effect for Time was found (T1: *M* = 16.94, *SD* = 4.78; T2: *M* = 18, *SD* = 4.14), meaning that participants improved their scores between T1 and T2 observations, in this dimension, regardless of the group.

At the *social competence level*, there was a significant main effect for Group. Post-hoc analysis for groups revealed that SG presented higher social competence scores (*M* = 19.06, *SD* = .73) than the CG (*M* = 16.31, *SD* = .77), *p* = .013, regardless the assessment

time. The difference between the SG and TG (*M* = 16.97, *SD* = .77) was marginally significant *(p* =.055). A marginal significant Group x Time interaction was also found is this variable, only in SG, *t*(17) = -1.838, *p* = 0.084, η^2_p = .166, according to paired sample t-test. This result revealed an improvement in this group between T1 and T2 assessment.

Concerning the *athletic competence*, there was no significant Group effect, but a substantial Time effect was found (T1: *M* = 15.48, *SD* = 3.82; T2: *M* = 16.38, *SD* = 3.61), demonstrating that participants, considered altogether, improved between T1 and T2. The interaction Group x Time in athletic competence was not statistically significant, despite its effect size has been moderate. A paired sample t-test revealed that only the TG increased, *t(*15) = -1.801, *p* =.092, η^2_p = .104 , (with marginal significance; low effect size) from T1 to T2 in this variable.

Regarding the physical appearance, behavioral conduct, and *global self-worth* no significant effects or interactions were found as well as significant effect sizes.

2.3. Anthropometry and Body Composition

At the *BMI* level, the results showed a marginal significant effect for Group. The SG (*M* = 23.62, *SD* = .74) presented a smaller BMI when compared with CG (*M* = 26.33, *SD* = .80, *p* = .016). There were no significant statistical differences between the SG and the TG.

Concerning the Time effect, although there was a decrease in BMI between the T1 and T2 in SG and TG, and an increased BMI in the CG, these changes were not considered statistically significant.

Regarding the *fat mass*, a Group x Time interaction was found. A paired sample t-test reveled that the body mass changed between T1 and T2 in TG (*t[*15] = 3.374, *p* = .004, η^2_p = .431) and CG (*t[*17] = -3.442, *p* = .003, η^2_p = .411). A marginal effect in SG (*t[*22] = 1.860, *p* = .076, η^2_p = .136) was found. These results revealed that between the two points in time there was a loss of fat mass in SG and TG, whereas in the CG an increase was verified.

Moreover, a marginal significant effect for Group was found, only between SG and CG (*p* = .018). These results showed that the SG (*M* = 17.84, *SD* = 1.84) exhibited lower fat mass levels when compared to the CG (*M* = 24.62, *SD* = 2.09, *p* = .018).

No significant effect for Time was found in the fat mass.

Table 2. Descriptive statistics for the psychological variables, anthropometry and body composition between T1 and T2 observations.

	Soccer Group		Traditional PA Group		Control Group	
	T1 *M* (*SD*)	T2 *M* (*SD*)	T1 *M* (*SD*)	T2 *M* (*SD*)	T1 *M* (*SD*)	T2 *M* (*SD*)
PedsQL						
Physical QoL	72.10 (23.28)	82.25 (16.20)	68.38 (18.46)	78.68 (14.20)	64.32 (28.78)	70.05 (26.32)
Psychosocial QoL	68.29 (22.15)	78.42 (13.26)	71.55 (20.32)	79.94 (17.29)	68.33 (19.17)	66.63 (23.54)
Global QoL	69.58 (21.51)	79.66 (13.16)	70.96 (16.87)	79.69 (14.71)	67.51 (20.62)	67.45 (23.61)
SPPC						
Scholastic Competence	16.18 (3.80)	17.94 (4.07)	16.81 (5.68)	18.13 (4.72)	17.88 (4.88)	17.94 (3.87)
Social Competence	18.50 (3.20)	19.61 (2.17)	16.44 (3.52)	17.50 (3.63)	17.00 (3.83)	15.63 (4.69)
Athletic Competence	16.61 (3.35)	17.61 (2.43)	14.56 (4.70)	16.56 (3.63)	15.13 (3.20)	14.81 (4.26)
Physical Appearance	15.22 (3.56)	16.72 (3.34)	13.37 (4.99)	14.38 (4.88)	14.19 (4.18)	14.50 (4.29)
Behavioural Conduct	16.67 (2.72)	17.72 (3.23)	17.13 (3.61)	18.13 (4.43)	17.63 (3.56)	17.81 (4.45)
Global Self-Worth	17.22 (3.34)	18.67 (3.29)	16.88 (3.63)	18.06 (4.14)	16.81 (3.71)	16.44 (4.90)
BMI	23.75 (2.77)	23.48 (2.56)	24.86 (3.37)	24.85 (3.42)	26.21 (4.47)	26.45 (4.86)
Fat Mass	18.26 (7.33)	17.41 (6.70)	21.55 (6.68)	19.27 (7.35)	23.26 (11.56)	25.99 (12.68)

Table 3. Analysis of variance for psychological variables, anthropometry and body composition between T1 and T2 observations.

	Group Effect				Time Effect				Group x Time Interaction			
	F	*p*	*df*	η^2_p	*F*	*p*	*df*	η^2_p	*F*	*p*	*df*	η^2_p
PedsQL												
Physical QoL	1.45	.245	2,53	.052	7.55	**.008***	1,53	.125	.21	.812	2,53	.008
Psychosocial QoL	1.00	.376	2,53	.036	5.68	**.021***	1,53	.097	2.37	.103	2,53	.082
Global QoL	1.17	.318	2,53	.042	7.13	**.010***	1,53	.119	1.77	.180	2,53	.063
SPPC												
Scholastic Competence	0.17	.845	2,46	.007	4.32	**.043***	1,46	.086	1.02	.368	2,46	.043
Social Competence	3.71	**.032***	2,47	.136	0.28	.598	1,47	.006	2.64	**.082**†	2,47	.101
Athletic Competence	2.11	.133	2,47	.082	3.06	**.087**†	1,47	.061	1.64	.204	2,47	.065
Physical Appearance	1.53	.227	2,47	.061	2.61	.113	1,47	.053	0.36	.702	2,47	.015
Behavioural Conduct	0.14	.871	2,47	.006	1.78	.188	1,47	.037	0.25	.782	2,47	.010
Global Self-Worth	0.64	.531	2,47	.027	2.22	.143	1,47	.045	1.26	.294	2,47	.051
BMI	3.10	**.053***	2,57	.098	0.00	.978	1,57	.000	.591	.557	2,57	.020
Fat Mass	2.99	**.059**†	2,54	0.10	0.13	.719	1,54	.002	15.43	**.000***	2,54	.364

* Significant values ($p < .05$)
† Marginal results ($.05 < p < .10$)

3. Psychological predictors of weight loss

Regarding the relationship between weight loss and the psychological variables, there was a negative correlation between weight loss and psychosocial QoL (r = -.311, p = .020), global QoL (r = -.242, p = .073) and athletic competence (r = -.241, p = .092). The results are presented in table 5. This means that children who lost more weight were the ones who scored higher in psychosocial QoL, global QoL and athletic competence.

Linear regression analysis was used to evaluate the relative contribution of psychological variables in weight loss. The psychosocial QoL, physical QoL, athletic competence and physical appearance variables were included in the model based on two aspects: their significant relationship with weight loss and theoretical reasons. The results are presented in table 4. Together, psychosocial QoL, physical QoL, athletic competence and physical appearance accounted for a significant proportion of the variance in weight loss, $F(4,49) = 3.53$, p = .014, R^2 = .24, adjusted R^2 = .17. In this model, psychosocial QoL (β = -.451, p = .006) and physical QoL (β = .412, p = .011) were the only significant predictors. Therefore, those who scored higher in psychosocial QoL were the ones who lost more weight, and those that scored higher in physical QoL were the ones who lost less weight.

Table 4. Multiple Linear Regressions analysis predicting weight loss as a function of psychosocial QoL, physical QoL, athletic competence and physical appearance.

Outcome	Predictor	*B*	*SD*	β
QoL	Psychosocial QoL	-0.04	0.02	-.451***
	Physical QoL	0.03	0.01	0.412***
Self-Concept	Athletic Competence	-0.08	0.07	-0.192
	Physical Appearance	-0.2	0.06	-0,047

Note: QoL – Quality of Life
*** p < .001

Table 5. Pearson correlation's test for psychological variables and BMI.

	Psychosocial QoL	Physical QoL	Global QoL	Scholastic Competence	Social Competence	Athletic Competence	Physical Appearance	Behavioural Conduct	Global Self-Worth	BMI
Psychosocial QoL	1									
Physical QoL	**.617****	1								
Global QoL	**.965****	**.800****	1							
Scholastic Competence	**.451****	.140	**.386****	1						
Social Competence	.271	-.087	.184	.207	1					
Athletic Competence	**.312***	**.283***	**.348***	.235	.171	1				
Physical Appearance	.169	.061	.153	**.283***	.125	**.538****	1			
Behavioural Conduct	.169	.164	.194	-.207	.161	**.376***	.207	1		
Global Self-Worth	**.337***	.022	.267	.245	**.481****	.224	**.388****	.210	1	
BMI	**-.311***	.024	$-.242^{\dagger}$	-.141	-.188	$-.241^{\dagger}$	-.201	-.066	-.144	1

Note: QoL – Quality of Life: BMI – Body Mass Index

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Discussion

The present study aims to understand the impact of two different types of PA in QoL, self-concept, global self-esteem, and Anthropometry and Body Composition in OW boys with ages between 8 and 12 years old and, additionally, to identify psychological predictors of weight loss.

Regarding the first objective, when we compare the differences between all groups, regardless of the observation time (group effect), there are some significant results. The SG scored higher, when compared with the CG, in social competence, athletic competence, BMI and fat mass. The results suggest that soccer might have a positive effect in these variables. In particular, at the level of social competence, SG demonstrated higher scores than TG. The differences between SG and TG were marginally significant, suggesting that the participation in sports, namely a group sport, can be more advantageous for the development of social competences when compared with traditional PA. Differences between the participation in sport and traditional PA for psychosocial health (improve of self-esteem and social interaction, and decrease in depressive symptoms) had only been reported in the literature for NW children (Eime, et al., 2013) and, as suggested by the present study, the social interaction component results seems to extend to OW children.

Regarding the effect of PA in athletic competence, the results we found were in line with the ones presented in the systematic review with NW children by Babic et al. (2014). However, the present data analysis demonstrates that in OW boys the participation in sport is more relevant, when compared with the traditional PA, in terms of improving the athletic competence.

Concerning the BMI and fat mass, the results showed that SG participants presented lower BMI levels and lower percentage of fat mass when compared with CG. Therefore, the participation in sport, in particular (since there are no significant differences between the SG and TG), has a positive impact in the reduction of the BMI and fat mass, as previously reported by Poeta et al. (2013) in the case of BMI.

Concerning the differences between T1 and T2 assessment, regardless of the group (time effect), we observed the changes for all participants in each variable. There were improvements in the following variables between the two observation times: physical QoL, psychosocial QoL, global QoL, scholastic competence and athletic competence. However, considering the scores of each group in the T1 and T2, particularly in athletic competence, psychosocial QoL and QoL, it appears that this evolutionary tendency between the two

time points is essentially due to the PA groups (SG and TG) whose average increased, unlike the CG, that does not show improvements. Thus, since the impact of PA was not evidenced in group effect because the differences are not statistically significant between the SG and TG, this result demonstrates the impact of PA in general, regardless of its type. However, it should be noted that the differences between the SG and TG may arise if there was a larger sample or the implementation of a longer program.

Regarding the general increase in scores on physical QoL, these results may be associated with the fact that younger children do not possess cognitive skills to accurately access their motor-skill competence, always reporting higher levels (Babic et al., 2014) that may explain the results found in this study. Another explanation could be the social desirability, as these children have lower self-concept levels compared to children NW (Chen et al., 2014; Danielsen et al., 2012). Thus, there may be a greater need for approval from others (Oliveira, 2004), which in this case is verified through the highest scores in T2, when compared to T1 results for all participants.

Considering the scholastic competence, the general improvement in this variable between T1 and T2 may be due to the relation between the data collection and the school timings of the children, given that the first data collection occurred at the beginning of the school year (period that requires an adaptation to the new routines and school demands), and the second data collection occurred in the half term of the year (moment some evaluations moments when already occurred, and the adaptation to school context was more stable, contributing to a greater awareness of self-concept and well-being of every child).

Regarding the comparison between T1 and T2 observations in each group (group x time interaction effect), the results show that there are significant effects on the following variables: psychosocial QoL, global QoL, social competence, athletic competence and fat mass. Regarding psychosocial QoL and global QoL, the results showed a significant increase in SG and TG. Thus, it appears that PA in general, regardless of the type (participation in sports or traditional PA), has an impact on these variables. It is worth to mention that the global QoL consists of the physical QoL and psychosocial QoL, and since the PA does not demonstrate any impact on physical QoL, the improvement in global QoL described above is mainly due to the impact on the psychosocial QoL (variable that demonstrated significant improvements in PA groups). These results are consistent with Lin et al. (2012), who showed that more active OW/OB children reveal a superior QoL when compared with less active OW/OB children, respectively.

Concerning social competence, the changes between T1 and T2 only occurred in the SG, demonstrating that only the participation in sport had an impact on social competence. In turn, in athletic competence, only traditional PA demonstrated impact on this variable, as showed by the increase in scores between the two time points in the TG.

Considering the fat mass, the results showed a decrease in the PA groups and an increase in CG. Therefore, it was demonstrated that, regardless of the PA, in general it has an impact on fat mass loss.

It is worth to mention that there was no impact of the PA in physical appearance, behavioural conduct and global self-worth. Considering the global self-worth, the results are consistent with the previous studies from Goldfield et al. (2007) and Faulkner, et al. (2014). Nevertheless, it should be noted that different results are also documented in literature (Martínez - López, et al., 2009; Seabra, et al., 2014). Griffiths, et al. (2010), in their systematic review, argued that the inconsistency of results in this variable, especially in OW /OB children, was due to the complexity of causal process between global self-worth and obesity, additionally to the fact that both variables were very resistant to change. Long-term longitudinal studies could be informative about the variables that could be more influential in the increase of self-esteem in obesity. Currently it is only possible to conclude that PA does not seem to have a significant short-term impact in OW/OB children's self-esteem. It is possible that other variables, such as behavioural conduct and body image satisfaction, could have a greater impact.

It should be highlighted that at this age there are many maturity differences (Mirwald, Baxter-Jones, Bailey & Beunen, 2002). These differences appear to be expressed through the values of SD, which generally are high.

Regarding the second objective of this study, the tested model of psychological predictors of weight loss showed that physical QoL, psychosocial QoL, athletic competence and physical appearance together explained 24% of the variance of weight loss. The relevance of psychosocial factors in OW/OB treatment is then supported in this study, in accordance with what has been advocated by other authors (Blair, 2009; Eime, et al., 2013).

Both dimensions of QoL assumed a relevant role in weight loss prediction. In particular, the psychosocial dimension had a higher predictive value which reinforces the need to focus the socioemotional adjustment, as well as the integration in school context, in the treatment of OB. It is possible that QoL works as a mediator in the relationship between PA and weight loss.

Interestingly, the results also showed that children who revealed more improvements in physical QoL were the ones that lost less weight. The items that measure physical QoL focus primarily on the difficulties associated with daily tasks (walking, running, physical activity, lifting weights) and the presence of symptoms (feeling pain, ill-being and little energy). Thus, this result may be associated with the fact that children who perceive less need to lose weight feel that they are more able to perform these tasks, meaning that in the presence of improved physical QoL, there is a lower weight lost. Similarly, in the presence of a lower physical QoL, the need to lose weight may be greater than the difficulty experienced in performing everyday tasks, which results in a greater weight loss.

This study represents further progress in the accumulation of knowledge about the impact of PA in psychological well-being and weight loss in child obesity. The main strong points of this work were the use of an experimental design, the comparative analysis of different PA types, and the focus on the age group in which the frequency of the PA begins to decrease (Martínez López et al., 2009). In the literature, there is insufficient evidence on the types of PA associated specifically with psychological health (Eime et al., 2013). In this respect, our study provides some evidence that traditional activity and sport might have common benefits in QoL (psychosocial and global), athletic competence and fat mass. In particular, soccer seems to have a moderate effect on the increasing of social competence and the decreasing of BMI. There are some psychological variables that seem to uninfluenced by a 6-month period of PA, namely physical appearance, behavioural conduct and global self-worth.

Some important limitations of the present study need to be mentioned. A higher sample size would have been desirable, as it would provide adequate power for detecting smaller differences. The fact that this sample is composed only of male OW participants does not allow extending the conclusions to girls and obesity diagnosis. Another aspect to stress is the short period of PA intervention and the lack of follow-up. A follow-up assessment would be informative about the maintenance of the achieved changes and the development of other medium to long-term changes a. Finally, we mention the complexity of completing the SPPC, which may have skewed the results due to the difficulty to understand some concepts related with self-concept. Therefore, although this measure is valid for this age group, it is suggested that the scale should be changed in order to make its fullfiment easier for this age group.

In future research it would be appropriate to understand the impact of PA also in OW girls of the same age interval, in order to enhance its effectiveness through a planning according to the specific difficulties of each gender. It would also be relevant to understand the impact of PA in other variables, such as eating behaviour style changes in order to identify any relationships that facilitate more healthy habits that contribute to obesity treatment. Finally, we consider it would be relevant to test models of mediation and moderation in the relationship between PA and weight loss, in order to contribute to the implementation of more adjusted programs of weight control and adequate clinical interventions, and consequently more effectiveness.

Conclusion

This study found that PA in general (participation in sport or traditional PA) has an impact on psychosocial QoL, global QoL, athletic competence and fat mass. However, in particular, participation in sport is related to the increase of social competence and the decrease of BMI. Concerning physical appearance, behavioural conduct and global self-worth, no impact of PA in OW boys was found.

Regarding the level of weight loss, it was found that there are two psychosocial predictors: physical QoL and psychosocial QoL, demonstrating the importance of physical, psychological and social components in this condition, and therefore in its treatment.

This short duration (6-month) program showed some psychosocial benefits. In conclusion, this research supports the relevance of the impact of PA in psychological well-being and weight lost in child obesity. So the practice should be encouraged, particularly in this clinical population, regardless of the PA.

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