

Effects of a physical activity programme on body perception and composition in overweight adolescents

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RESEARCH

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ABSTRACT

Background

The purpose of this study was to examine the effectiveness of a six months' physical activity programme for overweight and obese adolescents, in order to improve the perception of their own body image and composition between two groups of adolescents, and to check possible gender differences.

Aims

The aim is to improve the body perception and composition in overweight adolescents with a physical activity programme.

Methods

It was a quasi-experimental design, with a control group and intervention group. Measures of pre-test and post-test were taken. A total of 38 adolescents that belong to the first cycle of Compulsory Secondary aged 12–15, with a body mass index (BMI) higher than the 85th percentile according to the WHO (World Health Organization), participated in the intervention. The anthropometric variables, height, weight, BMI, body fat percentage, and the circumference of the waist, hip, arm and medial calf, were measured pre- and post-treatment. The body image perception was measured using the Gardner test. The experimental group participated in the physical activity programme for a six months period. The physical activity intervention consisted of three sessions of 90 minutes each week in a sports centre. The structure of the sessions consisted of a warm-up (5–10 minutes), a main activity (60–70 minutes), combining strength and cardiovascular training and a cool-down (7–10 minutes).

Results

After physical activity intervention the results showed significant improvements in the experimental group compared to the control group in the circumference of the waist, the hip, the arm, the medial calf ($p < 0.01$) and as well as the fat percentage, the percentage of muscle mass ($p < 0.05$). The results showed how the body image distortion presented a significant and negative correlation with the circumference of the waist ($p < 0.001$), of the hips ($p < 0.01$), and of the arm ($p < 0.001$), differences were observed between gender.

Conclusion

Our study suggests the importance of an adequate physical activity extracurricular programme as a way to enhance the perception of body image as well as the body composition between adolescents with overweight and obesity.

Key Words

Physical activity programme, body image, overweight and obese adolescents, body composition

What this study adds:**1. What is known about this subject?**

The effects of physical activity on body perception in adolescents have been studied but without focusing on overweight adolescents.

2. What new information is offered in this study?

This study offers information about the effects of a physical activity programme in overweight adolescents, both boys and girls.

3. What are the implications for research, policy, or practice?

There is a need to consider how a physical activity programme can improve the body perception in overweight adolescents, without the distortion of it.

Background

Childhood obesity has become one of the biggest health problems today and it has converted into the XXI century epidemic.¹ In Spain, the number of overweight and obese children between the ages of 6–10 years reaches 44.5 per cent,² but, in addition, one out of every three Spanish children between the ages of 13 and 14 are overweight, and this circumstance ranks Spain as one of the highest in childhood obesity in Europe.³

Overweight and obesity in childhood result in short and long term health and welfare implications. An obese child has a high probability of becoming an obese adult,⁴ and belonging to a population group with an increased risk of heart, liver, respiratory or osteo-articular diseases.⁵ But apart from these health problems, children and adolescents with these issues could be also reflect psychosocial abnormalities such as low self-esteem, body dissatisfaction, anxiety, attention deficit, hyperactivity and eating disorders.⁶ In this regard, several studies have shown that body image dissatisfaction has increased considerably⁷ and it is becoming a public health problem in adolescence, where feeling obese or overweight and concerns about weight have been identified as risk factors in eating behaviour disorders.⁸

A survey conducted on adolescents revealed that obese youths have greater body dissatisfaction than overweight youths, who in turn showed greater dissatisfaction than those with normal weight, regardless of their age and

gender.⁹ In the same way, another study discovered a correlation between the degree of body dissatisfaction, self-esteem and BMI among young people.¹⁰ These circumstances mentioned above are unveiling new social realities and needs related to body image.¹¹ This is why people with obesity or who are overweight are more likely to develop eating disorders such as anorexia or bulimia nervosa.¹²

The increasing rates of childhood obesity run parallel to an increase in body dissatisfaction among adolescents.¹³ Body dissatisfaction may originate in perceptual distortion, in the discrepancy between the perceived body and the ideal body, or simply being unhappy with one's own body.¹⁴ It is a very common problem among children and adolescents, and it has become a risk factor that, together with eating disorders, impulsivity and negative affect, might lead to the development of obesity.¹⁵

In this sense, regular practice of exercise improves the fitness and physical competence, and this appears to be associated with a positive self-image as it involves biological, psychological and social factors that contribute to improving the perception, social interaction and changes in body weight and muscularity.¹⁶ In a study with a sample of boys who participated in a sports programme, overweight boys showed greater body dissatisfaction and lower actual physical abilities than normal-weight peers.¹⁷ In the same line, we find other works, which show how the subjects who performed aerobic activities were less concerned and had a more positive evaluation of their body image.¹⁸ Moreover, in a meta-analysis regarding the relations between body concerns and exercise, was found that exercise decreases body concerns.¹⁹ Similarly, other research studies, supported by this evidence, developed intervention programmes, whereby the body image of the subjects under study improved with physical exercise.²⁰

Therefore, due to the evidence of the existing problem of obesity and overweight among the teenage population in Spain, and the influence this problem has on other aspects such as body dissatisfaction and the positive effects that physical activity can have on all of this, we have set a research objective to test the effectiveness and impact of a physical activity programme in overweight or obese adolescents over a 6-month period. The aim is to improve their perceived image and body composition, as well as to check for possible differences according to the gender.

Method

A quasi-experimental design, with a control group and

intervention group was made. A total of 38 adolescents that belong to the first cycle of high school aged 12 to 15, with a body mass index (BMI) higher than the 85th percentile participated in the intervention. A total of 38 subjects that belong to the first cycle of high school Education were included during 2012– 2013 school year. They did not practice any exercise regularly, they were not on any type of diet, they were not under medical supervision, they did not have any illness or injury, and their BMI was above the 85th percentile. The researcher had a previous interview with each participant in order to know these characteristics. In that moment, the researcher requested the assent.

Participants were not randomized into a control or an experimental group, and both groups were subjected to pre-test and post-test measurements. The experimental group (EG) participated in the PA programme and consisted of 22 subjects (8 boys and 14 girls) who volunteered to participate in the intervention, while the control group (CG), which did not participate in the PA programme, was composed of 16 subjects (9 boys and 7 girls) who volunteered decided to not participate in the intervention. The mean age was 13.12 (SD=0.09). The demographic and anthropometric characteristics of the subjects are shown in Table 1. No significant differences were found in the age, gender, weight, height, fat, muscle, BMI and 6 skinfold sums between the CG data and EG. Not dropouts were registered.

Measures

Anthropometric assessment

Height was measured using a Seca 222 portable stadiometer (a 0.1cm range) and the participants were weighed on Tanita BF-522 scales. The BMI was calculated using the formula $\text{weight (kg)} / \text{height (m}^2\text{)}$. The body fat percentage was estimated using a Holtain AW-610 skinfold calliper (triceps, subscapular, supraspinal, abdominal, thigh, and medial calf), and the circumference measurements (waist, hip, arm and medial calf) were made with a non-elastic tape measure, Lufkin W-606. Body composition was measured using a Matiegka model, and the Slaughter et al.,²¹ formula for estimating the percentage of fat.

Body image perception evaluation

A body image assessment scale by Gardner et al.,²² was used that was adapted to the Spanish population.²³ The distortion of body perception was calculated by the difference between the perception of the subject's own silhouette and the silhouette as regards their BMI. To this end, the central silhouette was associated with an age and gender adjusted BMI according to the tables WHO,²⁴ while the BMI of the silhouettes to the right increased by 5 per

cent every time and those located to the left decreased by 5 per cent every time.

Body dissatisfaction score was calculated as the difference between perceived and ideal silhouette.²² The body image perception scale has adequate reliability (CG=0.84, $p<0.001$; EG=0.80, $p<0.001$).

Physical Activity Programme (PAP)

The intervention programme was designed by expert Physical Education teachers. The structure of the sessions consisted of a warm-up (5–10 minutes) that included joint mobility, running and stretching exercises. The main part (65–70 minutes) combined strength training (bodyweight exercises, resistance bands, medicine balls, dumbbells) and cardiovascular training (modified sports initiation games, fitness and dance), and a cool-down (7–10 minutes) that included stretching, breathing exercises and body awareness or relaxation techniques (Jacobson technique).

Procedures

All participants were aware of the study objectives and the tests to be performed. Informed parental consent and permission from school administrators and principal were obtained. The indications of the International Society for the Advancement of Kinanthropometry (ISAK) were followed to anthropometric assessment. Two anthropometrists trained (level 1) were responsible for the measurements, on school days and in school hours, and they didn't know the participants group.

The anthropometric measurements were made with the participants barefoot and in swimming costumes. The body image assessment scale (Figure 1), was presented on the day of the anthropometric evaluation. The participants were instructed to put a cross (X) on the silhouette that would represent the perception that they presently have of their body image, a circle (O) on the silhouette that best represented the figure that they would like to have and finally, the evaluator indicated his estimation of the body image of the participant with an asterisk (*). In order to avoid biases in the estimation of the evaluator of the body image of the participants' in this study, all evaluations were performed by the same trained evaluator.

The Physical Activity Programme was conducted without interruption between January and June 2013. Three weekly sessions of extracurricular physical sports activity were developed, which lasted 90 minutes. In addition, two Saturdays a month were dedicated to natural environment outdoor activities (hiking, cycling and orienteering). The

physical activity level was controlled by accelerometers (ActiGraph GT3X) in order to guarantee a level of physical activity moderate to vigorous. The subjects were instructed to wear the accelerometer on the waist at all times during activities. In addition, participant's attendance was also controlled and it was more than 95 per cent at follow-up.

The study followed the Declaration of Helsinki guidelines, and was supervised by the Bioethics Committee of the Castilla-La Mancha University, Spain. All the measurements were performed twice, once before starting the programme and the other one at the end of it. All data were collected in a private place.

Data analysis

A descriptive analysis was conducted to obtain information on the means, standard deviations and frequencies. The Wilcoxon Rank-Sum test (z) was conducted to examine the pre- and post- means of the CG and the EG, and the two-way analysis of variance (ANOVA) tests were used to examine the group and gender differences on all the dependent variables. The Spearman correlation coefficient (ρ) was used to identify a possible interdependence between the distortion levels and dissatisfaction with the waist, hip, arm and medial calf circumferences. SPSS 19.0 software was used. Statistical significance was set at $p < 0.05$.

Results

In general we can say that, compared to the situation at the start of the study, the CG worsened in contrast to the EG. This is because at the end of the intervention programme it was observed that within the CG the variables relative to the circumference of the waist ($Z = -3.20$, $p < 0.01$), of the hip ($Z = -3.18$, $p < 0.01$) and of the arm ($Z = -2.98$, $p < 0.01$), as well as the fat percentage ($Z = -2.17$, $p < 0.05$) had increased significantly, and also all the other variables also worsened but these results were not significant. On the other hand the EG had significantly decreased the circumference of the waist ($Z = -3.49$, $p < 0.01$), the hip ($Z = -4.11$, $p < 0.01$), the arm ($Z = -3.64$, $p < 0.01$), the medial calf ($Z = -4.11$, $p < 0.01$), the summation of six skinfolds ($Z = -3.05$, $p < 0.1$) and the body fat percentage ($Z = -2.19$, $p < 0.05$), and had increased the percentage of muscle mass ($Z = -1.96$, $p < 0.05$).

Table 2 offers more details and the results obtained by the CG are separated by gender. The results suggest that the group of boys had significant differences in the increase of the circumference of the waist, hip and arm, and the girls also significantly increased the circumference of the waist, hip, and body fat percentage. In addition there was an increase in the sums of the six skinfolds, the arm and medial

calf circumference, and the muscle mass percentage although not of significance.

As regards the EG, Table 3 shows significant improvements in both boys and girls in the circumferences of waist, hip, arm and medial calf. But in addition, it is in the girls where a significant reduction in body fat percentage and sum of six skinfolds was observed together with a significant increase in the muscle mass percentage.

An analysis was done of the perceived body and the ideal body, the silhouette in relation to the BMI, body distortion and body dissatisfaction. According to the results for the CG (Table 4), there were no significant changes observed in the group of girls in any of the above variables. However, in the group of boys, the body dissatisfaction variable improves post-test, i.e., at the end of six months the boys of the CG were shown to be more satisfied with their bodies, even though the results of the anthropometric variables increased.

Table 5 reflects the changes by gender of 'before and after' the implementation of the PAP. In this sense, despite the boys showing an improvement in the perception of the ideal body and in the distortion and body dissatisfaction variables at the end of the PAP, these changes are not significant. The group of the girls did obtain significant improvements in the ideal body variable, as well as a correction to the distortion and body dissatisfaction variables but not significantly, i.e., the group of girls adjusted their perception of body image towards the real image.

Upon examining the possible differences between the CG and the EG, a two-way ANOVA revealed that the EG had significantly improved in comparison to the CG in the circumferences of the medial calf [$F(1,36) = 8.10$, $p < 0.01$], abdominal skinfold [$F(1,36) = 11.48$, $p < 0.01$], and biceps skinfold [$F(1,36) = 6.79$, $p < 0.05$], with no significant differences found in the remaining variables under study.

In a similar manner, the differences according to gender were examined before and after the PAP. So for the CG, the results showed that the girls had a significantly higher body dissatisfaction before [$F(1,14) = 2.78$, $p < 0.01$] and after the PAP [$F(1,14) = 13.22$, $p < 0.01$] compared to the boys. While for the EG the only significant differences were observed in the percentage of muscle for the girls [$F(1,20) = 8.22$, $p < 0.01$] before the PAP, compared to the boys. No other differences according to gender were observed.

Finally, the correlation analysis was performed. The results showed how the body image distortion presented a significant and negative correlation with the circumference of the waist ($\rho=-0.67$, $p<0.001$), of the hips ($\rho=-0.47$, $p<0.01$), and of the arm ($\rho=-0.50$, $p<0.001$), while no correlation was found with the circumference of the thigh, nor within the variable of body satisfaction with the rest of the circumferences.

Discussion

The results of this study, which show the effects of an extracurricular physical activity programme on the body composition and body image, suggest significant differences by the end of the programme. These are related to anthropometric variables and body image in the EG, such as ideal body perception, the circumferences of the waist, hip, arm and medial calf, the percentage of fat and lean mass, as well as the sum of six skinfolds. We have been able to observe how, over time, some of the different parameters under consideration worsened significantly in the CG.

The results obtained in the case of EG have been positive with regards the improvement of the body composition after completing the physical/sports activity programme. This fact coincides with the results obtained in works such as: that carried out by Ford et al.,²⁵ which showed significant changes in fat mass in a group of primary school children, who walked briskly for 30 minutes a day, at least three times per week for 15 weeks; or in the investigation of Howe et al.,²⁶ who during a ten-month intervention, addressed aspects of diet and physical activity every day of the school year, thereby managing to reduce the fat percentage in addition to the BMI; or the work by Li et al.,²⁷ who developed a year's programme of 20-minute sessions of physical activity a day, in the classroom, with primary school children, and who achieved a lowering of the body fat percentages.

Furthermore, our results are consistent with other interventions that have also analysed the changes in body composition. Farias et al.,²⁸ with an annual physical education programme which included two 60-minute classes a week, found that the group of adolescent girls had better results than the group of boys in the circumferences of the waist and the triceps skinfold, as well as an increase in the muscle percentage. With an obese sample of children in primary school and parents, was conducted an interdisciplinary intervention programme of 3-month, with resistance and aerobic exercises 3 times a week, reduced the percentage of fat and waist circumference.²⁹

If we consider the differences observed in boys and girls, we should mention the work of Lazaar et al.,³⁰ who performed a physical, fun activity based intervention with traditional games which lasted 6 months with two 60-minute sessions per week, in a sample of obese and non-obese children aged 6 to 10 years. In this study, significant results were obtained in the group of girls reducing the waist circumference, the sum of the skinfolds and the fat-free mass, while in the group of boys only the BMI and the fat-free mass decreased. In a similar way, was noted in a research with African Americans, that girls had a greater probability of body dissatisfaction when their BMI increased or when they had a 95th percentile,³¹ as women have traditionally shown greater body dissatisfaction than men.³² These results coincide with those observed in our research, where the intervention in the group of girls is more effective than that in the group of boys, partly because their level of body dissatisfaction is greater.

Several studies suggest that exercise has a positive effect on body image,^{18,19,33,34} but it still remains unclear how exercise improves body image and the mechanisms that underlie the relationship between exercise and body image. In this regard we have observed how the EG improved the values of the body image distortion. At the end of the intervention the subjects' perception of their body image was more adjusted to their actual figure. These improvements appear to be due to the type of games and sports that were suggested in the intervention programme, as these tried to maintain an aerobic component with an intensity that ranged from moderate to vigorous. In this sense, previous studies found that moderate or vigorous activities had a greater effect on body image than those of lower intensity.¹⁸

This appears to be to such an extent, that people with a weak body image can obtain improvements with physical exercise.³⁵ In fact, in our work we have observed how the EG improved compared to the CG after the PAP was completed. These improvements were in the circumference of the waist, hip and arm, and the correlation analysis has told us that these three aspects were directly related to body distortion. This finding is significant, since it confirms the fact that body dissatisfaction is due to the concerns of being overweight in girls,³⁶ while in men it may be due to being too fat, too thin, insufficiently muscled or a combination of all these parameters.³⁷ Therefore, as (Levine and Somolak,³⁸ confirm, body dissatisfaction in girls appears to focus on the middle and lower torso (stomach, hips, buttocks and thighs), with approximately 40-70 per cent of girls being dissatisfied with two or more aspects of their

body. We confirm this aspect.

Limitations

This study contained some limitations that should be noted. First, it was quasi-experimental and participants could not be randomized to control and experimental groups.

This, unintended extraneous factors might have confounded the findings. Second, the sample size was small (N=38) and data were obtained from a single school. Therefore, the generalizability of findings beyond the study location is limited. Future research in this area will benefit from larger samples collected at multiple sites to improve generalizability. Third, this study didn't control variables such as diet, family history and genetic factors, which would probably, offered more results.

Conclusion

The results reported in this study strengthen the idea of the need to create physical activity programmes aimed not only to lower adolescent obesity and overweight levels, but also to deal with the emotional and social aspects related to a correct body image perception. In fact, we have shown how practicing structured PA for a population group with overweight or obesity problems, improves certain circumferences (waist, hip and arm), which are associated with improved personal body image.

Implications

The Standards for Healthy Activity and recommendations by the WHO state that children should participate in at least 60 minutes of moderate to vigorous physical activity (MVPA) everyday, but a recent data suggest that only 30 per cent to 40 per cent of children meet this requirement.³⁹ This study found that adolescents with overweight and obesity are dissatisfied with their body image, and how a regular physical activity programme, carried out by moderate and vigorous activities, can improve their body image and some anthropometric parameters, as previous studies with adolescents without overweight⁴⁰. However, we found some limitations that should be considered for future work along a similar line. In this way, could be interesting control not just anthropometric variables, but also could be interesting to monitoring variables such as diet, the amount of moderate and vigorous physical activity performed within the school time and out of this, the involvement of the families, as well as calories expenditure among participants, in order to improve future proposals for school intervention.

References

1. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2014 Sep 5;384(9945):766–81.
2. ALADDIN. A national study of prevalence of overweight and obesity in Spanish children. 2011. Available at: http://www.aesan.msc.es/AESAN/docs/docs/notas_pre_nsa/ALADINO_presentacion.pdf, 2011. Accessed March 5, 2013.
3. OECD (Organization for Economic Co-operation and Development). Obesity and the Economics of Prevention: Fit not Fat. 2012. Available at: http://www.naos.aesan.msssi.gob.es/naos/ficheros/investigacion/OCDE_Informe_situacion_Espana_Feb_2012.pdf. Accessed April 14, 2013.
4. Biro FM, Wien M. Childhood obesity and adult morbidities. *The American journal of clinical nutrition*. 2010 May 1;91(5):1499S–505S.
5. Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obesity reviews*. 2004 May 1;5(s1):4–85.
6. Pulgarón ER. Childhood obesity: a review of increased risk for physical and psychological comorbidities. *Clinical therapeutics*. 2013 Jan 31;35(1):A18–32.
7. Bucchianeri MM, Arikian AJ, Hannan PJ, et al. Body dissatisfaction from adolescence to young adulthood: Findings from a 10-year longitudinal study. *Body image*. 2013 Jan 31;10(1):1–7.
8. Nur MJ, Kartini I, Siti B, et al. The relationship between eating behaviors, body image and BMI status among adolescence age 13 to 17 years in Meru, Klang, Malaysia. *Am J Food Nutri*. 2011;1:185–92.
9. Goldfield GS, Moore C, Henderson K, et al. Body dissatisfaction, dietary restraint, depression, and weight status in adolescents. *Journal of School Health*. 2010 Apr 1;80(4):186–92.
10. Mirza NM, Yanovski JA. Body dissatisfaction, self-esteem, and overweight among inner-city Hispanic children and adolescents. *Journal of Adolescent Health*. 2005 Mar 31;36(3):267–e16.
11. Ruiz M. The human body as an aesthetic object. *A Parte Rei. Revista de Filosofía*. 2010;72:1–7.
12. Rukavina T, Pokrajac-Bulian A. Thin-ideal internalization, body dissatisfaction and symptoms of eating disorders in Croatian adolescent girls. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*. 2006 Mar 1;11(1):31–7.
13. Paxton SJ, Eisenberg ME, Neumark-Sztainer D. Prospective predictors of body dissatisfaction in

- adolescent girls and boys: a five-year longitudinal study. *Developmental psychology*. 2006 Sep;42(5):888.
14. Order J. *The Psychology of Eating*. Oxford: Blackwell. 2003.
 15. Stice E. Risk and maintenance factors for eating pathology: a meta-analytic review. *Psychological bulletin*. 2002 Sep;128(5):825.
 16. Hohensee CW, Nies MA. Physical activity and BMI: Evidence from the panel study of income dynamics child development supplement. *Journal of School Health*. 2012 Nov 1;82(12):553-9.
 17. Morano M, Colella D, Capranica L. Body image, perceived and actual physical abilities in normal-weight and overweight boys involved in individual and team sports. *Journal of Sports Sciences*. 2011 Feb 15;29(4):355-62.
 18. Hausenblas HA, Fallon EA. Exercise and body image: A meta-analysis. *Psychology and Health*. 2006 Feb 1;21(1):33-47.
 19. Reel JJ, Greenleaf C, Baker WK, et al. Relations of body concerns and exercise behavior: A meta-analysis. *Psychological reports*. 2007 Dec 1;101(3):927-42.
 20. Goldfield GS, Adamo KB, Rutherford J, et al. The effects of aerobic exercise on psychosocial functioning of adolescents who are overweight or obese. *Journal of pediatric psychology*. 2012 Sep 30;js084.
 21. Slaughter MH, Lohman TG, Boileau R, et al. Skinfold equations for estimation of body fatness in children and youth. *Human biology*. 1988 Oct 1;709-23.
 22. Gardner RM, Stark K, Jackson NA, et al. Development and validation of two new scales for assessment of body-image. *Perceptual and motor skills*. 1999 Dec;89(3):981-93.
 23. Rodríguez MA, Beato L, Rodríguez T, et al. A Spanish adaptation of the Gardner body image assessment scale in patients with food disorders. *Actas Españolas de Psiquiatria*. 2003;31:59-64.
 24. WHO (World Health Organization). Growth reference 5-19 years. 2007. Available at: http://www.who.int/growthref/who2007_bmi_for_age/en/
 25. Ford PA, Perkins G, Swaine I. Effects of a 15-week accumulated brisk walking programme on the body composition of primary school children. *Journal of sports sciences*. 2013 Jan 1;31(2):114-22.
 26. Howe CA, Harris RA, Gutin B. A 10-month physical activity intervention improves body composition in young black boys. *Journal of obesity*. 2010 Oct 12;2011.
 27. Yan-Ping LI, Xiao-Qi HU, Schouten EG, et al. Report on childhood obesity in China (8): effects and sustainability of physical activity intervention on body composition of Chinese youth. *Biomedical and Environmental Sciences*. 2010 Jun 30;23(3):180-7.
 28. Farias ES, Paula F, Carvalho WR, et al. Influence of programmed physical activity on body composition among adolescent students. *Jornal de Pediatria*. 2009 Feb;85(1):28-34.
 29. Farris JW, Taylor L, Williamson M, Robinson C. A 12-week Interdisciplinary Intervention Program for Children who are Obese. *Cardiopulmonary physical therapy journal*. 2011 Dec 1;22(4):12-20.
 30. Lazaar N, Aucouturier J, Ratel S, et al. Effect of physical activity intervention on body composition in young children: influence of body mass index status and gender. *Acta Paediatrica*. 2007 Sep 1;96(9):1321-5.
 31. Wang Y, Liang H, Chen X. Measured body mass index, body weight perception, dissatisfaction and control practices in urban, low-income African American adolescents. *BMC public health*. 2009 Jun 12;9(1):183.
 32. Agam R, Tamir S, Golan, M. Gender Differences in Respect to Self-Esteem and Body Image as Well as Response to Adolescents' School-Based Prevention Programs. *Journal of Psychology and Clinical Psychiatry*. 2015;2(5):00092.
 33. Campbell A, Hausenblas HA. Effects of exercise interventions on body image: A meta-analysis. *Journal of health psychology*. 2009 Sep;14(6):780-93.
 34. Vicedo P, Carlos J, Gil Madrona P, et al. Efectos de un programa de actividad física extracurricular en niños de primer ciclo de ESO con sobrepeso y obesidad. *Revista de psicología del deporte*. 2012;21(2):0379-385.
 35. Martin KA, Lichtenberger CM. Fitness enhancement and changes in body image. In T.F. Cash, & T. Pruzinsky (Eds.), *Body image: A handbook of theory, research, & clinical practice* pp. (414-422). New York, NY: The Guilford Press. 2004.
 36. Furnham A, Badman N, Sneade I. Body image dissatisfaction: Gender differences in eating attitudes, self-esteem, and reasons for exercise. *The Journal of psychology*. 2002 Nov 1;136(6):581-96.
 37. McCabe MP, Ricciardelli LA. Body image dissatisfaction among males across the lifespan: A review of past literature. *Journal of psychosomatic research*. 2004 Jun 30;56(6):675-85.
 38. Levine MP, Smolak L. Body image development in adolescence. In T.F. Cash, & T. Pruzinsky, (Eds). *Body image: A handbook of theory, research, & clinical practice* (pp.74-83). New York, NY: The Guilford Press. 2004.
 39. Ekelund U, Tomkinson G, Armstrong N. What proportion of youth are physically active? Measurement issues, levels and recent time trends. *British Journal of Sports*

Medicine. 2011 Sep 1;45(11):859-65.

40. Jordán OR, Madrona PG, López LM, et al. Incidencia de un programa de educación física en la percepción de la propia imagen corporal. Revista de educación. 2012(357):187-8.

PEER REVIEW

Not commissioned. Externally peer reviewed.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

ETHICS COMMITTEE APPROVAL

The study followed the Declaration of Helsinki guidelines, and was supervised by the Bioethics Committee of the Castilla-La Mancha University, Spain.

Table 1: Characteristics of the subjects before starting the programme

	CG (n=16) M SD	EG (n=22) M SD	z	p
Age (years)	13.1 0.9	12.9 0.9	-2.00	0.046
Gender	9 boys; 7 girls	8 boys; 14 girls		
Weight (kg)	72.7 15.7	68.0 13.9	-1.25	0.210
Height (cm)	162.7 10.8	159.7 6.9	-3.77	0
BMI (kg/m ²)	27.2 3.4	26.5 3.4	-.963	0.35
Fat (%)	28.2 9.8	28.5 11.3	-.089	0.92
Muscle (%)	18.3 5.4	15.5 4.8	-1.33	0.19
∑ 6 skinfold	164.9 23.7	174.3 26.0	-1.06	0.28

BMI: body mass index; ∑ 6 SF: summation of six skinfolds.

Table 2: Comparison of the different anthropometric variables by gender in the CG

Control Group	Boys (n=9)				Girls (n=7)			
	Pre	Post	z	p	Pre	Post	z	p
Waist	86.20 (5.11)	87.69 (5.39)	-2.49	0.01	82.94 (8.00)	83.90 (8.67)	-2.03	0.04
Hip	100.47 (8.87)	102.47 (9.29)	-2.24	0.02	101.76 (11.22)	104.23 (12.40)	-2.37	0.02
Arm	30.23 (3.11)	31.42 (3.17)	-2.52	0.01	30.43 (2.88)	31.24 (2.99)	-1.44	0.15
Medial Calf	31.48 (4.52)	34.14 (4.16)	-1.24	0.21	35.09 (5.35)	35.99 (4.97)	-1.01	0.31
Fat (%)	28.54 (9.77)	29.63 (9.63)	-0.77	0.44	27.77 (10.63)	31.59 (13.10)	-2.20	0.03
Muscle (%)	17.95 (6.91)	17.22 (10.85)	-0.41	0.68	18.66 (3.15)	16.63 (2.23)	-1.86	0.06
BMI	26.98 (3.22)	27.16 (3.44)	-0.42	0.68	27.59 (3.92)	28.39 (4.31)	-1.52	0.13
∑ 6 Skinfold	160.13 (25.45)	163.88 (27.98)	-0.56	0.58	171.03 (21.62)	181.53 (21.67)	-1.86	0.06

BMI: body mass index; ∑ 6 SF: summation of six skinfolds.

Table 3: Comparison of the different anthropometric variables by gender in the EG

Experimental Group	Boys (n=8)				Girls (n=14)			
	Pre	Post	z	p	Pre	Post	z	p
Waist	85.25 (11.73)	83.28 (11.33)	-2.10	0.04	81.68 (7.93)	79.68 (8.68)	-2.69	0.01
Hip	100.11 (9.62)	96.86 (9.03)	-2.52	0.01	101.89 (4.78)	99.71 (5.09)	-3.30	0.00
Arm	30.05 (3.87)	29.30 (3.87)	-2.52	0.01	30.18 (2.56)	29.31 (2.81)	-2.74	0.01
Medial Calf	34.91 (4.77)	31.04 (3.61)	-2.52	0.01	35.50 (4.30)	30.89 (4.54)	-3.30	0
Fat (%)	32.35 (17.13)	29.72 (13.46)	-1.12	0.26	26.34 (5.73)	23.89 (5.36)	-2.23	0.03
Muscle (%)	12.19 (4.99)	14.42 (8.57)	-0.28	0.78	17.43 (3.57)	19.44 (2.89)	-2.67	0.01
BMI	26.50 (4.38)	26.00 (4.09)	-0.98	0.33	26.46 (2.84)	26.29 (2.94)	-0.53	0.59
∑ 6 skinfold	179.85 (35.18)	165.51 (24.44)	-1.26	0.21	171.14 (19.96)	154.17 (18.87)	-2.76	0.01

BMI: body mass index; ∑ 6 skinfold: summation of six skinfolds.

Table 4: Comparison of the body image variables by gender in the CG

Control Group	Boys (n=9)				Girls (n=7)			
	Pre	Post	Z	p	Pre	Post	Z	p
Perceived Body	9.11 (1.36)	9.00 (1.12)	-0.26	0.79	9.71 (1.98)	11.14 (1.21)	-1.45	0.15
Ideal Body	5.67 (2.18)	6.56 (2.13)	-1.99	0.05	5.43 (1.27)	5.86 (1.86)	-0.64	0.52
BMI Silhouette	10.67 (1.58)	10.78 (1.86)	-0.45	0.65	10.86 (1.46)	11.29 (1.25)	-1.73	0.08
Body Distortion	-1.56 (1.67)	-1.78 (1.48)	-0.54	0.59	-1.14 (2.73)	-0.14 (2.04)	-1.06	0.29
Body Dissatisfaction	3.44 (1.33)	2.44 (1.33)	-2.17	0.03	4.29 (1.80)	5.29 (1.80)	-1.02	0.31

BMI: body mass index

Table 5: Comparison of the body image variables by gender in the EG

Experimental Group	Boys (n=8)				Girls (n=14)			
	Pre	Post	Z	p	Pre	Post	Z	p
Perceived Body	9.00 (1.41)	9.00 (1.69)	-0.09	0.93	9.50 (1.65)	9.93 (1.27)	-0.73	0.46
Ideal Body	5.00 (1.31)	5.75 (2.49)	-0.57	0.57	5.07 (1.73)	6.07 (1.38)	-2.17	0.03
BMI Silhouette	10.13 (2.10)	9.75 (2.25)	-0.74	0.46	10.57 (1.74)	10.21 (2.01)	-1.15	0.25
Body Distortion	-1.13 (1.55)	-0.75 (1.28)	-0.54	0.59	-1.07 (2.13)	-0.29 (1.20)	-1.92	0.06
Body Dissatisfaction	4.00 (1.41)	3.25 (1.91)	-0.95	0.34	4.43 (2.38)	3.86 (1.92)	-0.87	0.38

BMI: body mass index.

Figure 1: Scale of gardner

