The Effects of an Interdisciplinary Intervention on Cardiovascular Health Indicators of Children with Excess Body Weight: A Randomized Clinical Trial

Thaynã Alves Bezerra¹, Anastácio Neco de Souza Filho², José Fernando Vila Nova de Moraes³, Anderson Costa Armstrong⁴, Dannyl Roosvelt de Vasconcelos Lima⁴, Ferdinando Oliveira Carvalho³,⁴

¹University Center of João Pessoa – UNIPÊ / João Pessoa / PB / Brazil, ²Regional University of Cariri / Iguatu / CE / Brazil, ³Masters Program in Physical Education / Federal University of San Francisco Valley / Petrolina / PE / Brazil, ⁴Masters Program in Health Sciences / Federal University of San Francisco Valley / Petrolina / PE / Brazil

ABSTRACT

Bezerra TA, Souza Filho AN, Armstrong AC, Lima DRV, Moraes JFVN, Carvalho FO. The Effects of an Interdisciplinary Intervention on Cardiovascular Health Indicators of Children with Excess Body Weight: A Randomized Clinical Trial. JEPonline 2017;20(5):114-122. The purpose of this study was to evaluate the effects of an interdisciplinary intervention on cardiovascular health indicators in overweight and obese children. Sixty children with excess body weight and their respective mothers were recruited. Nineteen of the 60 subjects refused to participate in the research. Anthropometric measures as well as cardiorespiratory fitness and a transthoracic echocardiogram were carried out. Ten weeks of physical activity, nutrition, and psychological interventions were applied to the children and their mothers. The data were submitted to the non-parametric Wilcoxon test for verifying the intragroup differences, and the Mann-Whitney U test for the intergroup differences. There were no statistically significant differences for the variables in the experimental group. However, there was a significant decrease in cardiorespiratory fitness in the control group. The findings indicate that while the proposed intervention was not sufficient to improve the children’s cardiovascular health indicators, it seems to have provided a protective effect on these indicators.

Key Words: Children, Overweight, Risk Factors
INTRODUCTION

It is clear that the lifestyle of individuals throughout society has increased the prevalence of obesity in the world. In particular, the low levels of physical activity, several hours a day exposed to sedentary behavior, and a diet rich in carbohydrates and fat, especially the saturated fats have provided the world population with an excess of pathological body weight (15). According to NCD-RisC (9) in 2014, over 641 million people worldwide were considered obese individuals.

Such high levels of obesity in the adult population are now common in the infant population. In 2013, obesity reached 42 million children under 5 yrs of age (16). This pandemic is evident among Brazilian children when analyzing the data published by the Brazilian Institute of Geography and Statistics (IBGE) (2). From 1975 to 2009, there was an increase of 35.5% of 5- to 9-yr-old children with excess body weight, which is closely related to the development of several health problems, such as cardiovascular diseases, systemic arterial hypertension, dyslipidemias, changes in glucose metabolism, as well as psychosocial disorders (15).

Given these concerns, evaluating the cardiovascular health indicators in obese children is a major recommendation of the Brazilian Society of Cardiology (SBC) (13). Cardiorespiratory fitness and the left ventricular mass are among these indicators, which are strongly associated with the risks of morbidity and mortality (1,11). Thus, it is important that interventions are used as a way of reducing obesity in childhood and, consequently, decreasing the cardiovascular risk factors (12). However, either multidisciplinary or interdisciplinary methodological interventions in the school-based population that involve their families and the focus on the improvement of cardiovascular risk indicators, as recommended by the World Health Organization (16), still seem scarce, especially in Brazil. Thus, the purpose of this study was to evaluate the effects of an interdisciplinary intervention on the cardiovascular health indicators in overweight and obese children.

METHODS

Subjects
This study is a randomized clinical trial. Eight schools were considered eligible to participate in the initial selection. The number of students enrolled in the eight schools from the 1st to the 4th year of the Urban Area in 2015 was 2,231 students. This amount was multiplied by the prevalence of childhood overweight and obesity in the Northeast, where according to IBGE (2) in 2008 and 2009 the value was 43.5%. Thus, it was concluded that 970 children should participate in the initial selection.

The 970 students were divided by the total number of schools (N = 8) resulted in ~122 children assessed per school. This value was divided by the total of classes from the 1st to 4th year of Elementary School in each school. Then, a previous list of the children was randomly formulated for the selection. For organizing the groups, a calculation using the software GPower 3.0.10 was performed, with a power of 0.80, an effect size of 0.3, and a probability of 5%. Thus, an amount of 24 children was obtained for each group with an increase of 25% for subsequent sample losses, which resulted in 30 children per group.

After the initial selection, the schools should have ~30 students with body weight excess in a single school period (morning or afternoon) that would be included in the raffle, since the
Intervention would take place after school. However, only two schools met this number so a raffle was carried out to determine the school that would represent the experimental group and, consequently, the other school would be the control group. The eligibility criteria of the schools were as it follows: (a) located in the outskirts of the urban area; (b) having an indoor court; and (c) presenting at least 30 overweight and obese children after the initial selection.

The present investigation is part of a broader study that conducted physical, medical, nutritional, and psychological evaluations of obese children (the final results are not shown here). In order to be part of the sample, each child had to be between 6 and 9 yrs of age, completed the Free Informed Consent Form (FICF), and was classified as overweight or obese according to the World Health Organization criteria (10), which met the Body Mass Index (BMI) of >85th percentile.

**Intervention**

The intervention consisted of physical activities and nutritional and psychological monitoring. It was carried out during a 10-wk period, with meetings taking place on Tuesday and Thursday of each week with the children during which they spent 60 min doing physical activity, developed through popular games previously planned and structured. On Saturdays, the children were exposed to physical activity, in addition to instructions on healthy eating habits and behavior change through directed activities developed in the classroom model. Also, the mothers participated in the gym sessions that were 60 min in duration, nutritional instructions for 60 min as well as 120-min sessions on behavior change via lectures. The control group continued with its routine activities, participating only in the evaluations (Figure 1).

**Figure 1. The Intervention Logical Model.**
**Procedures**

All the evaluations except for the echocardiogram were carried out in the schools where the experimental and control groups were. Some anthropometric measures were taken according to the WHO standardization (17). The measures included the subjects’ weight (kg), height (cm), and waist circumference (cm). Weight was measured using a digital scale with a resolution of 100 g and a maximum load of 150 kg. The children were weighed standing, barefoot and wearing light clothes. A portable stadiometer with a scale and resolution of 1 mm was used to measure height. The scale was fixed to a wall with no baseboard, taking the vertex and the plantar region as reference points. The BMI was calculated according to the relationship between the body mass (kg) and squared height (m). The waist circumference was defined as the midline between the lower border of the rib cage and the upper border of the iliac crest. It was measured with a 1 mm resolution metal tape measure.

The left ventricular mass (LVM) was measured with a transthoracic echocardiography performed by using the General Electric® Vivid S6 model that was manufactured in 2011. The children were evaluated by a team of cardiologists at the Cardiovasf Clinic. They were not wearing a shirt and were examined in a lateral decubitus position. The presence of either the mother or someone responsible for the child was requested together with the doctors in the procedure room. The left ventricular mass index (LVMI) was obtained through the LVM and height (m) elevated to 2.7 power rating.

The subjects’ cardiorespiratory fitness (CRF) was assessed by using the 6-min walk and run test proposed by Gaya and Gaya (4), which considers the distance covered within the given time limit. This test was carried out in the courts of each school by a team of researchers from the present study.

**Statistical Analyses**

All the variables analyzed in the present study were continuous. The data non-normality was verified by using Shapiro Wilk test, and then submitted to the non-parametric Wilcoxon test to obtain the intragroup differences, in addition to Mann-Whitney U test for the intergroup differences. The significance was set at P<0.05. All statistical analyses were performed using the SPSS 20.0 software.

This study was submitted and approved (Opinion 1.311.598) by the Ethics and Deontology Committee in Studies and Research of the Brazilian University referred to as Universidade Federal do Vale do São Francisco, and registered in clinicaltrials.gov (NCT03041142).

**RESULTS**

Initially, 60 children and their respective mothers were invited to participate in this study. Nineteen of the 60 decided not to participate in the study. The breakdown consisted of: (a) 10 subjects from the experimental group (schedule incompatibility = 6; disinterest in the research = 2; withdrew before beginning the research = 2); and (b) 9 subjects from the control group (schedule incompatibility = 2; lack of interest in the research = 3; withdrew before the beginning the research = 4). In the course of the study there were 8 dropouts; 6 subjects from the experimental group (disinterest in the research = 3; moving to another city = 1, incompatibility with the parents’ schedule = 2); and 2 from the control group (disinterest in the
Therefore, 41 subjects started the study with the purpose of receiving treatment, that is, 20 from the experimental and 21 from the control. However, the final number of subjects was of 33 children, 14 in the experimental group and 9 in the control group (Figure 2). There were no statically significant differences for the variables analyzed in the present study among the subjects who completed the study and those who dropped out (\(P>0.05\)).

The mean age in the experimental group was of 7.55 ± 1.05 yrs and for the control group 8.19 ± 0.87 yrs. There were no physical education classes for the elementary education in both schools participating in this research, so the children in the present study had only 20 min of free recreation a day at school, which was shared with the break time. Most of the families involved in this research had a monthly income between one and three minimum wages.

The homogeneity of the groups at the initial moment was verified in all variables shown hereby (\(P>0.005\)). There were no significant changes in any of the cardiovascular health indicators in the experimental group after the intervention (\(P>0.05\)). However, as indicated in Table 1, the cardiorespiratory fitness in the control group was significantly decreased (\(P<0.05\)). This finding helps to show the protective effect of the intervention in this variable for the experimental group.

Figure 2. The Study Flowchart.
Table 1. Median and Interquartile Range of the Variables that Embrace the Anthropometric Profile and the Cardiovascular Health Indicators in Children Body Weight Excess.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>P</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Intervention</td>
<td>Post-Intervention</td>
<td></td>
<td>Pre-Intervention</td>
<td>Post-Intervention</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>40.60 (34.57;49.45)</td>
<td>41.80 (33.40;47.62)</td>
<td>0.649</td>
<td>37.20 (33.80;40.90)</td>
<td>37.80 (35.60;44.60)</td>
<td>0.025</td>
</tr>
<tr>
<td>Stature (cm)</td>
<td>134.15 (126.37;139.37)</td>
<td>134.50 (126.75;140.12)</td>
<td>0.151</td>
<td>132.50 (126.90;136.50)</td>
<td>133.00 (128.00;137.00)</td>
<td>0.011*</td>
</tr>
<tr>
<td>BMI (kg·m⁻²)</td>
<td>23.20 (19.64;25.72)</td>
<td>23.08 (20.02;25.68)</td>
<td>0.152</td>
<td>21.25 (18.96;22.95)</td>
<td>21.88 (20.00;23.13)</td>
<td>0.191</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>71.30 (64.37;78.17)</td>
<td>68.70 (63.00;75.57)</td>
<td>0.096</td>
<td>65.00 (61.00;72.50)</td>
<td>66.80 (59.90;70.20)</td>
<td>0.702</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>P</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Intervention</td>
<td>Post-Intervention</td>
<td></td>
<td>Pre-Intervention</td>
<td>Post-Intervention</td>
<td></td>
</tr>
<tr>
<td>Cardiorespiratory Fitness (m)</td>
<td>757.25 (681.85;808.62)</td>
<td>707.00 (653.30;777.15)</td>
<td>0.140</td>
<td>759.00 (725.00;791.00)</td>
<td>655.30 (600.98;715.40)</td>
<td>0.000*</td>
</tr>
<tr>
<td>Left Ventricular Mass (cm)</td>
<td>39.10 (34.40;54.95)</td>
<td>45.30 (40.45;51.10)</td>
<td>0.695</td>
<td>47.70 (40.20;55.70)</td>
<td>47.10 (38.30;52.40)</td>
<td>0.535</td>
</tr>
<tr>
<td>Left Ventricular Mass Index (cm/m²)</td>
<td>19.90 (16.74;24.17)</td>
<td>20.10 (19.25;24.35)</td>
<td>0.463</td>
<td>21.84 (19.40;25.05)</td>
<td>19.80 (18.65;24.45)</td>
<td>0.332</td>
</tr>
</tbody>
</table>

*Significant difference among the moments verified by using the Wilcoxon test.

DISCUSSION

The purpose of the present study was to evaluate the effects of an interdisciplinary intervention in the school environment on cardiovascular health indicators of overweight and obese children. It is believed that the logical model developed in this research had a positive effect on the subjects’ cardiovascular health indicators. However, it is also believed that a longer intervention period is necessary to provide even more significant healthcare changes and benefits.
Therefore, the present research differs from other studies in the methodological aspects, since the intervention was also developed with the mothers of the subjects who were submitted to sessions of physical activity, nutritional orientation, and behavioral therapy. This is not common among other studies that focused on children cardiovascular health (6,8,14). One point that should be highlighted is the use of echocardiography in the present study. This is again an uncommon practice, given that the analysis of left ventricular mass in overweight children is still scarce. Yet, it is a recommendation of the Brazilian Society of Cardiology (13) in cases in which children show cardiovascular risk factors, such as hypertension, glucose metabolism disorder, and severe obesity among others.

Although the changes that occurred between the groups and within the groups were not significant for left ventricular mass and the left ventricular mass index of children with excess body weight, it is imperative that researchers embrace the methodology of the present study. Interestingly, while these results are in agreement with Horner et al. (5) who evaluated obese adolescents, the lack of intervention studies in this population makes it difficult to understand the findings of the present study. There simply isn’t enough research to allow for analysis and comparison of the intervention programs to prevent and treat the cardiovascular diseases in obese children (3).

The increase in left ventricular mass, referred to as left ventricular hypertrophy, diagnosed by using the left ventricular mass index, shows an association with cardiovascular events in adults. Although these events are not common in childhood, it is believed that the left ventricular hypertrophy and the first signs of atherosclerosis occur in this age group (1). For these reasons, it is suggested that in obese children, investigations similar to the present study should occur as early as possible in order to better understand the best interventions that may attenuate the deleterious effects of cardiovascular disease (3,7).

The subjects (i.e., children) in the experimental group benefited from the protective effect of the cardiorespiratory fitness intervention, which is an important marker of cardiovascular health. Yet, in a somewhat similar study by Hrafnkelsson et al. (6), they found no changes in the subjects’ cardiorespiratory fitness over a 2-yr intervention. The intervention they used consisted of daily physical activities introduced in the school routine, with an initial duration of 30 min that was increased gradually until reaching 60 min daily. Regarding the change absence related to cardiorespiratory fitness, the authors reported that the period was short to modify such a variable. However, although the study had a multidisciplinary nature, it did not involve the parents or used the behavioral therapy. In addition, another factor that may have been important in their results was the fact that the intervention was not carried out by the researcher, but by the school teachers. Hence, by comparison, it is believed that with the methodological design developed in the present research along with a longer intervention period, it may have been likely to find improvements in the experimental group.

This study had the short intervention period as a limitation. However, it had the following strengths: (a) having an interdisciplinary nature, that is, working simultaneously with physical education, nutrition, and psychology; (b) involving the mothers in the study, thus trying to promote change in the family lifestyle as a whole, since it is believed that the children are not able to change behaviors that affect their health; (c) highlighting the homogeneity regarding BMI for selecting the sample; and (d) performing the intervention with the researchers themselves.
CONCLUSIONS

It is noteworthy that an interdisciplinary intervention applied to children with excess body weight can strongly help in the prevention of the risk factors and cardiovascular diseases to which this population is predisposed. However, a longer intervention period is suggested in order to verify the real effects of these proposals.

ACKNOWLEDGMENTS

The present study had partial funding from FACEPE, CAPES, and CNPQ with master and scientific initiation scholarships.

Address for correspondence: Thaynã Alves Bezerra, Department of Physical Education-UNIPÊ, BR 230, KM 22, João Pessoa/PB/Brazil. Email: thaynaalves.ef@gmail.com

REFERENCES


**Disclaimer**
The opinions expressed in *JEPonline* are those of the authors and are not attributable to *JEPonline*, the editorial staff or the ASEP organization.