Effects of Recreational Physical Activity during Summer Camp on Body Composition and Physical Fitness of Overweight and Obese Children

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ABSTRACT

Ribeiro HL, Rauber SB, Oliveira-Silva I, Venâncio PEM, Campbell CSG. Effects of Recreational Physical Activity during Summer Camp on Body Composition and Physical Fitness of Overweight and Obese Children. JEPonline 2017;20(2):134-143. The purpose of this study was to determine the influence of 5 days of camping on body composition and physical fitness related to the health of overweight and obese children. Twenty overweight or obese children (9 boys and 11 girls) 9 to 11 yrs of age participated in this study. The group was submitted to a 5-day camp in total immersion under the supervision of a multi-professional team. A significant improvement was observed in the subjects' body mass, summation of skin folds, waist circumference, sit and reach flexibility, upper limb strength, and lower limb strength. Thus, the findings indicate that the 5-day recreational camp was effective for improving body composition and physical fitness of overweight and obese children.

Key Words: Camp, Children, Overweight, Obesity, Physical Fitness
INTRODUCTION

Obesity is a multi-factorial disease that is characterized as a syndrome (3,29). The evidence indicates that its beginning is in childhood and adolescence period of life (10). Among the most prevalent factors for the development of obesity are a sedentary lifestyle and inadequate eating habits (21). However, it is important to note that this syndrome reaches a large part of the world population in all age groups (28), even to the point of that the WHO (32) has affirmed that childhood obesity is one of the biggest public health problems of the 21st century.

The number in relation to being overweight and obese has increased considerably. The projection for the year 2025 is 2.3 billion overweight adults and 700 million obese adults. The child population could reach 75 million overweight and obese. To complete this panoramic view, 50% of the Brazilian adult population and ~15% of the children are classified as either overweight or obesity (2).

Associated with indicators that point to an increase in obesity, there is an increase in the incidence of some chronic non-communicable diseases (such as cardiovascular, type 2 diabetes and cancer) (26). To alter this reality, this is the reason why intervention strategies are used worldwide to (12,27) to increase adherence to a healthier lifestyle (20). In addition, recreational activities have gained visibility due to the simple form of application (18), alternating the intensities of the exercises, and providing pleasure. According to Aparecido et al. (1), the end result is an improvement in body composition as well as excited and confident children and adolescents who are better able to deal with overweight and obesity.

For these reasons, there are studies from several universities (10,11) and one from the Catholic University of Brasilia (24) that have followed an intervention model of immersion of children in an active lifestyle (25). These models are different from other models in the literature (7,27). A good example is the EVASYON study, a program applied in Spanish adolescents with overweight and obesity. This model promotes multidisciplinary intervention with the family (feeding, physical activity, and psychological support) that aims at weight loss. It has been associated with satisfactory results (9), but the model is carried out in a medium-term perspective (i.e., 13 months).

The strategy of recreational intervention, using games and games as tools of learning in health has already been used (24,25,27). Meanwhile, however, there are no studies that have demonstrated the effects of recreational physical activity on total immersion of children for 5 uninterrupted days with a multidisciplinary team. It is important to highlight that the performance of multidisciplinary teams has been reported in the literature as one of the most effective methods in the treatment and control of obesity (8).

Thus, we believe it is important to present the effects of a planned camp in total immersion model on the body composition and physical fitness of overweight and/or obese children. The purpose of the present study was to evaluate the effect of 5 days of camping on body composition and physical fitness related to health in overweight and obese children.
METHODS

Subjects
Twenty children (9 boys and 11 girls) participated in this study. Their average age was 9.4 ± 1.1 yrs old. None of the subjects had diabetes, hypertension, cardiovascular disease, dyslipidemia or limited motor skills due to a physical disability. They were not taking any type of medication. After a written consent of parents and/or guardians, each subject voluntarily participated in the study. All subjects complied with the procedures established in Figure 1. All children attended school regularly in a single shift and participated in physical activities twice a week in the school unit itself. The study was approved by the Ethics Committee of the Catholic University of Brasilia (CAAE: 34361414.0.0000.0029), and originated as a part of the recreational program of institutional education and child health (PRESI) of children who are overweight or obese.

Figure 1. Sample Selection.

General Procedures
Study Design
The study was developed over a period of 8 days starting with a physical and maturational evaluation on the Saturday preceding the camp, followed by the intervention (i.e., 5-day camp from Monday through Friday) and reassessment on the Saturday immediately after the intervention. During the 5 days of the camp the subjects stayed away from their relatives and were monitored by a multi-professional team. Every subject had 30 min·d⁻¹ to talk with their parents by a cell phone or WhatsApp.
Characterization the Camp
The camp took place on a farm with an area of 12,000 m² that contained a soccer field, swimming pool, sports court, lodging, and dining room. The activities were programmed and executed by a multi-professional team that consisted of 2 physical educators, 1 nutritionist, 1 psychologist, and 1 pedagogue besides the support staff (i.e., 2 staff persons, 1 cook, and 3 security guards). The camp recreational activities included popular games that prioritized the playful activities in addition to educational lectures on the importance of physical activity and stress management. These interventions began at 8:00 am and ended at 9:00 pm with 1 hr and 30 min of activities followed by 30 min of rest.

Physical Assessment and Body Composition
The first physical evaluation was on Saturday preceding the camp, and the second was on Saturday immediately after camp. Body mass (kg) was measured on a scale (G-Tech 05, Tecline®, China), and stature (m) measured by means of a stadiometer (E210, Wiso®, Brazil) to determine body mass index (BMI) (kg)/height (m)². Body fat percentage (%BF) was measured using Lange Skinfold Caliper®, USA in accordance with the recommendations of Lohman et al. (16). Measurements were made in triplicate, and presented by the mean for the subscapular (SE) and tricipital skinfolds (TR). The %BF was calculated by the protocol of Slaughter et al. (31):

\[
\%\text{BF (♀ black and white - 7 to 17 yrs)} = 1.33 (TR + SE) - 0.013 (TR +) 2 - 2.5
\]
\[
\%\text{BF (♀ black prepubescent)} = 1.21 (TR + SE) - 0.008 (TR + SE) 2 - 3.2
\]
\[
\%\text{BF (♂ pre-pubescent white)} = 1.21 (TR + SE) - 0.008 (TR + SE) 2 - 1.7
\]

Anthropometry
The waist circumference (WC) was measured with a tape measure (Sanny® SN-4010, Starret, Brazil). The WC was taken with no clothing in the region of interest, the child in the upright position, with the abdomen relaxed (at the end of expiration), arms extended along the body and legs closed. The WC was determined at the point of least circumference of the trunk using a metal ribbon (Sanny® SN-4010, Starret, Brazil). The Height Waist Ratio (HWR) was calculated from the division of the WC value (cm) by the height value (cm). Values greater than or equal to 0.50 were considered high (22).

Sexual Maturation
The sexual maturation was determined following the recommendations of Tanner, being developed in the laboratory of the Catholic University of Brasilia (UCB), where the individual child, at the time that entered the laboratory, marked the image that most identified with his/her sexual characteristic of pubic hairiness.

Physical Fitness
The flexibility (Sit and Reach), localized muscular resistance (Curl Up), upper limb strength (ULS), a medicine ball throwing test, and lower limb strength (Long Jump) were performed according to the Brazilian Sports Project (PROESP-Brazil) (23). The University Montreal Track Test (UMTT) was used to determine VO₂ max. During the UMTT test, the children ran at a pace determined by a cyclist following procedures from Boulosa and Tuimil (6) and Oliveira-Silva et al. (19) on a 400 m track. The initial velocity was 7 km·h⁻¹ with increment of 1 km·h⁻¹ every 2 min until voluntary exhaustion. Maximum heart rate (HR max) was recorded
by a heart monitor (RS800, Polar Electro Oy, Finland) at the end of the test. The estimated VO₂ max was obtained by applying the equation of Berthoin et al. (5): [VO₂ max = 0.0324 x (VAM) 2 + (2.143 x VAM) + 14.49].

**Statistical Analysis**

The data were submitted to statistical analysis using SPSS v 20.0, IBM. The Shapiro-Wilk test was used to test the normality of the data. Descriptive statistics were used to present the mean, standard deviation (SD), and 95% confidence interval. The paired t-test was used to identify the effect of the camp on the variables tested. The magnitude of the changes between pre and post camp was evaluated using Cohens' D effect size (ES). For each variable the percentage of change (%Δ) was calculated. Correlations were used to verify the relationship between sexual maturity and the other parameters studied, as well as the classificatory condition of being overweight (i.e., overweight or obese). The level of statistical significance was set at P<0.05.

**RESULTS**

The results of the anthropometric data and physical tests performed before and after camp are presented in Table 1, followed by the differences caused by the activities developed during the period. There were changes in 7 of the 11 variables tested during the camp period.

<table>
<thead>
<tr>
<th></th>
<th>Before Camp</th>
<th>After Camp</th>
<th>P</th>
<th>%Δ</th>
<th>d'</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body Mass (kg)</strong></td>
<td>53.1 ± 9.1</td>
<td>52.0 ± 8.9</td>
<td>0.00</td>
<td>-2.10</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>BMI (kg·m⁻²)</strong></td>
<td>25.1 ± 2.4</td>
<td>24.5 ± 2.4</td>
<td>0.00</td>
<td>-2.10</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>WC (cm)</strong></td>
<td>77.7 ± 7.8</td>
<td>75.9 ± 7.8</td>
<td>0.00</td>
<td>-2.31</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>WCH</strong></td>
<td>0.88 ± 0.06</td>
<td>0.87 ± 0.05</td>
<td>0.14</td>
<td>-1.23</td>
<td>0.18</td>
</tr>
<tr>
<td><strong>Σ-Sk (mm)</strong></td>
<td>80.7 ± 12.8</td>
<td>75.1 ± 12.2</td>
<td>0.00</td>
<td>-6.81</td>
<td>0.46</td>
</tr>
<tr>
<td><strong>Body Fat (%)</strong></td>
<td>33.2 ± 4.4</td>
<td>32.8 ± 4.7</td>
<td>0.11</td>
<td>-1.54</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Sit and Reach (cm)</strong></td>
<td>30.2 ± 7.6</td>
<td>34.1 ± 9.3</td>
<td>0.01</td>
<td>12.91</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Curl Up (rep)</strong></td>
<td>18 ± 8</td>
<td>19 ± 8</td>
<td>0.21</td>
<td>11.11</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>Upper Limb Strength (cm)</strong></td>
<td>181.4 ± 49.5</td>
<td>224.7 ± 46.6</td>
<td>0.00</td>
<td>24.57</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>Long Jump (cm)</strong></td>
<td>95.4 ± 23.4</td>
<td>102.4 ± 19.5</td>
<td>0.00</td>
<td>7.33</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>VO₂ max (mL·kg⁻¹·min⁻¹)</strong></td>
<td>31.4 ± 6.6</td>
<td>32.1 ± 6.1</td>
<td>0.07</td>
<td>2.29</td>
<td>0.11</td>
</tr>
</tbody>
</table>

BMI = Body mass index; WC = Waist circumference; WHR = Waist to hip ratio; Σ-Sk = Sum of skinfold thickness

The sexual maturation showed a slight negative correlation with the differences in waist circumference averages (P = 0.03), see Table 2. Seventeen of the 20 subjects (85% of the sample) were in stage 1 of Tanner, being characterized as pre-pubertal. Regarding BMI, a
positive correlation was observed with differences in mean abdominal resistance (Curl Up) \( (P = 0.02) \) (Table 2).

**Table 2. Correlation between the Pre-Pubertal Stage of Tanner and BMI Variables with the Changes (Δ) Resulting from the Camp.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>ΔBF(%)</th>
<th>ΔWC</th>
<th>ΔFlex</th>
<th>ΔAbd</th>
<th>ΔJump</th>
<th>Δarm</th>
<th>ΔVO₂ Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanner</td>
<td>-0.039</td>
<td>-0.49*</td>
<td>0.01</td>
<td>-0.29</td>
<td>-0.08</td>
<td>0.13</td>
<td>0.47</td>
</tr>
<tr>
<td>BMI</td>
<td>-0.08</td>
<td>0.08</td>
<td>0.41</td>
<td>0.51**</td>
<td>0.21</td>
<td>-0.09</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*\( P = 0.03; \)** \( **P = 0.02 \)

From the studied sample, 4 children (i.e., 20%) were overweight and 16 (i.e., 80%) were obese according to age-specific BMI. Although there was a significant reduction in the variables tested, the scores according to the BMI did not change. There was no difference between obese and overweight in any of the evaluated variables. All had similar results.

There was a significant improvement in mean values of body mass (-1.1 kg), body mass index (-0.6 kg·m\(^{-2}\)), waist circumference (-1.8 cm), summation of skin folds (-5.6 mm), sit and reach flexibility (+3.9 cm), and long jump that characterized the lower limb strength (+7.0 cm), despite the low effect sizes. The only result which in addition to being significant had a high effect size (i.e., 0.77) was the subjects’ upper limb strength (+43.3 cm).

**DISCUSSION**

To our knowledge, this is the first study reporting the effects of a 5-day camp in total immersion on the body composition and physical fitness of overweight and obese children. The findings indicate that this model is effective and surprising, given the short time period of 5 days. It changed 7 (Body Mass, BMI, WC, Σ-Sk, Sit and Reach, Upper Limb Strength, and Lower Limb Strength) of the 11 variables tested. From different models of intervention (7,27), the present study consisted of a model of immersion of children in an active lifestyle that was in an environment different from that experienced by them. It is also worth noting that the results presented here are especially due to a committed multidisciplinary team and effective planning, recognized in the literature (8,14) as being fundamentally important to achieving positive results.

In addition to the factors highlighted above, the recreational intervention strategy, using games and games as health learning tools, contributed to the reduction of the indicators of variables related to body composition (i.e., Body Mass, BMI, WC, and Σ-Sk). Also, the emphasis on physical fitness (i.e., flexibility and strength) is a strategy that has been used in other interventions with the purpose to treat and/or control obesity (8). Of course, the combination of multidisciplinary knowledge, proposals, and application of healthy habits (e.g., balanced and adequate diet along with physical activity in the most diverse situations of the day to day existence) helped considerably in the subjects’ loss of weight, which is in agreement with the findings from Miguel-Etayo et al. (9).
As to the subjects’ body fat and aerobic capacity, it is likely that the intervention time was too short to have an effect. For this reason it is interesting to add to the strategy of the present study a continuity of the intervention, which is similar to what happens in other research studies that proposed a continuation of monitoring after the initial intervention (9,30,33).

Possibly due to the homogeneity of the sample in regards to BMI and sexual maturation, the results were not very expressive. While the BMI correlated with the expected ΔAbd (0.51) (17), the maturation correlation with the ΔWC deserves to be highlighted as negative (-0.49). The findings suggest that the risk of developing cardiometabolic diseases in overweight children who are not engaged in physical exercise to increase physical fitness as they become more mature (4,9,17,30) is a major concern. For this reason, it is important to pursue studies with a larger sample size and with children in all maturational bands to better clarify the health risks.

**Limitations of this Study**

Due to some logistical challenges we were unable to evaluate a control group, which limited us to better control of the variables under investigation. Due to the limited sample number, we did not segregate the sample into genders, which is a factor that may have influenced the results because we understand that there are maturational and biological differences between boys and girls.

**CONCLUSION**

The findings in the present study indicate that 5 days in a health camp immersion model with an emphasis on promoting a healthy lifestyle through educational and recreational physical activities can be effective for improving the body composition and health related physical fitness of overweight children and obesity.

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**REFERENCES**


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