Original article

Role of camping in the treatment of childhood obesity

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Abstract. Obesity is constantly increasing among children. Since treatment for obesity on outpatient bases often fails, we evaluated whether camps may help to improve eating habits. Forty-one children, 21 males and 20 females (BMI > 97° percentile, weight excess > 30%, Tanner stage I) agreed to participate to a 8 day camp. After 1-year follow-up, measurements carried out by plicometry, bioelectrical impedance, metabolic and hormonal evaluations, showed a significant reduction of skinfolds, as well as glycemic and insulinemic response to the oral glucose tolerance test. These results suggest that camps may help to improve nutritional and physical education and psychological outcome of obese children.

Key words: Childhood obesity, school-camp, eating habits, nutritional education, physical activity

Background

Several studies suggest that obesity is constantly increasing among young population and that at least one-third of adulthood obesity is the result of obesity during childhood (1-5). Furthermore, obesity has implications not only for present nutritional status, since obese children are at risk to develop complications later in life, such as atherosclerosis, cardiovascular disease, type 2 diabetes mellitus (6-8). Treatment for obesity helps to prevent metabolic complications (9, 10) and improves the psychological outcome. However, treatment of obese subjects on an outpatient bases with dietary restriction associated or not with a physical activity programme, often fails and more intensified interventions are required. In this context, camps for children with obesity has the primary aim of nutritional re-education which should improve eating habits.

Here we present an experience on the effect of a summer camp in obese children in Italy.

Materials and methods

School-camp for obese children lasted eight days during summer holidays and took place in a seaside resort. Forty-one prepubertal children, 21 males (10.8 ± 1.4 years, BMI 24.7 ± 2.8 kg/m^2) and 20 females (9.8 ± 1.4 years, BMI 25.7 ± 2.8 kg/m^2), attending the outpatient clinic, agreed to participate. To be selected for participation in the study, young patients had to fulfil the following inclusion criteria: BMI > 97° centile, weight excess > 30%, Tanner stage I (table 1). Parents of each young participant gave informed consent and stayed with their children during the first day of camping, then once in a week and finally, at the end of the camp. The camp team comprised a pediatrician, a dietitian, a psychologist, a trainer, a school teacher and two specialist nurses.

During camping and after 1-year follow-up, obese children had 5 sligthly hypocaloric meals a day (Basal Metabolism [BM] x 1.2) (11). Children played or participated to a physical activity programme for at

Table 1. Clinical characteristics of obese children at the entry of the study

Variables	
N	41
Sex (F/M)	20/21
Age (years)	10.3 ± 1.4
Height (cm)	142.9 ± 10.5
Weight (kg)	52.1 ± 11.3
Weight excess (%)	41.2 ± 17.2
BMI (kg/m2)	25.2 ± 2.8
Cole Index	139.1 ± 15.7
Abdomen/pelvis ratio	0.8 ± 0.05
Fat mass (%)	37.5 ± 5.9

Data are expressed as mean ± SD

least three or four hours a day. The staff of school-camp also provided a theoretical nutritional learning programme. Measurements of body composition were carried out at the beginning and at the end of camping, then after 6 and 12 months of follow-up. For each young camper, weight, height, skinfolds, BMI, fatty mass (12), muscular area of arm were measured (13). Bioelectrical impedance and biochemical measurements (OGTT, cholesterol, HDL, LDL, triglycerides, cortisol, ACTH, DHEAS, TSH, FT4 values) were also evaluated. During seven days before camping, obese children wrote on a special diary their eating habits and physical activity. None of the children left the camp and we were able to re-examine everybody after six months. Six children (5 males and 1 female) dropped out before the re-examination at 12 months.

Statistical analysis. Data were processed through the SPSS for Windows (SPSS, Inc, Chicago, IL) statistical package. All data are expressed as mean ± standard deviation (SD) and differences were evaluated by Student's t test for paired sample or analysis of variance and a Bonferroni correction was applied. Values are given as mean ± SD. For all tests, p values <0.05 were considered significant.

Results

Eating habits. Nutritional data obtained during camp compared to those before entering the study demonstrated an improvement in eating habits (e.g. breakfast, vegetables, fruit, fish). Dietary restrinction and dietary self-control were implemented throughout the 1-year follow-up, leading to persistent favourable results, particularly when supported by one check per month on outpatient bases.

Physical activity. Before entering the study, only 13.6% of obese children used to participate in physical activity for more than 10 hours a week, 47% for 2 to 10 hours, whereas 39.4% participated less than 2 hours a week. School-camp experience showed several difficulties in obese children physical activity (e.g. awkwardness). However, children agreed to participate in sport and in every activity (games, hobbies) for at least three hours a day. During follow-up, obese children were encouraged in physical activity as much as possible (1 hour a day, or at least 4 hours a week), recommending to them walking to school rather than taking bus or cars, participating in sports or in other activities, changing their activity habits (e.g. limiting the time spent watching television) (14, 15).

Anthropometric evaluation. During 1-year of follow-up, obese children achieved an average height within the range of 75°-90° centile with a not significant increase (mean±SD males: 152.7 ± 14 cm; females: 144.3 ± 12 cm). No significant reduction in weight and BMI was observed at the end of the camp; after 1 year, boys but not girls, showed a further reduction in both weight excess and BMI. Plicometry showed a significant reduction of subcutaneous skinfolds values among boys, particularly in subscapular, superiliac, epigastrium, hypogastric, regio femoris anterior, medialis and popliteal sites. Lohman nomograph showed a decreased fat mass in all obese children at the end of the camp, and a further reduction in boys after 1 year of follow-up. Bioelectrical impedance showed a similar trend at the end of camping, whereas results were not significant during follow-up. We found a marked improvement of subscapular/tricipital, superiliac/tricipital and regio femoris anterior/tricipital fat ratio, which is the expression of peripheral adipose mass redistribution (16). Both anthropometry and bioelectrical impedance also demonstrated increased lean mass in short as well as long-term results.

Biochemical measurements. Before entering the study, all young participants showed marked hyperinsulinism and low glucose tolerance, but this finding didn't correlate with weight excess degree. At the end

Table 2. Mean laboratoristical data of children before and after the school-camp

	Before school-camp	After school-camp
Glycemia (mmol/l)	5.47±0.3	5.36±0.3*
Insulinemia (mU/l)	24.7±4.7	17.0±5.9**
Serum ACTH (μg/l)	44.3±20.1	40.1±19.1*
Serum Cortisol (nmol/l)	324.2±164.7	226.2±168.8*
DHEAS (μg/dl)	0.7±0.2	0.7±0.1
TSH (mU/l)	4.2±0.1	4.0±1.0
FT4 (pmol/l)	11.1±0.3	11.4±0.5
FT3 (pmol/l)	3.9±0.5	4.0±0.7
T4 (nmol/l)	86.2±14.2	87.5±11.5
T3 (nmol/l)	1.47±0.08	1.48±0.09
Serum Cholesterol (mmol/l)	4.09±0.05	4.08±0.05
Serum Tryglicerides (g/l)	0.8±0.07	0.8±0.06

* $p < 0.05$ vs evaluation before school-camp
* $p < 0.001$ vs evaluation before school-camp

of camping, we were able to demonstrate a significant reduction of both glycemic and insulinemic levels and a further but not significant decrease during follow-up. We also demonstrated a significant reduction of ACTH and cortisol levels among obese boys and a further significant reduction after follow-up. All laboratoristical data of the children re-evaluated after the end of school-camp are shown in table 2.

Conclusion

In this study, we found that camp experience in children with obesity is associated with normal growth, unvaried BMI and weight excess, reduced fat mass and redistribution of adipose tissue. We also found increased lean mass and reduced insulin and glycemic levels. During six months of follow-up, obese girls showed a less positive trend in BMI and weight excess compared to boys. However, at the end of the study we did not find any significant difference between males and females. Our results were confirmed after 1-year follow-up. Improvement of these parameters are related to improved alimentary modeling and increased physical actvity (17). Improvement of obese children behaviour persisted during 1-year follow-up.

As childhood obesity is a disease involving all the family, it is very important to support not only the obese children but also their parents; therefore, the obese child must be treated as a part of his family (18, 19). Moreover, it is well known that frequently psychological behaviour of obese children can be characterized by inadequacy, fear, poor self-estimation, anxiety, aggression, isolation/self-pity.

This aspect is another important reason to try to find a successful treatment for obesity: if camps can help to reduce obesity, these behavioral complications might be prevented with a significant improvement for the health of these children.

In conclusion, we suggest that as treatment for obesity with dietary restriction associated or not with a physical activity programme on an outpatient bases often fails (20), more intensified interventions are required. In this context, camps for children with obesity may be a useful approach to children weight management, and should improve eating habits as well as psychological outcome.

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