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Camp Jump Start: Effects of a Residential Summer Weight-Loss Camp for Older Children and Adolescents

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KEY WORDS

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WHAT'S KNOWN ON THIS SUBJECT: Several studies have reported on results of residential summer weight-loss camps in older children and adolescents. These studies have demonstrated reductions in weight, improved physical fitness, and favorable psychological outcomes.

WHAT THIS STUDY ADDS: Our report provides in-depth analysis of favorable changes in BMI, BMI z[r] score, physical fitness, and blood pressure in a group of obese older children and adolescents attending a residential summer weight-loss camp and adds to the evidence that such camps are an effective short-term intervention for reducing morbidities associated with excess weight.

abstract

OBJECTIVE: Residential weight-loss camps offer an opportunity for overweight and obese children to lose weight in a medically safe, supervised, supportive environment. The purpose of this report is to describe short-term outcomes in 76 children participating in a 4- or 8-week residential weight-loss camp for children and adolescents.

PATIENTS AND METHODS: The camp program enrolled obese 10- to 18-year-old adolescents. The program consisted of structured and non-structured physical activities and group educational sessions covering nutrition, physical fitness, and self-esteem. A diet plan of 3 balanced meals and 2 snacks per day was prepared under the supervision of a registered dietitian. Participants had height, weight, and blood pressure measured and performed a 1-mile run at maximum effort on an outdoor track.

RESULTS: For all campers, statistically significant ($P < .0001$) reductions were observed for BMI, BMI z score, systolic blood pressure, body weight, and 1-mile run times. Compared with campers in the 4-week session, campers in the 8-week session had greater reductions in BMI, BMI z score, body weight, and systolic blood pressure. Multivariate analysis revealed that gender was a significant predictor for reduction in body weight, BMI, and BMI z score, all of which decreased more in boys than in girls.

CONCLUSIONS: This report adds to the evidence that residential weight-loss camps are highly effective in improving measures of health and fitness among overweight and obese children and adolescents. Additional study is needed on the long-term effects of such camps in terms of weight maintenance, behavior change, and metabolic and health outcomes. *Pediatrics* 2010;125:e000

According to recent data from the National Health and Nutrition Examination Survey, the prevalence of being overweight (BMI in the 85th–95th percentile for age and gender) or obese (BMI $>$ 95th percentile) among children aged 2 to 19 years in the United States is 31.9%.[1] This figure rises to 34.1% among children aged 12 to 19 years, and to a staggering 38.1% among black children in this age group. These figures have increased from an estimated 12.5% in girls and 9.0% in boys in the early 1950s.[2] These major changes in prevalence of childhood obesity occurred primarily during the last 2 decades, and childhood obesity now ranks among the top-rated pediatric public health concerns reported by adults, especially among whites and blacks.[3] In addition to medical complications, severely obese children and adolescents experience impairments in quality of life similar to children with cancer who are undergoing chemotherapy.[4]

Effective community-based interventions for childhood obesity have been difficult to implement and have had only limited success. One strategy involves overnight, residential programs, such as summer weight-loss camps, which are widely available in many states in the United States and Canada, as well as abroad.[5] In this report, we describe short-term outcomes of an 8-week summer residential weight-loss program for overweight and obese children and adolescents. We hypothesized that children and adolescents participating in our camp program would demonstrate significant short-term weight loss as well as improvements in physical fitness, and that a longer stay at camp would result in greater improvements in outcomes.

PATIENTS AND METHODS

Camp Jump Start is a coeducational, residential summer camp for overweight and obese children and adolescents. Since its inception in 2002, the goal of the camp has been to develop a weight-management program for children and adolescents centered on nutrition education, physical activity, and counseling.

Children and adolescents aged 9 to 18 years who are identified by themselves or their parents as overweight or obese are eligible to attend. Those with a BMI at $<$85th percentile for age are eligible to attend after a personal interview with the camp director to ensure willingness to adhere to camp programming and policies. Other than treatment with insulin, there are no specific exclusion criteria for camp attendance, although those with significant disordered eating behavior, psychiatric conditions, or neurologic impairment are carefully evaluated before camp attendance. Because of safety concerns, children and adolescents with significant chronic diseases such as asthma or diabetes are assessed on a case-by-case basis by the camp director to determine their suitability for the camp program. Factors such as current disease control and level of physical impairment are taken into consideration.

Campers are divided into cohorts of age and gender in shared cabins and remain grouped together for many activities throughout the camp session. Nutrition classes are offered by a registered dietitian twice per week. Topics covered include recommended daily allowances and calorie requirements, nutritional content of food, measuring portion sizes, reading food labels, dining out, and choosing healthy snacks. A trip to a local grocery store provides a hands-on opportunity to practice healthy shopping habits. A licensed Shapedown instructor provides counseling regarding the psychobehavioral aspects of eating. Shapedown is a behavior-modification intervention that addresses diet, activity, psychosocial functioning, and the family dynamics underlying weight or eating difficulties. Although Shapedown was formulated as a family-based program, elements of the program are adapted to the camp setting and include group discussions, skills-practicing, and role-playing based on the principles of the Shapedown intervention. Weekly family conference calls are conducted to update and involve family members as to the camper's progress. Campers are taught problem-solving skills, assertiveness training, cognitive therapy techniques, stress-management techniques, and body-image therapy. Shapedown workbooks are provided to the camper and family for completion outside of the camp setting.

A menu of 1500 calories/day is provided with 400 calories in each of 3 balanced meals and 100 to 150 calories in each of 2 snacks daily. Campers work the serving line under direction of the dietitian. Food servings are apportioned, providing the camper the opportunity to reinforce portion-control education. No other food is allowed at camp, and food is only served in the dining hall under the direction of the registered dietitian. Staff supervises all meals and reports any dining irregularities (such as sharing, swapping, or sneaking) to the camp director, who is a registered nurse.

The camp holds daily organized play activities, including many common team sports and a particular focus on nonimpact water-based activities. Campers attend aerobics classes 3 times per week and resistance-training sessions twice per week. Self-defense in the form of Tae Kwon Do is provided to campers on a voluntary basis once per week by a certified instructor. Confidence-building activities such as horseback-riding, ropes courses, climbing walls, and wilderness camping are an integral part of the camp program. Campers are weighed weekly but are only made aware of their weights at the end of the camp session.

At the beginning of camp and at the end of the 4- or 8-week camp sessions, campers have measurements of height, weight, resting blood pressure, and pulse. Height is measured in inches by using a stadiometer. Weight is obtained in pounds without shoes in light clothing on a SECA (Hanover, MD) digital scale at the beginning of the day when campers are in the fasting state. Blood pressure and pulse are measured by manual sphygmomanometer using the appropriate cuff size after remaining seated quietly in an air-conditioned room for 8 to 10 minutes at the beginning of the day when campers are in the fasting state. Sphygmomanometer cuffs in child, adult, large adult, and thigh sizes are available to ensure accurate measurement of blood pressure. Physical fitness is measured by using a 1-mile run on a packed-gravel track and recorded in minutes and seconds. The 1-mile run time has been shown to be a valid test for estimation of cardiorespiratory fitness and has good correlation with the gold-standard $\dot{V}O_{2max}$ test.[6–9] All measurements are obtained by a registered nurse.

Permission to obtain deidentified data on all campers was obtained from the camp director and approved by the Washington University Human Research Protection Office.

Statistical procedures were conducted by using SAS 9.1 (SAS Institute, Inc, Cary, NC). Descriptive analyses with means and SDs were used to describe continuous variables. Frequency and percent were used to describe categorical variables. BMI *z* score was computed and included in the analyses, because changes in BMI *z* score more accurately reflect loss of fat in obese adolescents over a wide age range.[10] A paired *t* test for within-subject comparisons, Student's *t* test for between-group comparisons, or Wilcoxon test, as appropriate for the distribution of data, was used to determine changes in the outcome variables between 2 camp sessions and gender. Pearson correlation analysis was used to assess the relationship between outcomes and age and starting BMI. The correlation coefficient and the 95% confidence interval were reported. Multivariate regression was used to explore the association of camp factors and BMI *z*-score changes. All results were considered statistically significant at the $P < .05$ level.

TABLE 1 Baseline Characteristics of Study Sample

	Entire Cohort ($N = 76$)	4-wk Cohort ($N = 62$)	8-wk Cohort ($N = 14$)	*P*
Gender, *n* (%)				
Male	25 (33)	19 (31)	6 (43)	.38
Female	51 (67)	43 (69)	8 (57)	
Age, mean ± SD	13.6 ± 1.9	13.4 ± 1.8	14.3 ± 2.1	.12
No. of weeks (attended)	4.7 ± 1.6[a]	4	8	
Weight start, mean ± SD, lb	205.5 ± 51.8	198.6 ± 46.3	236.1 ± 64.8	.06
BMI *z* score return campers (2006–2007)[b]		2.27	2.51	.06
Yes, *n* (%)	9 (12)	6 (10)	3 (21)	.35
No, *n* (%)	67 (88)	56 (90)	11 (78)	

[a] Mean ± SD; not all campers attended full 4- or 8-week sessions.
[b] Adjusted mean, after adjusting for gender in 2 sessions.

RESULTS

A total of 76 campers attended the summer 2007 session and were included in the data analysis. Table 1 shows selected baseline characteristics of the entire cohort of campers, as well as those attending the 4- and 8-week sessions. Most campers attended the camp for 4 weeks ($n = 62$). Sixty-seven percent of the participants were female. The average age was 13.6 ± 1.9 years, with a range of 9 to 18 years. Twelve percent of the campers had attended the camp during the previous summer (in 2006). Only 1 camper, a 15-year-old girl, dropped out of camp prematurely after 1 week because of her parents' perception that she was not enthusiastic about the camp program. Mean ± SD BMI and BMI *z* score at baseline for the entire cohort were 34.9 ± 6.9 and 2.28 ± 0.44, respectively. Six percent of the campers were overweight (BMI in the 85th–95th percentile) and 92% were obese (BMI > 95th percentile). Only systolic blood pressure was subjected to statistical analysis. Mean initial systolic blood pressure was 124.9 ± 13.2 mm Hg, and 39% were hypertensive (>95th percentile for age, gender, and height).[11] There were no differences in average age, gender distribution, starting BMI, and starting weight between campers attending the 8-week versus the 4-week sessions.

To assess the relationship at baseline between obesity (as measured by BMI) and other anticipated outcomes (blood pressure and physical fitness), we performed a correlative analysis between BMI and the baseline systolic blood pressure and the 1-mile run times (a measure of physical fitness). These analyses are shown in Table 2 and reveal that initial BMI was positively correlated with initial systolic blood pressure ($r = 0.6$; $P < .0001$) and negatively correlated with fitness as measured by longer 1-mile run times ($r = 0.5$; $P < .0001$).

Table 3 shows the weight, BMI, BMI *z* score, systolic blood pressure, and 1-mile run time for the entire group of campers at the beginning and end of the camp session. Statistically significant (all $P < .0001$ by paired *t* test) reductions were observed for body

TABLE 2 Correlations Among Starting BMI and Age and Selected Outcomes

	Correlation Coefficient, *r* (95% CI)	*P*
Starting BMI and starting systolic BP	0.6 (0.48 to 0.76)	<.0001
Starting BMI and initial 1-mile run time	0.5 (0.33 to 0.66)	<.0001
Age and change in BMI	0.2 (−0.01 to 0.42)	.06
Age and change in systolic BP	0.03 (−0.20 to 0.26)	.8
Age and change in 1-mile run time	−0.27 (−0.47 to 0.04)	.02

BP indicates blood pressure; CI, confidence interval.

TABLE 3 Comparisons of Outcomes Between Start and End: Entire Cohort

	Start (*N* = 76)	End (*N* = 76)	Change During Camp Session	*P*[a]
BMI *z* score	2.28 ± 0.44	2.05 ± 0.51	0.23 ± 0.13	<.0001
BMI	34.9 ± 6.9	31.6 ± 6.2	3.29 ± 1.50	<.0001
Systolic BP, mm Hg	124.9 ± 13.2	119.1 ± 11.6	5.79 ± 9.68	<.0001
Weight, lb	205.5 ± 51.8	187.1 ± 46	8.37 ± 4.17	<.0001
1-mile run time, min	15.6 ± 4.1	11.7 ± 2.6[b]	3.78 ± 2.23	<.0001

Data are presented as means ± SD. BP indicates blood pressure.
[a] By paired *t* test.
[b] *N* = 74; 2 campers did not complete the final 1-mile run.

weight, BMI, BMI *z* score, systolic blood pressure, and 1-mile run times, indicating improvement in all these parameters. Compared with campers in the 4-week session, campers in the 8-week session had greater reductions in BMI (5.6 ± 1.8 vs 2.8 ± 0.8; $P < .0001$), BMI *z* score (0.32 ± 0.19 vs 0.21 ± 0.09; $P = .06$), body weight (30.6 ± 12.2 vs 15.7 ± 5.5 lb; $P < .0001$), and systolic blood pressure (9.4 ± 10.0 vs 5.0 ± 9.5 mm Hg; $P < .0001$ by student *t* test).

Multivariate analysis indicated that higher initial BMI, greater length of stay at camp, and male gender tended to predict greater reductions in BMI (Table 4). Likewise, higher initial systolic blood pressure and longer starting 1-mile run times were associated with greater changes in these outcomes throughout the camp period.

TABLE 4 Multivariate Model to Predict Change in BMI

	Regression Coefficient	*P*
Starting BMI	0.026	<.0001
Weeks (attended)	0.14	<.0001
Return campers (2006–2007)		
Yes compared to no	0.1	.36
Age	−0.02	.28
Gender		
Male compared to female	0.17	.01

Starting BMI, longer length of stay in weeks, and gender were significant predictors of change in BMI.

The frequency distribution based on BMI percentile (obese, overweight, and normal) is presented in Fig1. In accordance with Centers for Disease Control and Prevention children's growth charts, obese was defined as BMI greater than the 95th percentile for age and gender, overweight was defined as a BMI in the 85th to 95th percentile, and normal as a BMI at <85th percentile. At baseline, 92% of the campers were obese, 6% were overweight, and only 1 camper was in the normal weight category (80th percentile at baseline; 70th percentile at camp end). By camp end, 78% of the campers were obese, 17% were overweight, and 5% were of normal weight. No campers moved from a lower to a higher BMI-percentile category.

Blood pressure data also are presented in Fig1 for 3 categories (normal for <90th percentile, prehypertensive for 90th–95th percentile, and hypertensive for >95th percentile) according to age, gender, and height references set forth by the National High Blood Pressure Education Program, Working Group on Children and Adolescents.[11] At the start of camp, 39% of campers were hypertensive, 22% were prehypertensive, and 38% were in the normal blood pressure range. By camp end, the percentage of campers in the hypertensive group decreased to 20%, and 62% were in the normal blood pressure range. No campers moved from a lower to a higher blood pressure category during the camp session.

Although we did not collect formal data on camper satisfaction, attrition was very low, with only 1 camper not completing the full session in which she had enrolled. Two campers completed their respective sessions but were unavailable for their final 1-mile runs.

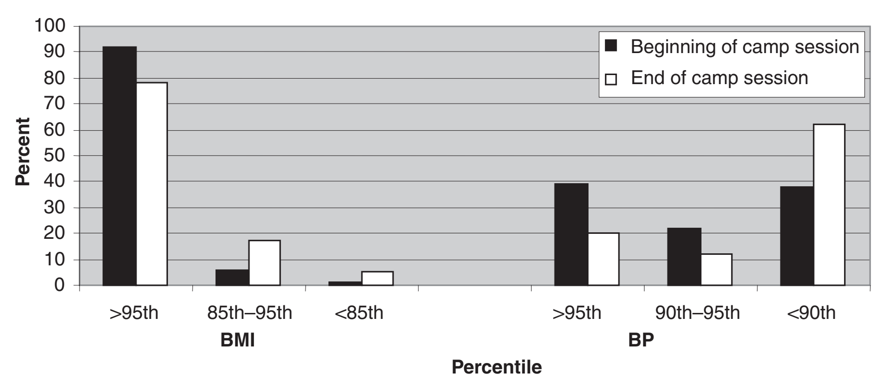

FIGURE 1
Rates of obesity/overweight/normal weight and hypertension/prehypertension/normal blood pressure (BP) at the beginning and end of the camp session. Left, Rates of obesity (BMI > 95th percentile), overweight (BMI 85th–95th percentile), and normal weight (BMI < 85th percentile). Right, Rates of hypertension (blood pressure > 95th percentile), prehypertension (blood pressure 90th–95th percentile), and normal blood pressure (blood pressure < 90th percentile). No campers moved from lower to higher BMI or BP categories.

DISCUSSION

The results of this study confirm the hypothesis that a residential summer weight-loss camp for older children and adolescents is highly effective in reducing weight and improving measures of health and fitness among participants. Our findings of reduced weight, BMI, BMI *z* score, and systolic blood pressure and improvements in physical fitness are in agreement with previously published reports. Our analysis revealed a significant dose-response relationship between time at camp (4 vs 8 weeks) and changes in BMI and blood pressure, with 8-week campers having greater changes than 4-week campers. This is in agreement with other studies that have revealed significant correlations between length of camp stay and changes in BMI, BMI *z* score, percentage body fat, and physical fitness.[12,13] These findings are important in guiding parents and camp personnel to set appropriate weight-loss goals for camp participants on the basis of their projected length of stay at camp.

Reports documenting the effectiveness of summer weight-loss camps for children remain sparse. In 1960, Peckos et al[14] reported on their experience with an 8-week summer camp for obese adolescent girls. They reported an average weight loss of 22 pounds as well as improvements in subjective elements such as "personality" and "confidence." In a more comprehensive report, Rohrbacher[15] presented outcomes of an 8-week-long camp for 204 overweight and obese boys aged 8 to 18 years. Using a program focused on physical activity, nutrition reeducation, and psychosocial support, subjects lost an average of 33 lb and had measured improvements in body image. Although specific weight or BMI was not presented, Rohrbacher stated that the "trend of normal weight gain" in the subjects was interrupted and that weight lost during the camp session was not regained at 4 months after camp completion. Since these earlier reports, several studies have documented the positive effects of residential weight-loss programs for children on body composition, physical fitness, and psychological outcomes.[12,13,16]

Our analyses revealed several unique findings that have not been reported previously in studies on residential weight-loss camps. We found that a higher initial BMI correlated significantly with higher initial systolic blood pressure and longer 1-mile run times. These findings are in keeping with previously published data illustrating a clear association between elevated BMI and higher blood pressure and reduced physical fitness.[17,18] By multivariate analysis, higher initial BMI predicted a greater reduction in BMI during the camp session. Likewise, higher initial systolic blood pressure and longer starting 1-mile run times were associated with more favorable changes in these outcomes throughout the camp period. These findings are encouraging and suggest that the heaviest and least fit participants have the greatest potential to benefit from their participation in camp. We also found that males had greater reduction in BMI than did females. Additional study is needed to determine the influence of body composition, maturation, and other gender-specific differences on weight-loss outcomes in adolescents who attend such camps.

Our blood pressure analysis revealed that a significant percentage of campers who were in the prehypertensive or hypertensive categories at the start of the camp session had normal blood pressure at the end of the camp period. These data suggest that short-term interventions aimed at weight loss may be associated with reduction of hypertension, a major cardiovascular disease risk factor.

Although 14% of campers lost enough weight to move from the obese to the overweight category, the vast majority of campers in our study were still overweight or obese by the end of the camp session. Thus, a key question regarding the short-term improvements in health and fitness outcomes associated with residential weight-loss camps is the long-term sustainability of these benefits. Gately et al[19] reported on outcomes 1 year after residential weight-loss camp completion for 102 overweight and obese children averaging 12 years of age. Eighty-nine percent of children had a lower BMI 1 year later than at camp entry the previous year, and average BMI *z* score did not change significantly between camp entry and 1 year after camp completion. Additional study should be devoted to the long-term effects of residential weight-loss camps, both in the areas of health and fitness and in the areas of lifestyle and behavior change among participants.

Residential weight-loss camps use a number of proven techniques to achieve their desired outcomes, including modification of dietary habits, increasing physical activity, and peer and other psychosocial support services. These methods result in health benefits as well as significant psychological benefits, including improved self-esteem and body image.[20] Removing children from their home environment and placing them in a neutral, peer-supported environment allows participants to challenge previously held normative beliefs and gain positive reinforcement from camp personnel and peers as they actively work toward behavior change. Applying models of behavior change that address environmental factors, normative health beliefs, and self-efficacy have been proven to be effective for the treatment of child and adolescent obesity.[21]

One component of residential weight-loss camps that warrants additional study is the relative lack of parental involvement during the camp session. Although recent expert committee recommendations encouraged parental involvement in intensive weight-management programs for obese children, it is possible that older children and adolescents can achieve desirable outcomes with less parental support.[22]

A major limitation of our study is the lack of a control group or a randomly selected group of participants from a population-based sample as a comparison group. There have been no published population-based randomized, controlled trials of child and adolescent residential weight-loss camps. Thus, selection bias remains a problem before one can generalize these results to the broader population. Furthermore, with no control group, we cannot provide insight into the natural history of overweight and obesity for a similar group of children and adolescents over the same period of time (eg, summer or school vacation), and we are not able to compare our results with those that may occur during other summer camp experiences during which increased physical activity and controlled access to calories might also occur. In addition, without blinding of the examiner, we cannot rule out other environmental factors or bias in our blood pressure results.

CONCLUSIONS

We have demonstrated that participation in a 4- or 8-week residential weight-loss camp reduces weight and BMI and is associated with lower blood pressure and improved fitness. Determining whether these benefits are sustained over time and whether they are reproducible in other settings requires additional study. Although we did not collect information on parental income in our study, it is likely that the cost of these camps remains prohibitive for many families. Future efforts to make such camps more affordable through other funding mechanisms will allow a greater diversity of individuals to take advantage of their success.

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