International Journal of Obesity (1998) 22, 513–519

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Outcomes of obese children and adolescents enrolled in a multidisciplinary health program

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OBJECTIVE: The study was designed to evaluate the impact of a multidisciplinary program on children and adolescents' weight control.
DESIGN: Retrospective study regarding changes in relative weight of all patients treated regularly in an out-patient care public service between January 1992 and December 1993.
SUBJECTS: 198 children and adolescents (108 girls and 90 boys; mean age: 9.25 y; mean body mass index (BMI): 24.26 kg/m^2, range 19.1–40.31).
MEASUREMENTS: Anthropometric data collected at the visits were obtained until June 30 1994. BMI compared to reference data was used. Dual Photon X-ray Absorptiometry (DEXA) was used for 64 patients, to determine percent body fat.
RESULTS: Relative weight at the last visit was significantly lower when compared with initial relative weight for the whole sample. Significantly better outcome of relative weight was obtained when six or more visits occurred for the whole sample, and for girls when the days' interval between visits was shorter than 52 d. Variables such as percent body fat, body shape at the first visit, family obesity pattern, length of obesity and pubertal stage, did not significantly influence the outcome of relative weight for the subjects during the treatment.
CONCLUSION: Results obtained indicated that good outcomes can be obtained in a program using nutrition education focused on small modifications of eating habits in order to avoid excess energy intake. The best predictors of weight improvement for children and adolescents participating in the program were the higher frequency of visits and shorter intervals between them.

Keywords: obesity; children; adolescents; weight maintenance

Introduction

The growing concern with health and physical appearance has led many people to wish for a lean body image that conforms with current popular cultural models.[1] This has also been occurring with children and even more so, adolescents.[2,3] However, despite the increasing preoccupation with weight control, there has been a gradual widespread rise in the prevalence of obesity in all age groups throughout the industrialized world.[4–8] In Latin America, the incidence of obesity in young people is currently a major source of apprehension for specialists in nutrition.[9,10]

The choice of the most effective therapy for excessive weight in children and adolescents is, therefore, fundamental. Its planning must take into account the knowledge of the involved metabolic and psychosocial mechanisms, in order to promote a safe reduction in relative weight.

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Received 7 January 1997; revised 5 January 1998; accepted 20 January 1998

However, the difficulties in achieving these objectives indicate that it is necessary to evaluate the impact of new strategies, as well as study all the possible factors involved in treatment evolution. This will permit the development of more adequate therapy strategies for obesity, preventing the progression of the condition and allowing the patient to achieve better relative body weight as well as its long term maintenance.

Our experience in treating obese children and adolescents in a public out-patient clinic has suggested that dietetic counselling based on helping the patients accomplish small permanent modifications in eating habits would be effective in controlling weight gain in the long-term. The main goal of the treatment is the acquisition of a better weight/height without weight loss (based on an inverse in stature). Thus, small, permanent changes in eating habits are proposed to the patient, without severe energy restriction and without reductions in metabolism or loss of lean body mass.

After some years, we decided to evaluate our patients' outcomes. We collected treatment data with the objective of studying the obese children's and adolescents' outcomes, included in a program developed and used by the staff of a Public University Hospital whose patient population includes people with sparse socio-economic resources.

Method

Subjects

The present study was designed to evaluate the outcomes of obese children and adolescents treated regularly by the multiprofessional staff (nutritionist, pediatrician and psychologist) of the São Paulo Federal University Hospital's Department of Pediatrics' Obesity Outpatient Clinic.

The population sample included all children seen at the outpatient facility in the period between January 1992 and December 1993. The authors excluded from the study 45 individuals who were characterized as drop-outs (38 individuals who attended only one session, two individuals due to absence of information, five who had an interval between visits of more than 180 d) and 14 individuals that presented any type of genetic syndrome or endocrine disturbance that could affect treatment outcomes (Pradder-Willi's Syndrome, Lawrence-Moon-Biedl's Syndrome and others). The 'drop-out' group included 26 boys and 21 girls whose mean age was 9 y and 3 months for girls and 9 y and 7 months for boys. Their average body mass index (BMI) was 26.47 for girls and 24.71 for boys. The studied sample included 198 children and adolescents, subdivided into 108 girls and 90 boys, average age 9.25 y (varying from $1-17.5$ y) at the onset of treatment.

Characteristics of the intervention

The treatment consisted of individual visits to the nutritionist, pediatrician and psychologist, with the objective of a long term reduction in the weight/height ratio, without focusing on weight loss as a main goal of the treatment. The treatment included routine physical examination and dietetic counselling. Thus, based on each patient's evaluation, individual strategies were developed with the objective of correcting excess weight and other associated risk factors. Psychological evaluation and support was included during the children's and adolescents' treatment period.

The object of the dietetic counselling was to allow the patients to monitor quantitatively their habitual diet, without prohibition of ingestion of specific foods or short term modification in the quality of the diet. The patients were provided with some tasks which could easily be incorporated into their lives. In the long term, and as the outcome of the patients permits the introduction of alterations to their eating habits, nutritional counselling was provided. The purpose was to offer information to the patients that enabled them to make adequate food choices, consistent with each one's own preferences and habits. Counselling was directed at the patients, except when they were too young and, thus, not able to participate in the treatment without the attendance of their parents. The patients were stimulated to have independence in their eating choices, to avoid excessive ingestion of energy, lipids or of foods with high energy density, reducing their quantities in the habitual daily meals. The object of the program was to show the patients that the diet must be controlled in its entirety, with permission to ingest all types of foods, in controlled quantities.

In the routine of the clinic, monthly intervals between visits were usually established by the staff at each session. Nevertheless, sometimes due to overcrowded attendance, review cancelling or an appointment postponed, longer intervals occurred between visits.

Data collection

All clinical files were analysed retrospectively and information about weight, height and other variables studied were collected in the questionnaires previously completed in interviews with the patient and respective mother.

Procedures

Definition of obesity. Each subject's weight and height at the time of the first and last visit until 30 June 1994 were used to calculate his/her relative weight. The BMI was calculated[11] for classification of the subjects, which has been described by several authors[12,13] as the most appropriate indicator to define obesity in childhood and adolescence.

Thus a table containing reference BMI values in percentiles for males and females from the age of $6-64$ y[14,15] was used to calculate the adjusted BMI (ABMI), by the application of the following formula:

$$\text{ABMI} = \frac{\text{Actual BMI}}{\text{Ideal BMI (50th percentile)}} \times 100$$

The ABMI was used due to the increase of the ideal BMI with age, which allowed the comparison of the values between two different time points.

The ABMI of the first and last visits were used as the basis for calculation of the percent difference of the ABMI (DABMI%) to evaluate patient evolution during treatment:

$$\text{DABMI\%} = \frac{\text{Adjusted final BMI} - \text{Adjusted initial BMI}}{\text{Adjusted initial BMI}} \times 100$$

Variables analysed. The authors evaluated the patient's evolution during treatment in a Public Health Service, as well as the influence of certain factors on that evolution. Data regarding duration of obesity (defined as the length between detection of overweight by the family or a health professional and search for treatment) and its incidence in each family member were obtained. Pubertal stage was determined during clinical examinations performed by trained pediatricians and was classified according to the criteria established by Marshal and Tanner.[16,17] Adolescents who were in pubertal stages 4 and 5 at the

Table 1 Characteristics of obese children and adolescents of both genders.

	Female		*Male*		*Total*	
Characteristics	*Average*	*(Range)*	*Average*	*(Range)*	*Average*	*(Range)*
Initial weight (kg)	50.7	(11.2 – 106.0)	55.9	(19.2 – 116.5)	53.0	(11.2 – 116.5)
Final weight (kg)	54.8	(15.5 – 125.6)	61.0	(28.0 – 119.6)	57.6	(15.5 – 125.6)
Initial height (cm)	137.6	(71.5 – 170.0)	141.8	(111.0 – 173.0)	139.5	(71.5 – 173.0)
Final height (cm)	144.3	(112.0 – 169.5)	147.6	(111.2 – 176.0)	145.8	(111.2 – 176.0)
Initial age (years, months)	9.3	(1 – 15)	9.7	(1.10 – 17.10)	9.3	(1 – 17.10)
Final age (years, months)	10.2	(1.11 – 17.10)	10.8	(3.10 – 18.2)	10.5	(1.11 – 18.2)
Initial BMI (kg/m^2)	25.8	(19.1 – 39.3)	26.71	(19.2 – 40.3)	26.24	(19.1 – 40.3)
Final BMI (kg/m^2)	25.6	(17.6 – 42.9)	27.1	(18.4 – 46.3)	26.32	(17.56 – 46.29)
Adjustment of initial BMI (%)	158.8	(109.7 – 214.2)	164.7	(125.4 – 263.8)	161.5	(109.7 – 263.8)
Adjustment of final BMI (%)	152.0	(112.6 – 226.5)	159.9	(103.2 – 286.3)	155.6	(112.6 – 286.3)
Duration of obesity (months)	59.49	(5 – 157)	62.14	(5 – 154)	60.7	(1 – 157)
Number of visits	7	(2 – 20)	7	(2 – 19)	7	(2 – 20)
Interval between visits (d)	71	(7 – 179)	64	(15 – 176)	68	(7 – 179)

BMI = body mass index

time of the first visit were excluded from the comparison of groups in different stages of pubertal development, since there were very few of them. Anthropometric data collected at the visits were obtained by trained staff and the basis for calculation of the intervals between the individual visits (in days) was the number of days between one visit and the next. The intervals were added up and divided by the number of visits minus one to obtain the mean individual interval between visits. Total percent body fat was determined by the Dual Photon X-ray Absorptiometry Method (DEXA) using a DPX (Lunar Radiation Corporation, Madison, WI) model.[18]

The ABMI at the first visit was analysed according to duration of obesity, gender, pubertal stage and obesity in the patient's family members. The evolution of the patient (DABMI%) was compared according to the number of visits, interval between visits, relative body weight at the first visit, duration of obesity, gender, pubertal stage, percent body fat, obesity in the patient's family members and age group.

Statistical analyses

Nonparametric tests were used for the analyses of results according to the nature of the studied variables. The Mann-Whitney test was applied to compare girls and boys, and when the results showed no significance, children of both genders were grouped. The Mann-Whitney test, the Kruskal-Wallis' Variance Analyses complemented by the multiple comparison test (when this analysis showed significant difference), the Wilcoxon Test and the Spearman Correlation[19,20] were calculated with the aid of the SPSS4 Software Program. In all tests 0.05 ($\alpha \leq 0.05$) was set as the rejection level for the null hypothesis.

Results

The mean ABMI of the group was 161.5% at the initial visit and 155.6% at the last analysed visit. Treatment averaged 7 (varying from 2−20) visits per patient (Table 1). 54.5% of the girls and 61.4% of the boys were in stage 1 of pubertal development at the beginning of treatment; 36.3% of the girls and 35.2% of the boys were in stages 2 or 3 and 9.2% of the girls and 3.4% of the boys in stages 4 or 5.

Statistical analyses demonstrated that there was a statistically significant difference between the patients' ABMI at the first and last visits, the initial visit being higher (Figure 1). When the group was divided according to the number of visits, it was observed that the children who had six or more visits, showed DABMI%, in absolute values, significantly higher (−7.0%) than those who had 2 or 3 (−0.6%) or those with 4 or 5 visits (−1.8%). There was no statistical difference between these last two groups (Figure 2). The three groups analysed did not differ statistically when the variables of age, gender, duration of obesity and interval between visits were evaluated.

When comparing boys and girls with a mean interval between visits < 52 d, it could be observed that the girls had significantly higher DABMI% than the boys. This finding did not allow the grouping of both genders for the analyses of the influence of the mean interval between visits on the DABMI%. Thus, the statistical analyses demonstrated that the group of girls with < 52 d of mean interval between visits (−5.9%) had greater improvement when compared to the group of girls with > 52 d of interval (−3.2%) (Figure 3). There was no statistically significant difference found in the comparison of boys with mean interval between visits > 52 d (−3.6%) to those with < 52 d (−2.4%). No statistically significant differences were observed when age, duration of obesity and number of visits where compared between the groups with less than or more than 52 d interval, for girls and also for boys.

Figure 4 shows no significant difference when the magnitude of obesity (ABMI) for the boys was compared between the group with duration of obesity < 4 y (162.6%) and the group ≥ 4 y (168.1%). In the group of girls, there was a statistically significant

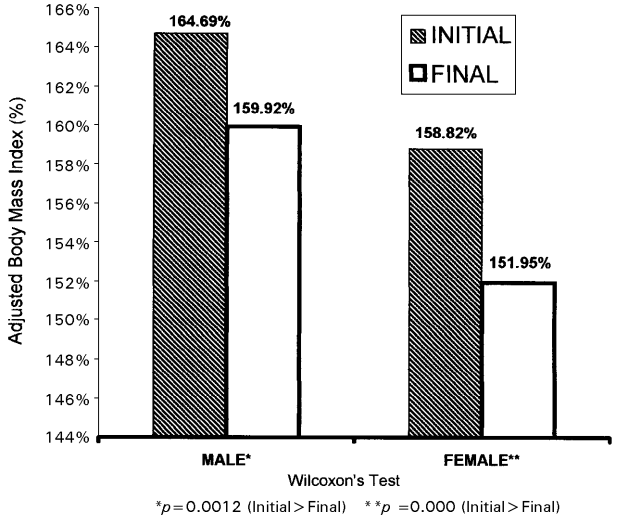

Figure 1 Initial and final adjusted body mass index of obese children and adolescents followed up by multiprofessional staff.

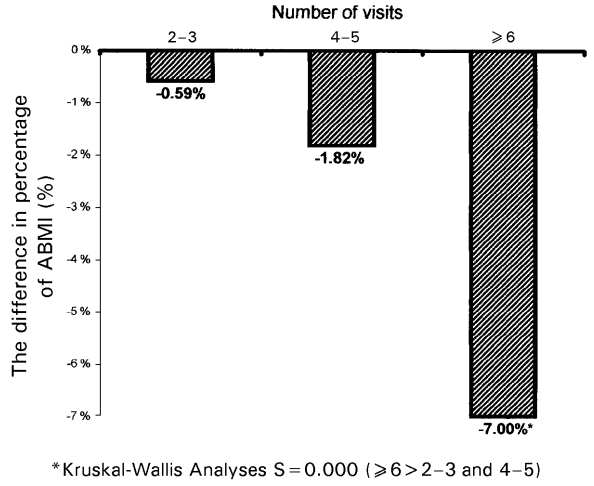

Figure 2 The difference in percentage of adjusted body mass index of obese children and adolescents according to the number of visits attended during follow-up.

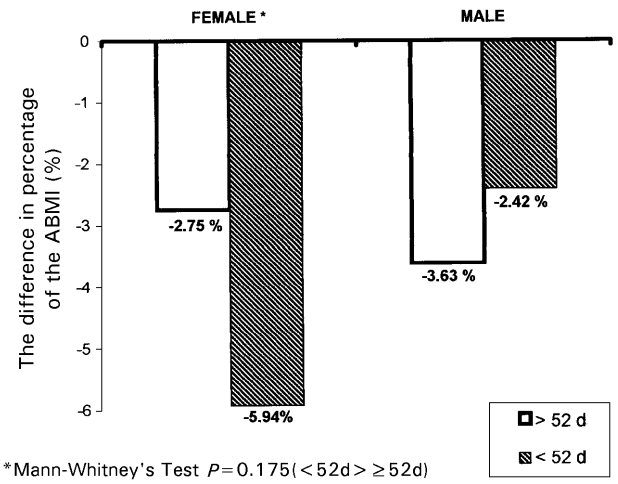

Figure 3 The difference in percentage of the adjusted body mass index (ABMI) of obese children and adolescents according to the interval (number of days) between visits attended.

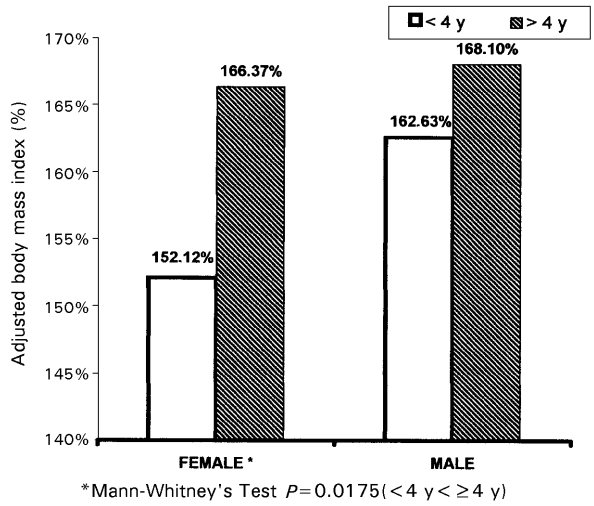

Figure 4 Adjusted body mass index (%) of obese children and adolescents according to duration of obesity.

difference in ABMI for different durations of obesity, with higher ABMI in the girls with duration of obesity ≥ 4 y (166.4%) than in those with onset under four years (152.1%).

There was no statistically significant difference in the initial relative weight (ABMI) according to gender *(male = 158.7% × female = 164.5%: P = 0.16)* and pubertal stage *(1 = 162.1% × 2 and 3 = 161.9%: P = 0.79)*. No statistically significant differences were found when the variation of weight during treatment (DABMI%) was studied according to gender *(male = −3.03 × female = −4.26: P = 0.09)*, percent body fat *(male: $r_s = 0.03$/critical $r_s = 0.35$; female: $r_s = 0.06$/critical $r_s = 0.34$)*, duration of obesity *(< 4 y = −4.16 × ≥ 4 y = −3.36: P = 0.6)*, obesity in the family *(without obesity = −4.80 × mother = −2.94 × father = −5.38 × father and mother = −4.06 × father or mother and brothers = −2.88 × brothers = −4.51 × father, mother and brothers = −2.54: P = 0.83)*, pubertal stage *(1 = −4.05 × 2 and 3 = −3.86: P = 0.32)*, age group (*pre-school = −3.47 × school = −4.07: P = 0.15)* and initial relative weight *(≤ 145.3% = −3.99 × 145.3% to 159.3% = −3.23 × 159.3% to 177.5% = −3.42 × > 177.5% = −3.53: P = 0.81)*.

Regarding family obesity patterns, it could be observed that only 35 children (17.7%) did not have obese relatives (father, mother or siblings), 88 children (44.4%) had obese fathers, 65 (32.8%) had obese siblings and the majority, 120 children (60.6%), had obese mothers.

No statistically significant influence of obesity in the different members of an individual's family over patient's relative weight at the first visit was detected. There was higher ABMI, at the first visit for the boys (175.5%) when compared to the girls (150.8%), who had only the father obese among close relatives.

The presence of obesity in the different members of the family did not significantly influence patient

evolution during treatment. In the subjects whose mothers were obese, however, the DABMI% varied from −2.51% −3.77%, lower values than those shown by the subjects for whom obesity is only present in the fathers (−6.93%), only in the brothers (−4.51%) or by those without obesity in the immediate family (−4.74%).

Discussion

Several types of intervention have been described in the literature for the treatment of obese children and adolescents. They include various forms of diet therapies, physical activity programs, as well as behavioral therapies with or without parents participation.[21–25] The results obtained with such treatments, as well as those achieved in the treatment of adults are controversial and the available answers to the problem seem inconclusive.[26–31]

There are very few studies on the evolution of obese patients treated in common health care services. Most published on the subject are the result of research protocols. These protocols are extremely important for the development and evaluation of intervention strategies as well as of programs for the care of these patients. The results obtained, however, may differ when children and adolescents are assisted within the routine of the health care system, without specific research objectives. The results of the present study indicate that the treatment of obesity developed by our group, with diet therapy guidance adapted to pediatric patients, can be used as a routine in public health services with good outcome results. This is confirmed by our findings that the proportion of children over the 95th percentile went from 89.4% to 77.9%, and that 69.2% of the sample achieved ABMI improvement while in treatment, showing clear benefit to most of the children within the study group. An earlier study by Vitolo *et al*,[32] using the NCHS tables as reference, under which 64 patients of the outpatient service were evaluated, showed that 68.7% of the subjects presented improvement of the Weight/Height ratio. Despite little comparability between the results, as different methods were used for nutritional status evaluation, this indicates that the percentage of children that presented improvement has been maintained constant.

The results obtained in this study demonstrate significant relative weight reduction from the first to the last study visit. Furthermore, when one observes the relative weight reduction of the children that were present for six or more visits, very satisfactory evolution is shown, when compared to the results found in the specialized literature which present average reduction of around 10 −20% of relative weight in children and adolescents treated for obesity.[33,34] This is due to the fact that the aim of this therapy which is based on utilizating educational activities regarding nutrition, as previously described,[35] is long term reduction of relative weight, without the immediate decrease of weight and without use of severe restriction of food intake or specific diets for weight loss.

Results obtained by several researchers[36–39] seem to indicate that when the treatment of obese children and adolescents includes severe energy restriction to bring about weight loss, the children appear not to be able to maintain their reduced relative weight for a long period of time. It is important to emphasize that the treatment of obesity in childhood and adolescence must be very cautious, as growing bodies are more susceptible to the aggravating effects of certain practices for weight loss, such as severe energy restriction.[40] Besides these considerations, the use of this type of diet seems to promote, in the course of time, adaptation mechanisms that allow the body greater conservation of energy, making it necessary to decrease the energy ingestion in order to maintain weight.[41]

On the other hand, Amador *et al*[42] demonstrated that growing children can substantially improve their body composition without actual weight loss, with the use of the normocaloric diet associated with physical activity. In the present study, both groups of girls and boys gained weight from the beginning of treatment, but the majority were able to reduce their body size. Jacobson *et al*[43] also showed that in an intervention based on reduction of total fat intake rather than energy restriction, adolescents could achieve reduction in BMI and in BMI percentile without weight loss. The results of both groups reinforce the accomplishment of the evaluated protocol, which aims at slow and long lasting modifications to the relative weight of the subjects. However, the follow-up of these patients for a longer period of time is necessary to provide the means to verify if this goal is being achieved in the long run.

The number of visits attended, as well as the interval between them (for the girls), were very important factors in the evolution of these patients. These findings are in agreement with the results obtained by several other authors who studied adult patients and found that the frequency of the sessions was a strong predictive factor of long term weight loss.[44–46] Davis and Christoffell[47] also found the number of visits within a year to be an important factor for success in the treatment of children. According to these authors this is due to the fact that the continued verification of weight and the more frequent support from staff provide better stimuli to the patient, and also, because the families that follow the visits more frequently are those that, probably, have greater interest in the treatment outcome. This also appears to be in agreement with Lavery and Loewey[48] who stated that acceptance of the treatment is improved by frequent visits and the continuous support provided by the program's professionals. It cannot be ignored that the patients who stayed on

treatment for longer are possibly those who have had better outcomes, however we may postulate that the permanence in the program is beneficial and permits effective control of patient weight gain.

While studying the duration of the period of obesity, we observed the same as other authors who have demonstrated that the longer that obese children stay in this condition, the stronger the probability of remaining obese in adult life.[49,50] The comparability of the results to the present study is difficult, as the sample studied here represents a population of obese children that sought medical treatment. Thus, the results obtained in this protocol could not be extended to the general population, since children that look for treatment, were probably not able to lose or maintain weight without specialized help. This finding is important, as it indicates that a proportion of obese children cannot regulate body size naturally, simply relying on linear growth. Therefore, the longer these children stay without treatment, the more severe will be their obesity and the greater their weight gain. It is important to observe that our results indicate that the children's performance does not seem to be altered by the duration of obesity until the beginning of treatment. It should be stressed, however, that the severity of the obesity will be greater in direct proportion to the length of that interval. It has been demonstrated that rapid pubertal maturation has long-term consequences for obesity. This fact shows that maturation velocity must be considered a risk factor for the adverse excessive increase of weight in adult life.[51,52]

Presence of obesity in the immediate family, gender, pubertal stage, age group and also body size at the beginning of treatment did not significantly interfere statistically in patient evolution. Thus, the most important factors for satisfactory patient outcomes were greater frequency of the visits and a shorter interval between them, showing that obese children and adolescents can achieve very positive results if a minimal number of visits occur within short intervals.

It can be concluded that little changes in eating habits, without alteration to the quality of the diet, and the setting of goals that do not include short-term weight loss, are compatible with the good outcome of the children and adolescents studied. This also indicates that the treatment can have adequate results in the medium term, even if there are no drastic goals for the short term such as weight loss. According to Rees,[53] weight reduction should not be set as an objective of the treatment, even for adolescents, since it does not take into account the physiological variations of the individual potential for loss, and it should be substituted by less drastic goals as exemplified by the introduction of new eating habits. Confirming this proposition, Murphree[54] has observed that obese patients believed that modifications in their habitual diet would be easier to accept than the use of the traditional hypocaloric diets. Following the same line of thinking, the Task Force to Establish Weight Loss Guidelines recommends individualized treatment, based on long term changes of lifestyle for adults.[55] If these are the proposals for the treatment of adults, these guidelines should be adopted, with even stronger reasoning, as the ideal intervention strategy for children and adolescents, who are in the physiological and psychosocial development stage and are even more susceptible to this form of treatment than adults.

Finally, recognizing that obesity results from multiple factors, reinforces the necessity of the engagement of a multidisciplinary staff of professionals in the treatment of this condition, without the expectation that isolated interventions will achieve the normalization of these patient's weight.

Acknowledgements

The valuable collaboration and the important suggestions made to this work by Marc S. Jacobson, Professor of Pediatrics at the Albert Einstein College of Medicine and Director of the Center for Atherosclerosis Prevention at the Schneider Children's Hospital of Long Island Jewish Medical Center (USA), are gratefully acknowledged.

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