ABSTRACT. Background: A low glycemic index (LGI) diet has been proposed as a treatment for obesity in adults; few studies have evaluated LGI diets in obese children. Aim: The purpose of the study was to compare the effects of two diets, with similar energy intakes, but different glycemic indexes in a pediatric outpatient setting. Subjects and methods: A parallel-group, randomized controlled trial was conducted, and 22 obese outpatient children with a body mass index (BMI) Z-score >2 (11 females and 11 males, BMI 28.9±2.9 kg/m²) were included in the study. Patients were randomly allocated to a hypocaloric LGI (GI:60), or to a hypocaloric high glycemic index (HGI) diet (GI:90). The LGI and HGI diets were almost equivalent for macronutrient composition. Anthropometric and biochemical parameters were measured at baseline and after 6 months. Results: In both groups there were significant decreases in BMI, BMI Z-score, blood pressure, and high-sensitivity C-reactive protein. Only LGI diets produced a significant decrease in waist circumference and homeostasis model assessment. Analysis of variance demonstrated that the BMI Z-score decrease from baseline values was significantly greater after the LGI diet than after the HGI diet [–0.20 (95% confidence interval (CI) –0.29 to –0.10) vs –0.34 (95%CI –0.43 to –0.24)], mean difference between groups –0.14 (95%CI –0.27 to –0.01), p<0.05). Changes in triglyceride concentrations were significantly lower in LGI as compared to HGI diet (p<0.05). Conclusions: This study demonstrates that a hypocaloric LGI diet has beneficial metabolic effects in comparison to a hypocaloric HGI diet in obese children. (J. Endocrinol. Invest. 35: 629-633, 2012) ©2012, Editrice Kurtis

INTRODUCTION

In recent years, pediatric obesity has become an important health problem. In the USA, 10.9% of children and adolescents aged 2 through 19 yr were at or above the 97th percentile of the body mass index (BMI) for age growth charts; 15.5% were at or above the 95th percentile; and 30.1% were at or above the 85th percentile of BMI for age (1). In Italy, in a population of children aged 2-6 yr, the prevalence of overweight was 16.6% and the prevalence of obesity was 8.0% (2). Obese children are prone to develop co-morbidities such as hypertension, dyslipidemia, hyperglycemia, and insulin resistance (3). Excessive weight gain between the ages of 2 and 10 yr increases the risk of adult obesity, glucose intolerance, and cardiovascular mortality (4-7). Type 2 diabetes, once rarely observed among young people, now accounts for a substantial proportion of diabetes cases in youth (4). Epidemiological studies suggest a relationship between carbohydrate intake, especially from refined food and sugar-sweetened soft drinks, and obesity incidence (8, 9). Mild caloric restriction is usually safe and effective in obese children; however, the role of specific macronutrients in the treatment of obesity is still controversial. Some studies in obese adults have shown that low-glycemic-index (LGI) diets were more beneficial for weight loss (10, 11). There are no controlled studies on the effects of low glycemic index diets on weight loss in children (12). Glycemic index indicates the relative rise in blood glucose occurring after consumption of a food containing a standard amount of carbohydrate.

The purpose of the present study was to compare the effects of two diets with similar macronutrients, but with different glycemic indexes [LGI and high-glycemic-index (HGI) diets], in a pediatric outpatient setting for 6 months. We tested the hypothesis that a LGI diet would result in greater weight loss as well as in an improvement of risk factors for cardiovascular diseases.

SUBJECTS AND METHODS

Research design and subjects

This study was a parallel-group, randomized controlled trial. Seventy consecutive overweight or obese children attending the Outpatient Weight Clinic of the Department of Pediatrics, A. Cardarelli Hospital (Naples, Italy), after a detailed explanation of the protocol to the children and their parents, were invited to participate in the study, and 26 agreed to participate in the intensive program of dietary treatment (12 males and 14 females). We defined obesity on the basis of a threshold BMI Z-score of 2.0 or more, adjusted for age and sex (13). Four children (2 in the HGI and 2 in the LGI group) had a BMI Z-score <2 and were excluded from statistical analyses. None of the children had acute or chronic disease and none were on pharmacologic therapy. None of the children’s parents reported a history of cardiovascular disease. After a run-in period of 1 month, patients were randomly allocated to one of the two diets. Clinical characteristics of the patients are reported in Table 1. There was a similar distribution of socio-economic status in the...
two groups of children as assessed by their parents' educational qualifications.

The waist circumference was measured at the level of the umbilicus and the superior iliac crest at the end of a normal expiration, while the child stood upright. BMI was calculated as the weight in kilograms divided by the height in meters squared. Measurements were converted into Z-scores of BMI for age and sex using the World Health Organization (WHO) Growth Standards (14). Systolic (SBP) and diastolic blood pressures (DBP), were measured 3 times at 1-min intervals using a standard mercury sphygmomanometer with cuffs whose bladder width was approximately 40% of the arm circumference of the examined child. The measurements were then averaged for statistical analysis.

The study was in accordance with the Ethics Guidelines of our Institutional Committee. Before initiating the study, both parents of all children provided written informed consent.

Dietary intervention

At the start of the run-in period, a nutritionist performed a quantitative and qualitative analysis of the child's food intake, based on a 3-day food record. All subjects received a hypocaloric diet that provided an energy intake 30% less than the intake sufficient to maintain the ideal weight. The low and high glyemic diets were matched for macronutrient composition: fat (25-30%), protein (15-20%), carbohydrate (50-60%), and fiber intake (0.5 g/kg). The diets prescribed were based exclusively on natural food stuffs. The glyemic index values of the foods were obtained from international tables (15). The LGI diet had a calculated GI of 60, whereas the HGI diet had a calculated GI of 90. The LGI diets, carbohydrates were derived principally from legumes, pasta, and fruits, whereas in the HGI diets carbohydrates were derived from bread, potato, rice, and fruit juice. Dietary counseling with instruction to recognize carbohydrate-rich foods and lifestyle counseling were explained by an experienced dietitian to all children and at least 1 their parents, in individual sessions, at the beginning of the study and after 15 and 30 days. The importance of both a healthy diet and glycemic index were emphasized. Adherence to the dietary treatment was assessed monthly on the basis of clinical assessments, structured interviews and 7-day food records. All nutrient calculations from 7-day dietary records were done by the dietitian with the use of a computer database of foods. The standard lifestyle and diet recommendations were provided in the form of written information. All patients received a weekly menu based on personal habits and a list of LGI or HGI foods for allowing exchanges within foods group. When subjects returned their records at the control visit, the dietitian checked the records and, if needed, modified the diet.

The patients were advised to perform the same moderate physical activity during the study. Total daily physical activity was assessed using 7-day recall questionnaire.

Laboratory analysis

Each child visited the hospital initially for a physical examination and venisection after a 12-h overnight fast. Plasma glucose, triglyceride, total cholesterol, and HDL cholesterol concentrations were measured with enzymatic assays (Roche/Hitachi 747, Roche Diagnostics GmbH, Mannheim, Germany). High-sensitivity C-reactive protein (Hs-CRP) was measured by nephelometry (BNTII, Dade Behring, Liederbach, Germany). Plasma insulin was measured with an analyzer for heterogeneous immunosays (Elecsys 2010, Roche Diagnostics). Insulin resistance was estimated by homeostasis model assessment [homeostasis model assessment (HOMA) score] and calculated with the formula described by Matthews et al. (16).

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (version 17.0, SPSS, Inc., Chicago, Illinois). The results are reported as mean±SD. In statistical analyses, Hs-CRP values were not normally distributed and were logarithmically transformed.

The differences in baseline characteristics of children in the two groups were examined using Student’s t-test for unpaired comparisons. First, we investigated within-group changes of variables before and after hypocaloric diet via crude analyses with the paired samples via Student’s t-test. Secondly, we examined between-group differences of variables or changes in variables via the Student’s t-test for unpaired comparisons. Subsequently, we developed a general linear model with the following covariates: age, sex, and each baseline value.

RESULTS

Baseline characteristics were similar between the two groups for BMI, age, and all metabolic parameters evaluated (Table 1). Self-reported data determined from the dietary records indicated good subject compliance. There were no significant differences in GI food intake between the two groups at baseline. After 2 months of the study all the subjects reached the target of a GI less than 60 for the LGI diet and approximately 90 for the HGI diet. Dietary records showed that there were no significant differences in energy, protein, fat, carbohydrate, and fiber intake between the two groups. Physical activity was similar between the two groups.

After 6 months, in both groups there was a significant decrease in BMI, SBP, DBP, and Hs-CRP, but only LGI diets produced a significant decrease in waist circumfer-