Objective  Evaluated the effects of a 10-month inpatient treatment program and implemented as a nondiet healthy lifestyle approach. In addition, the effects of two extended treatment programs were compared to a standard cognitive–behavioral treatment program for maintenance of the treatment gains.

Methods  A within-subjects design was employed to evaluate treatment outcome, including a 14-month follow-up. Children (N = 122) ranged in age from 7 to 17 years (M = 12.7 years) with a mean Body Mass Index (BMI) of 32.5, expressed as a percentage of overweight (M = 77.4%).

Results  The children lost 49.0% of their weight during the course of treatment. Comparing baseline with the 14-month follow-up, a weight loss of 31.7% was maintained. The children continued to show healthy eating behavior at follow-up, and their psychological well-being had improved. No significant interaction effects were found for the extended coping programs.

Conclusion  An inpatient cognitive–behavioral nondiet approach is a promising treatment option for childhood obesity, with lasting effects throughout the 14-month posttreatment.

Key words  treatment; children; obesity; psychological well-being.
A second aim of the present study was to evaluate whether an inpatient treatment program would succeed in having the children maintain typical eating habits without developing any form of eating disorder. Cognitive–behavior techniques (CBT) have been identified as important tools for modifying the behavior of children (Braet & Van Winckel, 2000). A CBT program implemented in an inpatient treatment protocol can teach children how to control energy intake in a flexible way. This skill can be continued after the children return to their everyday environment. Next, daily aerobic exercises are seen as helpful for controlled calorie consumption as well as an attempt to avoid loss of lean muscle tissue. Finally, extreme low-calorie diets have adverse effects in the long term and are no longer recommended (Garner & Wooley, 1991). Therefore, the diet used during the program is based on recommendations represented in the food pyramid (Retrieved December 1, 2003 from http://www.nutrition.gov). As such, the current treatment program did not focus on weight reduction but rather on teaching the children to attain a healthy lifestyle with the help of three strategies: CBT, aerobic exercise, and healthy eating habits.

Children seeking treatment for obesity have been found to display a higher prevalence of psychological problems than obese children who were not seeking treatment (Braet, Mervielde, & Vandereycken, 1997). Moreover, obesity during adolescence has been associated with unhealthy concerns about body image and eating (French, Story, & Perry, 1995). Most of these problems are considered the result of a long-term struggle against obesity. Treatment programs are therefore expected to reverse the psychological burden for children who are obese.

Another objective of the present study was to evaluate specific intervention programs for coping with binge eating, which is frequently observed in obese adults seeking treatment (Marcus, Wing, & Hopkins, 1988) and in adolescents struggling with obesity (Decaluwé & Braet, 2003). However, no weight-control programs that are successful in reducing symptoms of disordered eating are available for childhood obesity (Epstein, Paluch, Sealens, Ernst, & Wilfley, 2001). Thus, it is reasonable to assume that as long as current treatment programs for obesity fail to address binge eating, relapse is expected to occur. Since literature on coping with binge eating offers different treatment options for adult binge eaters, we decided to develop two child programs that could provide coping strategies to manage binge eating—namely, cue exposure treatment (Jansen, 1993, 1998) and cognitive therapy (Fairburn & Wilson, 1993). Jansen (1993) hypothesized that, parallel to the addiction model, the craving and excessive food intake of binge eaters is cue controlled. The model predicts that as long as binge eating is not treated with cue exposure and response prevention, no reduction of binges should be expected. Six pilot studies on cue exposure suggest good results (Jansen, 1998). According to Fairburn and Wilson (1993), dysfunctional cognitions are the core symptoms of binge eating. Because standard CBT does not specifically target the automatic thoughts of binge eaters, cognitive therapy is viewed as a necessary intervention for those with binge-eating problems. Thus, the purpose of the present study is to test the effect of two coping programs in a controlled design. These interventions were seen as extensions of the standard CBT and were predicted to improve the maintenance of weight loss after treatment.

Only a few studies focusing on children with obesity have explored age effects (Braet & Van Winckel, 2000; Epstein et al., 2001; Jelalian & Saelens, 1999). Interventions with younger children may be more effective than those done with older children for at least two reasons. First, because younger children have a shorter history of poor eating habits, it is hypothesized that they would be more open to acquiring new habits and would thus score better on eating behavioral outcome measures. Second, as long as children are still growing, energy is required for growth, and this factor affects their balance of energy in the expected direction.

To conclude, the purpose of this study is to evaluate the effectiveness of an inpatient treatment program for childhood obesity. We hypothesized that all children would lose weight and maintain a weight loss of 10% of their initial weight through a 14-month follow-up period. In addition, we hypothesized that the program would produce increased healthy eating behavior but no increased eating pathology and that the children would evidence improved psychological well-being after treatment. Furthermore, we hypothesized that children who received cue exposure treatment or cognitive therapy would be more likely to maintain their newly acquired healthy eating behavior, with younger children demonstrating better weight loss than older children.

**Method**

**Participants**

Participants were 122 patients (7-17 years) admitted to a 10-month inpatient treatment program for obesity. All children were referred by medical doctors after outpatient treatment had failed. The referees were asked to complete a written declaration specifying the medical
advice they had been given in the past and their reason for the referral. The mean age of the children was 12.7 years \( (SD = 2.3) \); the mean weight was 84.7 kg \( (SD = 19.7) \); and the mean height was 160.7 cm \( (SD = 10.9) \). The children in the present study had an average Body Mass Index (BMI) of 32.5 \( (SD = 5.3) \); range = 22–46), and their degree of obesity was 77% \( (SD = 29\% \); range = 30–155\%).

Of the children, 31% belonged to the moderately obese category (< 60\%); 28%, obese (60–80\%); and 41% seriously obese (> 80\%; World Health Organization, 1998). There were no mentally retarded children: 90% of the participants attended school in regular class rooms, and 10% received special education services. The majority of the sample was Caucasian (93\%) with 7\% of the sample African American or Asian. According to the Hollingshead Index for socioeconomic groups (Hollingshead, 1975), 30\% of parents were of lower social class; 42\%, middle class; and 28\%, upper class. The children who applied for residential care had used a broad range of strategies to lose weight: 35\% had followed at least one diet of fewer than 1,200 cal; 16\% had tried other diets; and the remaining had followed alternative strategies, such as imbibing specific teas, infrequent purging, or using laxatives. The mean duration of their obesity before starting our treatment program had been 5.5 years \( (SD = 3.4) \).

**Measures**

**Weight Parameters**

Percentage overweight was calculated for all children based on normative data of weight for height (Van Wieringen and Roede, 1985). The formula used is: \[ \text{Percentage overweight} = \left( \frac{\text{Actual Weight}}{\text{Percentile 50 (weight for height)}} \right) \times 100. \] BMI was also calculated for each child using the formula of weight/height^2. For adults, the BMI is recommended as a mean to assess the degree of obesity, but for children the World Health Organization (WHO, 1998) still recommends the weight-for-height method.

**Self-Perception Profile for Children (SPPC)**

The Self-Perception Profile for Children (SPPC; Harter, 1985; Dutch version by Veerman, Straathof, Brink, & Treflers, 1997) was used to assess the child’s self-perception and self-worth. The SPPC assesses global self-worth as well as five areas of perceived competence: academic, physical, athletic, social acceptance, and behavioral conduct \( (\alpha = .68–.79; \text{Veerman et al., 1997}) \).

**Child Behavior Checklist (CBCL)**

The Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983; Dutch version by Verhulst, Koot, Akkerhuis, & Veerman, 1990) provides T scores on several behavioral problem areas and identifies internalizing and externalizing problems. The scale has shown good reliability and validity. Test–retest reliability correlations are between .82 and .95 for the eight subscales and .93 for the Total Problem score. The CBCL was sent to the children’s home by mail.

**Dutch Eating Behavior Questionnaire (DEBQ)**

The Dutch Eating Behavior Questionnaire (DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986) includes three subscales: emotional eating, external eating, and restrained eating. The DEBQ scales have proven good internal consistency, satisfactory factorial validity, and dimensional stability (Cronbach’s \( \alpha > .90; \text{Gorman & Allison, 1995} \)).

**Eating Disorder Inventory (EDI)**

The Eating Disorder Inventory (EDI; Garner, Olmsted, & Polivy, 1983) is a self-report questionnaire that assesses the psychological characteristics common to anorexia and bulimia nervosa. Three subscales measure binge-eating pathology:

- **drive for thinness**: the subject’s preoccupation with weight and dieting;
- **bulimia**: whether the participant has episodes of uncontrollable overeating (binge eating), whether followed by purging or not; and
- **body dissatisfaction**: the subject’s conviction that specific parts of his or her body are too fat.

Williamson, Anderson, Jackman, and Jackson (1995) provided data on the EDI’s reliability (test–retest reliability was above .80, with the exception of the Maturity Fears (MF) subscale) and internal consistency (coefficient \( \alpha = .65–.93 \) in a group of 11- to 18-year-olds).

**Eating Disorder Examination (EDE)**

The Eating Disorder Examination (EDE; Fairburn & Cooper, 1993) was administered to assess the specific core psychopathology of individuals with eating disorders. Because no children’s EDE was available at the time of the study, minor modifications were made to the EDE, following Bryant-Waugh, Cooper, Taylor, and Lask (1996). The EDE contains four subscales (restraint behavior, eating concern, shape concern, and weight concern) and a list of additional questions (e.g., total number of binges per month and frequency of taking meals and in-betweens). The EDE was administered in an interview format by independent, trained psychologists. Preliminary findings on the EDE version used in
Participants

Thirty-six (36) children were selected randomly from a total of 100 participants who had enrolled the clinic in September 1996. For the following three Septembers (1997–1999), the same procedure was repeated for another 38 children per enrollment (114 total). Thus, a total of 150 children were selected; informed consent was obtained from the children and their parents. During the study, 28 children left the program (19%; 13 boys, 15 girls; by year: 6, 1996; 7, 1997; 9, 1998; 6, 1999). The mean age of those who prematurely withdrew from the study was 12.4 years. Their mean overweight at baseline was 70% and had gone down to 37% by the end of their stay. Medical files revealed that 4 children left the program at their own request but against the advice from the medical staff; 2 children were referred to a psychiatry unit because of severe emotional problems; 1 child had an accidental injury; and 21 children reached an overweight of less than 30%.

The treatment center admitted children with chronic diseases. All children were treated as inpatients, with a school associated with the center. The children were allowed to return home for the weekend twice a month. For the other two weekends and for half of the holidays, the children remained in the center. A special program was developed to meet the needs of those children who had previously failed to respond favorably to outpatient obesity treatment. A nondiet healthy lifestyle approach was chosen as the kernel of this program, centering on three major components: healthy eating habits, moderate exercises, and CBT.

Meals. The children ate three meals a day (breakfast, lunch, dinner) and two snacks. The children were encouraged to drink water, preferably up to 1.5 L a day. Each meal consisted of all necessary components as prescribed by the National Institute for Food, with a minimum of 100 g protein (33% of the total energy), 294 g carbohydrates (53% of the total energy), and 39 g fats (13.6% of the total energy). Total intake was about 1,400 to 1,600 cal per day. The norm for fiber was set at 22 g per 1,000 cal. During each meal, fruit or vegetables were offered, and the children were allowed to decide for themselves whether they wanted a small or large portion. Apart from this, no other choices were available to them. At home, the children were allowed some consumption of soft drinks and high-calorie foods, albeit in limited portions, which meant they were left to make their own choices.

Exercise. Before and after school hours, the children were encouraged to exercise. The center offers organized sports events for 2 hr per day or 10 hr a week. Apart from that, each child received 4 hr of individual guided exercises, such as swimming (1 hr per week), cycling on a home trainer (1 hr per week), jogging at their own speed, and performing abdominal exercises, with the aim being for each child to reach a heart rate that was 20% lower than his or her maximum heart rate. Although individual variations were possible, all children had facilities to take part in exercise programs for at least 14 hr per week.

Cognitive–behavioral techniques. During the first 4 months of treatment, all children received a 12-week cognitive–behavioral treatment (CBT) program, in small groups (4–6 children). As part of the CBT program, the children were taught about the energy balance as a model to understand the mechanism of obesity. To achieve lifestyle changes, the children were taught self-regulation skills, such as self-observation, self-instructions, self-evaluation, and self-reward. The children were invited to design a personal plan for managing their eating habits on the weekends. Working with the therapist, the participants learned how to evaluate their plans when faced with difficult eating situations (Braet, Van Winckel, & Van Leeuwen, 1997). Parents were seen on a 2-week basis, when they visited the center. They were requested to assist their child in adopting a new lifestyle. For this purpose, they were provided with leaflets that gave
information on how to prepare healthy food, how to organize shopping habits, and how to organize aerobic exercises.

Two Extended Programs
The protocol developed by Jansen (1993) describes in vivo exposure sessions with relevant food cues. It includes the following steps: The participant is invited to bring in the typical food that he or she finds difficult to resist; next, the participant is allowed to open up the different packages, take the food in the hands, and smell it.

During the session, it is important for the participant to concentrate on the preferred food without consuming it. Generally, this elicits a strong craving for the food. It is hypothesized that if the exposure lasts long enough, the craving for food slowly diminishes after approximately 30 to 50 min.

The cognitive protocol teaches children to analyze emotional situations with cognitive techniques, and it helps them to cope with antecedents of their problem behavior. In contrast with the standard treatment program, where only high-risk eating situations were analyzed, problem situations are now extended to a variety of problems (feelings of loneliness, feeling bad, bullying by peers). Included were relaxation exercises that the children could use to assist them in coping with emotional antecedents. The present program was a modified version of Kendall’s protocol (1990) designed for anxious children.

After receiving the standard CBT treatment for coping with obesity, the children were randomly assigned either to participate in one of the two extended coping programs or to continue the standard treatment program without the extended program. The extended programs consisted of 10 weekly sessions. They both started in Month 5 of the treatment and ended in Month 8. To control for therapist effects, the same therapists lead different treatment programs. Treatment sessions were held in small groups. All treatment sessions were audiotaped to check for treatment integrity. Adherence to the treatment protocol was also evaluated in supervision sessions. Children who were allocated to the standard treatment protocol received 10 weekly personalized booster sessions during Months 5 to 8 so that all children received the same amount of individual attention.

Results

Overview of the Statistical Analyses
A multivariate repeated measures design was employed for analyzing the data. Because several subscales of the instruments are correlated, thus leading to possible interdependencies between the tests, a series of analyses was conducted using a doubly multivariate repeated measures approach for the SPPC, the CBCL, and the eating pathology measures (EDE, DEBQ, EDI).

Each analysis employed the same design consisting of one within-subject factor (Time) and four between-subject factors (Group × Gender Category × Age Category × Binge Status). Because of the limited sample size, four-way interactions were omitted from the model. The primary focus of the analyses was the effect of time. If significant effects were found, pairwise contrasts were conducted comparing pretreatment and posttreatment, as well as pretreatment and follow-up. Next, interaction effects between the Time factor and the four between-subject factors were inspected.

Missing Data
Analyses were conducted on all baseline variables, comparing those who did not complete the 10-month treatment (n = 28) with those who did complete the treatment (n = 122). No significant differences were found for age; obesity; or scores on the DEBQ, EDE, EDI, CBCL, and SPPC. Because it was the aim of this study to focus on those children who completed the entire program, no further analyses were conducted on the data of those who terminated prematurely. At 14-month follow-up, all children were invited to come back to the center; however, 6 refused and 6 proved untraceable. T tests were conducted on all outcome measures, comparing the follow-up dropouts (n = 12) with those who participated in the follow-up (n = 110). Follow-up dropouts obtained a significantly higher score on body dissatisfaction, t(120) = 2.39, p < .05, and on drive for thinness, t(120) = 2.12, p < .05. No other differences were found. All analyses that included psychological questionnaires were conducted for those participants who completed data at all assessment points (n = 89).

For the different samples in this study, a priori power analysis can be computed for different effect sizes (Cohen, 1988). Since we expected to find medium effects (f = .25), it was calculated that the dropouts would have little effect on the main analyses.

Baseline Comparisons
Baseline differences between the participants who were allocated to a standard treatment program with or without an extended program were analyzed using one-way analyses of variance. No significant differences were found between the three groups.
Main Effect of the Within-Subject Time Factor
For the primary outcome variable of percentage overweight, the multivariate repeated measures analysis revealed a significant effect of the within-subject Time factor, $F(2, 89) = 231.88, p < .001$.

Further, the multivariate repeated measures analyses revealed a significant main effect of the within-subject Time factor for the measures of psychological well-being, as reported on the SPPC, $F(12, 58) = 4.51, p < .001$; the CBCL, $F(6, 33) = 3.18, p < .01$ (see Table I); for eating pathology, $F(20, 46) = 4.88, p < .001$ (see Table II); as well as several interaction effects (see the following section).

Weight Evolution and Psychological Well-being Pre- to Posttreatment
Contrast analyses comparing pretest and posttest data revealed that the children lost a significant percentage of weight (49%, SD = 22.9; range = 0–113%). Their BMI

Table I. Mean Scores (and Standard Deviations) on Measures of Psychological Well-Being and Weight Parameters for Obese Children Who Completed the Treatment Program

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Pre- vs. posttest</th>
<th>14-mo. follow-up</th>
<th>Pre- vs. follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overweight (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 110</td>
<td>175.8 (28.0)</td>
<td>126.8 (17.2)</td>
<td>461.95***</td>
<td>144.1 (22.9)</td>
<td>145.40***</td>
</tr>
<tr>
<td><strong>Body Mass Index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 110</td>
<td>32.2 (5.2)</td>
<td>23.6 (3.9)</td>
<td>426.31***</td>
<td>27.3 (4.7)</td>
<td>101.02***</td>
</tr>
<tr>
<td><strong>Weight (kg.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 110</td>
<td>84.1 (20.0)</td>
<td>63.5 (15.2)</td>
<td>330.46***</td>
<td>76.7 (6.1)</td>
<td>24.41***</td>
</tr>
<tr>
<td><strong>Height (cm.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 110</td>
<td>161.1 (10.9)</td>
<td>162.8 (10.8)</td>
<td>168.41***</td>
<td>166.7 (10.1)</td>
<td>323.23***</td>
</tr>
<tr>
<td><strong>Psychological well-being</strong></td>
<td>n = 89</td>
<td>n = 89</td>
<td>F value (1, 69)</td>
<td>F value (1, 69)</td>
<td></td>
</tr>
<tr>
<td>SPPC—school</td>
<td>2.4 (0.6)</td>
<td>2.4 (0.7)</td>
<td>&lt;1.5</td>
<td>2.6 (0.6)</td>
<td>7.05**</td>
</tr>
<tr>
<td>SPPC—social</td>
<td>2.6 (0.7)</td>
<td>2.8 (0.7)</td>
<td>3.28</td>
<td>2.9 (0.7)</td>
<td>11.95***</td>
</tr>
<tr>
<td>SPPC—global</td>
<td>2.4 (0.7)</td>
<td>2.7 (0.7)</td>
<td>16.29***</td>
<td>2.7 (0.7)</td>
<td>17.30***</td>
</tr>
<tr>
<td>SPPC—behavior</td>
<td>2.6 (0.6)</td>
<td>2.7 (0.6)</td>
<td>3.18</td>
<td>2.7 (0.5)</td>
<td>&lt;1.5</td>
</tr>
<tr>
<td>SPPC—athletic</td>
<td>2.1 (0.5)</td>
<td>2.5 (0.6)</td>
<td>15.59***</td>
<td>2.5 (0.6)</td>
<td>22.53***</td>
</tr>
<tr>
<td>SPPC—physical</td>
<td>1.8 (0.7)</td>
<td>2.3 (0.8)</td>
<td>33.41***</td>
<td>2.2 (0.8)</td>
<td>23.27***</td>
</tr>
<tr>
<td><strong>Parental report</strong></td>
<td>n = 72</td>
<td>n = 72</td>
<td>F value (1, 38)</td>
<td>F value (1, 38)</td>
<td></td>
</tr>
<tr>
<td>CBCL—internalizing</td>
<td>59.0 (12.0)</td>
<td>54.0 (12.1)</td>
<td>13.69***</td>
<td>53.9 (11.3)</td>
<td>7.16**</td>
</tr>
<tr>
<td>CBCL—externalizing</td>
<td>53.8 (10.7)</td>
<td>52.9 (10.3)</td>
<td>3.53</td>
<td>56.5 (11.8)</td>
<td>&lt;1.5</td>
</tr>
<tr>
<td>CBCL—total</td>
<td>58.8 (11.0)</td>
<td>53.6 (12.3)</td>
<td>17.70***</td>
<td>56.5 (11.5)</td>
<td>5.97**</td>
</tr>
</tbody>
</table>

SPPC = Self-Perception Profile for Children; CBCL = Child Behavior Checklist.
*p < .05.
**p < .01.
***p < .001.

Table II. Means (and Standard Deviations) on Measures of Eating Pathology for Obese Children Who Completed the Treatment Program

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Pre- vs. posttest</th>
<th>14-mo. follow-up</th>
<th>Pretest vs. follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 89)</td>
<td>(n = 89)</td>
<td>F value (1, 63)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EDI—drive for thinness</strong></td>
<td>7.4 (3.1)</td>
<td>6.0 (5.0)</td>
<td>5.21*</td>
<td>5.6 (5.2)</td>
<td>13.26***</td>
</tr>
<tr>
<td><strong>EDI—bulimia</strong></td>
<td>3.1 (4.0)</td>
<td>2.3 (3.8)</td>
<td>6.59**</td>
<td>1.2 (2.1)</td>
<td>19.10***</td>
</tr>
<tr>
<td><strong>EDI—body dissatisfaction</strong></td>
<td>15.2 (6.4)</td>
<td>11.6 (8.0)</td>
<td>13.39***</td>
<td>12.4 (8.4)</td>
<td>33.65***</td>
</tr>
<tr>
<td><strong>DEBQ—emotional eating</strong></td>
<td>2.4 (1.0)</td>
<td>2.4 (1.0)</td>
<td>&lt;1.5</td>
<td>2.2 (0.9)</td>
<td>&lt;1.5</td>
</tr>
<tr>
<td><strong>DEBQ—external eating</strong></td>
<td>3.0 (0.9)</td>
<td>2.7 (0.7)</td>
<td>11.21***</td>
<td>2.6 (0.7)</td>
<td>7.97**</td>
</tr>
<tr>
<td><strong>DEBQ—dietary restraint</strong></td>
<td>2.7 (0.7)</td>
<td>3.1 (0.8)</td>
<td>8.11**</td>
<td>3.0 (0.8)</td>
<td>3.85*</td>
</tr>
<tr>
<td><strong>EDE—eating concern</strong></td>
<td>1.1 (1.1)</td>
<td>0.7 (0.8)</td>
<td>10.71**</td>
<td>0.5 (0.8)</td>
<td>13.46***</td>
</tr>
<tr>
<td><strong>EDE—weight concern</strong></td>
<td>2.5 (1.2)</td>
<td>1.8 (1.0)</td>
<td>25.34**</td>
<td>1.6 (1.2)</td>
<td>28.95***</td>
</tr>
<tr>
<td><strong>EDE—shape concern</strong></td>
<td>2.5 (1.4)</td>
<td>1.5 (1.2)</td>
<td>42.01***</td>
<td>1.5 (1.2)</td>
<td>29.94***</td>
</tr>
<tr>
<td><strong>EDE—restraint eating</strong></td>
<td>1.0 (0.9)</td>
<td>1.3 (0.9)</td>
<td>&lt;1.5</td>
<td>1.0 (0.9)</td>
<td>&lt;1.5</td>
</tr>
<tr>
<td><strong>EDE—binges per month</strong></td>
<td>9.8 (16.1)</td>
<td>1.0 (3.5)</td>
<td>12.30***</td>
<td>0.7 (2.5)</td>
<td>10.27***</td>
</tr>
</tbody>
</table>

EDI = Eating Disorder Inventory; DEBQ = Dutch Eating Behavior Questionnaire; EDE = Eating Disorder Examination.
*p < .05.
**p < .01.
***p < .001.
was reduced by 8.6. The mean amount of weight loss was 20.6 kg. Over the course of the treatment, the children grew, on average, 1.7 cm.

Significant effects were found for global self-worth, athletic competence, and physical appearance. A significant reduction in general psychopathology was found on the total subscale as well as on the internalizing scale.

**Weight and Psychological Well-Being: Maintenance Through the 14-Month Follow-Up**

Comparing pretest and follow-up scores, contrast analyses revealed that the children still had lost a significant percentage of weight (31.7%, $SD = 24.7$; range = −33–100%). Their BMI was reduced by 4.9. The amount of weight loss was 7.4 kg, and the children had grown an average of 5.6 cm. Of the children, 82% still lost 10% or more of their weight.

To limit statistical bias in the follow-up caused by study dropouts ($n = 12$), an intention-to-treat analysis was completed for the primary outcome variable to determine how substantially study dropouts affected the results. The results remained unchanged.

In comparison with the pretest, analyses on measures of psychological well-being showed a significant improvement for school competence, social competence, global self-worth, athletic competence, and physical appearance. A significant decrease in general psychopathology was found on the total subscale and for internalizing problems. All analyses revealed maintenance of posttreatment gains.

**Measures of Eating Pathology: Pre- to Posttreatment**

Significant improvement was found for drive for thinness, bulimia, body dissatisfaction, external eating, eating concern, weight concern, and shape concern. The DEBQ restrained eating score increased, whereas the score for EDE restrained eating remained unchanged. The total number of binges reduced significantly. At follow-up, 19% of the youngsters suffered at least one binge per month; 1% maintained the diagnosis of BED; and 1% now met the criteria for bulimia nervosa.

Four parameters of healthy eating behavior were analyzed based on the EDE interview at follow-up. The frequency of breakfast increased in comparison with baseline, $p < .01$, whereas the frequency of lunches was unchanged. Finally, the frequency of evening meals and the frequency of snacks both decreased ($p < .05$).

**Interaction Effects**

First, the overall patterns found by the doubly multivariate repeated measures analyses are reported. Subsequently, interaction effects found for particular dependent variables are reviewed in detail.

A two-way interaction effect ($Time \times Gender Category$) was found for the weight variable, $F(2, 89) = 4.38$, $p < .01$; for psychological well-being, $F(12, 58) = 2.07$, $p < .05$; and for eating pathology, $F(20, 46) = 1.78$, $p < .05$. A two-way interaction effect ($Time \times Age Category$) was found for the weight variable, $F(4, 180) = 2.81$, $p < .05$; and finally, a two-way interaction effect ($Time \times Binge Status$) was found for eating pathology, $F(20, 46) = 2.50$, $p < .01$. However, no interaction effects of $Time \times Group$ were found. Thus, no differential effect for the extended treatment programs was found when compared with the standard treatment program. Several three-way interaction effects were obtained, although they did not invariably lend themselves to a straightforward interpretation. A $Time \times Group \times Gender Category$ effect was obtained for eating pathology, $F(40, 92) = 1.58$, $p < .05$. A $Time \times Group \times Age Category$ effect was found for eating pathology, $F(80, 184) = 1.466$, $p < .01$; and for psychological well-being, $F(48, 244) = 1.45$, $p < .05$. No $Time \times Group \times Binge Status$ effect was found.

**Gender Differences**

Analyses revealed a $Time \times Gender$ interaction for restraint eating, $p < .01$, and for weight concern, $p < .05$, in
favor of males. Time × Group × Gender effects (all p < .05) were revealed for drive for thinness, restrained eating, global self-worth, and social competence. Boys attained more positive scores on all these measures in the treatment condition with a supplementary cue exposure, whereas girls benefited more from cognitive therapy.

**Age Differences**

Inspection of the means revealed that the youngest children lost the largest amount of weight. With regard to eating pathology and psychological well-being, analyses revealed Time × Group × Age Category interaction for social competence, p < .01; bulimia, p < .05; and body dissatisfaction, p < .001. Younger children demonstrated more improvement on these measures after the cue exposure intervention, whereas older children profited more from cognitive therapy.

**Bingers and Nonbingers**

Children who suffered from binges at baseline (56%) were compared to those who never had a binge (44%). For overweight and psychological well-being, no interaction effects were obtained. For eating pathology only, Time × Binge Status interaction effects were found for bulimia, F(2, 68) = 9.40, p < .001; body dissatisfaction, F(2, 68) = 3.80, p < .05; shape concern, F(2, 68) = 3.68, p < .05; and number of binges, F(2, 68) = 10.96, p < .001. In comparison with nonbingers, bingers evidenced improvement on all these measures and were normalizing their scores except for body dissatisfaction, where nonbingers displayed the largest effect. Moreover, a Time × Group × Binge Status interaction was found on the bulimia scale, p < .001. Bingers showed a higher level of improvement on this measure after supplementary cue exposure.

**Discussion**

Children who participated in a 10-month multicomponent inpatient treatment program lost a significant amount of their weight during their stay and maintained a loss up to 31.7% at the 14-month follow-up. Of these participants, 82% had reached the goal of 10% weight reduction. The effect of this result is estimated as f = 1.3. The long-term outcome is particularly encouraging, compared with the poor long-term results obtained by adult weight-control programs (Jefferey et al., 2000).

In addition, the children in this investigation evidenced enhanced psychological well-being at posttest. At the 14-month follow-up, their self-esteem continued to evidence improvement on scales associated with obesity. Moreover, a significant increase on school competence was found. One possibility is that, because of their enhanced global self-worth, the participants subsequently exhibited greater feelings of self-efficacy, which may be generalizable to other domains of their lives. At follow-up, the parents continued to report a reduction in emotional problems. Thus, the data in this investigation suggest that it may be possible to reverse the psychological problems associated with childhood obesity.

The treatment program did not concentrate solely on weight reduction; rather, it encouraged the children to acquire a healthy lifestyle. In this investigation, 6% of the participants were found to suffer from an eating disorder at posttreatment. This is low albeit comparable with the prevalence rate in this age group (Epstein et al., 1994). At the 14-month follow-up, there was a continued reduction on various measures of eating pathology; however, restrained eating increased, as measured with the DEBQ. A possible explanation is offered by Birch and Fisher (1998), who demonstrated that the more the environment displays control in children’s feeding behaviors, the more the child shows dysfunctional eating attitudes. Yet a closer inspection of the items of the DEBQ reveals that the restrained scale refers to rather healthy coping strategies for overweight persons (e.g., eating less than what they want to eat, saying no to sweets). Thus, it is questionable if the increase on the DEBQ is dysfunctional. It is hypothesized that for children with obesity, an elevated score on restrained eating may be suggestive for an adaptive strategy developed by the children to maintain weight control.

Some important gender differences were found. Boys achieved higher weight loss, demonstrated improved self-reported physical appearance, and evidenced less eating pathology. The literature provides no clear explanations regarding why boys should profit more from weight-loss interventions than girls. Given that the environmental factors during inpatient treatment were strictly controlled, one possible explanation is a potential biological susceptibility protecting weight loss in girls. Clearly, this hypothesis is in need of further research. Epidemiological studies have revealed a gender-different manifestation in weight gain (Dietz, 1998b). It is advisable for future treatment intervention programs to devote greater attention to these gender differences. Indeed, the cultural pressure to be thin is particularly intense for women (Horm & Anderson, 1993). Given that they lose less weight, it is possible that overweight girls will especially experience more dissatisfaction and failure than will boys (Garner & Wooley, 1991).
As expected, children under the age of 12 years lost the most amount of weight. The evidence in recent literature (Epstein et al., 1994) demonstrates that as long as children are growing, high weight-loss effects can be expected. However, a closer inspection of the data shows that the youngest children were slightly more overweight at entrance to the study, which resulted in an overweight status of 47% at follow-up, whereas the older-age children ended with an overweight status of 41% at follow-up. Thus, children of all age categories may profit from inpatient treatment. This is of particular interest because there have been no rigorously controlled trials documenting that weight-loss intervention programs for adolescents are effective, although some of them are categorized as “promising” (Jelalian & Saelens, 1999).

No firm conclusions can be made regarding the value of the extended coping programs. One factor that may have underestimated the significant effects obtained is low power. Because we assumed that differences between the groups would be moderate, we expected a medium effect (f = .25). Given a power of .80 (acceptable), we needed 159 participants. However, to detect large treatment effects, we would have needed 969 participants to detect between-group effects. Clearly, the current sample size was insufficient to detect subtle differences between the three treatment conditions.

It may well be worthwhile speculating whether we need different treatment programs for different groups of children. The present data indicate that young children especially benefit from the effects of extinction after cue exposure, probably due to a shorter learning history of disordered eating, whereas children aged 12 to 14 seem to demonstrate better results when cognitive therapy is added, a factor likely due to enhanced cognitive capacities. However, these explanations must be considered preliminary. Further research is clearly indicated.

It is necessary to examine our data more closely and to find caveats that temper our conclusions. At the 14-month follow-up, the children were still 44.1% overweight. In most studies, including ours, children who attend a treatment program do not lose all of their weight, which most families find difficult to accept. Therefore, modest weight prognoses should be made, and the rationale of weight control needs to be emphasized. In the future, treatment should include additional techniques aimed at developing a greater tolerance for more gradual weight loss.

Inpatient treatment programs vary considerably in length. Boeck et al. (1993) reported a mean stay of 8 months, although some children left the program earlier and others stayed for 21 months. For practical reasons (school requirements), a 10-month program was designed, though not all children may require a treatment course of this duration. This will be subject to further investigation aimed at determining which children are in need of the full program and which are best served with a shorter program.

One disadvantage of studying multicomponent treatment programs in childhood obesity is that we do not know the specific ingredients that should be incorporated in such programs. Apart from the exercise program, we expected controlling the food environment of the child to be quite effective. Moreover, during inpatient treatment, the children are enabled to really practice their CBT techniques that will contribute to their adoption of a new lifestyle. However, it is uncertain if inpatient treatment is necessary to create such optimal conditions. For those who question the feasibility of a 10-month inpatient care program, adapted formats based on the same principles require further study. The lifestyle approach could be integrated into day treatment programs. Another possibility would be to create “healthy schools.” Here, positive attitudes toward weight control for all children could be addressed as part of the overall school policy. Several school interventions studies are ongoing, with some demonstrating encouraging results (Müller, Asbeck, Mast, Langnäse, & Grund, 2001; Sahota, Rudolf, Dixey, Hill, Barth, & Cade, 2001).

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References


