Prediction of Treatment Outcome by Prae-Treatment Eating Characteristics in Overweight Children

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Abstract

Background: Obesity in children is a major health problem showing growing prevalence rates. Prediction of treatment outcome with respect to body weight and psychosocial criteria has not considered prae-treatment eating characteristics so far. The present study provides data on prediction of outcome for a multimodal therapy with obese girls.
Methods: Sixty-four girls with a mean BMI of 28.3 and a mean age of 12.2 years were studied before and after treatment. Characteristics of eating behaviour and psychosocial outcome (depression, self-esteem) were measured by standardised and validated German questionnaires. Regression analyses were conducted to predict outcome from prae-treatment variables.
Results: Stress-induced eating and restrained eating before treatment significantly predicted post-treatment BMI (p<.006). Restrained eating before treatment was also a significant predictor of post-treatment % overweight (p<.02). Post-treatment depression and self-esteem were best predicted by prae-treatment stress-induced eating (p<.001; p<.005). BMI before treatment was only able to predict body weight after treatment, but not psychosocial outcome.
Conclusion: The results point to the significance of stress-induced and restrained eating in obese girls. They suggest paying special attention to the modification of these eating habits in intervention programs (German J Psychiatry 2011; 14: 40-45).

Keywords: overweight, children, eating characteristics, prediction, treatment outcome

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Introduction

The prevalence of overweight and obesity in children is increasing. In Germany prevalence rates in the ages 7 to17 are approximately 16% for overweight and 7.5% for obesity (Robert Koch Institut, 2003).

The current treatments of choice are multimodal intervention programs, most of them including three main components (Dietz, 2010), including nutritional management, which aims at weight loss, with following stabilisation of weight by long-term modification of quality of food intake (i.e., proportion of macronutrients, in particular reducing intake of fat and sugar), exercise which aims to increase energy expenditure, body fitness and muscles, but also is related to psychological well-being, cognitive behavioural therapy which aims to stabilise new learned dietary habits and promotes coping with psychological and psychosocial consequences of obesity. The short and long-term outcome of such programs for children has been evaluated as good with respect to weight but also with regard to psychosocial criteria (Luttikhuis et al., 2009).

However, only few studies report on pretreatment characteristics of children that are related to treatment outcome in terms of body weight or psychosocial outcome criteria (Madsen et al., 2009; Goossens et al., 2009a). Because a main goal of treatment is to promote weight loss or at least weight maintenance by establishing healthy eating behaviours, eating habits before treatment are of particular interest with respect to their influence on treatment outcome.

A recent German survey shows that nutritional intake patterns significantly differ between obese and normal weight children. This can partly be explained by psychological factors such as emotional eating and cognitive regulation of food intake (Lanfer et al., 2010). In a prospective design the present study uses prae-treatment characteristics of obese

Table 2: Results of regression analysis for prediction of post-treatment BMI

Pretreatment Predictor	Standardized Regression coefficient	Partial Correlation	Significance Level 2-tailed
Stress-induced eating	.41	.37	.003
Cognitive control of food intake	.28	.30	.02
Sensitivity for external eating stimuli	-.25	-.23	n.s.
Dependency of well-being from eating /body weight	.06	.07	n.s.

Regression model global test: $F_{(4/63)} = 4.2$; $p < .006$

children's eating behaviour to predict anthropometric and psychosocial outcome measures after a structured multimodal treatment program.

Method

Sample and treatment

Sixty-four girls with a mean age of 12.2 ± 1.8 years and a mean BMI of 28.3 ±4.1 were studied. Mean percent overweight before treatment was 154.8 ± 18.6. All girls were treated in an outpatient research unit of the University of Trier. Treatment was provided in a group format for 8 to 10 girls. The intervention program followed a structured manual and lasted 3 months. This multimodal treatment program is described in detail in Lehrke and Laessle (2009). The evaluation of this program for overweight children showed beneficial prae-post and pre-follow up effects with regard to anthropometric as well as psychosocial outcome criteria (Lehrke and Laessle, 2010).

Assessment

Characteristics of eating behaviour before treatment were assessed by the "Inventar zu Essverhalten und Gewichtsproblemen", a German questionnaire, which has well-established psychometric properties (IEG-Kind, Diehl. 1999). Among others, this instrument provides scales to measure

- *Stress-induced eating*: High values on this scale indicate that the child is likely to compensate emotional stress with overeating
- *Cognitive control of food intake (restrained eating)*: High values on the scale indicate that the child tries to regulate its food intake according to cognitive standards (e.g. strict

calorie limits per day) instead of using physiological signals (perception of hunger and satiety)

- *Sensitivity for external eating stimuli:* High values on this scale indicate that the child frequently has feelings of hunger, so that food intake is easily stimulated by external cues such as viewing or smelling food stuff
- *Dependency of well-being from eating and body weight:* High values on this scale indicate that well-being and self-confidence of the child is influenced to a high degree by eating and weight problems

Because depression and self-esteem ratings are recommended as important and meaningful psychosocial outcome criteria in treatment studies of obese children (Luttikhuis et al., 2009), these two variables were selected for the present analysis. Before and after treatment, depression was measured by the "Depressionsinventar für Kinder und Jugendliche" (DIKJ; Stiensmeier-Pelster et al., 2002). Self-esteem was assessed by a subscale of the "Persönlichkeitsfragebogen für Kinder" (Seitz & Rausche, 1992). The scale is negatively poled; higher values mean lower self-esteem.

Statistical analysis

Multiple regression was used to predict post-treatment outcome variables from the four prae-treatment eating variables. For each criterion, a global test for the regression model as a whole was done which had to be significant at least at the 10% level. In addition, tests for the single predictors were conducted, calculating standardised regression coefficients and partial correlations. For the analysis the statistical package for the social sciences (SPSS 17) was used.

Results

The changes in body weight and weight related outcome are shown in Table 1. All these variables resulted in significant changes after the treatment program.

The coefficients of the regression analysis to predict post-treatment BMI are depicted in Table 2. Stress-induced eating and cognitive control of food intake before treatment were both significantly positive related to a higher BMI after treatment, whereas the scales "sensitivity for external eating stimuli" and "dependency of well-being from eating" did not show significant predictive value.

The coefficients of the regression analysis to predict post-treatment percent overweight are shown in Table 3. Percent overweight is the BMI deviation of the mean referring to the age and sex matched distribution of Must et al. (1991). For this outcome measure cognitive control of food intake was the only significant predictor. The higher the cognitive control of food intake before treatment, the higher was the percentage of overweight after therapy.

Table 1: Changes in weight parameters from prae to post treatment (means ± SD)

	Prae-treatment	Post-treatment	p
Weight (kg)	70.2 ± 15.1	69.2 ± 15.0	< .03
BMI (kg/m^2)	28.3 ± 4.0	27.2 ±4.0	<.001
% Overweight	154.8 ± 18.6	148.0 ±19.1	<.001

Table 2: Results of regression analysis for prediction of post-treatment BMI

Pretreatment Predictor	Standardized Regression coefficient	Partial Correlation	p
Stress-induced eating	.41	.37	.003
Cognitive control of food intake	.28	.30	.02
Sensitivity for external eating stimuli	-.25	-.23	n.s.
Dependency of well-being from eating /body weight	.06	.07	n.s.

Regression model global test: F (4/63) = 4.2; p<.006

Table 3: Results of regression analysis for prediction of post-treatment % overweight

Pretreatment predictor	Standardized regression coefficient	Partial correlation	p
Stress-induced eating	.18	.16	n.s.
Cognitive control of food intake	.30	.30	.019
Sensitivity for external eating stimuli	-.15	-.13	n.s.
Dependency of well-being from eating /body weight	.14	.13	n.s.

Regression model global test: F (4/63) = 2.2; p<.08

The coefficients of the regression analysis to predict post-treatment depression are shown in Table 4. High values on stress-induced eating significantly predicted a high depression level after treatment. If a child's well-being was very dependent from eating and weight before treatment, depression scores after therapy were lower.

The coefficients of the regression analysis to predict post-treatment self-esteem are shown in Table 5. The only significant predictor was stress-induced eating, where high values before treatment were related to lower self-esteem after the intervention program.

The BMI before entering treatment has been found to be a strong predictor of weight related outcome in treatment studies of obese children (Goossens et al., 2009a).

The predictive value of prae-treatment behaviourally and cognitively oriented characteristics of obese children with regard to post-treatment body weight has not yet been considered. Furthermore, to our knowledge, no data are available comparing predictive power of BMI and prae-treatment eating characteristics with regard to psychological treatment outcome (Table 6).

As expected, BMI before treatment was the strongest predictor for weight after the intervention program. But the scales, measuring eating behaviour before treatment, also enabled significant prediction of the weight at the end of treatment, although with a markedly lower R square. No predictive power at all for BMI was found for the outcome variables depression and self assertiveness, whereas eating behaviour scales contributed significantly.

Discussion

This study has several limitations that warrant some caution when interpreting the data. The sample size was relatively small. Although we found significant effects, the analysis should be replicated in a larger sample of obese children. The prediction was done only with regard to short term outcome. Whether the predictors are also valid in the long-term, cannot be concluded straightforward from the present data. Sex differences in the predictive value of prae-treatment eating characteristics could not be taken into account. Therefore, no definite conclusions are possible, whether boys and girls share the same predictors for treatment outcome. The effect sizes for the predictors of treatment outcome were rather small (although statistically significant) and at best medium, indicating an only low impact of these eating characteristics. This might be due to the questionnaire measurement of stress-induced eating and restrained eating, giving no direct behavioural data. A laboratory test of stress-induced eating behaviour as has been used for example by Lindel and Laessle (2002) is possibly of greater predictive power than exclusively questionnaire data.

In addition, weight loss during treatment was not very large. This also might explain the low correlations between predictors and the outcome. Keeping these limitations in mind, our data elucidate the importance of prae-treatment eating characteristics in obese children, when trying to predict treatment success.

Unfavourable outcome in terms of a high absolute BMI and a high degree of overweight after treatment could be best predicted by frequent "stress-induced eating" and strong cognitive efforts to restrict food intake. When looking at the psychosocial outcome criteria self-esteem and depression, there was no predictive significance of restrained eating before treatment, but mainly of stress-induced eating. When comparing the predictive power of prae-treatment BMI and prae-treatment eating, BMI was only meaningful to explain body weight after treatment, but had no significance with regard to psychosocial outcome. Our data on restrained eating as a predictor are supported by Goossens et al. (2009a) in a sample of 132 obese youngsters.

Table 4: Results of regression analysis for prediction of post-treatment depression

Prae-treatment predictor	Standardized regression coefficient	Partial cor-relation	p
Stress-induced eating	.51	.46	.001
Cognitive control of food intake	-.009	-.01	n.s.
Sensitivity for external eating stimuli	.08	.08	n.s.
Dependency of well-being from eating /body weight	-.26	-.27	.03

Regression model global test: F (4/63) = 6,2; p<..001

Table 5: Results of regression analysis for prediction of post-treatment self-esteem

Prae-treatment predictor	Standardized regression coefficient	Partial cor-relation	p
Stress-induced eating	.41	.37	.004
Cognitive control of food intake	.06	.07	n.s.
Sensitivity for external eating stimuli	.10	.09	n.s.
Dependency of well-being from eating /body weight	-.19	-.19	n.s.

Regression model global test: F (4/63) = 3.9; p<.008

Table 6: Predictive power (R square) of prae-treatment BMI and four scales measuring prae-treatment eating, taken together

	BMI post-treatment	% Overweight post-treatment
BMI prae-treatment	.90 (p=.0001)	.68 (p=.0008)
Eating behavior scales prae-treatment	.22 (p=.005)	.13 (p=.07)

	Depression post-treatment	Self-esteem post-treatment
BMI prae-treatment	.01	.10
Eating behavior scales prae-treatment	.30 (p=.0001)	.21 (p=.007)

Additional support comes from Braet (2006), where both restrained eating and stress-induced eating significantly predicted a higher BMI at post-treatment. One study could not find a predictive role of prae-treatment eating behaviour (Madsen et al., 2009). This study, however, was conducted with a relatively broad age group (8–19 years) and an un-structured lifestyle modification program, so that this analysis does not necessarily reject our results.

Our results on the predictive significance of stress-induced eating for a high degree of depression after treatment are supported by the data of Goossens et al. (2009b) in a sample of 188 overweight children and adolescents. Stress-induced eating has also been found as a predictor of low self-esteem in a study of Brehm et al. (2003), treating 57 girls in a multi-modal program.

In our sample we identified stress-induced eating and restrained eating as significant predictors of unfavourable treatment outcome in obese children. Both behaviours have been frequently found in that population, and therefore there seems to be an urgent need to modify these habits during treatment. The predictive significance of stress-induced eating for weight related outcome may in part be explained by stress related changes in the microstructure of eating. This terminus refers to intake parameters that can be measured in laboratory meals and which describe for example eating rate, acceleration of eating rate or size of spoon portions. (see Hubel et al., 2006 for a detailed description).

Stress-induced eating in obese is correlated to changes in the microstructure of eating that lead to a high calorie intake. This has been shown in clinical samples of adults (Laessle & Schulz, 2009), but also in obese children (Barkeling et al., 1992). If the obese children showed the stress-related aberrations in the microstructure of eating already before treatment, they are likely to react in the same way after therapy and the increased calorie intake is then the cause for a higher BMI.

With regard to restrained eating, 3 studies show significantly higher values in the obese. Braet & Wydhooge (2000) compared 745 normal weight and overweight children, mean aged 10,6 years. Obese girls showed the highest mean value on the DEBQ scale "dietary restraint". The same result with the same instrument is reported by Braet and Van Strien (1997) in a sample of 292 children. Further support comes from a recent study of Shunk & Birch (2004) in 9-year old girls.

Two studies showed differences in stress-induced eating between obese and normal weight children. The obese children had significantly higher values in a study of Diehl (1999) as well as in the study of Braet & van Strien (1997).

The predictive significance of restrained eating for a higher body weight after treatment may be explained by biological mechanisms. If an obese child was practising restrained eating to a high degree before treatment, this has probably lowered resting metabolic rate. A low resting metabolic rate promotes weight gain or at least weight maintenance. In restrained eaters a significantly decreased resting metabolic rate has been shown (Platte et al., 1996); Laessle & Kikker, 2008), and the degree of restrained eating in our sample at post-treatment was as high as it was before therapy (prae: 62.8±21.6; post: 65.5±21.0).

How to explain the predictive significance of stress-induced eating for depressive symptoms and low self-esteem after treatment? Stress-induced eating in overweight children often implies loss of control over eating (Goossens et al.,

2009b), which in turn may activate feelings of guilt and self blame. These are core symptoms of depression and also contribute to low self-esteem.

In the obese girls a high dependency of well-being from their eating behaviour and weight before treatment predicts lower depression scores after the intervention program. The therapy aims to reduce this irrational dependency and instead focuses on other strengths of the girls' personality. For the program we have shown that self-esteem was markedly improved at the end (Laessle & Lehrke, 2009), so that positive influences on depression could be expected.

Clinical implications

Stress-induced eating and restrained eating were identified as predictors of unfavourable outcome in obese children.

Although most of the current treatment programs for obese children (for example Warschburger et al. 2002) contain some training in coping with stress situations, such an intervention element may be too unspecific and does not necessarily modify uncontrolled eating behaviour as a reaction to compensate negative emotions (Goossens et al., 2009b). Concluding from our present data we recommend as a core feature of overweight children's treatment a specific eating-related stress management training. In part, this is realised in our own manual, but the success of such stress specific interventions in obese children has also been shown by others (Braet et al., 2004).

When regarding the restrained eating behaviour of the children, two features have to be considered, namely rigid control and flexible control (Westenhöfer, 1991). In treatment programs for obese children it is not recommended to give up control over eating completely, but rather to change from rigid control strategies to flexible control as an ultimate treatment goal.

This has further positive implications because restrained eating in the form of rigid cognitive control efforts is seen to be a risk factor for eating disorders such as binge eating disorder already in childhood (Hilbert, 2005).

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