

## PAPER

# Predictors to success in outpatient training in obese children and adolescents

T Reinehr<sup>1\*</sup>, K Brylak<sup>1</sup>, U Alexy<sup>2</sup>, M Kersting<sup>2</sup> and W Andler<sup>1</sup>

<sup>1</sup>Vestische Kinderklinik Datteln, University of Witten-Herdecke, Datteln, Germany; and <sup>2</sup>Research Institute of Child Nutrition, Dortmund, Germany

**OBJECTIVE:** The treatment of obese children and adolescents is not yet satisfactorily effective. It is not clear which participants can profit by a long-time outpatient therapy.

**DESIGN:** Longitudinal, clinical intervention study based on a 1-y outpatient training programme consisting of physical exercise, nutrition course and behaviour therapy for children and their parents.

**SUBJECTS:** A total of 75 obese children (age 7–15 y; standard deviation scores of body mass index (SDS-BMI)+1.9–+3.8).

**MEASUREMENTS:** We characterised the participants as to their willingness to change their behaviour (changes in weight status, number of attempts at therapy, participation in exercise groups), somatic characteristics (BMI of children and family members, gender, age), socioeconomic status (level of education of the children and their parents, working mother), exercise and dietary habits, dietary intake as well as the quality of dietary records. These factors were related to the success of the treatment using a multiple logistic regression.

**RESULTS:** A total of 27 (37%) of the children were unsuccessful after treatment. For 48 (63%) of the children, there was a median weight loss of about 0.4 SDS-BMI (range –0.2 to –1.1). The only significant difference ( $P < 0.0001$ ) between these successful children and the unsuccessful ones was that they had taken part in the exercise groups before training began.

**CONCLUSION:** A training for the obese children and their parents enables the majority of the participants to reduce weight. Previous participation in exercise groups can be considered as a predictor to success of the treatment.

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**Keywords:** predictors; therapy success; children; outpatient training; weight loss

## Introduction

Obesity, with its manifold consequences on health and social integration, is an ever-increasing problem for children and adolescents everywhere, not only in Germany.<sup>1,2</sup> The treatment of obese children and adolescents is not yet satisfactorily effective.<sup>3–6</sup> An outpatient therapy using a combination of physical exercise, nutrition course and behaviour therapy for obese children and their parents taking place over several months can be successful for some participants.<sup>7–9</sup>

The motivation and willingness to change dietary habitual intake and exercise habits are decisive for success. Subjective estimates of the degree of motivation given by the children and their families are only of limited use. The desire to decrease weight does not always correspond with the willingness to change behaviour. A questionnaire on the

degree of motivation before the treatment showed that those obese children who were extremely well-motivated achieved worse results.<sup>10</sup>

It is still not clear how obese children's motivation to reduce weight can be proven. Suggestions have been a previous weight reduction, payment of the treatment by the patients themselves or psychological tests; but, the influence of these factors on success has not been evaluated. At the beginning of the treatment, we therefore characterised the participants in our outpatient training 'Obeldicks' and their families according to their dietary and physical habits, somatic characteristics, socioeconomic status and the quality of their dietary records, and related these factors with the weight status after training in order to identify predictors to the success of the treatment.

\*Correspondence: Dr T Reinehr, Vestische Kinderklinik Datteln, University of Witten-Herdecke, Dr F Steiner Str. 5, 45711 Datteln, Germany.  
E-mail: T.Reinehr@kinderklinik-datteln.de

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## Methods

All participants taking part between 1999 and 2001 in the outpatient training 'Obeldicks' for obese children and

adolescents were included in the study. At least 3 months before starting the training, all the obese children were examined in order to exclude primary disease and record comorbidity. Obesity was defined by an age-related BMI above the BMI centile passing through BMI values of 30 kg/m<sup>2</sup> at age 18y.<sup>11</sup>

All the children were asked to provide a 3-day weighed dietary record and to join a sports club or to take part in specially initiated exercise groups at our clinic. These exercise groups do not aim at being successful in sports but are aimed at the needs of obese children. The groups were divided according to age and gender. The children can take part in these groups before, during and after the training once weekly. For the first 8 weeks they can take part free of charge.

Inclusion criteria for the outpatient training 'Obeldicks' were a two-time presence in the obesity ambulance and to fill in a questionnaire according to exercise and dietary habits. The 1-y outpatient training 'Obeldicks' is based on a programme of physical exercise, nutrition course and behaviour therapy including individual psychological care of the child and its family (see Figure 1).<sup>12,13</sup> An interdisciplinary team of paediatricians, dietitians, psychologists and exercise physiologists is responsible for the training. The children were divided into groups according to sex and age. The training takes place over the period of 1 y, divided into three phases: in the intensive phase (3 months), the children take part in the nutrition course and the eating behaviour course in six group-sessions, each lasting 1.5 h. At the same time, the parents are invited to attend six parents sessions. In the establishing phase (6 months), individual psychological family therapy is provided. In the last phase of the programme (accompanying the families back to their everyday lives) (3 months), further individual care is possible, if and when necessary. The exercise therapy takes place once weekly the whole year through.

The nutritional course is based on the prevention concept of the 'optimised mixed diet'. This diet containing 30 E% fat, 15 E% proteins, 55 E% carbohydrates including 5 E% sugar is both fat and sugar reduced compared to the present-day diet

of children in Germany with a fat content of 38% of energy intake (E%), 13 E% proteins and 49 E% carbohydrates including 14 E% sugar.<sup>14</sup> The children follow a 'traffic light system' when selecting their food. The behaviour therapy is composed of contingency contracting, self-monitoring, praise, stimulus control techniques and problem-solving. The exercise therapy consists of aerobic exercise, lifestyle exercise and decreasing sedentary behaviour.

Before the 'Obeldicks' training, all participants and their families were characterised according to different criteria (see Table 1).

As an indication of the willingness to change behaviour patterns, we counted the number of therapy trials of the participants, registered whether they had taken part in exercise groups for the obese or joined a sports club before the training, and recorded the changes in weight status over the last 3 months before beginning the training. Height and weight (without clothing) were recorded at the initial examination and 3 months later when the training began.

Somatic characteristics that we used were age, sex, weight status of the participants and their family members. The weight status of children is recorded as standard deviation scores of body mass index (SDS-BMI) using the LMS method:<sup>15</sup> the M and S curves correspond to the median and coefficient of variation BMI for German children at each age and gender, whereas the L curve allows for the substantial age-dependent skewness in the distribution of BMI.<sup>15</sup> The assumption underlying the LMS method is that after Box-Cox power transformation, the data at each age are normally distributed.<sup>11</sup>

We established the socioeconomic status by marital status, whether the mother was working, whether others (eg grandparents) were involved in looking after the child, recording the type of school the children were attending and the parents' level of schooling. In Germany, 'Grundschule' is a primary school for all children in the first 4 y of school and 'Gesamtschule' includes all types of secondary schools ('Hauptschule', 'Realschule' and 'Gymnasium'). 'Hauptschule' refers to the lowest level of school education among the secondary schools compared to 'Realschule' and 'Gymnasium'. 'Hochschulreife' means qualification for university.

The exercise and dietary habits of the child were examined by the use of a questionnaire at the first visit. There were questions as to the weekly average amount of physical activity (except for school sports) and the daily average hours of time spent watching TV and at the computer. The dietary habits were established by using an evaluated questionnaire that had been adapted for children and that allows for both disinhibition of control and for cognitive control of dietary habits.<sup>16</sup>

For the assessment of dietary intake, 3-day weighed dietary records were used. Children or their parents weighed and recorded all foods and fluids consumed, as well as leftovers, using electronic food scales ( $\pm 1$  g). Semiquantitative recording (eg number of spoons, scoops) was allowed if weighing was not possible.

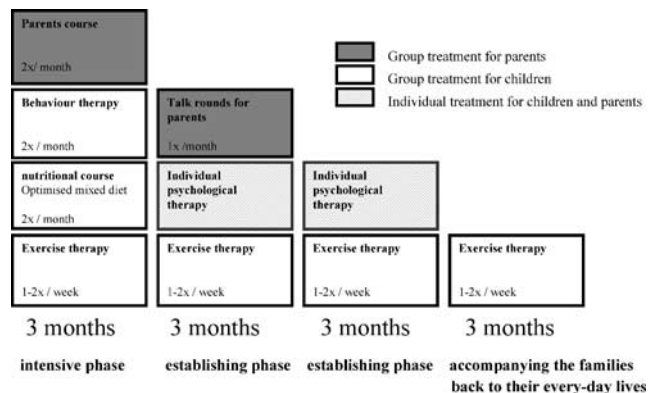


Figure 1 Structure of the outpatient training programme 'Obeldicks'.

**Table 1** Characteristics of successful and unsuccessful participants at the beginning of the training programme

	Successful	No success	P-value
Number	48	27	
<i>Willingness to change behaviour</i>			
Changes in SDS-BMI over the last 3 months	+0.0 (-0.4–+0.3)	+0.0 (-0.3–+0.2)	0.79 <sup>a</sup>
Number of therapy trials	1 (0–4)	1 (0–3)	0.05 <sup>a</sup>
Participation in exercise groups before training	46%	4%	0.0002 <sup>b</sup>
<i>Somatic characteristics</i>			
Age (y)	11.6 (7.8–15.3)	11.8 (7.0–15.2)	0.95 <sup>a</sup>
Gender	46% girls	52% girls	0.62 <sup>a</sup>
Weight status (BMI)	28.8 (21.2–47.2)	30.4 (20.9–41.5)	0.99 <sup>a</sup>
Weight status (SDS-BMI)	+2.5 (+1.9–+3.4)	+2.7 (+1.9–+3.8)	0.71 <sup>a</sup>
BMI mother	26.7 (20.6–47.9)	25.3 (18.3–36)	0.02 <sup>a</sup>
BMI father	27.3 (19.6–40.0)	28.2 (22.5–49.2)	0.25 <sup>a</sup>
Number of obese siblings	1 (0–3)	0 (0–2)	0.33 <sup>b</sup>
<i>Socio-economic status</i>			
Type of schooling of children			
Hauptschule	23%	22%	0.91 <sup>b</sup>
Realschule	17%	11%	
Gymnasium	15%	11%	
Gesamtschule	13%	15%	
Grundschule	33%	41%	
Mother's schooling level			
Hauptschule	48%	74%	0.08 <sup>b</sup>
Realschule	29%	11%	
Hochschulreife	22%	15%	
Father's schooling level			
Hauptschule	56%	78%	0.06 <sup>b</sup>
Realschule	25%	4%	
Hochschulreife	19%	19%	
<i>Single-parent family</i>			
Working mother	10%	30%	0.03 <sup>b</sup>
Others involved in taking care of the child except parents	75%	74%	0.92 <sup>b</sup>
	17%	33%	0.11 <sup>b</sup>
<i>Exercise habits</i>			
Average amount of physical exercise (h/week)	0.0 (0.0–6.0)	0.0 (0.0–6.0)	0.81 <sup>a</sup>
Average amount of watching TV/playing at the computer (h/day)	3.0 (0.5–6.0)	4.0 (0.5–6.0)	0.19 <sup>a</sup>
<i>Dietary habits</i>			
Cognitive control of dietary habits	42% (0–83%)	21% (0–67%)	0.15 <sup>a</sup>
Disinhibition of control of dietary habits	30% (0–90%)	40% (10–70%)	0.63 <sup>a</sup>
<i>Dietary intake</i>			
Reported energy intake (MJ/Tag)	6.4 (4.0–16.5)	6.6 (3.6–9.2)	0.86 <sup>a</sup>
Reported energy intake/predicted basal metabolic rate	0.93 (0.38–2.00)	0.95 (0.48–1.59)	0.60 <sup>a</sup>
<i>Quality of dietary recording</i>			
Percentage of weighed foods (1 =>90%, 2 = 50–90%, 3 = 25–50%, 4 = <25%)	2 (1–3)	2(1–3)	0.39 <sup>a</sup>
Validity of recording (number above cutoff)	25%	26%	0.92 <sup>b</sup>
Recorder (1 = only parents, 2 = predominantly parents, 3 = predominantly children, 4 = only children)	2 (1–4)	2 (1–4)	0.77 <sup>a</sup>
Number of recorded days	3 (0–7)	3 (0–5)	0.10 <sup>a</sup>

Data are median and range, [SDS-BMI: standard deviation of body mass index;<sup>15</sup>]

<sup>a</sup>Mann–Whitney U-test;

<sup>b</sup> $\chi^2$  test.

Five indices for the quality of dietary recording were used: (1) number of recorded days, (2) the quality of recording by percentage of weighed vs estimated food items per record and (3) the validity of reported energy intake. For that purpose, the ratio of reported energy intake (EI) and

predicted basal metabolic rate (BMR) was used according to Goldberg *et al.*<sup>17</sup> BMR was calculated using the equations of Schofield<sup>18</sup> including measured height and weight of the individuals. (4) The percentage of valid records was calculated based on sex and age-dependent cutoffs for EI/BMR

calculated for children<sup>19</sup> to identify under-reporting (cutoffs for 6- to 13-y-old males 1.04, females 1.01; 14- to 18-y-old males 1.07, females 0.97). (5) Additionally, record keeping (children or parents) was used as an indicator for parents, involvement.

Success was defined by reduction of SDS-BMI at the end of the 1-y training compared to baseline. The success of the training was first analysed in comparison to all the factors recorded using the Mann-Whitney U-test for quantitative items and the  $\chi^2$ -test for qualitative items. The univariate significant factors of these tests were then examined as independent variables in direct multiple logistic regression with the dependent variable reduction of SDS-BMI. *P*-values <0.05 were considered as significant. The subjects and their parents consented to be in this study.

## Results

A total of 75 children (age 7–15 y; SDS-BMI +1.91–+3.81) took part in the outpatient training 'Obeldicks' between 1999 and 2001. Measurement of height and weight without clothing was performed in all participants 3 months before, at the beginning of the training and at the end of the training. The attendance of children and their parents to the intervention sessions of the training was very high (>90%) except the dropouts. A total of 27 children (37%) were unsuccessful at the end of the training; 20 of these 27 children dropped out without finishing the training. All the children who dropped out did not reduce their overweight and dropped out in the first 6 months of the training.

At the end of the 1-y training, 48 children (63%) had reduced their overweight in median by 0.4 SDS-BMI (range –0.2 up to –1.1 SDS-BMI). These successful children differed from the unsuccessful children as follows (see Table 1): their mothers had a slightly higher BMI, they lived more seldom in single-parent families, they had therapy trials more often to reduce weight and they had taken part more often in the exercise groups for the obese offered at the clinic before beginning of the training.

Multiple logistic regression showed that only the previous participation in the exercise groups for the obese was an independent factor that was associated with the success of the training (see Table 2).

A total of 22 (96%) of the 23 children taking part in the exercise groups before beginning of the training had success, while one (2%) of the other 52 children who did not take part in the exercise groups had success. No child joined a sports club before training.

## Discussion

This is the first study on obese children, which examines the success of an outpatient training programme and the association to willingness to change behaviour, somatic characteristics, socioeconomic status, exercise and dietary

**Table 2** Multiple logistic regression of the dependent variable SDS-BMI reduction ( $n = 75$ ,  $r^2 = 0.45$ )

Independent variable	Coefficient	95% confidence interval	P-value
Participation exercise groups before training	+0.41	+0.29–+0.53	<0.0001
BMI, mother	0.00	–0.01–+0.01	0.99
Single-parent family	+0.05	–0.12–+0.22	0.57
Number of therapies	–0.04	–0.10–+0.02	0.23

habits, dietary intake as well as the quality of the dietary records, in order to predict the successful children before beginning of the training.

The results and structures of our training programme are comparable to the experiences of other established outpatient programmes.<sup>3,7,9</sup> Even such a comprehensive programme as our outpatient training 'Obeldicks' leads to SDS-BMI reduction in only some of the obese children corresponding to other studies.<sup>4–6</sup> Complete financial support from the health care system for the treatment of obese children is an exception in Germany.<sup>7</sup> The overall limited financial support should therefore primarily be focused at those obese children who are able to profit from an outpatient training programme. Besides further improving the actual treatment methods, it should also be considered how to identify those obese children who most likely profit from training. Different therapy concepts should be developed for the other children and their parents.

In some therapy programmes, patients have to lose weight before treatment or are asked about other therapy trials in order to prove their motivation. Our sample showed that the number of previous therapies had only a slight influence on success. This was also the case in studies on adults.<sup>20</sup> In our sample, weight loss in the 3 months before the training was not associated with success corresponding to a study on adults.<sup>20</sup> It is problematic to demand weight reduction before the treatment since the children and their families want to take part in the training for the very reason that they are not able to achieve weight reduction on their own. Furthermore, there is danger that weight loss is achieved due to a short-term hypocaloric diet which then leads to the yo-yo effect.

In our sample, the strongest predictor for success was the participation in exercise groups before the beginning of the training. Children taking part in these groups had more exercise sessions than children who did not use this offer. The amount of exercise probably has an influence on the success of the therapy.<sup>8,9</sup> In our experience, a further advantage of exercise groups for obese children before training is that the families are confronted with the difficulties involved when attending training regularly (time expenditure, means of transport, care for other family members). Furthermore, these obese children can make contact with other obese children who have already finished their training and who can report on what they experienced.

The children usually enjoy the exercise therapy, which is usually not the case for them when doing school sports. Conventional sports clubs are often unsuitable for obese children since they strive to achieve high sporting results. The difficulties for obese children being accepted within a conventional sports club can be seen by the fact that no child in our sample actually became a member of such a club.

In our sample, somatic characteristics of the participants and their families (age, sex, weight status) had no influence on the success of the treatment corresponding to other studies,<sup>21,22</sup> while other studies report on a better success rate with younger children, a negative correlation between the success of the treatment and the degree of overweight.<sup>8,24</sup> Obesity in the parents has been described as a negative predictor of success.<sup>8</sup> Besides genetic influence factors, obese parents are said to have worse control over their children's nutrition<sup>24</sup> and have less physical exercise and are thus negative role models.<sup>25</sup>

The family's socioeconomic status (level of education of the children and their parents, working mother, marital status) had no influence on the success of the treatment in our sample. In our sample, there was a tendency, although not significant, that children from single-parent families, who were also cared for by other people apart from their parents, had difficulty in losing weight. Another study, although on much smaller numbers, also showed that children from malfunctioning families had worse results.<sup>10</sup> If children regularly have meals elsewhere than in the family, the chances of success decrease.<sup>8</sup> Strict adherence to nutrition, dietary and exercise rules is made more difficult if different people like home helps, day care nurses or grandparents are all responsible for the child.

In our sample, neither the dietary habits (disinhibition of control and cognitive control) nor the quality of dietary recording as indicators of self-reflection and motivation could be seen in any connection to the success of the therapy. In both groups (successful and unsuccessful participants), percentage of nonplausible dietary records was high. In the ongoing observational Dortmund Nutritional and Anthropometric Longitudinally Designed-Study (DONALD-Study), conducted in the neighbourhood at the Research Institute of Child Nutrition Dortmund, using the same recording method, only 5% of dietary records from normal weight children were identified as nonplausible.<sup>19</sup> However, it is well known that under-reporting increases with increasing overweight.<sup>19,26</sup>

By 10y of age, children are able to give accurate dietary information and are well aware of foods they have eaten.<sup>27</sup> In both groups of obese children in this study (successful and unsuccessful participants), dietary records were predominantly kept by parents, indicating their willingness to participate in the therapy programme. Parental record-keeping means that under-reporting is easily possible if the children eat snacks away from home. In total, the factors reporting person, quality of dietary information and disin-

hibition and cognitive control of dietary habits were not associated with therapy success.

Apart from the factors that we examined, it has often been considered that patients might be more motivated if they pay for their treatment themselves. However, if the parents have to pay for their children's training, this would mean that the lower social classes (where obesity is more often found<sup>28</sup>) would be hindered to take part in the programme.

A disadvantage of using psychological tests to determine the degree of motivation is the necessary lengthy time and number of personnel involved. Studies on adults showed that psychological tests could not predict the rate of success after schooling.<sup>29,30</sup>

In our study, dropouts had a smaller amount of sessions caused by their nonwillingness to take part. Success is probably influenced by attendance. In our study, no success and dropout could not be separately analysed, since the participants without success frequently dropped out and dropouts were not able to achieve weight loss. Our study is not sufficient to differ if missing success is based on baseline characteristics or if missing success is based on dropout due to baseline characteristics connecting with a small number of intervention sessions. This has to be examined in further studies.

The interpretation of our data has to be very cautious, since we did not have a control group without intervention. We have no information on the spontaneous development of BMI-SDS without intervention in our study. Other studies demonstrate no reduction in overweight without intervention.<sup>31</sup> Real prediction will only be possible in a second study investigating the present hypotheses of a predicting factor like previous participation in an exercise group for the obese.

In summary the 'Obeldicks' training programme for obese children and their parents led to an SDS-BMI reduction in the majority of the participants. The factor most likely to predict the probability of success was a previous participation in an exercise group for the obese. Especially those children who take part continuously in such exercise groups should be given priority in outpatient training programmes.

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