Perception of Body Weight Status: A Case Control Study of Obese and Lean Children and Adolescents and Their Parents

Hagen Rudolph^{a,b} Susann Blüher^a Christian Falkenberg^a Madlen Neef^a Antje Körner^a
Julia Würz^b Wieland Kiess^a Elmar Brähler^b

^a University Hospital for Children and Adolescents, University of Leipzig,

^b Department of Medical Psychology and Medical Sociology, University Hospital Leipzig, Germany

Key Words

Adolescent · Body esteem · Children · Obesity · Overweight · Weight status

Summary

Background: The objective of this study was to investigate differences in weight perception and self-concept of obese and lean children, and to examine parents' awareness of overweight in themselves and their children. A total of 59 obese patients aged 7–17 years and 49 of their parents from a pediatric obesity out-patient clinic participated and were compared with 96 normal-weight patients and 81 of their parents from a pediatric pulmonary disease out-patient clinic. **Methods:** Children's and parents' self-perception of weight, desire for weight change and weight concerns, children's belief that their desired weight can be achieved, and parents' perception of their child's weight status were assessed using single questionnaire items. Children's self-concept was measured by the Self-Perception Profile for Children. In addition, children drew pictures about themselves and their favorite activity. **Results:** Obese patients wished to change their weight more frequently ($p < 0.001$) and had more weight concerns ($p < 0.001$). Their self-concept was significantly more negative. Physical activities were more common in their drawings than in those of normal-weight peers. Parents of obese children were more frequently overweight or obese themselves ($p < 0.001$). 35 of them and 73 parents of normal-weight children perceived their own weight realistically. Of the parents with overweight or obese children, 69.4% perceived their own child as overweight and 28.6% as very overweight, whereas

83% of them were obese. **Conclusion:** Children and adolescents as well as their parents recognize overweight as a health problem. In the majority, weight perception matches real body weight. Most parents at least recognize overweight in their children.

Introduction

Obesity is an increasing medical problem and has become the most common chronic disease of childhood and adolescence in the developed world [1–8]. In Germany, 17.15% of children aged between 3 and 17 years are overweight, and 6.3% suffer from obesity [9]. Over the last 25 years, the prevalence of childhood overweight has doubled in many European countries and tripled in the USA, and it is affecting about 1 in 10 children worldwide [6, 10, 11]. Not only the prevalence is rising, but also the absolute BMI: Obese children are becoming constantly more obese. Childhood obesity is not a cosmetic issue, but a risk factor for many diseases such as heart disease, diabetes, or musculoskeletal disorders [12–15]. At the same time, much concern is expressed about the doubtful idealization of thinness [16].

Over the last years, many programs for prevention and intervention were established, focusing on physical exercise, dieting, and the reduction of sedentary behavior [1]. To achieve weight reduction, an awareness of obesity, and the motivation for weight reduction in the affected children is required. Only few data of successful concepts for obesity treatment are available worldwide [17]. A British study showed that overweight often remains unnoticed by the parents. Only 40% of

the surveyed mothers and 45% of the fathers estimated the weight status of their child correctly. Only one quarter of the parents recognized overweight in their children [18]. In other studies, only between 17 and 66% of mothers of obese children perceived them as overweight [19–22]. Glaesmer and Brähler [23] found that the prevalence of overweight and obesity is underestimated in adults. Furthermore, childhood obesity is not perceived as being clinically important by the patients and their families. This is the main explanation for the low acceptance of prevention programs [19, 22, 24–26].

Obese children are considered as being less active than lean children and spending more time with passive behaviors such as television watching [27, 28]. Besides socio-cultural factors, like social status or the children's and parents' educational level, the presence of overweight and obesity in the parents has been identified as one of the main factors for the development of obesity in their children. Differences in the familial transmission of eating behaviors, as shown by Jahnke and Warschburger [29], are discussed as one related explanation. Children's drawings are a common instrument for the assessment of emotional well-being, and may be helpful as a screening instrument [30, 31]. Secondly, drawings may provide further information about the children's self-concept which is not captured by a questionnaire.

We hypothesized that obese children's and adolescents' weight perception and self-concept in relation to their actual body weight is different as compared to lean control children. Secondly, we postulated that parents of obese children have different perceptions than parents of lean children. In addition, we wanted to find out whether or not parents recognize overweight or obesity in their overweight and obese children.

Participants and Methods

Participants

Data were collected in a prospective clinic-based case control study from 60 children and adolescents aged 7–17 years (mean age 12.2 years) and 49 parents (4 fathers, 45 mothers; mean age 40.6 years) from the obesity out-patient clinic of the University Hospital for Children and Adolescents Leipzig, Germany, between April and August 2007. All of the surveyed children took part in the study. Five children attended the out-patient clinic alone, 2 were accompanied by their grandmother, and in 4 cases, parents refused to take part themselves but gave consent for their children to participate. A total of 130 children and adolescents aged 7–17 years and 90 parents from the pediatric pulmonary disease out-patient clinic of the University Hospital for Children and Adolescents Leipzig, Germany, served as control cohort. Nine children and their parents refused to take part in the study. So data were collected from 121 children and adolescents (mean age 11.3 years) and 81 parents (12 fathers, 69 mothers; mean age 39.1 years). If children were accompanied by both parents, only one parent got a questionnaire. Informed consent was given by all participants of our study. All participants were asked to take part in the study before the consultation with the physician, and questionnaires were answered during the waiting period. In both out-patient clinics, children were in different stages of treatment. For some children, it was the first consultation, whereas other children had attended the out-patient clinic several times before.

Instruments

Children's and parents' body weight perception was measured with one questionnaire item on a five-point scale ('very underweight', 'underweight', 'normal', 'overweight', 'very overweight'). Overweight or obese participants who selected 'overweight' or 'very overweight' and normal-weight participants who selected 'normal-weight' were classified as perceiving the weight realistically. The wish for weight change was also measured with one questionnaire item on a five-point scale ('gain a lot of weight', 'gain weight', 'no weight change', 'lose some weight', 'lose a lot of weight'). In both children and parents, weight concerns were measured with one question on a four-point scale ('no weight concerns', 'little weight concerns', 'some weight concerns', 'much weight concerns'). The children's belief that they will achieve or maintain their desired ideal weight was also measured with one item on a four-point scale ('very unsure', 'relatively unsure', 'relatively sure', 'very sure'). All single questionnaire items were self-developed. Knäuper and Turner [32] showed that single item measures can provide valid information, and that global questions about issues of high personal relevance may be better predictors of future health outcomes than more extended psychometric measures.

Children's self-concept was measured with the German version of Harter's Self-Perception Profile for Children (SPPC-D) [33]. The instrument is subdivided into 5 scales i) 'Scholastic Competence', ii) 'Athletic Competence', iii) 'Social Acceptance', iv) 'Physical Appearance', and v) 'Global Self-Worth'. Each scale consists of 6 items formulated as bipolar statements, e.g. 'Some children find it hard to make friends' but 'Other kids find it's pretty easy to make friends.' Answers to the questions should be given in two steps. First, the participant chooses which of the two statements applies to him or her, and in a second step the child indicates if the chosen statement is 'sort of true for me' or 'really true for me' [33, 34]. Higher scores indicate higher self-perceived competence. The SPPC has been tested in several US samples with altogether 1,500 children between the 3rd and 8th grade. The German version has been available since 1993, and has been validated in a sample of 81 boys and 81 girls of the 3rd grade, who were tested at the age of 9–9.9 years (mean 9.4 years) and 9 months later in the 4th grade [33]. A good reliability and internal validity was also found for adolescents up to the age of 16 years [35].

Furthermore, information was obtained regarding siblings of the participating children, schooling, and persons living in the same household. Height and weight were measured in centimeters and kilograms. Height was measured to the nearest of 0.1 cm using precision instruments and weight to the nearest of 0.1 kg using a digital scale [12]. In addition, children were asked to draw a picture of themselves and their favorite activity. For this task, they got a single white sheet of paper and 12 color crayons. The instruction was: 'Please draw a picture of yourself and your favorite activity on a single white sheet of paper. For this purpose, you will get 12 colored crayons which you can keep afterwards. You can choose yourself what you draw and which colors you use. When you are ready, I would like to ask you to give the picture to one of the investigators (H.R.).' The drawings were analyzed for their topic and the number of portrayed persons. Validity and reliability of children's drawings have been shown in several studies [36, 37].

The whole questionnaire was pilot-tested with a sample of 5 children aged between 8 and 11 years, who were healthy at the time. All of them had no problems in answering the questions without help. Parents' perception of their child's weight status was measured with one questionnaire item on a five-point scale ('very underweight', 'underweight', 'normal', 'overweight', 'very overweight'). Self-reported weight, height, and age as well as some information about educational level, professional qualification, yearly income of the household, and current jobs, completed the parental questionnaire.

Statistical Analysis

For statistical analysis, we selected the overweight and obese children and adolescents from the obesity out-patient clinic ($n = 59$) and the normal-weight individuals from the pediatric pulmonary disease out-patient clinic

Table 1. Clinical and anthropometric data of overweight, obese, and lean children and adolescents

Weight status	Age group	Gender, n (%)		
		male	female	all
Overweight ^a	7–10 years	0 (0.0)	5 (62.5)	5 (50.0)
	11–13 years	1 (50.0)	2 (25.0)	3 (30.0)
	14–17 years	1 (50.0)	1 (12.5)	2 (20.0)
	Total	2 (100.0)	8 (100.0)	10 (100.0)
Obese ^b	7–10 years	9 (34.6)	5 (21.7)	14 (28.6)
	11–13 years	8 (30.8)	8 (34.8)	16 (32.7)
	14–17 years	9 (34.6)	10 (43.5)	19 (38.7)
	Total	26 (100.0)	23 (100.0)	49 (100.0)
Normal weight	7–10 years	33 (58.9)	13 (32.5)	46 (47.9)
	11–13 years	12 (21.4)	15 (37.5)	27 (28.1)
	14–17 years	11 (19.7)	12 (30.0)	23 (24.0)
	Total	56 (100.0)	40 (100.0)	96 (100.0)

^aOverweight as defined as BMI $\geq$ 90th BMI percentile.

^bObesity as defined as BMI $\geq$ 97th BMI percentile.

($n = 96$). Overweight was defined as BMI $\geq$ 90th percentile and obesity as BMI $\geq$ 97th percentile [38]. In the parents, a BMI $\geq$ 25 kg/m² and a BMI $\geq$ 30 kg/m² defined overweight and obesity, respectively [39]. Overweight and obese children and adolescents (denominated as ‘children’ in the following text) were combined to one cohort. In the following text, we use the term ‘obese’ to describe ‘overweight and obese’. The two cohorts were matched for age and sex. Descriptive statistics were performed using SPSS version 15.0 for Windows software (SPSS Inc., Chicago, IL, USA). Data were tested for normality using the Kolmogorov-Smirnov test. Calculations were performed with the chi-square test for independence, the t-test for 2 independent samples, one-way ANOVA, and Pearson’s correlation analysis. A two-sided p value of < 0.05 was considered as statistically significant.

Results

Table 1 shows the clinical and anthropometric data of 10 overweight, 49 obese, and 96 lean children. The patients were subdivided into 3 age groups. The mean BMI standard deviation score (SDS) of obese patients (+ 2.52) was significantly higher than the mean BMI SDS of the normal-weight children (−0.18). There was no significant difference in mean age and sex of the participants. Mean age was 12.5 years for the obese and 11.3 years for the lean children.

Children’s Perception of Body Weight

Table 2 shows children’s self-perception of weight in relation to measured weight and gender. 48 (87.3%) of the obese and 77 (81.1%) of the lean children estimated their weight status realistically. Obese patients wished to change their weight more frequently than normal-weight individuals ($p < 0.001$; t-test) and reported more weight concerns ($p < 0.001$; t-test). The 11- to 13-year-old and the 14- to 17-year-old normal-weight patients reported significantly more weight concerns than the 7- to 10-year-old children (table 3). As for the belief

Table 2. Weight perception in relation to gender and measured weight in the children

Gender	Perceived weight	Measured weight, n (%)		
		overweight/ obese ^a	normal weight	all
Boys	much underweight	0 (0.0)	1 (1.8)	1 (1.2)
	underweight	0 (0.0)	7 (12.5)	7 (8.4)
	normal	3 (11.1)	46 (82.1)	49 (59.0)
	overweight	18 (66.7)	1 (1.8)	19 (22.9)
	much overweight	5 (18.5)	0 (0.0)	5 (6.0)
	no answer	1 (3.7)	1 (1.8)	2 (2.4)
	total	27 (100.0)	56 (100.0)	83 (100.0)
Girls	much underweight	1 (3.3)	0 (0.0)	1 (1.4)
	underweight	0 (0.0)	3 (7.1)	3 (4.2)
	normal	3 (10.0)	31 (73.8)	34 (47.2)
	overweight	18 (60.0)	6 (14.3)	24 (33.3)
	much overweight	7 (23.3)	0 (0.0)	7 (9.7)
	no answer	1 (3.3)	2 (4.8)	3 (4.2)
	total	30 (100.0)	42 (100.0)	72 (100.0)

^aBMI $\geq$ 90th BMI percentile.

Table 3. Weight concerns in relation to age and measured weight in the children

Weight concerns	Age group, n (%)		
	7–10 years	11–13 years	14–17 years
<i>Overweight/obese^a cohort</i>			
No	4 (21.1)	1 (5.3)	2 (9.5)
Little	3 (15.8)	7 (36.8)	5 (23.8)
Some	5 (26.3)	5 (26.3)	12 (57.1)
Much	2 (10.5)	6 (31.6)	2 (9.5)
No answer	5 (26.3)	0 (0.0)	0 (0.0)
Total	19 (100.0)	19 (100.0)	21 (100.0)
<i>Normal-weight cohort</i>			
No	34 (73.9)	10 (37.0)	10 (43.5)
Little	9 (19.6)	15 (55.6)	10 (43.5)
Some	2 (4.3)	2 (7.4)	3 (13.0)
Much	0 (0.0)	0 (0.0)	0 (0.0)
No answer	1 (2.2)	0 (0.0)	0 (0.0)
Total	46 (100.0)	27 (100.0)	23 (100.0)

^aBMI $\geq$ 90th BMI percentile.

that the desired ideal weight can be achieved or maintained, no significant difference was found. Table 4 shows the children’s weight concerns and their conviction to be able to reach the desired weight in relation to measured weight.

In the obese children, there were no significant differences between boys and girls in the self-perception of weight, the wish to change weight, weight concerns, and the belief that the desired weight can be achieved or maintained. In the normal-weight children, girls reported significantly more weight concerns than boys. Differences in weight perception, the

wish to change weight, and the belief that desired weight can be achieved or maintained were not significant.

The perception of own weight correlated positively with the BMI SDS ($r = 0.669$, $p < 0.001$; Pearson's correlation analysis). Furthermore, the desire for weight change ($r = 0.668$, $p < 0.001$; Pearson's correlation analysis) and the reported weight concerns ($r = 0.523$, $p < 0.001$; Pearson's correlation analysis) correlated positively with BMI SDS. A significant association between BMI SDS and the belief that the desired ideal weight can be achieved, which decreased with increasing weight concerns ($r = -0.261$, $p = 0.001$; Pearson's correlation analysis), could not be shown.

Table 4. Children's weight concerns and belief to be able to reach the desired weight

Options to answer	Measured weight, n (%)		
	overweight/ obese ^a	normal weight	all
<i>Weight concerns of the children</i>			
No weight concerns	7 (11.9)	55 (57.3)	62 (40.0)
Few weight concerns	15 (25.4)	34 (35.4)	49 (31.6)
Some weight concerns	22 (37.3)	7 (7.3)	29 (18.7)
Much weight concerns	10 (16.9)	0 (0.0)	10 (6.5)
No answer	5 (8.5)	0 (0.0)	5 (3.2)
Total	59 (100.0)	96 (100.0)	155 (100.0)
<i>Conviction to reach the desired weight</i>			
Very unsure	4 (6.8)	6 (6.3)	10 (6.5)
Quite unsure	11 (18.6)	13 (13.5)	24 (15.5)
Pretty sure	30 (50.8)	48 (50.0)	78 (50.3)
Very sure	10 (16.9)	25 (26.0)	35 (22.6)
No answer	4 (6.8)	4 (4.2)	8 (5.2)
Total	59 (100.0)	96 (100.0)	155 (100.0)

^aBMI $\geq$ 90th BMI percentile.

Table 5. Self-perception of overweight/obese and lean children and adolescents in relation to gender^a

Scale	Weight status				p value (two-tailed)
	overweight/obese ^b		normal weight		
	mean	SD	mean	SD	
<i>Boys</i>					
Scholastic competence	2.80	0.667	3.05	0.664	0.141
Social acceptance	2.71	0.901	3.11	0.755	0.056
Athletic competence	2.46	0.708	3.15	0.627	< 0.001
Physical appearance	2.59	0.756	3.43	0.603	< 0.001
Global self-worth	3.01	0.693	3.38	0.473	0.005
<i>Girls</i>					
Scholastic competence	2.77	0.601	2.97	0.610	0.175
Social acceptance	2.95	0.678	3.30	0.641	0.034
Athletic competence	2.45	0.715	2.79	0.711	0.056
Physical appearance	2.15	0.756	2.87	0.840	< 0.001
Global self-worth	2.83	0.934	3.21	0.689	0.061

^aMean scores of the German Self-Perception Profile for Children (SPPC-D) of 59 overweight/obese and 96 normal-weight children and adolescents ($p < 0.05$; t-test).

^bBMI $\geq$ 90th BMI percentile.

Self-Concept

The self-concept of obese patients was significantly more negative than that of normal-weight children in all domains assessed by the SPPC-D. In both, obese and lean children, physical appearance was influenced by the patients' age: 7- to 10-year-olds had significant better scores than 11- to 13-year-olds. In addition, 7- to 10-year-old lean children had better scores in 'Physical Appearance' than 14- to 17-year-old patients ($p = 0.001$; one-way ANOVA). Furthermore, 7- to 10-year-old lean children had better scores in the scale 'Global Self-Worth' than 11- to 13-year-olds ($p = 0.038$; one-way ANOVA). There were significant negative correlations between the children's BMI SDS and the 5 scales of SPPC-D, with 'Physical Appearance' showing the highest correlation ($r = -0.386$; Pearson's correlation analysis). The 5 scales of the SPPC-D correlated significantly positively with each other. Table 5 shows the mean scores in relation to gender. The children's gender influenced their self-perception. The scores of the normal-weight girls for the scales 'Physical Appearance' and 'Athletic Competence' were significantly lower than those of the boys. Among the obese patients, a significant difference was found only for the scale 'Physical Appearance'.

Self-Portraits, Drawings

Significantly more patients from the obesity out-patient clinic ($n = 24$) refused to draw a picture about themselves and their favorite activity ($p < 0.001$; t-test). 28 (80.0%) of the obese children depicted physical activities, with the 3 main topics being soccer ($n = 8$, 22.86%), horses/riding ($n = 6$, 17.14%), and swimming ($n = 4$, 11.43%). Drawings of the remaining 7 participants showed more sedentary activities such as playing video games, singing, or painting. From the pediatric pul-

Fig. 1. Examples of children's drawings of self-concept: self-portraits of 3 children depicting the child with his/her favorite activity: **a** 8-year-old girl, 37.2 kg, 1.35 m, 94th BMI percentile; **b** 7-year-old boy, 27.3 kg, 1.34 m, 30th BMI percentile; **c** 7-year-old boy, 24.4 kg, 1.26 m, 34th BMI percentile.

Fig. 2. Weight status of **a** parents with overweight/obese children: 30.6% normal-weight, 36.7% overweight, 32.7% obese; **b** parents with normal-weight children: 54.4% normal-weight, 37.0% overweight, 8.6% obese. Parents of obese children are more frequently overweight or obese themselves in relation to parents of normal-weight children ($p < 0.001$).

monary disease out-patient clinic, 86 patients drew a picture. Fifty (58.14%) of their drawings had an active theme, with the 3 main topics being soccer ($n = 30$, 34.88%), swimming, and playing ball games (each with $n = 3$, 3.49%). The other 36 drawings had a more passive theme such as singing ($n = 9$, 10.47%), playing video games, and spending time with their pets such as guinea pigs (each with $n = 5$, 5.81%). 22 (62.86%) of the obese patients' drawings showed only 1 person, 4 (11.43%) showed 2 persons, 2 (5.71%) 3 persons, 1 (2.86%) more than 3 persons, and 6 (17.14%) showed no person. In the drawings of 45 (52.33%) normal-weight patients, 1 person was portrayed. In 13 (15.12%) pictures, 2 persons were shown, in 6 (6.98%) 3 persons, and in 9 (10.47%) more than 3 persons. 13 (15.12%) pictures showed no persons. Figure 1 shows examples of children's drawings.

Parental Perceptions

Figure 2 shows the parental weight status in relation to their children's weight status. Of the parents with obese children, 32.7% were obese themselves, 36.7% were overweight, and 30.6% were of normal weight (fig. 2 a). In the cohort of normal-weight children, only 8.6% of the parents were obese, 37.0% were overweight, and 54.4% were of normal weight

(fig. 2 b). The mean BMI (29.2 kg/m^2) of the parents of obese children was significantly higher than the mean BMI (24.9 kg/m^2) of the parents of normal-weight children. The parents' BMI correlated positively with the BMI SDS of the children ($r = 0.343$, $p < 0.001$; Pearson's correlation analysis). Table 6 shows how parents perceived their own weight, whether and how they wanted to change their weight, how many weight concerns they had, and how they perceived the weight status of their child. Parents with obese children reported more weight concerns ($p = 0.025$; t-test). 35 (72.3%) of them and 73 (89.8%) parents with normal weight children perceived their own weight realistically. Except for 1 person, all parents recognized overweight in their child. The desire of the parents to change their weight correlated positively with their BMI ($r = 0.529$, $p < 0.001$; Pearson's correlation analysis), but even more with their body weight perception ($r = 0.625$, $p < 0.001$; Pearson's correlation analysis). A significant correlation between BMI and weight concerns was not detected.

Social Factors

A significantly larger number of lean children attended higher education compared to obese children. Parents of

Table 6. Parental perceptions in relation to the weight status of their children

Options to answer	Parents of ..., n (%)		
	overweight/obese children	normal-weight children	all
<i>Perceived own weight</i>			
Very underweight	0 (0.0)	1 (1.2)	1 (0.8)
Underweight	1 (2.0)	1 (1.2)	2 (1.5)
Normal	23 (47.0)	49 (60.6)	72 (55.4)
Overweight	18 (36.7)	27 (33.3)	45 (34.6)
Very overweight	7 (14.3)	3 (3.7)	10 (7.7)
Total	49 (100.0)	81 (100.0)	130 (100.0)
<i>Desire for weight change</i>			
Gain a lot of weight	0 (0.0)	0 (0.0)	0 (0.0)
Gain weight	0 (0.0)	2 (2.5)	2 (1.5)
No change	11 (22.4)	30 (37.0)	41 (31.5)
Reduce weight	35 (71.5)	49 (60.5)	84 (64.7)
Reduce a lot of weight	3 (6.1)	0 (0.0)	3 (2.3)
Total	49 (100.0)	81 (100.0)	130 (100.0)
<i>Weight concerns</i>			
No weight concerns	7 (14.3)	19 (23.4)	26 (20.0)
Little weight concerns	26 (53.0)	48 (59.3)	74 (56.9)
Some weight concerns	12 (24.5)	12 (14.8)	24 (18.5)
Much weight concerns	4 (8.2)	2 (2.5)	6 (4.6)
Total	49 (100.0)	81 (100.0)	130 (100.0)
<i>Perceived weight of the own child</i>			
Very underweight	0 (0.0)	0 (0.0)	0 (0.0)
Underweight	0 (0.0)	7 (8.7)	7 (5.4)
Normal	1 (2.0)	65 (80.2)	66 (50.8)
Overweight	34 (69.4)	9 (11.1)	43 (33.1)
Very overweight	14 (28.6)	0 (0.0)	14 (10.7)
Total	49 (100.0)	81 (100.0)	130 (100.0)

lean children were living in a partnership more frequently than parents of obese children ($p < 0.001$; t-test). There was no significant difference in the number of children living with either their mother or father alone between the two cohorts. Both cohorts contained families with joint children as well as families with children from a former partnership of either the mother or the father, but no 'patchwork families'. 38 (77.6%) of the obese and 58 (70.7%) of the lean children originated from the examined parent's actual partnership. Four (8.2%) obese children, but only 1 (1.2%) normal-weight patient, were an adopted child or foster child. No significant difference between the two cohorts was found in the number of siblings. Unemployment was more common in parents of obese children ($p < 0.001$; t-test), and they showed a lower mean educational level ($p = 0.005$; t-test). Families with obese children had lower monthly incomes than families with lean children ($p = 0.047$; t-test). Monthly income correlated negatively with the parents' BMI ($r = -0.356$, $p < 0.001$; Pearson's correlation analysis) and the BMI SDS of the children ($r = -0.200$, $p = 0.024$; Pearson's correlation analysis).

Discussion

Both in obese and lean children, the perception of body weight was generally realistic. Reported weight concerns and the wish for weight change were significantly more common in obese participants, but nevertheless half of them reported no or only little weight concerns. The self-confidence to achieve or maintain the desired weight was quite high in both cohorts. Most participants were sure or very sure to be able to lose weight. These findings may support a trend towards less concerns about weight in children and adolescents as shown in a longitudinal survey by Kaltiala-Heino et al. [16], where the proportion of those participants perceiving themselves as overweight decreased between 1979 and 1999 in both overweight and normal-weight adolescents.

In the present study, the affected children's self-perception was significantly lower in all domains assessed by the SPPC-D. Physical appearance seems to play a very important role, whereas other domains are not as deeply affected, and not all obese children are affected in the same way. The 5 domains correlated positively with the children's BMI SDS, but even more with their body weight perception. Several studies sup-

ported the assumption that self-esteem is more strongly linked to concerns about weight than actual body weight [40–42]. A strong correlation between physical appearance and global self-worth in school-aged children already has been reported in several validity studies [43]. In both cohorts of our study, the girls' scores for 'Physical Appearance' were significantly lower than the scores of the boys. Normal-weight girls also had significantly more weight concerns. Our findings are consistent with other studies in which obese children showed lower perceived athletic competence, physical appearance, and global self-worth scores than their lean peers. Lower scores in girls than in boys for both weight concerns and the SPPC were found in other studies as well [16, 44]. However, in a study on a Korean population, overweight children did not significantly differ in body satisfaction or general self-esteem from their normal-weight peers. This result may reflect intercultural differences. In some countries, overweight is a sign of high social status, beauty, and health [4, 45–47].

With reference to the children's drawings, the majority of the obese participants had chosen a physical activity as their favorite one, whereas nearly half of the normal-weight patients drew a more passive favorite leisure activity. Several studies have shown that children with asthma are generally less active than non-asthmatic peers. Organizational policies, family illness beliefs, and a wrong symptom perception could be an explanation [48]. In other studies, physical activity of asthmatic children did not differ from that of healthy children [49]. At the same time, obese children may provide an exceptional active picture of themselves that does not correspond with their actual situation, to meet the expectations about a healthy life style. Significantly more participants from the control cohort drew a picture. Less motivation in obese children because of experiences in stigmatization could be one reason for this behavior. Possibly, obese children were ashamed to draw their favorite activity to avoid new stigmatization if this was a passive activity. It is difficult to draw any conclusions about different self-concepts from the drawings, and further investigations are required. Analyzing a series of pictures drawn by one person instead of only a single one could provide more realistic concepts than a single picture could.

In our study, most parents perceived their own body weight realistically, but nearly one quarter of overweight or obese parents perceived themselves as normal-weight. Nearly all parents recognized overweight in their children. Recent studies have shown a high percentage of parents who misperceive their children's weight status [50, 51]. Baughcum et al. [19] surveyed a sample of 622 mothers with children 23–60 months of age. Nearly all of the obese mothers regarded themselves as overweight, but 79% of the parents did not perceive their overweight child as being overweight. Even if overweight was recognized by the mothers, only two thirds were concerned about it [18, 19]. Other studies, addressing parents with older children, have shown comparable results [26, 52].

Several social factors seem to play a role in the different health concerns. The influence of unemployment and low educational level of the parents, low family income, and the parents' weight status on the prevalence of obesity in children is already known [7, 19]. Additionally, we found that obese children were living significantly more often with only a single parent. We also saw a trend that they live more often as an adopted or a foster child. However, statistical significance could not be calculated because of the small number of affected participants. This could be an objective for further research with an aim to especially support such families in the context of prevention programs.

Our study design was clinic-based, and the obese participants had been recruited from an obesity out-patient clinic. Such patients may be more sensitized to their body weight than obese peers who do not attend an obesity clinic. A bias in our results could be the consequence. An awareness of obesity and weight concerns could be supposed in obese children who attend an obesity out-patient clinic. Therefore, weight concerns may be underreported in our study. On the other hand, we do not know about the reasons for attending an obesity out-patient clinic. Some children may take part only on their physician's recommendation, because physicians often recognize obesity in children when it is not noticed by the children themselves and their parents [53]. This may be an objective for further research. The children were in different stages of treatment when answering the questionnaire. Some participants attended the out-patient clinic for the first time, whereas others had been there several times. A bias towards desired answers could be the consequence especially in the obese cohort. Furthermore, also included in the obese cohort were 10 overweight patients. They were included because they attended the obesity out-patient clinic. Our control cohort was recruited from a pulmonary disease out-patient clinic. Only the normal-weight children were included. Most pulmonary and allergic diseases are chronic disorders. In contrast to obesity, children with asthma seem to have no deficits in health-related quality of life. The existence of effective treatments may be one explanation. Furthermore, obese children may suffer more from stigmatization than asthmatic children [54]. Information about parents' weight and height were only self-reported. This could have lead to bias, because earlier studies have shown that weight is often underreported whereas height is often overreported. The children's weight and height were measured while the questionnaires were being completed. A limitation of the applied questionnaire lies in the difficult differentiation between overweight and obesity, classifying those overweight and obese participants' perception as realistic who selected 'overweight' or 'very overweight'. Approximately 70% of the parents from the obesity out-patient clinic perceived their child as overweight and nearly 29% as obese, whereas only 17% were actually overweight and around 83% obese. This finding could be an indication of a shift in weight perception

and a trend towards overweight being increasingly perceived as normal. The weight-related perceptions of the children and parents were measured with self-constructed single questionnaire items. Therefore, we are not able to give information about the validity and reliability of these items. On the other hand, it has been shown that single item measures can provide valid information, especially in the measurement of subjective health [32].

In interpretations of the present study, we implied the assumption that the actual weight status influences the children's weight perception and self-concept. Because this is plausible, we draw conclusions about the direction of the causal ordering of variables based on correlation analysis. A strength of our study is that we investigated not only adolescents but also younger children, which made comparisons between the age groups possible, while younger children are still underrepresented in many obesity studies.

Childhood obesity is identified as a health problem by most of the affected children and their parents. Further research should emphasize more the group of overweight children at risk of shifting their body weight perception. Further investigations on big community-based samples are required to detect a trend for being overweight but feeling normal weight, both in children and their parents. Understanding the mechanisms of parental perceptions of their children's body weight should be another aim for further research. Baughcum et al. [19] showed that maternal misperception was more common

in mothers with less education and did not differ with maternal obesity status or child gender. Finally, the prevalence of obesity in adopted children, foster-children, and children of single parents as possible risk groups with a special need for prevention programs has been identified in our study. Health care professionals should involve parents in prevention programs and try to increase the parental perception of their children's body weight, because parents of obese children are often overweight or obese themselves. The positive effect of feedback about weight has been shown [55, 56]. It is true that the children's body perception is affected by popular media images, but it is influenced by maternal attitudes as well [57]. We conclude that evaluation of children's body weight perception should be part of obesity prevention programs.

Acknowledgements

We thank the children and their parents for participating in our study. W.K. gratefully acknowledges grant support by Deutsche Forschungsgemeinschaft (DFG), 'Atherobesity', KFO 152, Bundesministerium für Bildung und Forschung (BMBF), 'Kompetenznetz Adipositas', and 'Kompetenznetz Diabetes'.

Disclosure

The authors declared no conflicts of interest.

References

- 1 Reilly JJ: Obesity in childhood and adolescence: evidence based clinical and public health perspectives. *Postgrad Med J* 2006;82:429–437.
- 2 Bélanger-Ducharme F, Tremblay A: Prevalence of obesity in Canada. *Obes Rev* 2004;6:183–186.
- 3 Yoon KH, Lee JH, Kim JW, Cho JH, Choi YH, Ko SH, Zimmet P, Son HY: Epidemic obesity and type 2 diabetes in Asia. *Lancet* 2006;368:1681–1688.
- 4 Marsh HW, Hau KT, Sung RYT, Yu CW: Childhood obesity, gender, actual-ideal body image discrepancies, and physical self-concept in Hong Kong children: cultural differences in the value of moderation. *Dev Psychol* 2007;43:647–662.
- 5 Thorburn AW: Prevalence of obesity in Australia. *Obes Rev* 2005;6:187–189.
- 6 Lobstein T, Frelut ML: Prevalence of overweight among children in Europe. *Obes Rev* 2003;4:195–200.
- 7 Pérez-Rodrigo C, Aranceta Bartrina J, Serra Majem L, Moreno B, Delgado Rubio A: Epidemiology of obesity in Spain. Dietary guidelines and strategies for prevention. *Int J Vitam Nutr Res* 2006; 76:163–171.
- 8 Meigen C, Keller A, Gausche R, Kromeyer-Hauschild K, Blüher S, Kiess W, Keller E: Secular trends in body mass index in German children and adolescents: a cross-sectional data analysis via CrescNet between 1999 and 2006. *Metabolism* 2008;57:934–939.
- 9 Kurth BM, Schaffrath Rosario A: The prevalence of overweight and obese children and adolescents living in Germany. Results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). *Bundesgesundheitsbl Gesundheitsforsch Gesundheitsschutz* 2007;50:736–743.
- 10 Ogden CL, Flegal KM, Carroll MD, Johnson CL: Prevalence and trends in overweight among US children and adolescents, 1990–2000. *JAMA* 2002; 288:1728–1732.
- 11 World Health Organisation: Obesity: Preventing and Managing the Global Epidemic. WHO Obesity Technical Report Series 894. WHO, Geneva, 2000.
- 12 Reich A, Müller G, Gelbrich G, Deutscher K, Gödicke R, Kiess W: Obesity and blood pressure – results from the examination of 2,365 schoolchildren in Germany. *Int J Obes Relat Metab Disord* 2003;27:1459–1464.
- 13 Reinehr T, Kiess W, de Sousa G, Stoffel-Wagner B, Wunsch R: Intima media thickness in childhood obesity: relations to inflammatory marker, glucose metabolism, and blood pressure. *Metabolism* 2006; 55:113–118.
- 14 Reinehr T, Kiess W, Kapellen T, Andler W: Insulin sensitivity among obese children and adolescents, according to degree of weight loss. *Pediatrics* 2004; 114:1569–1573.
- 15 Kiess W, Galler A, Reich A, Müller G, Kapellen T, Deutscher J, Raile K, Kratzsch J: Clinical aspects of obesity in childhood and adolescence. *Obes Rev* 2001;2:29–36.
- 16 Kaltiala-Heino R, Kautiainen S, Virtanen SM, Rimpelä A, Rimpelä M: Has the adolescents' weight concern increased over 20 years? *Eur J Publ Health* 2003;13:4–10.
- 17 Summerbell CD, Ashton V, Campbell KJ, Edmunds L, Kelly S, Waters E: Interventions for treating obesity in children. *Cochrane Database Syst Rev* 2003;3: CD001872.
- 18 Jeffery AN, Voss LD, Metcalf BS, Alba S, Wilkin TJ: Parents' awareness of overweight in themselves and their children: cross sectional study within a cohort (EarlyBird 21). *BMJ* 2005;330:23–24.
- 19 Baughcum AE, Chamberlin LA, Deeks CM, Powers SW, Whitaker RC: Maternal perceptions of overweight preschool children. *Pediatrics* 2000;106: 1380–1386.
- 20 Carnell S, Edwards C, Croker H, Boniface D, Wardle J: Parental perceptions of overweight in 3–5 y olds. *Int J Obes* 2005;29:353–355.
- 21 Etelson D, Brand DA, Patrick PA, Shirali A: Childhood obesity: do parents recognize this health risk? *Obes Res* 2003;11:1362–1368.
- 22 Maynard LM, Galuska DA, Blanck HM, Serdula MK: Maternal perceptions of weight status of children. *Pediatrics* 2003;111:1226–1231.
- 23 Glaesmer H, Brähler E: Prevalence estimation of overweight and obesity based on subjective data of body-mass-index (BMI). *Gesundheitswesen* 2002;64:133–138.

- 24 Chamberlin LA, Sherman SN, Jain A, Powers SW, Whitaker RC: The challenge of preventing and treating obesity in low-income, preschool children. *Ach Pediatr Adolesc Med* 2002;156:662–668.
- 25 Jain A, Sherman SN, Chamberlin LA, Carter Y, Powers SW, Whitaker RC: Why don't low-income mothers worry about their preschoolers being overweight? *Pediatrics* 2001;107:1138–1146.
- 26 Warschburger P, Kröller K: Maternal perception of weight status and health risks associated with obesity in children. *Pediatrics* 2009;124:e60–68.
- 27 Meyer AM, Evenson KR, Couper DJ, Stevens J, Pereria MA, Heiss G: Television, physical activity, diet, and body weight status: the ARIC cohort. *Int J Behav Nutr Phys Act* 2008;17:68.
- 28 Anderson SE, Economos CD, Must A: Active play and screen time in US children aged 4 to 11 years in relation to sociodemographic and weight status characteristics: a nationally representative cross-sectional analysis. *BMC Public Health* 2008;22:366.
- 29 Jahnke DL, Warschburger PA: Familial transmission of eating behaviors in preschool-aged children. *Obesity* 2008;16:1821–1825.
- 30 Carroll MK, Ryan-Wenger NA: School-age children's fears, anxiety, and human figure drawings. *J Pediatr Health Care* 1999;13:24–31.
- 31 Tielsch AH, Allen PJ: Listen to them draw: screening children in primary care through the use of human figure drawings. *Pediatr Nurs* 2005;31:320–327.
- 32 Knäuper B, Turner PA: Measuring health: improving the validity of health assessments. *Quali Life Res* 2003;12(suppl 1):81–89.
- 33 Asendorpf JB, Aken MA: Deutsche Versionen der Selbstkonzeptskalen von Harter (German versions of Harter's SPPC). *Z Entwicklungspsychol Päd Psychol* 1993;25:64–86.
- 34 Harter S: Manual for the Self-Perception Profile for Children. CO. University of Denver, Denver, 1985.
- 35 Eapen V, Nagvi A, Al-Dhaheeri AS: Cross-cultural validation of Harter's self-perception profile for children in the United Arab Emirates. *Ann Saudi Med* 2000;20:8–11.
- 36 Clatworthy S, Simon K, Tiedemann ME: Child drawing: hospital – an instrument designed to measure the emotional status of hospitalized school-aged children. *J Pediatr Nurs* 1999;14:2–9.
- 37 Thomas GV, Jolley RP: Drawing conclusions: a re-examination of empirical and conceptual bases for psychological evaluation of children from their drawings. *Br J Clin Psychol* 1998;37:127–139.
- 38 Kromeyer-Hauschild K, Wabitsch M, Kunze D, Geller F, Geiß HC, Hesse V, et al: Percentiles of body mass index in children and adolescents evaluated from different regional German studies. *Monatsschr Kinderheilkd* 2001;149:807–818.
- 39 World Health Organisation: Obesity: Preventing and Managing a Global Epidemic, Report of a WHO Consultation. WHO, Geneva, 2004.
- 40 Kostanski M, Gullone E: Adolescent body image dissatisfaction: relationships with self-esteem, anxiety, and depression controlling for body mass. *J Child Psychol Psychiatry* 1998;39:255–262.
- 41 Xie B, Liu C, Chou CP, Xia J, Spruijt-Metz D, Gong J, et al: Weight perception and psychological factors in Chinese adolescents. *J Adolesc Health* 2003;33:202–210.
- 42 Kim O, Kim K: Body weight, self-esteem and depression in Korean females. *Adolescence* 2001;36:315–322.
- 43 Muris P, Meesters C, Fijen P: The Self-Perception Profile for Children: further evidence for its factor structure, reliability, and validity. *Pers Individ Diff* 2003;35:1791–1802.
- 44 Phillips RG, Hill AJ: Fat, plain, but not friendless: self-esteem and peer acceptance of obese pre-adolescent girls. *Int J Obes* 1998;22:287–293.
- 45 Shin NY, Shin MP: Body dissatisfaction, self-esteem, and depression in obese Korean children. *J Pediatr* 2008;152:502–506.
- 46 Malik M, Bakir A: Prevalence of overweight and obesity among children in the United Arab Emirates. *Obes Rev* 2006;8:15–20.
- 47 Brewis A: Biocultural aspects of obesity in young Mexican schoolchildren. *Am J Hum Biol* 2003;15:446–460.
- 48 Williams B, Powell A, Hoskins G, Neville R: Exploring and explaining low participation in physical activity among children and young people with asthma: a review. *BMC Fam Pract* 2008;30:40.
- 49 Welsh L, Roberts RG, Kemp JG: Fitness and physical activity in children with asthma. *Sports Med* 2004;34:861–870.
- 50 Doolen J, Alpert PT, Miller SK: Parental disconnect between perceived and actual weight status of children: a metasynthesis of the current research. *J Am Acad Nurse Pract* 2009;21:166–166.
- 51 Parry LL, Netuveli G, Parry J, Saxena S: A systematic review of parental perception of overweight status in children. *J Ambul Care Manage* 2008;31:253–268.
- 52 Towns N, D'Auria J: Parental perceptions of their child's overweight: an integrative review of the literature. *J Pediatr Nurs* 2009;24:115–130.
- 53 Chaimovitz R, Issenman R, Moffat T, Persad R: Body perception: do parents, their children, and their children's physicians perceive body image differently? *J Pediatr Gastroenterol Nutr* 2008;47:76–80.
- 54 Hölling H, Schlack R, Dippelhofer A, Kurth BM: Personal, familial and social resources and health-related quality of life in children and adolescents with chronic conditions. *Bundesgesundheitsbl Gesundheitsforsch Gesundheitsschutz* 2008;51:606–620.
- 55 Wee CC, Davis RB, Phillips RS: Stage of readiness to control weight and adopt weight control behaviors in primary care. *J Gen Intern Med* 2004;20:410–415.
- 56 West DS, Raczynski, JM, Phillips MM, Bursac Z, Heath Gauss C, Montgomery BE: Parental recognition of overweight in school-age children. *Obesity* 2008;16:630–636.
- 57 McCabe MP, Ricciardelli LA: A longitudinal study of body image and strategies to lose weight and increase muscles among children. *J Appl Dev Psychol* 2005;26:559–577.