Reduced facial emotion recognition in overweight and obese children

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ABSTRACT

Objective: Emotional problems often co-occur in overweight or obese children. However, questions of whether emotion recognition deficits are present and how they are reflected have only been sparsely investigated to date.
Methods: Therefore, the present study included 33 overweight and obese as well as 33 normal weight elementary school children between six and ten years that were matched for sex, age and socioeconomic status. Participants were shown different emotional faces of a well-validated set of stimuli on a computer screen, which they categorized and then rated on an emotional intensity level. Key measures were categorization performance along with reaction times and emotional intelligence as well as emotional eating questionnaire ratings.
Results: Overweight children exhibited lower categorization accuracy as well as longer reaction times as compared to normal weight children, while no differences in intensity ratings occurred. Reaction time to neutral facial expressions was negatively related to intrapersonal and interpersonal emotional intelligence and emotional eating correlated negatively with accuracy for recognizing sad expressions.
Conclusion: Facial emotion decoding difficulties seem to be of importance in overweight and obese children and deserve further consideration in terms of their exact impact on social functioning as well as on the maintenance of elevated body weight during child development.

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Introduction

Overweight and obesity, the imbalance between calorie intake and expenditure, show increasing prevalence rates amongst children and adolescents from year to year [1]. Being overweight or obese in childhood is associated not only with high risk for somatic illnesses like cardiovascular diseases or diabetes [2] but also with emotional suffering as reflected in higher rates of depression and teasing experiences [3]. Next to environmental variables like availability and easy access to high-caloric snacks, psychological factors are important to understand contributing factors for overweight in children and adolescents. However, to date, the relationship between higher weight status and psychological factors remains poorly understood and controversial [4–7].

Some studies indicate that obesity is related to disturbed general ways to regulate and process emotions, which in turn may indicate emotional eating, the tendency to eat when experiencing negative affect [8–11]. The concept of emotional eating derives originally from Bruch's psychosomatic theory [12,13] in which eating is considered to be a response to distress, as consequence of an inability to distinguish hunger from other aversive internal states, probably because of early learning experiences. It is further known from other studies that overweight and obese people generally score higher on alexithymia, a construct describing difficulties to experience and express emotions [14–17].

Moreover, research highlights associations between obesity and emotional problems in children. Griffiths and colleagues [18] reported emotional peer relationship problems in a nationally representative sample of young children (age 3–5 years), whereby emotional and behavioral problems were parentally assessed using questionnaires. Other studies found interpersonal and intrapersonal emotional problems, often assessed by questionnaires, in obese children of different age groups [e.g. 19,20]. While these studies provide data collected in large samples, results rely either on self-report or on reports provided by teachers or parents. Assessing performance in tasks using relevant emotional stimuli that are associated with everyday functioning in behavioral paradigms might help to further elucidate whether childhood obesity is accompanied by emotional intrapersonal and interpersonal problems and which domains of emotional competence are affected.

Identifying emotional faces is an ability with high relevance for everyday social functioning. The human face represents a powerful medium for social signaling and the ability to decode complex facial expressions is therefore essential to social behavior in general as well as to be able to actively participate in the social environment and to successfully interact with others (for a recent review on facial emotion processing in child psychiatric disorders see [21]). To our knowledge, only three studies have investigated whether overweight and obese children are hampered in their ability to correctly decode information from emotional faces, leading to inconsistent results: Baldaro and

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colleagues [22,23] demonstrated in two studies that obese children and their mothers showed a reduced ability to decode visual and verbal signs of emotions as compared to a control group when using pictures and film clips with actors expressing different kinds of emotions (anger, sadness, disgust, surprise, fear, happiness in their first study [22] anger, happiness, sadness and fear in their second study [23]). Surcinelli and co-workers [24] reported that young obese participants had significant lower scores than control participants in emotional awareness, but no differences were found in the recognition of emotional faces. Both studies used different experimental paradigms and rather few children in a broad range of age with different control group criteria, which might be reasons why inconsistent results were obtained. Questions of how children experience e.g. the intensity of a facially expressed emotion, of possible speed differences in categorization, as well as of possible associations of behavioral data with emotional questionnaire data have not been addressed yet. Therefore, the present study utilized a novel, more standardized and computerized paradigm to categorize emotional expressions that allowed recording reaction times and intensity ratings in comparison to paper–pencil tasks that were used before [22,23]. To our knowledge, there has been no study so far that investigated the link between emotion recognition and emotional eating although both characteristics have been well described in overweight and eating pathology populations [11,13,22].

The goal was to investigate recognition accuracy and emotional intensity rating towards emotional faces in a group of overweight elementary school children compared to diligently matched normal weight children. We used happy, sad, angry and neutral emotional faces from the Karolinska Directed Emotional Faces Battery (KDEF) [25] and applied a forced choice reaction task to let the children categorize them. We assumed that overweight and obese children should show more difficulties in categorizing emotional faces, especially of negative content, which should be reflected in both reduced hit rates as well as prolonged reaction times in the corresponding task. Whether or not such difficulties would be accompanied by differences in emotional intensity attribution should also be investigated. In a last step, we examined whether obtained behavioral data correlated with obtained questionnaire data on emotional eating as well as on intrapersonal and interpersonal emotional intelligence.

Method

Participants

According to body mass index (BMI), we invited 37 overweight children (BMI > 90th BMI percentile, based on the national reference data for German children [26]) and 37 normal weight children (≥25th to ≤75th BMI percentile, based on the national reference data for German children [26]) between six and ten years originating from a larger ongoing longitudinal study on intrapersonal developmental risk factors in childhood and adolescence (PIER study) for an additional appointment in the lab. The whole longitudinal study sample consisted of 1657 children, recruited and tested in school, with a current representative weight distribution (81.1% normal weight and 12.9% overweight or obese, see [27] for further information on sample characteristics and study procedure). Both additionally invited groups were matched for age, sex and socioeconomic status (SES). One child and its match had to be excluded due to technical problems (behavioral data was not recorded) and after data inspection, three further children and their matches were excluded due to invalid behavioral data. Therefore, we included 33 overweight and 33 normal weight children in the final sample for analyses. There were 32 girls and 34 boys in the sample. Table 1 depicts further demographics and weight status data for both groups. There were no differences in demographic measures between groups ($1.46 \leq t\,(64) \leq 1.71$, $.10 \leq p \leq .15$) but body status measures differed highly significantly between the overweight group and the normal weight group ($9.52 \leq t\,(64) \leq 21.33$, $p \leq .001$, $2.34 \leq d \leq 5.25$). 13 children

Table 1
Subjects' demographics and weight status data.

	Overweight group $N = 33$		Normal weight group $N = 33$	
	M	SD	M	SD
Age (years)	8.59	.96	8.94	.79
SES (Blossfeld scale; mean both parents)	1.79	1.10	2.23	.99
Educational attainment (mean both parents)	4.08	.95	4.41	.91
BMI***	22.61	2.67	16.23	.85
BMI-SDS***	1.98	.44	− .13	.36
Whole-body percent fat (%)***	30.77	5.46	18.01	2.90
Waist circumference (cm)***	73.42	8.13	57.43	5.21

*** Significant difference, unpaired t-test between groups, $p < .001$.

were classified as overweight (BMI > 90th BMI percentile), 15 as obese (BMI > 97th BMI percentile) and 5 children as severely obese (BMI > 99.5th BMI). Legal guardians were provided with a full explanation of procedures and gave written informed consent before testing. Approval for the study was obtained from the local Ethics Committee. Parents received €10 and children received €5 and a small gift for their participation afterwards.

Socioeconomic measures

We assessed SES according to actual parental occupation following the classification scheme of Blossfeld [28]. Here, the occupational qualification of each parent is classified from 0 (= unemployed) to 4 (= highest qualified occupation). Further, parents' educational attainment was distinguished from 1 (= no educational degree) to 6 (= university degree).

Body related measures

We determined children's height to the nearest 1.0 cm using a mobile stadiometer (*Seca 213*). Children's weight and percentage of body fat were measured to the nearest 0.1 kg/% by means of a calibrated digital body fat scale (*Tanita BC-532*). BMI was calculated as the standard ratio of weight in kg divided by the square of height in meters. Individual BMI-values were also converted to Z-scores (*BMI-SDS* values, standard deviation score values) based on the national reference data for German children [26] that also served as reference for weight classification (normal weight vs overweight). We measured children's waist circumference to the nearest 0.1 cm at the midpoint between the lower border of the rib cage and the iliac crest by using a flexible body measuring tape.

Emotional Faces Categorization Task

A total of 20 full-color photographic standardized pictures of young European adult faces from the Karolinska Directed Emotional Faces database [24] served as stimuli. Referring to their normative ratings and to the validation study of Goeleven, De Raedt, Leyman, and Verschuere [29], happy, angry, sad and neutral facial expressions (five different pictures of each category, five men and five women with the highest hit rate accuracy scores, each displaying two expressions, all photographed from the front) were selected.

Emotion category and intensity ratings were obtained for each picture. The two rating scales per picture were presented separately for each facial expression. All pictures were presented in random order with equal probabilities on a computer screen. First, participants were asked to classify the faces according to the four emotional categories that were written under the picture as answer options by clicking on the word that they thought best matched the emotional expression of