



Research report

A longitudinal investigation of overweight children's body perception and satisfaction during a weight management program [☆]



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ABSTRACT

Background: The Children's Body Image Scale (CBIS) is a measure of body perception and satisfaction. Obesity has a negative impact on children's body satisfaction. This study aimed to (1) determine the construct validity of the CBIS in a purely overweight/obese sample, and (2) explore longitudinal changes in body perception and satisfaction in overweight/obese children participating in a six month weight management program delivered to parents. Data were self-reported by overweight/obese 5 to 9 year old children ($n = 127$) over a 36 month period. **Findings:** The CBIS demonstrated good construct validity (ρ : range 0.38 to 0.71, $p < 0.05$). Accuracy in body size perception did not alter significantly over time (ρ : range 0.45 to 0.59, $p < 0.001$). No consistent differences in body satisfaction by age or sex were observed. Body satisfaction improved after the six month weight management intervention (mean difference = 0.74, 95% CI 0.15–1.26) which was maintained at 36 month follow up. **Conclusion:** The CBIS is a useful measure to monitor overweight/obese children's body satisfaction. In this cohort, it is suggestive that the child weight management program delivered to parents did not impact negatively on children's body satisfaction.

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Introduction

Childhood obesity is known to affect both physical and psychosocial domains of health (Ebbeling, Pawlak, & Ludwig, 2002). Overweight children experience higher levels of body dissatisfaction compared with their non-overweight counterparts (Lombardo, Battagliese, Pezzuti, & Lucidi, 2013), indicating that larger body size impacts negatively on children's experience of their bodies. Negative body image is implicated in the development of extreme dieting behaviours which can be the precursor of eating disorders (Smolak,

2004). Despite this, there is a lack of research on body satisfaction in overweight children and how weight management interventions may alter this over time.

In a recent review of children's views on body size and shape (Rees, Oliver, Woodman, & Thomas, 2011), only 3/28 studies included overweight or obese children. Further, only 3/64 studies (Braet, Tanghe, Decaluwe, Moens, & Rosseel, 2004; Golley, Magarey, Baur, Steinbeck, & Daniels, 2007; McCallum et al., 2007) from the 2009 Cochrane review on childhood obesity interventions (Oude Luttikhuis et al., 2009) included body satisfaction as an outcome. Measures of body satisfaction that have been validated in overweight or obese children are scarce (Lombardo et al., 2013; Rees et al., 2011), and this may be one reason for the lack of data on the relationship between children's body satisfaction and weight loss.

The Children's Body Image Scale (CBIS) is a pictorial scale that has been used widely to measure pre-adolescent children's self-perception of their body size and further to elucidate what their ideal body size would be (Truby & Paxton, 2002, 2008). Williamson, Gleaves, Watkins, & Schlundt (1993) first described and validated the use of self-ideal discrepancy scores as a method to measure body dysphoria in pre-adolescents in 1993. The construct validity of the CBIS as a measure of body satisfaction was supported by medium-strong correlations when tested in a cohort of 153 7–12 year old children across a range of BMI percentiles (Truby & Paxton, 2002). The CBIS was also shown to be reliable in this sample (Truby &

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Paxton, 2002). The CBIS comprises a sex-specific scale of seven black and white photographs of children of known BMI. When categorised according to the International Obesity Task Force (IOTF) BMI cut off points (Cole, Bellizzi, Flegal, & Dietz, 2000) boy figures 5, 6 and 7 are classified as overweight, obese and obese categories respectively and girl figures 5, 6 and 7 represent overweight, overweight and obese categories respectively.

To date, the construct validity of the CBIS as a measure of body satisfaction has been tested primarily in cohorts spanning a range of BMIs (Truby & Paxton, 2002). These studies have not investigated whether its validity alters in overweight and obese children. Therefore this study aimed to (1) determine the construct validity of the CBIS in a purely overweight/obese sample and (2) explore longitudinal changes in body perception and satisfaction in overweight/obese children participating in a six month weight management program delivered to parents.

Subjects and methods

Data and sample description

Data were from two Australian child weight management studies – the Healthy Eating and Lifestyle through Positive Parenting (HELPP) and the Parenting, Eating & Activity for Child Health (PEACH™) randomised controlled trials (RCTs) (Golley et al., 2007; Golley, Perry, Magarey, & Daniels, 2007; Magarey et al., 2011). Families were recruited from the community (i.e. via media publicity, school newsletters) and the studies were conducted through three metropolitan teaching hospitals. Further details of recruitment are provided in the respective results papers (Golley et al., 2007; Magarey et al., 2011). The study selection criteria were 5- to 9-year-old prepubertal, overweight/mildly obese (IOTF definition, BMI z score < 4.0), otherwise healthy (i.e. no co-morbidities) children (Golley et al., 2007; Magarey et al., 2011). The intervention was a six month parenting-skills training plus lifestyle education program delivered to parents of 5- to 9-year-old children (Golley et al., 2007). The lifestyle intervention was similar in both studies and did not specifically focus on children's weight loss; rather it provided parents with knowledge and skills to support them to establish appropriate child and family weight-related lifestyle behaviours, such as choosing lower fat foods and reducing sedentary behaviours (Golley et al., 2007).

Measures and data collection

The CBIS was employed as an outcome measure to assess the impact that the interventions had on the children's body satisfaction. Children were weighed and measured by trained researchers and BMI was calculated (kg/m^2) and converted to a BMI z score by using United Kingdom reference data provided as a computer program (Child Growth Foundation, London, United Kingdom) (Golley et al., 2007; Magarey et al., 2011). The CBIS (Truby & Paxton, 2002) was administered to children by trained researchers, who were blinded to randomisation, at baseline, 6, 12, 18 and 36 months. Children completed the CBIS via a standardised interview process (Truby & Paxton, 2002). Questions were read to children individually in a quiet room without parents present. The interview was structured such that children could clarify questions and built in prompts were used to check children understood the task and that their answers accurately reflected their feelings. Following adequate time and repeating of the question, children were able to choose not to answer the question.

Children were shown an A4 page on which the seven sex relevant CBIS figures were depicted and asked to identify the figure they believed looked most like themselves (perceived body size). The difference between a child's actual measured BMI and their perceived

CBIS figure (actual-perceived discrepancy score) was a measure of accuracy of *body image perception*. A score of 0 (i.e. no discrepancy) indicates that the child was able to accurately determine their body size. A positive (high) score indicates a child perceives themselves as thinner than they actually are.

The children were then asked to pick the CBIS figure that they would most like to look like (desired body size); the difference between children's perceived and desired figure (perceived-desired discrepancy score) was a measure of *body image satisfaction*. The CBIS body satisfaction ranges from -6 to +6 with 0 indicating satisfied with body (i.e. no discrepancy). Both +6 and -6 indicate dissatisfaction: positive indicates they are dissatisfied and want to be thinner, negative indicates they are dissatisfied and want to be fatter.

Data analyses

Statistical analyses were performed using IBM-SPSS for Windows v20. Analyses included participants for whom data at all relevant points were available (i.e. $n = 126$ and $n = 75$ at 12 and 36 months respectively). The CBIS body satisfaction score is ordinal data, but as is convention, scores were treated as interval data, with means and standard deviations presented (Truby & Paxton, 2002).

Construct validity was assessed using Spearman's correlation to compare the CBIS body satisfaction score with responses to two questions: the first relating to *perceived body image* ('Do you think your body is: (1) much too thin; (2) a little too thin; (3) just right; (4) a little too fat or (5) much too fat?') and the second relating to *desired body image* ('Would you like your body to be: (1) a little thinner; (2) stay the same; (3) a little fatter or (4) much fatter?'). Data were collected for three consecutive years so at the end of the studies, the oldest children were 12 years. Data were found to have equality of variance of residuals. The main effect of time (factor variable 0, 6, 12, 18 and 36 months) on BMI z score, CBIS body perception and satisfaction scores (outcome variables) were examined via repeated measures ANOVA. Post hoc analysis was performed using the Bonferroni method. The Mann-Whitney U test was used to determine whether there were sex and age differences in body perception and satisfaction.

Results

Data were available for 126/244 children with complete data at baseline, 6 and 12 months (45% and 53% from the PEACH and HELPP studies respectively), with complete data to 36 months available for 75/244 participants (31% and 29% from the PEACH and HELPP studies respectively). There were no significant differences between the completers used in this analysis and all study participants with respect to sex ($p = 0.92$), age ($p = 0.99$) or baseline BMI z score ($p = 0.34$). In the sample analysed, the majority of children were female (59%), the average age at baseline was 8.2 ± 1.1 years and baseline BMI z scores ranged from 1.35 to 3.92. Mean baseline BMI z score was 2.68 ± 0.58 (i.e. 99.6th percentile) and was significantly lower at six months, i.e. end of the intervention (2.43 ± 0.66 , $p < 0.001$ i.e. 99.2nd percentile) and 36 months (2.33 ± 0.75 , $p < 0.001$ i.e. 99.0th percentile) compared to baseline.

The construct validity of the CBIS as a measure of body satisfaction was supported by medium-strong correlations which tended to increase over time (Table 1). A positive correlation indicates that as CBIS body satisfaction scores become more positive (i.e. children want to be thinner), children perceive themselves as being heavier on the perceived body image question. A negative correlation indicates that as CBIS body satisfaction scores become more positive (i.e. children want to be thinner), children reported more desire to be thinner on the desired body image question. No consistent sex or age differences within time points were observed.

Table 1

Spearman's rank correlation coefficients between body satisfaction (perceived-desired CBIS figure discrepancy) and the single item asking about (a) perceived and (b) desired body image at baseline, six and 12 months for the whole sample and stratified by sex and age.

	Baseline	6 Months	12 Months
Perceived body image			
All (n = 126)	0.41***	0.46***	0.61***
Boys (n = 50)	0.44**	0.53***	0.55***
Girls (n = 76)	0.41***	0.44***	0.66***
Age < 9	0.38*** (n = 90)	0.48*** (n = 69)	0.71*** (n = 45)
Age ≥ 9	0.55*** (n = 36)	0.49*** (n = 57)	0.53*** (n = 81)
Desired body image			
All (n = 127)	-0.33***	-0.43***	-0.47***
Boys (n = 50)	-0.40**	-0.45**	-0.43**
Girls (n = 77)	-0.30**	-0.45***	-0.50***
Age < 9	-0.32** (n = 91)	-0.55*** (n = 70)	-0.59*** (n = 46)
Age ≥ 9	-0.34* (n = 36)	-0.21 (n = 57)	-0.36** (n = 81)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

CBIS, Children's Body Image Scale.

Mean(SD) of body image perception was >0 at all time points indicating that children consistently perceived their body size to be lower than their actual BMI (Table 2). Body perception did not change significantly over time ($F_{4,72} = 0.56$, $p > 0.05$). Mean(SD) of body image satisfaction was >0 at all time points, indicating that children who desired to be thinner than their perceived body size were dissatisfied with their body size at baseline and remained so across the study time points. However, the magnitude of perceived-desired discrepancy score decreased over time ($F_{4,84} = 0.70$, $p < 0.0005$, multivariate partial eta squared = 0.30), i.e. body satisfaction improved. Post hoc analysis indicated a mean reduction of 0.74 in perceived-desired discrepancy score during the six month intervention phase which was maintained over the follow up period (Table 2). No significant sex or age differences were identified for scores of body perception or satisfaction (data not shown).

Discussion

The CBIS has recently met the criteria as an outcome measure for the evaluation of obesity treatment interventions by the UK National Institute of Health Research (Bryant et al., 2004). It is therefore timely that the construct validity of the scale in a purely overweight sample is reported, to our knowledge, for the first time. Based on the current findings, the CBIS appears to be a valid tool to measure

Table 2

Mean(SD) for actual-perceived (body perception) discrepancy score and perceived-desired (body satisfaction) discrepancy scores and BMI z score.^a

	Body perception	Body satisfaction ^b	BMI z score
N=	77	88	77
Baseline	0.85(1.22)	2.66(1.44)	2.68(0.58)
6 Months ^c	0.99(1.08)	1.92(1.35)	2.43(0.66)
12 Months	1.10(1.11)	1.85(1.27)	2.43(0.68)
18 Months	1.04(1.07)	1.82(1.18)	2.40(0.68)
36 Months	1.04(1.08)	1.85(1.17)	2.33(0.75)
P value ^d	>0.05	0.0005	<0.01

CBIS, Children's Body Image Scale.

^a A positive (high) score for body perception indicates perceived BMI was lower than actual and a positive (high) score for body satisfaction indicates perceived BMI is higher than desired (i.e. more dissatisfaction).

^b Data available for $n = 88$ including children attending all data collection points, but did not provide weight or height measures at 36 months.

^c End of intervention period. Post hoc $p < 0.05$ compared to baseline: Body satisfaction and BMI z score remained significant at other time points compared to baseline, but no other significant differences between 6 to 36 months.

^d P-values derived from repeated measures ANOVA with a post hoc Bonferroni correction.

body satisfaction longitudinally in overweight children, including evaluation of the impact of weight management interventions. It would be helpful however to have these findings confirmed in other longitudinal cohorts who are undergoing weight management. The CBIS provides a means of examining the impact of overweight and obesity on children's psychosocial health and measuring intervention effectiveness or unintended effects.

The lack of sex differences in body perception in the present analysis is consistent with non-overweight samples using tools other than the CBIS to measure body perception and satisfaction (Gardner, Friedman, Stark, & Jackson, 1999; Williamson & Delin, 2001). However, previous research using the CBIS in a mainly non-overweight population (Oude Luttikhuis et al., 2009) found sex differences in body perception, whereby girls were more accurate at perceiving their figure using the CBIS compared to boys. The inconsistencies between studies in non-overweight samples may be explained by the use of different measurement tools. Unlike the CBIS, the pictorial scale used by Williamson & Delin (2001) included only five figures and was not linked to children's measured BMI. Hence to measure body perception, children's perceived figure was matched with their measured BMI rather than the figure their BMI represented. Gardner et al. (1999) employed a video technique to adjust the width of a human image to determine children's perception of body size. Hence, children were not limited to choosing from a set of pre-defined images. An alternative explanation for these inconsistent findings relating to sex differences in body perception utilising the CBIS in overweight/obese and non-overweight studies may be that weight status distorts sex-differences in body perception.

In this overweight/obese group, body perception was not influenced by age. This is different from our (Truby & Paxton, 2002) and others' (Lombardo et al., 2013) experience in mainly non-overweight children, where findings suggest that children's accuracy in being able to match their body size with that of a picture of known BMI (body size perception) improves with age (Collins, 1991). It may be that the effect of always being overweight distorts children's body perception so they remain inaccurate at perceiving their figure size as they grow older. It must also be noted that there was a need to split the children into two age categories (<9 years and ≥ 9 years) to enable sufficient sample sizes for analyses. In previous research where age differences were observed (Truby & Paxton, 2002), children were split into three age groups (<8 years, ≥ 8 years to <10 years and 10–12 years). Differences between what age groups children were split into may explain differences in study results in regard to whether age impacts accuracy of body perception. However, another study (Collins, 1991) suggested that body perception improved around 9 years of age, which was not observed in the current study even though subjects were split at 9 years of age.

A positive outcome was that body satisfaction improved during the intervention period, possibly because the child weight management program focused on parenting skills applied to child lifestyle behaviours and was designed to support parents to make family lifestyle changes and not overtly focus on weight loss. This is consistent with another weight loss intervention (Braet et al., 2004) but not with McCallum et al. (2007), who reported that body satisfaction was relatively constant over time; however this could be attributed to the minimal weight changes achieved in their study (0.2 kg/m² and 0.0 kg/m² at 9 and 15 months respectively). Braet et al. (2004) reported on obese children (7–17 years) admitted for an intensive 10-month inpatient intervention program in whom mean BMI decreased by 8.6 kg/m², and by 4.9 kg/m² at 14-month follow up. These results suggest that a large reduction in degree of overweight is required to improve body satisfaction. This highlights the chronic nature of overweight and the importance of on-going support from health professionals who need to be mindful of body image concerns.

Previous literature has identified a gendered phenomenon, with girls experiencing greater body satisfaction (Jung & Peterson, 2007; Truby & Paxton, 2002; Williamson & Delin, 2001). Sex differences in the current dataset may have been concealed by the impact being overweight or obese has on overall body satisfaction. Evidence suggests that girls can experience weight concerns when they are normal weight or even underweight, whereas boys are more likely to have weight concerns when they have high BMIs (McCreary, 2002). Hence, in a cohort consisting exclusively of overweight children, boys' desire to be thin appears to equal that of girls. The absence of sex differences may also be explained by the age of participants. Literature suggests that sex differences emerge between 8 and 10 years (Gardner, Sorter, & Friedman, 1997); therefore the sample may have been too young to show sex differentiation.

There was no difference in body satisfaction between the age groups. This observation is inconsistent with previous literature (Gardner et al., 1997; Ricciardelli & McCabe, 2001) which indicates that body satisfaction decreases with age but again these data are derived from mainly non-weight children and early onset of childhood obesity could illicit a different response in terms of children's body satisfaction.

A limitation of these analyses was that they only included participants for whom data were available at all time points. Results are therefore only generalisable to overweight/obese children seeking treatment and completing follow up. However the sample analysed did not differ from the whole study sample with respect to sex, age or baseline weight status, providing some confidence for the generalisability of the study findings.

In conclusion, the CBIS demonstrates construct validity in overweight/obese children. In this cohort, it is suggestive that by focusing on delivery of a child weight management program via the parents, the intervention *per se* had no negative effect on children's body satisfaction. The CBIS provides a simple and quick method of examining the impact of overweight and obesity on children's psychosocial health and measuring intervention effectiveness longitudinally.

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