

BMI and sociodemographic correlates of body image perception and attitudes in school-aged children

Ofra Duchin¹, Mercedes Mora-Plazas², Constanza Marin², Carlos Mendes de Leon³, Joyce M Lee^{1,4}, Ana Baylin^{1,3} and Eduardo Villamor^{3,*}

¹Department of Environmental Health Sciences, University of Michigan School of Public Health, Ann Arbor, MI, USA; ²Fundación para Investigación en Nutrición y Salud, FINUSAD, Bogotá, Colombia; ³Department of Epidemiology, University of Michigan School of Public Health, M5055 SPH II, 1415 Washington Heights, Ann Arbor, MI 48109-2029, USA; ⁴Division of Pediatric Endocrinology, University of Michigan, Ann Arbor, MI, USA

Submitted 22 March 2013; Final revision received 26 June 2013; Accepted 25 July 2013; First published online 4 September 2013

Abstract

Objective: The aim of the present study was to identify correlates of body image perception and dissatisfaction among school-aged children from Colombia, a country undergoing the nutrition transition.

Design: Cross-sectional study. Using child-adapted Stunkard scales, children were asked to indicate the silhouette that most closely represented their current and desired body shapes. Body image dissatisfaction (BID) score was estimated as current minus desired silhouette. Height and weight were measured in all children. Sociodemographic data were collected through questionnaires completed by the children's mothers.

Setting: Public primary schools in Bogotá, Colombia.

Subjects: Children aged 5–12 years (n 629) and their mothers.

Results: Mean BID score was 0.1 (SD 1.7). The strongest predictor of BID was actual BMI-for-age Z-score (BAZ). Compared with children with $BAZ \geq -1$ and <1 , those with $BAZ \geq 2$ had a 1.9 units higher BID score (P for trend <0.0001). BID tended to be higher in girls than boys at any level of BAZ. Other correlates of BID included child's height-for-age Z-score, maternal BMI and dissatisfaction with the child's body, and home ownership.

Conclusions: Among school-aged children from a country experiencing the nutrition transition, body image perception was associated with the child's weight and height, and with maternal BMI, dissatisfaction with the child's body and socio-economic level.

Keywords
Body image perception
Body image dissatisfaction
BMI
School-aged children

Low- and middle-income countries around the world are experiencing a rapid increase in the prevalence of overweight and obesity^(1,2). This trend, also evident in Latin American countries^(3,4), is associated with a nutrition transition, which entails marked changes in dietary habits and physical activity as a country moves from a traditional way of living to a more Westernised lifestyle. Accelerated increase in obesity rates among children is of special concern because childhood obesity not only has many short-term adverse effects⁽⁵⁾, but is also likely to track into adulthood⁽⁶⁾ and predict chronic diseases later in life⁽⁷⁾.

In addition to dietary intake and physical activity^(8,9), psychological factors including body image perception and weight-related concerns are associated with childhood obesity. For example, children may perceive their current body image as either heavier or thinner than it really is and may desire a thinner body image compared with the current one^(10,11). These associations have been documented at ages as early as pre-school years⁽¹²⁾.

Parental perception of the child's body image may play an important role in shaping the child's body perception and behaviours related to body image, through parents' weight-related attitudes, diet-talk and feeding practices^(13–15). In addition to its potential influence on the child's own body image, parents' perception of the child's body image may pose a serious obstacle for clinicians or public health professionals who are attempting to address childhood obesity⁽¹⁶⁾, particularly when interacting with parents who misperceive their child's actual weight^(17–20).

Perceptions of body image by both the child and the parents depend on additional factors such as socio-economic status (SES) and exposure to mass media and acculturation towards a Westernised lifestyle that promotes stereotypical ideas of body shape^(17,19,21–24). Although associations between the child's weight status and body image perceptions in children have been previously investigated in developed countries, little is known in populations undergoing the nutrition transition.

*Corresponding author: Email villamor@umich.edu

In these populations, both obesity rates and exposure to Westernised ideals of thinness are expected to continuously increase among adults and children.

The aim of the present study was to identify socio-demographic and anthropometric correlates of body image perception and attitudes among school-aged children from Colombia, a country undergoing the nutrition transition. In addition, we examined various psychosocial constructs of body image perception and examined their potential contribution to body image dissatisfaction in the child.

Methods

Study population and field methods

We conducted the present cross-sectional study in the context of the Bogotá School Children Cohort. This ongoing nutrition and health investigation of primary-school children in Bogotá, Colombia is described in detail elsewhere⁽²⁵⁾. Briefly, in February 2006 we recruited 3202 children aged 5–12 years to represent all primary public schools in Bogotá by the end of 2005. The children came from 2981 households, when accounting for siblings. The majority of children attending public schools are from low- and middle-income families in the city⁽²⁶⁾; thus the study population is representative of these strata.

Parents or main caregivers filled out self-administered questionnaires (82% response) during the first week of classes. These questionnaires were used to obtain information on several characteristics of the child, including sex, age, birthplace and number of hours spent weekly in front of a screen or engaging in outdoor physical activity. The questionnaires also elicited information on mother's age and birthplace, marital status, maternal parity and years of education. Finally, caregivers were asked to provide information on various indicators of socio-economic level, such as the number of home assets; household SES based on the government's classification for tax and planning purposes; and home ownership status.

Trained research assistants visited the schools and obtained the children's height and weight measurements, using standard protocols⁽²⁷⁾. Height was measured without shoes to the nearest 1 mm with a wall-mounted portable Seca 202 stadiometer, and weight was measured in light clothing to the nearest 0.1 kg on a Tanita HS301 solar-powered electronic scale. In a random sub-sample of 629 children, information was obtained on their body image perceptions and attitudes with the use of child-adapted Stunkard figure rating scales. These sex-specific scales, formally validated in children⁽²⁸⁾, portray eight figurines in increasing order of body girth from 1 (thinnest) to 8 (heaviest). Using these scales, children were asked to indicate specific silhouette numbers in response to questions regarding their perceptual body image, i.e. to identify the silhouette that resembled their current body image, and

their attitudinal body image, i.e. the silhouette that represented the body image they desired to have. In addition, children were asked to select silhouettes that represented psychosocial constructs related to body image, including the silhouette that 'looked normal', 'looked best', 'had more friends' and 'looked strongest'. Mothers of 367 children in this sub-sample were asked to use the same child-adapted figurine scales to answer questions about the way they perceived their child's body image, including the silhouette that resembled the child's current body image and the one the mother desired for her child.

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving the participants were approved by the Ethics Committee of the National University of Colombia Medical School. The Health Sciences and Behavioral Sciences Institutional Review Board at the University of Michigan approved the use of data from the study. Prior to enrolment, informed consent was obtained in writing from parents or primary caregivers of all children.

Data analysis

The 629 children in the body image sub-sample did not differ from the rest of the cohort in terms of sex, age, SES or anthropometric characteristics. We examined three main outcomes of interest: (i) the silhouette representing the child's current body (body image perception); (ii) the silhouette representing the body desired by the child; and (iii) the difference between the two, which we identified as a body image dissatisfaction (BID) score and represents attitudinal body image⁽²⁸⁾. A negative BID score was obtained when the silhouette selected to represent the desired body image was greater than that chosen to represent current body image, i.e. a desire for a larger body size. A zero BID score was obtained when the silhouettes representing desired and current body images were equal, indicating satisfaction with body image. Finally, a positive BID score represented a desired body image that was leaner than the perceived current body image, a reflection of the desire for a thinner body.

We first examined the distribution of child and maternal characteristics. Height- and BMI-for-age Z-scores (HAZ and BAZ, respectively) were estimated based on the 2007 WHO growth references⁽²⁹⁾. Maternal BMI was calculated from measured height and weight in 40% of the mothers and from self-reported data in all other mothers. On the basis of a sum from among six items (refrigerator, bicycle, blender, television, stereo and washing machine), we created for analysis an index of home asset ownership. Household socio-economic stratum was determined according to the local government's classification of public service fees, which are higher in wealthier neighbourhoods than in poorer ones (1–4 in the sample, with 1 being lowest).

Next, we compared the distribution of each of the three body image perception outcomes (silhouettes indicated

by the child as current and desired body image, and BID score) by categories of sociodemographic and anthropometric predictors by estimating means (and standard deviations). Differences in the outcomes' distribution by dichotomous predictors were tested using Wilcoxon's rank-sum test. For ordinal predictors, a test for trend was obtained by introducing a continuous variable representing the ordinal categories of the predictor into a linear regression model. We used multivariable linear regression to examine the associations of child's BAZ with each outcome. Explanatory variables included BAZ and potential confounders such as child's age, HAZ and home ownership, an indicator of SES. Because the association of BAZ with these outcomes was non-linear, we used restricted cubic splines⁽³⁰⁾ to accurately represent its curvilinear shape. One linear term and three spline terms for BAZ were used in the models. These analyses were conducted separately for boys and girls.

Finally, we analysed the associations of the two components of child's BID, i.e. silhouette numbers indicating perceived ('current') and desired body image, with the child's responses to additional body image perception questions that represented psychosocial constructs of body image. In the subset of 367 children with data on maternal perception of the child's body, we studied the relationships of maternal and child body image perceptions and attitudes. Because these ordinal variables were not normally distributed, we calculated Spearman correlation coefficients between each pair of variables. Partial correlations were obtained by adjustment for child's age. These analyses were stratified by child's sex

and weight status (thin if $BAZ < -1$; normal if $BAZ \geq -1$ and < 1 ; heavy if $BAZ \geq 1$), on the assumption that body image perception depends on those characteristics.

All analyses were conducted with the use of the statistical software package SAS version 9.2.

Results

Mean age of the children was 8.6 (SD 1.7) years; 51% were boys (Table 1). Boys had a higher mean BAZ than girls (0.23 (SD 1.17) *v.* 0.04 (SD 0.99), $P = 0.10$). Nevertheless, compared with boys, girls chose a slimmer silhouette as their desired body image (3.5 (SD 1.3) *v.* 3.8 (SD 1.4), $P = 0.02$) and had a slightly higher BID score (0.2 (SD 1.7) *v.* 0.0 (SD 1.8), $P = 0.17$), representing a greater desire to be thinner (Table 2). In the subset with information on maternal body image perception, mothers also chose heavier silhouettes to reflect the desired body image for their sons (4.3 (SD 0.7)) compared with their daughters (3.9 (SD 0.8), $P = 0.002$). Maternal dissatisfaction with the child's body image score reflected a desire to have heavier children, especially for boys.

Silhouettes chosen by the children to indicate their current and desired body images were each positively associated with age (P for trend = 0.01 and 0.002, respectively; Table 3). Compared with shorter children ($HAZ < -2$), taller children ($HAZ \geq 1$) reported a current silhouette that was heavier by an average of 0.6 units and had a mean BID score that was higher by 1.2 units (P for trend = 0.006 and 0.002, respectively). The silhouette

Table 1 Characteristics of school-aged children and their mothers, Bogotá, Colombia, 2006*

	All (n 629)		Boys (n 320)		Girls (n 309)	
	Mean	SD	Mean	SD	Mean	SD
Child's characteristics						
Age (years)	8.6	1.7	8.6	1.7	8.5	1.7
Child was born in Bogotá (%)	88.4		89.0		87.7	
Height-for-age Z-score†	-0.66	0.93	-0.69	0.94	-0.64	0.92
BMI-for-age Z-score†	0.14	1.09	0.23	1.17	0.04	0.99
Maternal characteristics						
Age (years)	35.6	6.9	35.6	7.0	35.6	6.7
Mother was born in Bogotá (%)	39.0		35.9		42.1	
Education (years)	9.0	3.3	9.0	3.3	9.0	3.2
Mother is a single parent (%)	23.5		24.1		23.0	
Parity (%)						
1	12.7		13.4		12.1	
2	38.3		36.6		40.0	
3	28.0		26.0		30.0	
≥4	21.0		24.0		17.9	
Height (cm)	158.0	6.3	157.7	6.2	158.3	6.3
BMI (kg/m ²)	24.2	3.9	24.2	3.9	24.1	4.0
Household characteristics						
Number of home assets‡	4.1	1.6	4.1	1.6	4.1	1.5
Lower socio-economic status§ (%)	24.2		27.2		21.1	
House is owned by family (%)	31.3		31.7		30.9	

*Values are presented as means and standard deviations unless noted otherwise.

†According to the WHO 2007 growth references⁽²⁹⁾.

‡From a list that included bicycle, refrigerator, blender, television, stereo and washing machine.

§Stratum 1 or 2 of a maximum 4 in the sample and a maximum of 6 in total, according to the government's classification for tax and planning purposes.

Table 2 Body image perception and attitudes of school-aged children and their mothers in Bogotá, Colombia, 2006*

	All (n 629)		Boys (n 320)		Girls (n 309)	
	Mean	SD	Mean	SD	Mean	SD
Child's body image perception and attitudes						
Silhouette indicated as 'normal'	4.4	1.2	4.5	1.1	4.3	1.3
Silhouette indicated as 'looks best'	3.8	1.5	3.9	1.5	3.8	1.5
Silhouette indicated as 'has more friends'	4.4	2.1	4.4	2.1	4.4	2.1
Silhouette indicated as 'strongest'	6.7	1.5	6.6	1.6	6.8	1.5
Silhouette indicated as current	3.8	1.3	3.8	1.3	3.8	1.3
Silhouette indicated as desired	3.6	1.3	3.8	1.4	3.5	1.3
Body image dissatisfaction score†	0.1	1.7	0.0	1.8	0.2	1.7
Maternal body image perception of child‡						
Silhouette indicated as current	3.6	1.1	3.6	1.2	3.5	1.1
Silhouette indicated as desired	4.1	0.8	4.3	0.7	3.9	0.8
Dissatisfaction with child's body image score†	-0.5	1.1	-0.7	1.2	-0.4	1.1

*Silhouette number from child-adapted Stunkard scales consisting of eight silhouettes in increasing order of girth from 1 (thinnest) to 8 (heaviest).

†Body image dissatisfaction was calculated as the silhouette number representing the desired body image subtracted from the silhouette representing the current body image.

‡In a sub-sample of 367 children (186 girls and 181 boys).

indicated by the children to represent their current body and the BID score were both positively associated with the child's BAZ, with the mother's BMI and with her dissatisfaction with the child's body image. By contrast, the silhouette selected to indicate the desired body was strongly associated with these three characteristics in an inverse manner. In the subgroup of 367 children with information on maternal body image perception, the mother-child BID correlation (Spearman) was 0.46 ($P < 0.0001$). Compared with children whose families did not own their house, children from homeowners indicated a desired silhouette that was 0.2 units slimmer and had a 0.2 units significantly higher BID score ($P = 0.03$ and $P = 0.04$, respectively). The household's SES classification was not associated with body image perception of the child.

We further studied the associations of child body image dissatisfaction components (silhouettes chosen to indicate current or desired body, and BID score) with actual current weight status (BAZ), using multivariable linear regression adjusted for child's age, HAZ and home ownership, an indicator of SES. The silhouette chosen to indicate current body weight was positively associated with BAZ in boys and girls (Fig. 1). A steep linear relationship was observed above $BAZ > -1$. Compared with boys, girls chose a heavier current silhouette at BAZ values of about < -0.5 or > 0.5 ; however, this difference was statistically significant only at BAZ values > 1.5 . The mean estimated silhouette value for $BAZ = 0$ was about the same for boys and girls (3.9 (SE 0.1) *v.* 3.8 (SE 0.1), respectively; mean difference = 0.1, 95% CI -0.2, 0.4). There was a weak, positive association of desired body image score with BAZ at BAZ values < 0 and a weak, inverse relationship at $BAZ > 0$. This association did not vary significantly by sex.

The association of BID score with BAZ followed a 'J shape' in boys and girls (Fig 2). BID was larger in girls

than boys at any level of BAZ, although this difference was statistically significant only at BAZ values between 1.2 and 1.9. Estimated mean BID score at $BAZ = 0$ was -0.1 (SE 0.2) in boys and 0.0 (SE 0.2) in girls (mean difference = -0.1, 95% CI -0.6, 0.3).

We next examined the correlations of body image dissatisfaction perception components ('current' and 'desired' body image) with other psychosocial constructs of body image, after adjusting for child's age. The silhouette chosen by the boys to reflect their perceived body image ('current') did not correlate with any of the other psychosocial body image constructs (Table 4). Nevertheless, it was positively correlated with the silhouette indicated as 'normal' in thin girls and with the one indicated as 'best-looking' among normal-weight girls.

The silhouette selected to indicate the desired body image was positively correlated with the silhouette chosen as the 'best-looking' in all boys and among normal-weight girls. It was also positively correlated with the silhouette chosen to indicate a 'normal' body image in normal-weight boys and girls; and strongly among thin girls ($r = 0.7$). The silhouette selected to represent the desired body image was also positively associated with that chosen as 'having more friends' in normal-weight boys. Among thin boys, the silhouette representing the desired body image was positively correlated with that chosen to indicate the 'strongest' body ($r = 0.4$).

In the subgroup of 367 children with information on maternal body image perception and attitudes, the silhouettes chosen by the mother and the child to indicate their current perception of the child's body were positively correlated among normal-weight children only. The silhouettes chosen by the mother and the child to represent the desired body for the child were positively associated in normal-weight boys and, even more strongly, in thin and heavy girls.

Table 3 Body image perception in school-aged children (*n* 629) according to sociodemographic and anthropometric characteristics, Bogotá, Colombia, 2006

Characteristic	%	<i>n</i> *	Silhouette indicated as current†		Silhouette indicated as desired†		Body image dissatisfaction score‡	
			Mean	SD	Mean	SD	Mean	SD
Child's sex								
Boy	50.9	320	3.8	1.3	3.8	1.4	0.0	1.8
Girl	49.1	309	3.8	1.3	3.5	1.3	0.2	1.7
<i>P</i> ‡			0.79		0.02		0.17	
Child's age (years)								
5–6	22.9	144	3.5	1.5	3.4	1.9	0.1	2.4
7–8	28.5	179	3.8	1.3	3.6	1.3	0.2	1.7
9–10	42.9	270	3.9	1.1	3.8	1.0	0.1	1.3
11–12	5.7	36	3.8	1.1	3.8	1.0	-0.1	1.4
<i>P</i> for trend‡			0.01		0.002		0.51	
Child was born in Bogotá								
Yes	88.4	524	3.8	1.3	3.6	1.4	0.2	1.7
No	11.6	69	3.7	1.2	3.9	1.2	-0.2	1.8
<i>P</i> ‡			0.32		0.09		0.13	
Child's height-for-age Z-score§								
<-2	7.1	45	3.5	1.3	4.0	1.5	-0.4	2.1
≥-2 and <-1	29.1	183	3.6	1.3	3.7	1.4	0.0	1.8
≥-1 and <1	60.1	378	3.9	1.2	3.6	1.3	0.2	1.6
≥1	3.7	23	4.1	1.0	3.3	1.9	0.8	1.7
<i>P</i> for trend‡			0.006		0.11		0.002	
Child's BMI-for-age Z-score§								
<-2	2.1	13	2.8	0.9	3.5	1.2	-0.6	1.6
≥-2 and <-1	13.0	82	3.0	1.1	4.1	1.4	-1.1	1.5
≥-1 and <1	63.9	402	3.6	1.2	3.7	1.4	0.0	1.6
≥1 and <2	15.7	99	4.6	1.1	3.3	1.2	1.3	1.6
≥2	5.3	33	5.4	0.5	3.4	1.3	1.9	1.3
<i>P</i> for trend‡			<0.0001		0.0007		<0.0001	
Maternal age (years)								
20–29	23.4	136	3.8	1.3	3.6	1.5	0.1	2.0
30–34	25.8	150	3.7	1.2	3.5	1.3	0.2	1.6
35–39	23.6	137	3.8	1.3	3.7	1.4	0.1	1.9
≥40	27.2	158	3.8	1.2	3.7	1.2	0.1	1.6
<i>P</i> for trend‡			0.61		0.55		0.93	
Maternal BMI (kg/m ²)								
<18.5	3.3	18	3.4	0.9	3.8	1.6	-0.3	1.6
18.5–24.9	62.3	344	3.7	1.3	3.7	1.4	0.0	1.8
25.0–29.9	25.9	143	3.9	1.2	3.5	1.3	0.4	1.7
≥30.0	8.5	47	4.0	1.4	3.3	1.4	0.7	1.9
<i>P</i> for trend‡			0.02		0.02		0.0004	
Maternal dissatisfaction with child's body								
Desire for a larger body	45.8	168	3.2	1.3	3.9	1.5	-0.6	1.7
Satisfied	39.0	143	3.9	1.1	3.3	1.3	0.6	1.6
Desire for a thinner body	15.2	56	4.8	1.0	3.4	1.1	1.4	1.5
<i>P</i> for trend‡			<0.0001		0.002		<0.0001	
Socio-economic status¶								
1	2.1	13	3.7	1.2	3.8	1.1	-0.2	1.2
2	22.1	139	3.9	1.2	3.6	1.5	0.3	1.8
3	62.1	39	3.7	1.3	3.6	1.3	0.1	1.7
4	13.7	86	3.8	1.3	3.7	1.3	0.2	1.8
<i>P</i> for trend‡			0.57		0.99		0.69	
House owned by the family								
Yes	31.3	183	3.8	1.3	3.5	1.3	0.3	1.7
No	68.7	401	3.8	1.2	3.7	1.3	0.1	1.8
<i>P</i> ‡			0.74		0.03		0.04	

*Totals may be <629 due to missing values.

†Silhouette number from child-adapted Stunkard scales consisting of eight silhouettes in increasing order of girth from 1 (thinnest) to 8 (heaviest).

‡From Wilcoxon's rank-sum test for dichotomous variables. For all other variables (ordinal), *P* was for a test of linear trend when a variable that represented the ordinal categories of the predictor was introduced into a linear regression model as continuous (Wald test).

§According to the WHO 2007 growth references⁽²⁹⁾.

||In a sub-sample of 367 children. Body image dissatisfaction (BID) was calculated as the silhouette indicated by the mother as the desired body image for her child subtracted from the silhouette representing her perception of her child's current body image. A negative BID score represents a desire for a larger body. A BID score of zero represents body image satisfaction. A positive BID score represents a desire for a thinner body.

¶According to the government's classification for tax and planning purposes.

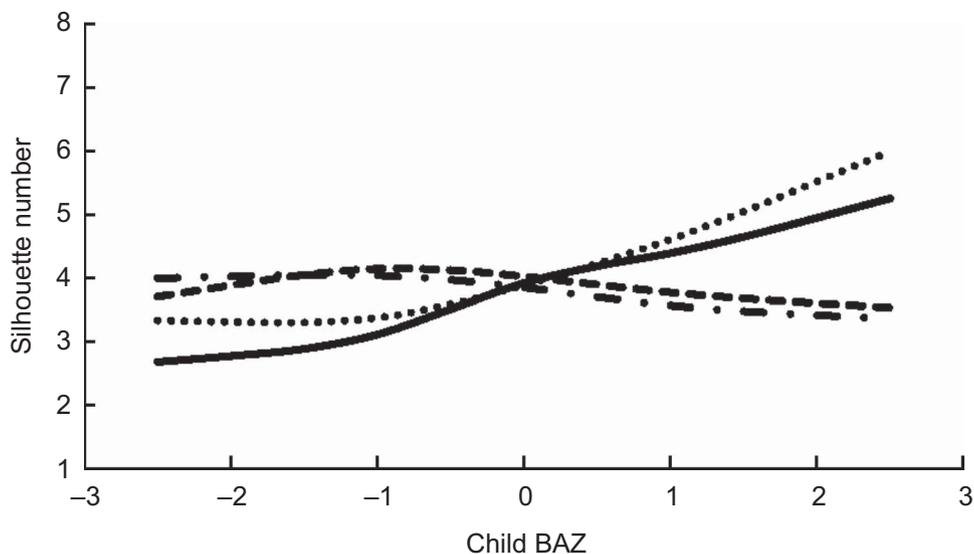


Fig. 1 Silhouettes representing school-aged children’s current (—■, boys; ••••, girls) and desired (---■, boys; -.-., girls) body image according to BMI-for-age Z-score (BAZ), Bogotá, Colombia, 2006. BAZ was calculated according to the WHO 2007 growth references⁽²⁹⁾. Children (*n* 629) selected one of eight silhouettes to indicate their current (perceived) or desired body image, on child-adapted Stunkard scales. Curves were constructed using linear regression models. In these models, the outcome was the silhouette number selected to represent either current or desired body image, whereas predictors included linear and spline terms for BAZ, child’s age and height-for-age Z-score (HAZ), and home ownership status. Values are plotted at the population mode for age (11–12 years), mean HAZ and no home ownership. Robust estimates of variance were used in all models

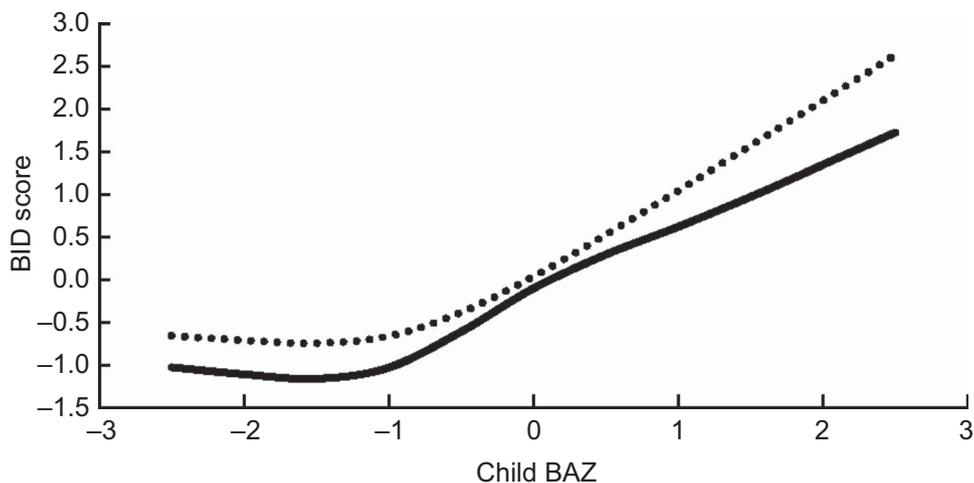


Fig. 2 Body image dissatisfaction (BID) score of school-aged children (—■, boys; ••••, girls) according to BMI-for-age Z-score (BAZ), Bogotá, Colombia, 2006. BAZ was calculated according to the WHO 2007 growth references⁽²⁹⁾. BID was calculated as the silhouette number selected by the children (*n* 629) as their desired body image subtracted from the number representing their perceived (‘current’) body image. Curves were constructed using linear regression models. In these models, the outcome was BID, whereas predictors included linear and spline terms for BAZ, child’s age and height-for-age Z-score (HAZ), and home ownership status. Values are plotted at the population mode for age (11–12 years), mean HAZ and no home ownership. Robust estimates of variance were used in all models

Discussion

We examined sociodemographic and anthropometric correlates of body image perception and attitudes in Colombian schoolchildren. Child’s body image perception and dissatisfaction were associated with child’s weight and height, as well as with the mother’s BMI and

her dissatisfaction with the child’s body. In addition, the constructs associated with the components of body image dissatisfaction varied according to the child’s sex and weight status.

The strongest predictor of body image dissatisfaction was the children’s actual weight status, consistent with previous reports in other populations^(10,31–35). Both thin

Table 4 Correlations of body image perception components in school-aged children, Bogotá, Colombia, 2006*†

	Boys		Girls	
	Silhouette indicated as current	Silhouette indicated as desired	Silhouette indicated as current	Silhouette indicated as desired
BMI-for-age Z-score < -1‡				
Silhouette indicated as 'normal'	-0.02	0.08	0.36§	0.73§
Silhouette indicated as 'looks best'	0.13	0.39§	0.29	0.02
Silhouette indicated as 'has more friends'	-0.03	0.16	0.29	0.29
Silhouette indicated as 'strongest'	0.08	0.44§	-0.05	0.16
Silhouette indicated as current by mother	0.07	-0.06	0.21	0.18
Silhouette indicated as desired by mother	-0.05	-0.07	0.28	0.53§
BMI-for-age Z-score ≥ -1 and < 1‡				
Silhouette indicated as 'normal'	0.13	0.25§	0.06	0.18§
Silhouette indicated as 'looks best'	0.02	0.20§	0.21§	0.33§
Silhouette indicated as 'has more friends'	0.07	0.25§	-0.01	0.03
Silhouette indicated as 'strongest'	0.14	0.14	-0.17	-0.01
Silhouette indicated as current by mother	0.42§	0.02	0.21§	-0.11
Silhouette indicated as desired by mother	0.08	0.22§	-0.08	-0.05
BMI-for-age Z-score ≥ 1‡				
Silhouette indicated as 'normal'	-0.15	0.23	0.24	-0.13
Silhouette indicated as 'looks best'	0.09	0.33§	-0.06	0.25
Silhouette indicated as 'has more friends'	-0.01	-0.14	0.05	0.05
Silhouette indicated as 'strongest'	0.01	-0.07	0.20	-0.03
Silhouette indicated as current by mother	0.20	-0.15	0.32	0.28
Silhouette indicated as desired by mother	0.03	0.00	-0.02	0.38§

*Spearman correlations are adjusted for child's age. Statistically significant correlation coefficients ($P \leq 0.05$) are noted by §.

†Based on the interviewee's rating of child-adapted Stunkard scales consisting of eight silhouettes in increasing order of girth from 1 (thinnest) to 8 (heaviest). Child's body image perception information: n 629. Maternal body image perception: n 367.

‡According to the WHO 2007 growth reference⁽²⁹⁾.

and heavy children expressed a desire to be of average size; thus, the association mostly reflects the children's perception of their truly thinner or heavier bodies. We also found strong positive relationships between maternal BMI and the child's body image perception. These associations may result from a high correlation between maternal and child BMI due to common causes. However, it is also possible that the child's perception of his or her mother's actual weight has an independent effect on the child's own body image perception^(36,37).

Child's height was also a significant correlate of body image perception in the present study. This finding is especially noteworthy, because the child-adapted scales depict silhouettes of identical height. It is possible that taller children perceive themselves as being heavier, independent of their actual weight status. Both men and women tend to overestimate their height^(38,39) and so do short children and their parents⁽⁴⁰⁾. Yet very few studies have addressed the role of height on body image concerns. Among patients with eating disorders^(41,42) body image dissatisfaction depends also on constructs not related to weight, including height. In a study of adolescents and young adults in China⁽⁴³⁾, physical stature was an important correlate of body image dissatisfaction because tallness conforms to local norms of desired physical appearance, independent of weight. Our results extend the findings from these studies by suggesting that height might play an important role in shaping weight perceptions among children.

Consistent with previous studies^(33,44-47), we found that an SES indicator, house ownership, was associated with

body image dissatisfaction. SES is also directly related to obesity in populations at the early stages of the nutrition transition⁽⁴⁸⁾, including ours⁽⁴⁹⁾. Hence, the association between SES and body weight could be mediated in part by body image perception. The association of house ownership with BID seemed driven by a desire for a slimmer body, possibly reflecting exposure to Westernised ideals of thinness among wealthier children^(21,33,40-43).

Girls in our study perceived themselves as heavier compared with boys, regardless of their actual weight. In consequence, mean BID score was higher in girls than boys, in line with findings from developed countries^(33,44). Our findings also suggest that, compared with boys, psychosocial constructs may play a larger role in girls' body image perception and attitudes. For example, while perception of current image was unrelated to looking 'normal', 'best' or 'strongest' in boys, it was positively related to looking 'normal' in girls. Similarly, the desired body image was highly correlated with looking 'normal' in girls only. Previous studies of Taiwanese⁽²¹⁾ and Australian⁽⁵⁰⁾ children found that girls expressed more awareness and internalisation of socio-cultural or media body ideals than boys. Similarly, a study of Chinese adolescents⁽⁵¹⁾ found that among girls, but not boys, BID was associated with greater exposure to foreign media and with concerns regarding physical appearance. A longitudinal study among US adolescents⁽⁵²⁾ found that social interactions and social norms contributed more to BID in girls, whereas BID stemmed mainly from ideals of muscularity in boys. In our study, a

correlation of desired body image with the silhouette looking 'strongest' was observed among thin boys only. It is possible that normal-weight or overweight boys are more concerned about adiposity than muscularity. Inconsistencies on the relationships of body image with muscularity in previous studies of males⁽⁵³⁾ may be the result of failing to consider their actual weight status.

We examined the correlations of child body image perception and attitudes between mothers and children in a subset of 367 pairs. Perceptions of current body image were positively correlated only among normal-weight children. This may be because body image perceptions reflect less accurately actual status among overweight or thin children than they do among children of normal weight^(17–20). Therefore, discordant misperceptions of child's actual weight between mothers and their thin or heavy children may result in attenuated mother–child correlations. Maternal–child correlations of attitudes toward the child's body image were stronger for girls than boys, consistent with previous studies^(13,14,54–57), and were apparent only among thin or heavy girls. This suggests that the mother–child agreement on body shape ideals is larger than the agreement on the perception of current body image.

Of note, whereas child's mean BID score reflected a desire to be thinner, the average maternal score indicated a desire for heavier children, even though children were already heavier than the international reference. This discrepancy may represent intergenerational differences in the appraisal of weight as a health attribute, which are characteristic of societies undergoing the nutrition transition. The maternal desire for a heavier child may reflect traditional concepts associating improved health and physical appearance with heaviness as a result of better economic conditions or health literacy⁽⁵¹⁾. By contrast, children may be more likely to associate these qualities with a leaner body due to internalisation of Westernised ideals of thinness and therefore tend to desire a slimmer body for themselves.

Our study has several strengths. Participants represented low- and middle-income children from a population experiencing the nutrition transition. We were able to investigate various aspects of body image perception and attitudes according to the child's sex and weight, as well as mother–child correlations. There are also some limitations. First, the study's cross-sectional design limits the possibility of inferring the temporal sequence of the associations observed. Second, because study participants were of low- and middle-SES levels, generalisation of the results to higher SES groups is limited. Third, the selection of a given silhouette to represent 'current' body image is subject to variability. Because there are no normative BMI values assigned to the silhouette drawings in the Stunkard scale, it is not possible to account for this variability on the children's perception of their current body. Finally, although the child-adapted figurine rating scale has been

formally validated in comparable settings^(28,58), it has not been validated in our population.

Conclusion

We found that body image perception in children is associated with weight and height, as well as with maternal BMI and dissatisfaction with the child's body. The psychosocial foundations of body image perception and attitudes vary by sex and actual weight status of the child. Additional research is needed to further clarify the influences of parental perceptions and attitudes on child's body image and health. Longitudinal studies are warranted to enhance our understanding of the impact of body image perception on weight trajectories in the child and whether interventions on these perceptions may affect growth patterns during childhood and into adolescence.

Acknowledgements

Sources of funding: The Bogotá School Children Cohort Study is currently sponsored by the ASISA Research Fund at the University of Michigan. The funder did not contribute to the study design, conduct of the study, the analysis of samples or data, the interpretation of findings, or the preparation of the manuscript. *Conflicts of interest:* None of the authors have any conflicts of interest or financial disclosures. *Authors' contributions:* O.D. contributed to data analyses, interpretation of the results and writing of the first draft of the manuscript; M.M-P. and C.M. contributed to the study design and data collection; A.B. contributed to the study design, data collection and data interpretation; J.M.L. and C.M.d.L. contributed to data interpretation; E.V. contributed to the study design, data collection and analyses, interpretation of the results and preparation of the manuscript. All authors critically reviewed the manuscript.

References

1. Popkin BM (2004) The nutrition transition: an overview of world patterns of change. *Nutr Rev* **62**, 7 Pt 2, S140–S143.
2. Popkin BM (2009) Global changes in diet and activity patterns as drivers of the nutrition transition. *Nestle Nutr Workshop Ser Pediatr Program* **63**, 1–10.
3. Kain J, Vio F & Albala C (2003) Obesity trends and determinant factors in Latin America. *Cad Saude Publica* **19**, Suppl. 1, S77–S86.
4. Martorell R, Khan LK, Hughes ML *et al.* (1998) Obesity in Latin American women and children. *J Nutr* **128**, 1464–1473.
5. Must A & Strauss RS (1999) Risks and consequences of childhood and adolescent obesity. *Int J Obes Relat Metab Disord* **23**, Suppl. 2, S2–S11.
6. Singh AS, Mulder C, Twisk JW *et al.* (2008) Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes Rev* **9**, 474–488.

7. Dietz WH (1998) Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics* **101**, 518–525.
8. Gupta N, Goel K, Shah P *et al.* (2012) Childhood obesity in developing countries: epidemiology, determinants, and prevention. *Endocr Rev* **33**, 48–70.
9. Uauy R & Diaz E (2005) Consequences of food energy excess and positive energy balance. *Public Health Nutr* **8**, 1077–1099.
10. Pallan MJ, Hiam LC, Duda JL *et al.* (2011) Body image, body dissatisfaction and weight status in South Asian children: a cross-sectional study. *BMC Public Health* **11**, 21.
11. Al Sabbah H, Vereecken C, Abdeen Z *et al.* (2009) Associations of overweight and of weight dissatisfaction among Palestinian adolescents: findings from the national study of Palestinian schoolchildren (HBSC-WBG2004). *J Hum Nutr Diet* **22**, 40–49.
12. Tremblay L, Lovsin T, Zecevic C *et al.* (2011) Perceptions of self in 3–5-year-old children: a preliminary investigation into the early emergence of body dissatisfaction. *Body Image* **8**, 287–296.
13. Helfert S & Warschburger P (2011) A prospective study on the impact of peer and parental pressure on body dissatisfaction in adolescent girls and boys. *Body Image* **8**, 101–109.
14. Mchiza ZJ, Goedecke JH & Lambert EV (2011) Intra-familial and ethnic effects on attitudinal and perceptual body image: a cohort of South African mother–daughter dyads. *BMC Public Health* **11**, 433.
15. Thompson SH & Sargent RG (2000) Black and white women's weight-related attitudes and parental criticism of their childhood appearance. *Women Health* **30**, 77–92.
16. Warschburger P & Kroller K (2012) Childhood overweight and obesity: maternal perceptions of the time for engaging in child weight management. *BMC Public Health* **12**, 295.
17. Towns N & D'Auria J (2009) Parental perceptions of their child's overweight: an integrative review of the literature. *J Pediatr Nurs* **24**, 115–130.
18. Doolen J, Alpert PT & Miller SK (2009) Parental disconnect between perceived and actual weight status of children: a metasynthesis of the current research. *J Am Acad Nurse Pract* **21**, 160–166.
19. Ward CL (2008) Parental perceptions of childhood overweight in the Mexican American population: an integrative review. *J Sch Nurs* **24**, 407–416.
20. Rietmeijer-Mentink M, Paulis WD, van Middelkoop M *et al.* (2013) Difference between parental perception and actual weight status of children: a systematic review. *Matern Child Nutr* **9**, 3–22.
21. Chen LJ, Fox KR & Haase AM (2008) Body shape dissatisfaction and obesity among Taiwanese adolescents. *Asia Pac J Clin Nutr* **17**, 457–460.
22. Khan AN, Khalid S, Khan HI *et al.* (2011) Impact of today's media on university student's body image in Pakistan: a conservative, developing country's perspective. *BMC Public Health* **11**, 379.
23. Madanat HN, Lindsay R, Hawks SR *et al.* (2011) A comparative study of the culture of thinness and nutrition transition in university females in four countries. *Asia Pac J Clin Nutr* **20**, 102–108.
24. Xu X, Mellor D, Kiehne M *et al.* (2010) Body dissatisfaction, engagement in body change behaviors and sociocultural influences on body image among Chinese adolescents. *Body Image* **7**, 56–64.
25. Arsenault JE, Mora-Plazas M, Forero Y *et al.* (2009) Provision of a school snack is associated with vitamin B-12 status, linear growth, and morbidity in children from Bogota, Colombia. *J Nutr* **139**, 1744–1750.
26. Alcaldía Mayor de Bogotá, Secretaría de Educación (2006) Estadísticas del sector educativo de Bogotá 2005 y avances 2006. http://www.sedbogota.edu.co/ActivivosSED/Centro_Documentacion/anexos/publicaciones_2004_2008/estadisticas_05_avances_2006.pdf
27. Lohman TG, Roche A & Martorell R (editors) (1988) *Anthropometric Standardization Reference Manual*. Champaign, IL: Human Kinetics Books.
28. Mciza Z, Goedecke JH, Steyn NP *et al.* (2005) Development and validation of instruments measuring body image and body weight dissatisfaction in South African mothers and their daughters. *Public Health Nutr* **8**, 509–519.
29. de Onis M, Onyango AW, Borghi E *et al.* (2007) Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* **85**, 660–667.
30. Durrleman S & Simon R (1989) Flexible regression models with cubic splines. *Stat Med* **8**, 551–561.
31. Stice E (2002) Risk and maintenance factors for eating pathology: a meta-analytic review. *Psychol Bull* **128**, 825–848.
32. Colella D, Morano M, Robazza C *et al.* (2009) Body image, perceived physical ability, and motor performance in nonoverweight and overweight Italian children. *Percept Mot Skills* **108**, 209–218.
33. Xanthopoulos MS, Borradaile KE, Hayes S *et al.* (2011) The impact of weight, sex, and race/ethnicity on body dissatisfaction among urban children. *Body Image* **8**, 385–389.
34. Davison KK, Markey CN & Birch LL (2000) Etiology of body dissatisfaction and weight concerns among 5-year-old girls. *Appetite* **35**, 143–151.
35. Dalton WT, Johnston CA, Foreyt JP *et al.* (2008) Brief report: weight dissatisfaction, weight status, and weight loss in Mexican-American children. *J Pediatr Psychol* **33**, 673–677.
36. Keery H, Eisenberg ME, Boutelle K *et al.* (2006) Relationships between maternal and adolescent weight-related behaviors and concerns: the role of perception. *J Psychosom Res* **61**, 105–111.
37. Cooley E, Toray T, Wang MC *et al.* (2008) Maternal effects on daughters' eating pathology and body image. *Eat Behav* **9**, 52–61.
38. Connor Gorber S, Tremblay M, Moher D *et al.* (2007) A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. *Obes Rev* **8**, 307–326.
39. Engstrom JL, Paterson SA, Doherty A *et al.* (2003) Accuracy of self-reported height and weight in women: an integrative review of the literature. *J Midwifery Womens Health* **48**, 338–345.
40. Chaplin JE, Kristrom B, Jonsson B *et al.* (2012) When do short children realize they are short? Prepubertal short children's perception of height during 24 months of catch-up growth hormone treatment. *Horm Res Paediatr* **77**, 241–249.
41. Gupta MA & Johnson AM (2000) Nonweight-related body image concerns among female eating-disordered patients and nonclinical controls: some preliminary observations. *Int J Eat Disord* **27**, 304–309.
42. Kolle I, Schieber K, de Zwaan M *et al.* (2013) Body dysmorphic disorder and nonweight-related body image concerns in individuals with eating disorders. *Int J Eat Disord* **46**, 52–59.
43. Chen H & Jackson T (2009) Predictors of changes in body image concerns of Chinese adolescents. *J Adolesc* **32**, 977–994.
44. Bully P & Elosua P (2011) Changes in body dissatisfaction relative to gender and age: the modulating character of BMI. *Span J Psychol* **14**, 313–322.

45. Strauss RS (1999) Self-reported weight status and dieting in a cross-sectional sample of young adolescents: National Health and Nutrition Examination Survey III. *Arch Pediatr Adolesc Med* **153**, 741–747.
46. van den Berg PA, Mond J, Eisenberg M *et al.* (2010) The link between body dissatisfaction and self-esteem in adolescents: similarities across gender, age, weight status, race/ethnicity, and socioeconomic status. *J Adolesc Health* **47**, 290–296.
47. Wilkosz ME, Chen JL, Kenndey C *et al.* (2011) Body dissatisfaction in California adolescents. *J Am Acad Nurse Pract* **23**, 101–109.
48. Monteiro CA, Moura EC, Conde WL *et al.* (2004) Socio-economic status and obesity in adult populations of developing countries: a review. *Bull World Health Organ* **82**, 940–946.
49. McDonald CM, Baylin A, Arsenault JE *et al.* (2009) Overweight is more prevalent than stunting and is associated with socioeconomic status, maternal obesity, and a snacking dietary pattern in school children from Bogota, Colombia. *J Nutr* **139**, 370–376.
50. Knauss C, Paxton SJ & Alsaker FD (2007) Relationships amongst body dissatisfaction, internalisation of the media body ideal and perceived pressure from media in adolescent girls and boys. *Body Image* **4**, 353–360.
51. Xie B, Chou CP, Spruijt-Metz D *et al.* (2006) Weight perception and weight-related sociocultural and behavioral factors in Chinese adolescents. *Prev Med* **42**, 229–234.
52. Carlson Jones D (2004) Body image among adolescent girls and boys: a longitudinal study. *Dev Psychol* **40**, 823–835.
53. McCabe MP & Ricciardelli LA (2004) Body image dissatisfaction among males across the lifespan: a review of past literature. *J Psychosom Res* **56**, 675–685.
54. Gualdi-Russo E, Manzon VS, Masotti S *et al.* (2012) Weight status and perception of body image in children: the effect of maternal immigrant status. *Nutr J* **11**, 85.
55. Stevens J, Cornell CE, Story M *et al.* (1999) Development of a questionnaire to assess knowledge, attitudes, and behaviors in American Indian children. *Am J Clin Nutr* **69**, 4 Suppl., 773S–781S.
56. Elfhag K & Linne Y (2005) Gender differences in associations of eating pathology between mothers and their adolescent offspring. *Obes Res* **13**, 1070–1076.
57. Cutting TM, Fisher JO, Grimm-Thomas K *et al.* (1999) Like mother, like daughter: familial patterns of overweight are mediated by mothers' dietary disinhibition. *Am J Clin Nutr* **69**, 608–613.
58. Stevens J, Story M, Becenti A *et al.* (1999) Weight-related attitudes and behaviors in fourth grade American Indian children. *Obes Res* **7**, 34–42.