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A 3-year longitudinal study of effects of parental perception of children's ideal body image on child weight change: The Childhood Obesity Study in China Mega-cities

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Abstract

This study examined prevalence of childhood overweight and obesity (ov/ob) and central obesity in five mega-cities across China (Beijing, Shanghai, Xian, Nanjing and Chengdu); described parental perceptions of children's ideal body image (IBI); and prospectively examined associations between parental perception of child IBI and child weight changes over 3 years. In this NIH-funded, open cohort study, data were collected from students and their parents in 2015, 2016 and 2017 (n = 3298, in 3 waves). Cross-sectional analysis included all 3,298 children; longitudinal data analysis used mixed effects models and included 1691 children aged 6–17 years with ≥ two body mass index (BMI) measurements during 2015–2017. Ov/ob prevalence based on Chinese age-sex-specific BMI cut-points was 30.0%. Based on waist-to-height ratio (WHtR), the abdominal obesity rate was 19.8%. Parents reported different preferred IBI for boys vs girls, being about 3 times more likely to select ov/ob as ideal for boys than for girls (4.5% vs 1.5%, respectively, $P < 0.001$). In longitudinal analysis, children whose parents selected ov/ob as ideal had higher BMI Z-scores and WHtR increase over time than those whose parents selected an average body image (β [SE] = 0.042 [0.011], and β [SE] = 0.010 [0.004], respectively, all $P < 0.05$). Ov/ob rates were high

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Contributors

YFW conceptualized the study. LWG led the paper writing and revising with the contributions from LM, HX, JWM, and HJW. All authors read and approved the final draft for revision.

Conflict of Interest

The authors declare no conflict of interest.

among children in major cities in China. Chinese parents preferred a heavier ideal body image for their boys. Health promotion programs should help empower parents and their children to develop appropriate body images and maintain healthy body weight.

Keywords

obesity; overweight; ideal body image; child; adolescent; China

Introduction

Childhood obesity has become a serious public health problem that jeopardizes global public health.[1, 2] Over the past four decades, the prevalence of childhood obesity has increased in almost all countries worldwide.[3, 4] In the context of globalization, and with the rapid development of the social economy and tremendous changes in the lifestyle of residents, the prevalence of overweight and obesity (ov/ob) has increased rapidly in China.[5–7] Being in the forefront of China's economic development, the mega-cities (like Beijing and Shanghai) with the fastest change in environment and consciousness have led the country's development and reflected the country's dynamics, including changes in childhood obesity.

Given that parents are the primary caregivers for children, understanding their perceptions of children's actual and ideal body image (IBI) is an important step in developing intervention strategies for promoting healthy weight among children. Perception is a multifaceted expression that is highly influenced by different social and cultural environments, such as cultural ideas, social pressure, and social support networks of parents.[8] For instance, research has suggested that Mexican American mothers wanted their children to be smaller than they currently were, while mothers in Mexico wanted their children to be bigger than they were.[9] Influenced by traditional culture and attitudes, some Chinese parents view a bigger body size for boys as a symbol of physical health and thus beautiful. They have greater misperceptions of their children's actual weight status compared with parents in some other countries.[10] It is reported that 56.0% of Chinese parents had an inaccurate assessment of their children's weight status, with 14.0% of mothers over-perceiving their children's actual weight status.[11, 12] However, little is known about how many Chinese parents may have an IBI for their children that is overweight, nor about the differences in IBI that parents have for boys vs girls.

Several previous studies, including ours, have examined the association between parental perception of children's actual body image and children's weight status, and the association between children's self-perceived body image and their subsequent weight change. Our study using data from 6–17-year-old Chinese children found that children who perceived themselves as being obese had a higher body mass index (BMI) increase than those with an average-weight body image, increasing their BMI by 0.99 kg/m^2 per year.[13] This may be related to children's misperception of body shape, which may affect children's eating habits.[14] In our study of African American children, children's body image had a significant association with their subsequent weight change.[15] However, knowledge about parental

perceptions of children's IBI and how it might affect weight status among children remains limited.

Obesity risk is affected by economic development and cultural cognition. People with different economic and educational levels have large differences in obesity risks.[16] Although some studies in China have examined the prevalence of childhood obesity and the characteristics of children's perception of body image and related social demographics, no previous research has studied parental perceptions of children's IBI in Chinese mega-cities. There is also a paucity of research in the field on longitudinal associations between parental perceptions of children's IBI and children's weight change.

To fill these knowledge gaps, using longitudinal survey data collected from five mega-cities in China, this study examined: 1) the prevalence of ov/ob and central obesity in children; 2) parental perceptions of children's IBI and any gender differences; and 3) the association between parental perceptions of children's IBI and children's weight changes, testing how the associations might differ by children's gender, age, and weight status. These findings could provide useful insights for future efforts to fight the childhood obesity epidemic.

Methods and Materials

1. Study design and study sample

The Childhood Obesity Study in China Mega-cities (COCM) is part of a US NIH-funded study aimed at examining the etiology of childhood obesity and chronic diseases in China, especially in major cities, which have been experiencing rapid social and economic changes over the past three decades. COCM is an open cohort study. Initially, four major cities across China (Beijing [the capital of China, in North China], Shanghai [the largest city in China, in South China], Nanjing [the capital of China before 1949, in South China], and Xi'an [the ancient capital of China for over 1300 years, in the mid-west of China]) were included in 2015 at baseline. In 2016, Chengdu, the capital of Sichuan Province (with the largest population among provinces in China, in the west of China) was added.

In each city, two primary schools and two middle schools were included. In each school, a class from each grade (grades 4–6 in primary schools, and grades 7–9 in middle schools) was included. Students in grades 6 and 9 in 2015 had graduated by the time of the second survey in 2016, so new students in grades 4 and 7 in the selected schools were recruited. This affected the attrition rate. At baseline in 2015, 1,648 children were enrolled, while 2,554 children were surveyed in 2016 (1,078 of the students having been surveyed in 2015). The attrition rate was 34.6% (= 570/1,648).

The study was approved by the Ethical Committee of the State University of New York at Buffalo and related collaborative institutes in China. Written informed consent was obtained from parents or children.

Children with missing data on age, gender, weight and height measurements were excluded from analysis (n = 70). Our cross-sectional data analysis used the children's data from the first observation each year during 2015–2017 for all the students participating in the surveys

(n = 3,298). For longitudinal data analysis, 1,691 children who had ≥ two BMI measurements during 2015–2017 were included to test associations between parental perceptions of children's IBI and children's BMI z-score and waist-to-height ratio (WHtR), respectively. (WHtR indicates central adiposity.)

2. Assessment and measures

1) BMI and WHtR.—Height was measured by a Seca 213 Portable Stadiometer Height-Rod with a precision of 0.1 centimeter; body weight was measured by a Seca 877 electronic flat scale with a precision of 0.1 kilogram. Waist circumference (WC) was measured by a tape with a precision of 0.1 centimeter. Children's BMI (kg/m^2) was calculated and transformed to a BMI Z-score according to the sex- and age-specific World Health Organization (WHO) reference growth charts.[17] General obesity was defined according to the age- and gender-specific BMI cutoffs points issued by the National Health Commission of the People's Republic of China.[18] Abdominal obesity was defined as WHtR ≥ 0.48.[19]

2) Child IBI.—Line drawings used in previous studies showing 8 silhouette body sizes ranging from very thin to very heavy were adapted in our study. Students and parents were asked a question separately: a) "Which one do you wish that your body looked like?" and b) "Which one do you wish that your children's body looked like?" For each question, students and parents were instructed to circle only one silhouette from the 8. The silhouettes were scored as A (thinnest) to H (heaviest) (see Figure 1). As previous studies did,[20, 21] we further grouped the 8 silhouettes into three levels: "underweight" (silhouettes A, B, and C), "normal" (silhouettes D and E), and "ov/ob" (silhouettes F, G, and H).

3) Lifestyle behaviors.—We used a validated questionnaire that includes a series of questions to ask about the type and frequency of the child's diet. Children were asked to report weekly consumption frequencies of the following foods (livestock meat or red meat, poultry, vegetables, fruits, pure milk, dairy products, soybeans and soy products.) over the last 3 months. Then, based on their reported dietary intake frequencies, the students were classified as low- (< 3 days/week) vs. high-consumers (3–7 days/week) for data analysis. This was done for each of the food items [22].

The validated Chinese Children Physical Activity Questionnaire was used to measure the physical activity patterns of the children[23]. Physical activity was assessed by asking the students to report how often and how long they had engaged in the following activities outside of school time in the previous seven days: cycling, roller-skating, running, swimming, dancing, team sports, tennis, sit-ups, push-ups, etc. The intensity of their physical activity was classified based on the total days per week in which they reported spent at least 30 minutes/day participating in extracurricular, off-campus physical activities. The subjects were divided into 2 categories of having high or moderate (3–7 days/week) vs low (< 3 days/week) physical activity.[24]

4) Parental and household characteristics.—To consider the influence of family and household characteristics on the associations between IBI and children's weight status, we used parents' BMI, highest parental education (up to middle school or below, high or

vocational schools, and college or above), family homeownership (rent or share residency with relatives, own apartment, own house) in our analysis.

3. Statistical analysis

First, we described children's characteristics such as socio-demographics, distributions of actual weight statuses, and children's or their parents' perceptions of IBI using cross-sectional analysis of data collected from different children during 2015–2017 (n = 3,298). The chi-square tests were used to compare the gender differences for categorical variables and the t-test was used for continuous variables. Weighted kappa tested the child-parent agreement. The weight was given by (1-|i-j|)/(k-1), where i and j index the rows of columns of the ratings by the two raters and k is the maximum number of possible ratings. (Where "1" is the weight for the cells in the diagonal, and 0 and 0.5 are the values for the cells moving sequentially away from the diagonal.)

In longitudinal data analysis, mixed effects model were used to assess the associations between parental perceptions of their children's IBI and their children's actual BMI z-score and WHtR, adjusted for children's perceptions of their IBI, age, gender, father's BMI, mother's BMI, parental highest education level, family homeownership, consumption of red meat, poultry, vegetables, fruits, pure milk, dairy products, and soybeans and soy products, and amount of off-campus physical activity. Further subgroup analyses were conducted by gender, age groups, and baseline weight status.

Analyses were conducted using Stata software version 14 (StataCorp, College Station, Texas, USA). The effect size was presented as beta coefficients with standard error (SE). Statistical significance was set at $P < 0.05$.

Results

1. Participants' characteristics and prevalence of overweight and obesity in cross-sectional data analysis of 3,298 students

Table 1 shows the sample characteristics. Boys had higher BMI and WC than girls (all $P < 0.05$), and girls' mothers were slightly heavier and their parents more likely to have more education. Based on BMI, 15.3% of children were obese (19.2% of boys and 11.2% of girls), while based on WHtR, the abdominal obesity rate was 19.8% (28.1% for boys and 11.3% for girls).

2. Gender difference of parental perceptions of children's IBI in cross-sectional data analysis of 3,298 students

Figure 1 shows the distribution of parental perception of children's IBI by gender. The most common selection among boys and girls was figure D (boys 54.5% and girls 53.5%), corresponding with the BMI classification for normal weight. In general, the objectively assessed BMI clearly increased with higher ideal body size.

As shown in Figure 2, 3.0% of parents thought that the IBI for children should be ov/ob, and it differed for boys and girls (4.5% vs 1.5%, respectively, $P < 0.001$). As for the IBI as

perceived by children, boys were also different from girls (3.7% vs 0.8%, respectively, $P < 0.001$). Boys and boys' parents were more inclined to see ov/ob as ideal.

Table 2 presents the weighted kappa between parental perception of children's IBI, children's perception of their own IBI, and children's BMI-based weight status. As the parents evaluated their children's IBI from underweight to ov/ob, the ratio of childhood weight status showed an increasing trend: nearly 2% of the children whose IBI was evaluated by their parents as ov/ob actually measured as ov/ob. The resemblance between parental perception of their children's ideal body and the children's perception of their IBI, however, was weak, as shown by weighted kappa (0.168), just as the resemblance between parental perception of children's IBI and children's BMI-based weight status (0.033).

3. Association between parental perception of children's IBI and BMI Z-score and WHtR in longitudinal data analysis of 1,691 students

Table 3 shows that children whose IBI was considered by their parents as ov/ob were more likely to have a higher BMI Z-score and WHtR increase during follow-up (β [SE] = 0.042 [0.011], and β [SE] = 0.010 [0.004], respectively; all $P < 0.05$). Significant gender differences were found for the associations between parental perceptions of children's IBI and children's weight status. Boys whose parents selected large body sizes (i.e., "ov/ob") as the IBI were more likely to increase their BMI Z-score and WHtR (β [SE] = 0.041 [0.011], and β [SE] = 0.012 [0.005], respectively; all $P < 0.05$), but no significant associations were found among girls.

Adolescents (12–17 years old) whose IBI was considered by their parents as ov/ob were more likely to have increased their BMI Z-score during follow-up than those who were assessed as normal (β [SE] = 0.046 [0.012], $P < 0.001$), while young children (7–11 years old) whose IBI was evaluated by their parents as ov/ob were more likely to have increased their WHtR than those who were assessed as normal (β [SE] = 0.014 [0.006], $P < 0.05$).

In addition, among children who were ov/ob at baseline, children whose IBI was considered by their parents as ov/ob were more likely to have a higher BMI Z-score (β [SE] = 0.046 [0.019], $P < 0.05$), while girls who were ov/ob at baseline and whose IBI was considered by their parents as thin had a higher WHtR (β [SE] = 0.008 [0.003], $P < 0.05$).

Discussion

Using the data collected during 2015–2017 from five mega-cities across China, we studied childhood obesity and overweight rates, Chinese parents' weight perception of IBI for children, and the effect of parental perceptions of children's IBI on the subsequent changes in child BMI Z-scores and WHtR. To our knowledge, this is the first study examining the association between parental perceptions of children's IBI and children's weight changes using longitudinal data in China. Studying the world's second-largest economy and the nation with the largest number of ov/ob people had several important findings. First, one-third of children in big cities in China were ov/ob, and more boys than girls were ov/ob (40.6% vs 25.1%, respectively). Second, parents reported very different IBIs for boys vs girls. They were about 3 times more likely to select "ov/ob" as an IBI for boys than for girls

(4.5% vs 1.5%, respectively). Third, parents who perceived their children as ov/ob were more likely to increase their children's BMI and WHtR. Stratified analysis found that boys, older children (≥ 12 years old), and ov/ob children had higher BMI gains than girls, young children, and non-ov/ob children.

Actual and ideal body image are two important aspects of the evaluation of body (dis)satisfaction. There are several studies examining the association between children's actual body image and childhood obesity, with some reporting that body weight misperception is associated with unhealthy eating.[14, 25–28] One of those studies has tested the association between children's IBI and childhood obesity in other countries [21]. Body image concern among children may be strong enough to exert a positive influence, along with social support, in motivating health behaviors.[29] Another source of children's ideas about ideal body image and their motivations to act upon those ideas may come from their parents. The relationship between parental perceptions of children's IBI and childhood obesity has remained to be examined in China.". In our study, the degree of parent-child resemblance in children's IBI was weak, just as the resemblance in parental perception of children's IBI and children's weight status (weighted kappa: 0.168 and 0.033, respectively). We did not find a similar study, but our result was generally consistent with some research that has examined parent-child resemblance in body weight status. For example, one of our previous US studies (among 4,846 boys, 4,725 girls, and their parents) reported weighted kappa coefficients between BMI quintiles of parent and child ranging from −0.02 to 0.25.[30] Previous research regarding weak parent-child resemblance in energy balance-related behaviors may help explain the relatively weak resemblance in actual weight status,[31] and the weak parent-children resemblance in children's IBI might be due to increased independence in children.[32]

In this study, the prevalence of ov/ob children in mega-cities in China reached 33%, and the prevalence of ov/ob was higher than the national level of about 19.4% in 2014.[33] This is consistent with the association between socioeconomic status and ov/ob in developing countries, that is, the higher the socioeconomic status, the higher the ov/ob rates.[34] However, Monteiro et al. concluded that with the economic growth and nutritional transformation of developing countries, the relationship between obesity and socioeconomic status would gradually change, and there would be a negative correlation between obesity and socioeconomic status.[35] According to the idea of "nutritional transition," with the development of a nation's economy, the change of the overall nutritional status of a country will go through three stages: hunger reduction, a higher incidence of chronic diseases, and behavior change.[36] Our research indicated that even in China's economically developed regions, "nutritional transition" was still in the second stage.

Some research indicates Chinese parents and grandparents have a stereotypical image of children—chubby boys and slim girls.[37] Our study found that 3.0% of parents chose large body sizes (ov/ob) as children's IBI, with 4.0% of parents thinking that boys' IBI was ov/ob and 3.7% of boys reporting their IBI as ov/ob, while 1.5% of parents thought that girls' IBI was ov/ob, yet only 0.8% of girls' self-reported IBI was ov/ob. That highlights unique gender-specific cultural views about body image: the preference for thinness in girls and bigger body size in boys was prevalent.[38] Our figure was higher than those in a study of

374 Mexican mothers. In that study, 4.0% of mothers chose underweight or overweight as children's IBI,[9] but 23.9% of parents chose underweight or overweight as their children's IBI in our study.

Another important finding was the positive association between parental perception of children's IBI and children's BMI and WHtR. This association might be due to the acceptance of a large IBI among parents putting less pressure on children to try to control their own weight. We also found a significant association between children's self-assessed IBI and children's BMI and WHtR (Supplemental Table 1); boys who self-evaluated their IBI as ov/ob had a higher BMI Z-score and WHtR increase over time than those who assessed themselves as normal.

Our gender-stratified analysis showed that boys whose parents selected ov/ob as an IBI were more likely to increase their BMI and WHtR than boys whose parents selected normal weight as an IBI. This might partly explain the difference in the prevalence of obesity between boys and girls in China. In Mexican mothers' perceptions of their children's body weight, they appropriately perceived overweight children; however, these mothers were not concerned by this situation because for them, it was something temporary that would disappear as the child grew. But mothers typically perceived overweight and obesity in girls with greater precision, which motivated them to change their children's habits and behaviors.[39] Our age-stratified analysis in China found that parental perceptions of children's IBI was associated with adolescents' (12–17 years old) BMI, and children's self-assessed IBI was associated with adolescents' (12–17 years old) BMI and WHtR (Supplemental Table 1). This might be due to parents paying more attention to their children's growth and development when the children enter puberty,[40] thus adolescents were more likely to have a weight status consistent with their IBI and to maintain their body image over time than were younger children. In addition, we found that ov/ob children at baseline whose parents selected "ov/ob" as an IBI were more likely to increase their BMI than those whose parents selected "normal weight" as the ideal. Other longitudinal studies have revealed that children who are obese or have a negative self-perceived body image have a higher weight gain (e.g., β in BMI = 0.38 [SE = 0.13], $P < 0.01$ and 0.25 [95% CI: 0.10–0.39], respectively) and an increased risk of obesity (e.g., odds ratio of having obesity = 1.6 [95% CI: 1.20–2.30]) compared to the children who are their counterparts.[41, 42]

Key strengths of this study include that it examined the little-studied issue of parental attitudes toward IBI; it targeted the emergence of these attitudes in a rapidly developing economy like China's; and it was a prospective study, utilizing data collected from 5 mega-cities across China. The findings will be useful to policy makers addressing the obesity problem. The study also has some limitations. It only investigated the prevalence of overweight and obesity in large cities, but not nationwide. In addition, the follow-up period of 3 years is not long.

In conclusion, our results highlight the high rates of childhood obesity/overweight (based on BMI) and central obesity, and much higher rates in boys than in girls, in mega-cities in China. Chinese parents preferred large body sizes for boys and thinness for girls. Children of parents who perceived a childhood IBI as heavier had a faster BMI increase with age than

those with parents who had an average-size body image for children, especially among boys, older children, and those who were overweight/obese at baseline. Health promotion programs in China should communicate about and help parents recognize healthy ideal body image in children. Parents and children should be empowered to develop an appropriate body image and maintain healthy body weight.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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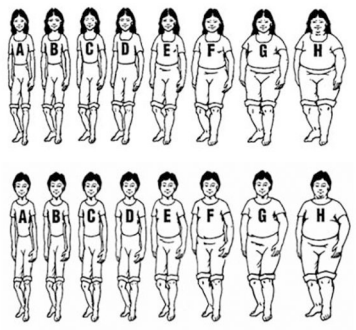
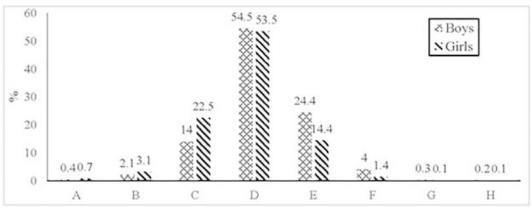
Highlights

- High rates of childhood ov/ob and central obesity in mega-cities in China
- Chinese parents preferred large body sizes for boys and thinness for girls
- Children of parents who perceived a childhood IBI as heavier had a rapid BMI growth
- Health programs should help parents recognize healthy IBI in children

A



B



C

Measured BMI*	A	B	C	D	E	F	G	H
Boys	19.0 ± 3.8	18.8 ± 3.8	19.4 ± 3.7	19.4 ± 3.6	20.1 ± 4.3	21.6 ± 4.0	22.3 ± 4.9	19.2 ± 2.7
Girls	16.8 ± 3.5	18.3 ± 2.9	18.1 ± 3.2	18.6 ± 3.6	19.1 ± 3.9	21.9 ± 5.1	25.3#	29.5#

Figure 1.
Distribution of parental perception of children's ideal body image by gender

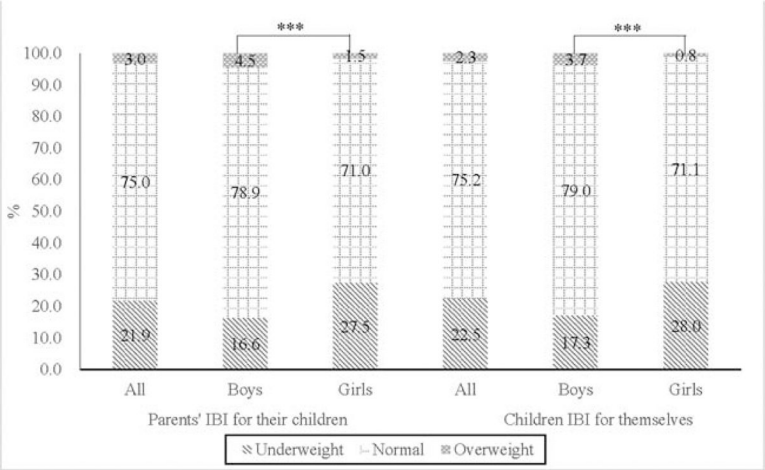


Figure 2.

Distribution children's ideal body image (%) evaluated by himself/herself or his/her parents

Table 1.

Sample characteristics of Chinese school children based on cross-sectional analysis of data from the Childhood Obesity Study in China Mega-cities (n = 3,298 different children)

	All (n = 3298)	Boys (n =1675)	Girls (n = 1623)	*P*
Age	11.0 ± 2.0	11.0 ± 2.0	11.0 ± 2.1	0.734
BMI (kg/m^2)	19.1 ± 3.8	19.7 ± 3.9	18.6 ± 3.6	< 0.001
Waist (cm)	65.3 ± 10.3	68.0 ± 11.2	63.3 ± 8.8	< 0.001
Demographics & family socioeconomic status				
Father's BMI (kg/m^2)	24.2 ± 3.6	24.3 ± 3.6	24.2 ± 3.6	0.538
Mather's BMI (kg/m^2)	22.2 ± 3.7	22.1 ± 3.5	22.4 ± 3.8	0.019
Parental highest education level (%)				0.008
Middle school or below	15.6	17.4	13.9	
High or vocational schools	25.7	25.5	25.9	
College or above	53.4	51	55.9	
Family homeownership (%)				0.249
Rent or share residency with relatives	27.1	28	26.1	
Own apartment	56.4	54.6	58.3	
Own house	10.9	10.9	10.8	
General obesity (%)				< 0.001
Underweight	4.6	4.7	4.6	
Normal	62.4	54.8	70.2	
Overweight	17.7	21.4	13.9	
Obesity	15.3	19.2	11.2	
Abdominal obesity (%)				< 0.001
Non-obesity	80.2	71.9	88.7	
Obesity	19.8	28.1	11.3	

Values are means ± SDs unless otherwise indicated; *P* values were calculated using t-test or chi-square test. General obesity was defined according to age- and gender-specific BMI cutoff points issued by the National Health Commission of the People's Republic of China [17]. Abdominal obesity was defined as WHtR ≥ 0.48 [18]. BMI, body mass index. WHtR, waist-to-height ratio.

Table 2.

Agreement between parental perception of children's ideal body image (IBI), children's perception of own IBI, and children's BMI-based weight status in cross-sectional data analysis in the Childhood Obesity Study in China Mega-cities (n = 3,298 different children).

		Parental IBI for their children		
		Underweight	**Normal weight**	**Overweight/obesity**
Children's IBI for themselves	Underweight	8	14.2	0.3
	Normal weight	13.8	57.7	2.4
	Overweight/obesity	0.3	1.8	0.4
	Weighted agreement		83.4	
	Weight kappa		0.168	
	P		< 0.001	
Children's weight status based on BMI	Underweight	1.1	4	0
	Normal weight	16.4	47	1.1
	Overweight/obesity	5.3	24	1.9
	Weighted agreement		72.5	
	Weight kappa		0.033	
	P		< 0.001	

P values calculated by using weighted kappa. Weight given by (1-|i-j|)/(k-1), where i and j index the rows of columns of the ratings by the two raters and k is the maximum number of possible ratings.

Table 3.

Longitudinal data analysis of associations between parental perception of children's ideal body image (IBI) and child BMI Z-score and WHtR in the Childhood Obesity Study in China Mega-cities (n = 1,691)

	Parental IBI for their children (reference = average)	
	Overweight/obesity (β [SE])	**Underweight (β [SE])**
BMI Z-score		
All	0.042 (0.011) ***	−0.003 (0.004)
Analysis stratified by:		
1. Gender		
Boys	0.041 (0.011) ***	0.005 (0.006)
Girls	0.029 (0.027)	−0.009 (0.006)
2. Age at baseline		
6–11	0.003 (0.017)	−0.006 (0.006)
12–17	0.046 (0.012) ***	−0.001 (0.005)
3. Weight at baseline		
Not overweight/obese	−0.006 (0.011)	−0.001 (0.003)
Overweight/obese	0.046 (0.019) *	−0.001 (0.011)
WHtR		
All	0.010 (0.004) *	0.001 (0.002)
Analysis stratified by:		
1. Gender		
Boys	0.012 (0.005) *	0.005 (0.003)
Girls	0.005 (0.007)	−0.003 (0.002)
2. Age at baseline		
6–11	0.014 (0.006) *	−0.001 (0.002)
12–17	0.006 (0.006)	0.002 (0.003)
3. Weight at baseline		
Not overweight/obese	−0.002 (0.005)	−0.001 (0.001)
Overweight/obese	0.004 (0.006)	0.008 (0.003) *

Participants had ≥ two BMI measurements during follow-up, thus, sample size became smaller. Parental perception of children's ideal body image as "average" (silhouettes 4–5) used as reference in models. Mixed effect model after adjustment for IBI by children, age, gender, father's BMI, mother's BMI, parental highest education level, family homeownership, consumption frequency of red meat, poultry, vegetables, fruits, pure milk, dairy products, and soybeans and soy products, and engagement in off-campus physical activity, as well as cohort and considering COCM sampling methods and hierarchical data structure. Subgroup analysis applied same mixed model except for stratified variable.

* P < 0.05.

** P < 0.01.

*** P < 0.001. BMI, body mass index. WHtR, waist-to-height ratio.