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Obesity, Body Image, and Its Impact on Children's Eating and Exercise Behaviors in China: A Nationwide Longitudinal Study

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Abstract

Body image seems to mediate the association between obesity and health behaviors as well as weight control attempts. We examined the distribution of children's body image by demographic characteristics and their subsequent associations with eating, exercise, and weight change. Child body image and health behaviors from the China Health National Survey 2000–2011 were assessed at baseline and in follow-up for 6- to 17-year-old children during 2000–2011 using mixed models. There was a large discrepancy between children's actual weight status (overweight: 16.9%) vs. self-rated body image (fat: 2.4% in 2011). Less than 1% of children desired a fat body; girls were more likely to want to be thin (52.5% vs. 40.9%) than boys. About 11% of children needed to lose weight in order to be at their desired baseline. During follow-up, those needing weight loss to be as desired were more likely to attempt dieting to change their weight (OR, 95% CI = 1.9, 1.1–3.5 in boys; 1.7, 1.1–2.5 in girls) and less likely to feel they had enough physical activity (OR, 95% CI = 0.5, 0.4–0.7 in boys; 0.6, 0.5–0.9 in girls), although their weight gain had been significantly higher than those having consistent self and desired body images (β [SE] = 0.4[0.1] in boys; 0.2[0.1] in girls, all $p < 0.05$). However, no significant difference was shown in subsequent health behaviors among overweight children by body image discrepancy. The discrepancy in self vs. desired body image motivated children to change their obesity-related health behaviors among non-overweight children in China.

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Conflicts of Interest

The authors declare no conflict of interest.

Keywords

body image; child; obesity; diet; physical activity; China

Introduction

The rapid rising in childhood obesity (prevalence of overweight/obesity: 3% in 1985, 6% in 1995, 15% in 2005, and 19.2% in aged 7–18 years¹) has drawn much public attention in China due to obesity's future chronic disease risk and economic costs. However, Chinese parents and children did not change their body perception for the child. About 40% of mothers and children aged 6–18 years correctly perceived the child as overweight with moderate consistency between their perceptions.² Chinese parents and grandparents still keep their stereotyped images of children—chubby boys and slim girls.³ Also, portrayed body image in Asian mass media influences adolescent girls to think thinness is ideal and boys to desire muscular features.^{4, 5, 6} Indeed, Chinese children have gender difference in weight-related beliefs and behaviors. Non-overweight girls were more likely to perceive themselves as heavy, while normal-to-overweight boys were more likely to believe themselves as underweight.⁷ Chinese middle-high school boys were more likely to consume sugary beverages and have longer screen time but less likely to try to lose weight by restricting diet than girls.^{8, 9} Yet Asians still think a thin body is normal and ideal compared to Caucasians.¹⁰

Self-rated body image had a substantial correlation with actual body mass index (BMI) and weight status¹¹ and mediated the association of school-age children's obesity with screen-based media use and infrequent breakfast consumption.¹² A high correlation was shown between positive body image with appropriate nutrition and higher engagement in physical exercise.¹³ Obesity intervention resulted in significant improvements in body esteem and weight gain.¹⁴ When Chinese mothers thought their children were fat, they were more likely to encourage their children to increase their physical activity and to diet.² However, this maternal encouragement did not improve children's weight gain, possibly due to the struggle between self-motivation and low self-esteem from weight stigma.

A recent study shows that the gap between self and desired body image is also significantly related to physical self-concept and physical activity level.³ Based on the discrepancy theory,³ the self-desired discrepancies in body image could motivate children to change their daily health habits as well. Yet no longitudinal study has investigated the possible role of children's desire to be as ideal in preventing childhood obesity through self-motivation in China.

Using nationwide longitudinal survey data from children aged 6–17 years, the study examined: 1) differences in self-rated and desired body images by demographic characteristics and 2) the longitudinal effects of self-rated body image and the discrepancy between self vs. desired body images on children's eating and exercise behaviors, weight gain, and overweight/obesity risks at follow-up. The study results may emphasize children's self-motivation to achieve weight management goals in childhood obesity intervention programs.

Methods and Materials

1. Study Design and Study Sample

The China Health and Nutrition Survey (CHNS), which began in 1989, was conducted by the University of North Carolina at Chapel Hill and the Chinese Center for Disease Prevention and Control. As a long-term prospective open-cohort study, it collects information from 4,400 households in overall surveys from 15 provinces and municipal cities that collectively represent approximately 45% of China's total population with substantial varieties in geography, economic development, public resources, and health indicators.

Data on children and their parents were collected by in-home visit interviews and survey questionnaires. Detailed information about CHNS is provided elsewhere.¹⁵ Informed consent was obtained from all participants. The study was approved by the State University of New York at Buffalo Institutional Review Board.

The present study includes children aged 6–17 years in families surveyed in 2000, 2004, 2006, 2009, and 2011 (child body image data was collected in those years) and having information for age, gender, self and desired body image, and measured weight and height (with at least two anthropometrics measurements for longitudinal analysis). The total analytic sample was 2,310, and sample size in each survey year varied. For stratified analysis, two age groups were created: 6–11 and 12–17 years.

2. Assessment and Measures

1) Child weight status—At each wave, child weight and height were measured to the nearest 0.1 kg and 0.1 cm in light, indoor clothing, without shoes by trained and certified staff during the detailed physical examination. Child 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.¹⁶ Change in BMI Z-score was used to show weight gain during follow-up. Child weight status was classified as underweight, normal weight, or overweight and obese based on the International Obesity Task Force (IOTF) BMI cut-offs.¹⁷

2) Child body image—Children were asked to choose which silhouette was most like them (self-rated body image) and which one they wanted their body to look like (desired body image) using the Silhouette Matching Task (Appendix 1), which provides a set of silhouette drawings varying from very thin to very obese. As previous studies did,^{18, 19} we used categorized body image (thin [silhouettes 1 to 3], average [silhouettes 4 to 6], and fat [silhouettes 7 to 9]) to serve the average group as the reference in data analysis.

The difference between self vs. desired body images was classified as consistent, need to lose weight, and need to gain weight. The consistent group served as the reference in data analysis.

3) Child health behaviors—Children’s responses to their daily physical activity (PA) amount as well as self-evaluation on their level of exercise, food intake, and weight control attempts through dieting were used in our analysis.

We described daily PA as the average number of minutes spent on six specific PAs before or after school or on weekends: 1) martial arts (e.g., kung fu); 2) gymnastics, dancing, acrobatics; 3) track and field (running, etc.), swimming; 4) soccer, basketball, tennis; 5) badminton, volleyball; 6) other PAs (ping pong, Tai Chi, etc.). All six activities were classified as moderate-to-vigorous physical activities (MVPA).²⁰ Following WHO recommendations, we defined appropriate daily MVPA as 60 min/day.²¹ Also, children evaluated their level of PA as too little, just right, or too much during sports or activities that increased the heart rate or made them sweat.

Children’s food consumption data were collected using a 24-hour recall and same-day interview conducted by trained nutritionists over three consecutive days. We compared the calculated total energy intake (kcal) by the Chinese Food Composition Table to the sex-, age-, and PA-specific recommendation for the daily amount of energy intake based on Chinese Dietary Reference Intakes (DRI).²² In addition, children reported whether they attempted to change their weight through dieting, which meant modifying their usual eating habits to change weight.

4) Parental and household characteristics—To consider the associations between family and household socioeconomic status and child weight status and body image, we used parental weight status (overweight, obese, not overweight or obese), highest parental education (up to primary school, middle school, vocational/college/higher degree[s]), household income per capita (tertiles), and residence (rural, urban). Parental weight status was classified using the Chinese BMI cut-points for overweight ($24 \leq \text{BMI} < 28 \text{ kg/m}^2$) and obese ($\text{BMI} \geq 28 \text{ kg/m}^2$). Both parents’ BMIs were calculated and with the higher of the two measurements were used for this study.

3. Statistical analysis

First, we cross-sectionally described the distributions of children’s actual weight status, self-rated and desired body images, and discrepancies between self-rated body image vs. actual weight status and between self vs. desired body images in 2000 and 2011 to examine their differences by demographics and over time using the χ^2 test. Second, we tested agreements in self-rated and desired body image compared to children’s actual weight status using weighted Kappa and the total percent of agreement in boys and girls.

To examine the longitudinal associations between self-rated body image, discrepancy between self vs. desired body image, and subsequent child weight gain and health behavior changes, we used baseline body images from pooled data of the CHNS surveys in 2000, 2004, 2006, and 2009 and measurements of weight-related child health behaviors and anthropometrics at least two years post-baseline.

Mixed models were used to consider the CHNS sampling methods/hierarchical data structure and include fixed and random effects (allowing individuals to have their own

intercepts) in the longitudinal analysis after adjusting for age, parental weight status, household income level, parental education, urban/rural residence area, and data collection years. We applied multiple regression models for subgroup analysis, i.e., boys and girls, as well as non-overweight and overweight/obese children at baseline due to their significant differences in the self-desired discrepancy in body image.

Analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC) and STATA 14 (StataCorp., College Station, TX). The effect size was presented as a beta coefficient with a standard error or odds ratio and a 95% confidence interval (95% CI). Statistical significance was set as $p < 0.05$.

Results

Childhood Overweight/Obesity Prevalence and Self-Rated Body Image

Childhood overweight/obesity prevalence steadily increased in the study population and became 19.9% in boys and 13.6% in girls in 2011, which was about 10%p increase after 2000 ($p < 0.001$); normal weight and underweight were 63.3% and 19.8%, respectively (in overall, Figure 1). Boys had 4%p higher increase in overweight/obesity rate than girls after ten years (12.2%p vs. 8.6%p difference between 2011 vs. 2000, $p < 0.001$).

Yet more than half of the children perceived themselves as being thin (54.9–61.9%, varied by gender and survey years; Figure 1). Less than 4% of children thought they were fat in 2011. Boys' self-rated body image became fatter over time, but there was no significant change in girls after ten years.

Comparing Self-Rated and Desired Body Images vs. Actual Weight Status

Overall, 2.4% of children rated their bodies as fat in 2011 (37 children out of 1536, Table 1). Regardless of gender and actual weight status, the total percentage of agreements ($< 50\%$) and weighted Kappa between self-body image and actual weight status were low (0.13, $p < 0.001$) (Table 1). Overweight children had the lowest consistency between body self-image compared to their actual weight status (boys: 14.0%, girls: 4.9%), yet underweight children had the highest consistency (boys: 72.1%, girls: 75.7%).

The majority thought that a fat body was not ideal. More than half of girls preferred thinness (52.5%). Boys were more likely to want an average body than girls, regardless of their weight status.

Regarding self-rated vs. actual weight status, girls had a higher consistency than boys (G: 51.6%, B: 42.2%); boys had a higher underestimate rate than girls (boys: 41.2%, girls: 39.2%) in 2000 ($p < 0.001$; Appendix 2). The underestimates became higher in both genders after ten years ($p < 0.05$). The gender difference in the discrepancy between body self-image and actual weight status disappeared in 2011. Children with overweight or highly educated parents and those living in urban areas were more likely to be overweight/obese and to underestimate their body image compared to their actual weight status (underestimates: 57.1% in obese parents, 62.0% in parents with college degrees or above, and 54.9% in urban areas; all $p < 0.01$, Appendix 3).

Related to desired body image (Appendix 2), in 2011, compared to 2000, a higher number of children preferred a thin body (46.5% vs. 38.1%) and fewer desired a fat body (0.2% vs. 1.4%, year difference in ideal body image $p < 0.05$). Girls were especially more likely to desire a thin body than boys ($p < 0.01$), and their preference for thinness became higher in 2011 (2011: 52.5%, 2000: 41.6%). Thus, more girls needed to lose weight to achieve their ideal (girls: 13.1%, boys: 6.4% in 2000; girls: 13.1%, boys: 11.7% in 2011). Young children were more likely to need to gain weight to achieve their desired body image than older children (22.9% vs. 17.3%, age difference in body image discrepancy $p < 0.01$; Appendix 3). However, children with obese parents were more likely to need weight loss (25.0% vs. 9.6% in children with non-overweight parents) to achieve their ideal (parental weight status difference in body image discrepancy $p < 0.001$).

Longitudinal Effects of Body Self-Image and the Self vs. Desired Discrepancy in Body Image on Eating and Exercise Behaviors and the Risk of Overweight and Obesity

During follow-up, 85.0% of children rating themselves as thin kept their body image, while 69.4% of children needing weight loss kept their self vs. desired discrepancy in their body images during follow-up. Both boys and girls who perceived themselves as fat at baseline subsequently had a greater increase in BMI Z-scores (0.59 [SE = 0.17] and 0.64 [SE = 0.17], respectively, all $p < 0.001$) and were at four to 18 times higher risk of being overweight/obese than those having an average body image (Table 2). Also, those having a thinner desired body image vs. body self-image at baseline had, at follow-up, a 0.37 (SE = 0.10 in boys) and 0.17 (SE = 0.08 in girls, all $p < 0.05$) higher increase in BMI Z-score than those with consistent self and desired body images. Their overweight/obese risk was 1.7–1.9 times higher than the consistent group. There was no significant gender difference in the association between body self-image, body image discrepancies between self-rated vs. desired, and subsequent BMI increase or overweight/obese risk.

However, those boys needing weight loss to achieve their desired body image had 82.1 kcal less energy intake increase (SE = 42.1) and 7.7-minute longer MVPA (SE = 4.09) increase during follow-up than those with consistent images, with marginal significance. In addition, both boys and girls needing weight loss were more likely to attempt dieting to change their weight (boys: OR = 1.94, 95% CI = 1.09–3.48; girls: OR = 1.69, 95% CI = 1.13–2.54) and less likely to feel they had good enough/lots of PA than others (boys: OR = 0.53, 95% CI = 0.38–0.73; girls: OR = 0.62, 95% CI = 0.46–0.85).

In contrast, boys and girls who thought they were thin at baseline had a 0.33 (SE = 0.06) and 0.34 (SE = 0.06, all $p < 0.001$) lower increase in BMI Z-score and a 67% (OR = 0.33, 95% CI = 0.20–0.55) and 61% (OR = 0.39, 95% CI = 0.20–0.74) lower risk, respectively, of being overweight/obese than those with average self-body image. Children with a thin body image subsequently had a 31% lower risk of having a high total energy intake (> Chinese DRI recommendation) than those with average body image.

In stratified analysis by weight status at baseline, we found no significant difference in follow-up BMI Z-score increase and health behaviors by body image among overweight children (Appendix 4). However, non-overweight children who needed to lose weight to be as desired had more energy intake reduction (β [SE] = -60.8 (28.3), $p < 0.05$) and a

marginally higher increase in PA (β [SE] = 5.39 [2.99]) than those with consistent self vs. ideal body image. Also, they were more likely to attempt dieting to change their weight (OR = 1.63, 95% CI = 1.13–2.37), and there was no difference in longitudinal overweight/obesity risk between them and those with consistent self vs. ideal body image.

Discussion

We found that the childhood overweight/obesity rate increased by 10.4%p in the last ten years. However, the majority of children kept perceiving themselves as thin, and only 2% rated themselves as fat. Girls were more likely to prefer thinness than boys. During follow-up, those needing to lose weight to achieve their ideal were more likely to change their health behaviors than those having consistent self and desired body images, although they still had higher weight gain.

China has a socio-demographic divergence in childhood obesity rate, weight-related perception, and behaviors.^{7, 23} A greater increase in childhood overweight and obesity was shown in children with higher socioeconomic status, especially after 1997, although all children had experienced increased overweight/obesity rates.¹ In particular, adolescent boys have about two times higher overweight/obesity rates than girls in multiple nationally representative data. As shown in previous studies, our results indicate the significant association between child body image and their health behaviors and risk of obesity.^{12–14} We consistently found that girls were more likely than boys to perceive their bodies as close to their actual weight status,⁷ desired a thin body image,^{4, 5} and wanted to lose weight to achieve their ideal.⁵ Nevertheless, boys' self-body image became fatter along with their increasing weight status over time in our study.

When children perceived themselves as fat, they were nevertheless likely to increase their weight gain and have a higher risk of being overweight/obese. Boys in this category were more likely to attempt weight change through dieting and to feel less confident about their amount of physical activity than those having an average body perception. This result is relevant to what we and others found: neither self-perception of overweight status nor parental perception of a child's overweight status is a protective factor for subsequent weight gain. In fact, those statuses were associated with an increased risk of future weight gain in longitudinal analysis.^{24–26} Children were more likely to gain weight into adolescence when they were labeled as fat by family or peers in early childhood.²⁷ As described in the cyclic obesity/weight-based stigma model, this association is possibly due to children's struggle between self-motivation from recognizing undesirable body fat and low self-esteem from weight stigma.²⁸

In contrast, our longitudinal analysis indicated that children's self-motivation to lose weight was significantly influential in their subsequent weight change attempts through dieting and resulted in feeling that their PA was not good enough. Girls' stronger desire to lose weight and subsequent self-regulation of eating and PA may lead to them having a lower rate of overweight/obesity than boys. On the other hand, although fewer boys needed to lose weight to achieve their desired image, boys had a lower increase in total energy intake and higher increase in PA level during follow-up than those having consistent self and desired body

images. These results suggest that self-motivation in improving one's own health could be a critical component in childhood obesity intervention programs. Weight control attempts via diet and exercise changes originating from self-motivation may result in substantial changes in long-term follow-up, although children who needed to lose weight to achieve their desired body image had a subsequently higher increase in BMI Z-scores than others at the current stage. Enhancing children's self-motivation and regulation on their weight-related behaviors with an appropriate weight management goal could lead to better outcomes in childhood obesity intervention programs, as promoting children's self-esteem is a key factor for successful obesity interventions.²⁹

This study had some limitations. Due to limited data, we could not examine children's body image effects on health behaviors and weight status in adulthood. Only a few children perceived themselves as fat and needing to lose weight to achieve their desired body image, so our sample size may not be able to define the significant association between children's body image and their health. However, this study used a nationwide sample and longitudinal data and studied the impact of children's body image and self-motivation to be the desired body type on their longitudinal health behaviors and risk of weight gain. The diversity of the CHNS sample in geography, economic development, and public resources across China could support the generalizability of our findings to the total Chinese population. These results provide some insight for future childhood obesity intervention programs in China and other countries.

Conclusions

The discrepancy between self vs. desired body images leads to significant differences in Chinese children's weight control attempts and their awareness of insufficient PA. Promoting healthy body images and establishing self-motivation for appropriate weight maintenance and control needs to be empowered in childhood obesity intervention programs in China.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- China had a large discrepancy between children's weight status vs. self-body image.
- Girls were more likely to want to be thin than boys.
- Self-desired body image discrepancy motivated children's behavioral changes.
- Yet this motivation does not improve children's weight status.

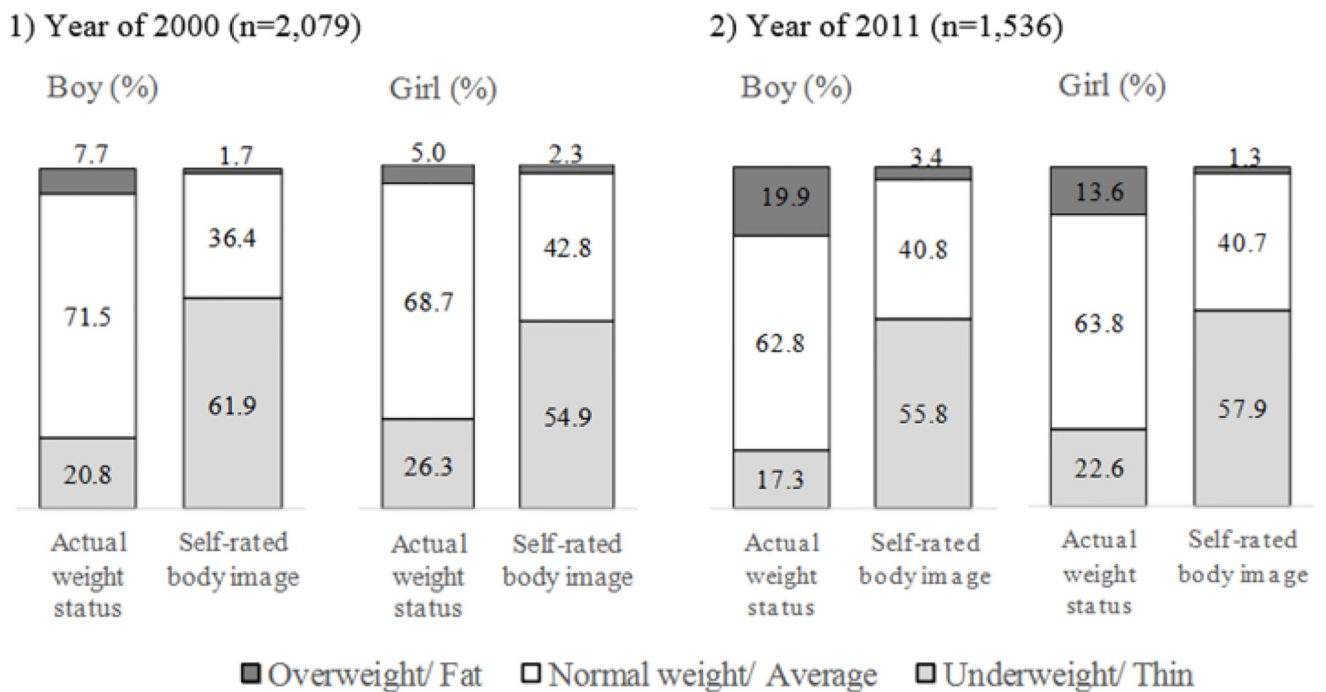


Figure 1.

Distributions of child actual weight status¹ and self-body image² (%) by gender and survey years among 6–17 year-old children in the China Health and Nutrition Survey (CHNS) in 2000 and 2011

¹Child height and weight were measured by trained and certified staffs during detailed physical examination (ref) and classified by the Extended International (IOTF) BMI cut-offs (Cole, TJ. et al., 2000).

²Children's self-ratings using nine silhouettes for the most like them were grouped into three levels: thin (silhouettes 1–3), average (silhouettes 4–6), and fat (silhouettes 7–9).

X² test was used to examine gender and year differences in child actual weight status and self-rated body image. There were significant gender and year differences in weight status and body image (all $p < 0.05$) except for gender difference in self-body image 2011 ($p = 0.08$) and year difference in self-body image among girls ($p = 0.20$).

Comparing self-rated and desired body images vs. actual weight status among 6–17 year-old children in the China Health and Nutrition Survey (CHNS) 2011 (n=1,536)

Table 1

Actual weight status based on BMI calculated using measured weight and height ¹						
1. Boy (n=787)		2. Girl (n=749)				
Underweight (n=156)	Normal weight (n=494)	Overweight (n=157)	Underweight (n=169)	Normal weight (n=478)	Overweight (n=102)	
1) Self-rated body image (n, column %) ²						
Thin	98 (72.1)	293 (59.3)	48 (30.6)	128 (75.7)	271 (56.7)	35 (34.3)
Average	37 (27.2)	197 (39.9)	87 (55.4)	39 (23.1)	204 (42.7)	62 (60.8)
Fat	1 (0.7)	4 (0.8)	22 (14.0)	2 (1.2)	3 (0.6)	5 (4.9)
p		<0.001				<0.001
Total % of agreement		40.3				45.0
Weighted Kappa		0.13 ***				0.13 ***
2) Desired body image (n, column %) ³						
Thin	56 (41.2)	205 (41.5)	61 (38.9)	89 (52.7)	263 (55.0)	41 (40.2)
Average	80 (58.8)	286 (57.9)	96 (61.1)	80 (47.3)	215 (45.0)	61 (59.8)
Fat	0 (0)	3 (0.6)	0 (0)	0 (0)	0 (0)	0 (0)
p		0.91				0.02
Total % of agreement		43.5				40.6
Weighted Kappa		-0.001 ***				0.001

X² test and Fisher's exact test were used to examine agreement between body images and actual weight status.

*** p<0.001.

¹ Child height and weight were measured by trained and certified staffs during detailed physical examination and classified by the Extended International (IOTF) BMI cut-offs (Cole, T.J. et al., 2000).

²⁻³ Children's self-ratings using nine silhouettes for 1) that was most like them and 2) the one they would most like to look like were grouped into three levels: thin (silhouettes 1–3), average (silhouettes 4–6), and fat (silhouettes 7–9).

The longitudinal associations of baseline self-body image and discrepancy between self vs. desired body images on subsequent child eating and exercise behaviors and weight gain by gender: the China Health and Nutrition Survey (CHNS) 2000–2011 (n=4,605)

Table 2

	1) Baseline self-rated body image (Ref= average)				2) Discrepancy between self vs. desired body images (Ref= consistent)					
	Boy	Thin	Fat	Girl	Boy	Need to lose weight	Need to gain weight	Girl	Need to lose weight	Need to gain weight
1. BMI- Z score	0.59 (0.17)***	-0.33 (0.06)***	0.64 (0.17)**	0.64 (0.17)**	0.37 (0.10)***	-0.10 (0.06)	-0.10 (0.06)	0.17 (0.08)*	-0.22 (0.06)***	
2. Energy intake (Kcal)	69.4 (71.1)	-50.8 (24.5)*	141.5 (68.2)*	141.5 (68.2)*	-82.1 (42.1)±	25.8 (25.0)	25.8 (25.0)	-15.0 (32.1)	39.3 (24.9)	
3. MVPA (min)	4.28 (7.17)	6.36 (2.40)**	-1.02 (8.35)	-1.02 (8.35)	7.70 (4.09)±	-4.52 (2.45)±	-4.52 (2.45)±	2.45 (3.97)	1.49 (3.14)	
	Odds ratio (95% CI)				Odds ratio (95% CI)					
4. Overweight/obese ²	4.15 (1.38–2.48)	0.33 (0.20–0.55)	17.84 (4.25–75.86)	17.84 (4.25–75.86)	4.22 (2.08–8.56)	0.59 (0.32–1.07)	0.59 (0.32–1.07)	1.74 (0.82–3.71)	0.55 (0.25–1.21)	
5. Attempted to change his/her weight through dieting	2.68 (1.18–6.06)	0.91 (0.60–1.38)	1.40 (0.64–3.05)	1.40 (0.64–3.05)	1.94 (1.09–3.48)	0.66 (0.41–1.06)	0.66 (0.41–1.06)	1.69 (1.13–2.54)	1.20 (0.78–1.82)	
6. Total energy intake> Chinese DRI recommendation ³	1.40 (0.72–2.70)	0.69 (0.54–0.88)	1.65 (0.87–3.12)	1.65 (0.87–3.12)	0.87 (0.57–1.31)	0.98 (0.76–1.26)	0.98 (0.76–1.26)	0.86 (0.62–1.20)	1.11 (0.85–1.44)	
7. Felt having good enough/lots of PA	1.29 (0.73–2.30)	1.02 (0.83–1.25)	0.52 (0.27–1.00)	0.52 (0.27–1.00)	0.53 (0.38–0.73)	0.88 (0.71–1.08)	0.88 (0.71–1.08)	0.62 (0.46–0.85)	1.10 (0.86–1.41)	
8. Daily MVPA 60 min ⁴	1.61 (0.66–3.89)	1.64 (1.16–2.32)	0.57 (0.09–3.45)	0.57 (0.09–3.45)	1.20 (0.68–2.10)	0.79 (0.55–1.12)	0.79 (0.55–1.12)	1.48 (0.75–3.02)	1.27 (0.71–2.28)	

Separate mixed models were fit for each outcome variable with self-body image and discrepancy between self vs. desired body images, respectively. Dietary intake and physical activity were assessed using a 24 hours recall/same-day interview and survey questionnaires for children's time spent on six specific PA before or after school or on weekends. Desired body size 'average' (4–6 silhouettes) and 'consistent' between self vs. desired body images were used as a reference in models. Child age (6–11 years old/12 and above), household income level (tertiles), parental education (up to primary school/middle school degree/vocational or college degree or higher), residence area (urban/rural), parental weight status (non-overweight/overweight/obese) and data collection years were adjusted in the models.

¹We tested interaction between child gender and baseline desired body image on weight gain and health behaviors using interaction terms between gender with self-/self vs. desired discrepancy in body images in additional model and no significant gender interactions with body images were found.

²Weight status was classified by the Extended International (IOTF) BMI cut-offs (Cole, T.J. et al., 2000).

³The DRI recommendation for daily energy intake is the sex-, age-, and physical activity level-specific recommendation for the daily amount of energy intake based on Chinese Dietary Reference Intakes (DRIs), 2013 version.

⁴Children are recommended to have 60 min/day of moderate-to-vigorous physical activity by World Health Organization (WHO).

p<0.001.
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p<0.01, and
*
p<0.05,
†
p<0.1,
‡

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