

## Original Article

# Is parental body weight related with their children's overweight and obesity in Gao Hang Town, Shanghai?

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**Objectives:** This study aimed to evaluate the relationship between parental body weight and their children's overweight and obesity in school students in Gao Hang Town, Shanghai. **Methods:** A cross-sectional study was performed in five primary schools in Gao Hang Town, Shanghai. Overall, 2,025 sets of parents and their children (7-13 years, 981 boys/1044 girls) were enrolled. Body mass index (BMI) and waist circumference for each child were measured. Age, gender, birth weight, and breastfeeding history was recorded for each child and the BMI of their parents was obtained by a self-completion questionnaire. Overweight (including obesity) was defined as a BMI of  $\geq 24.0$  kg/m<sup>2</sup> in parents and a BMI  $\geq P_{85}$  in children according to age- and gender-specific percentiles. **Results:** The total prevalence of overweight was higher in boys than in girls (35.5% vs 19.5%), while it was the same in fathers compared with mothers (50.6% vs 18.9%). The prevalence of overweight in boys showed a trend with increasing age, but remained stable versus age in girls. Parents were further divided into four subgroups as follows: I) both father and mother had a normal BMI; II) father overweight, mother normal weight; III) father normal weight, mother overweight; IV) both father and mother are overweight. The odds ratio of overweight was 2.26 for group II, 2.71 for group III, and 4.36 for group IV, respectively, compared with group I. Gender, paternal BMI, and maternal BMI were chosen as risk factors for children overweight. **Conclusions:** Parental BMI affects their offspring overweight and obesity in Chinese school students.

**Key Words:** overweight, children, parents, body mass index, waist circumference

## INTRODUCTION

The prevalence of overweight and obesity in children has become an important public health problem worldwide over the past century. Furthermore, the situation is more serious in developing countries compared with developed countries. For example, the new data from American National Health and Nutrition Examination Survey showed that 8.1% of infants (0-2 years) had a high weight compared with their recumbent length, and 16.9% of children (2-19 years) and 34.9% of adults ( $\geq 20$  years) were obese in 2011-2012. Overall, there was no significant change from 2003-2004 through 2011-2012.<sup>1</sup> In China, according to a series of studies from our group, the prevalence of overweight and obesity in primary school students doubled from 11.5% in 1999 to 26.7% in 2011.<sup>2,3</sup>

To control the epidemic of childhood overweight and obesity, a comprehensive treatment strategy is needed, including weight status assessment and monitoring, healthy lifestyle promotion, education, and policy advocacy. Changes in diet and physical activity are recommended as the critical interventional goal by almost all studies.<sup>4,5</sup> The importance of parental involvement in

managing childhood overweight and obesity is also emphasized. Parental socioeconomic status, education, physical activity, attitude to body weight, and smoking, amongst others, are closely related to childhood obesity.<sup>6-8</sup> Additionally, the involvement of parents in overweight and obesity intervention is a critical step to ensure successful outcomes. A systematic review concluded that the intensity of parental involvement and application of behavioural change techniques are important issues in the effectiveness of long-term childhood weight control interventions.<sup>9</sup> Direct approaches (parental attendance and participation in family behavioural counselling or parent

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training sessions) that engage parents are more likely to result in positive outcomes for obese children rather than indirect methods, such as the provision of information to parents without the requirement for a response.<sup>10</sup> However, related data is limited in China. The aim of this study was to elucidate the relationship between parental body weight and their childhood overweight and obesity.

## METHODS

### Study population

A cross-sectional study was conducted in five primary schools in Gao Hang Town, Shanghai, with the local residents of 110,420 people. All the samples were typical Chinese families that consisted of parents and one child who lived together. Informed consent forms were signed by parents and the study protocol has been approved by the Ethics Committee of Ren Ji Hospital, School of Medicine, Shanghai Jiao Tong University (AFINS-HOPE-2013-06). Overall, 2,025 sets of children (aged 7-13 years) and their parents entered the study. The proportion of the sample entered in the study accounts for 35.0% (2025/5785) of the total population of primary school-children in the area. The details of participant recruitment are shown in Figure 1.

## METHODS

### Anthropometric measurements

Anthropometric measurements were conducted by professional medical staff after appropriate training. Body weight was measured (in underwear) using an electronic scale (Tanita body composition analyzer TBF-410, Tokyo,

Japan). A standardized wall-mounted height board (SG-210 Height Board Instrument, Zi Lang Instrument Co., Ltd., Nan Tong, China) was used to measure height of barefoot children. BMI (body mass index) was calculated as the body weight (in kilograms) divided by the height squared (in meters). Overweight for children, including obesity, was defined as the children's BMI scale of  $\geq P_{85}$  for age- and gender-specific percentiles.<sup>11</sup> Because weight and height change during growth, a child's BMI must be interpreted relative to children of the same sex and age for recruiting overweight. Waist circumference (WC) was obtained midway between the iliac crest and the lower rib margin in bare abdomens and at the end of a normal expiration while the subjects were in a standing position.

### Questionnaire survey

Age, gender, breastfeeding history for each child, and height and body weight for their parents was obtained by a self-completion questionnaire (Table 1) that was completed by parents. Birth weights were obtained according to the birth certification. Parental BMI was also calculated. Overweight (including obesity) for parents, was defined as parents with a body mass index (BMI)  $\geq 24.0$  kg/m<sup>2</sup>.<sup>12</sup>

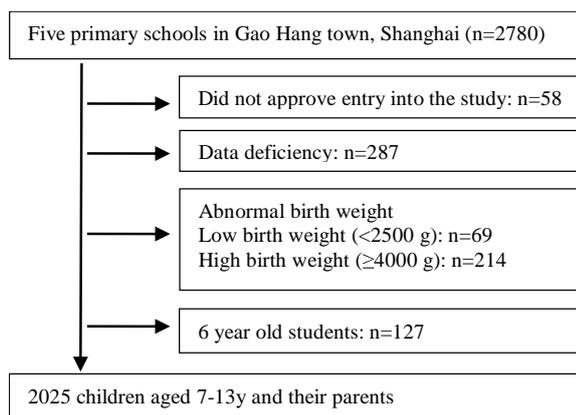
### Statistical analysis

Measurement data were expressed as mean $\pm$ SD while categorical data were expressed as percentages. The differences in the prevalence of being overweight were compared using the Chi-square test. *p* values  $<0.05$  were considered statistically significant. A Spearman line correlation between the BMI values of parents and children and their WC was determined using a partial correlation that was controlled for related factors. Binary logistic regression was used to assess risk factors for being overweight in children. All statistical analyses were performed using SPSS 19.0 software (SPSS Inc., Chicago, IL, USA).

## RESULTS

### The prevalence of overweight (including obesity)

The total prevalence of overweight in children was 27.2% (550/2025) in this study population. The rate was markedly higher in boys than girls ( $\chi^2=65.2$ ,  $p<0.001$ , odds ratio (OR)=2.27, 95% CI: 1.86-2.78), while it was the same in fathers compared with mothers (50.6% vs 18.9%,  $\chi^2=448$ ,  $p<0.001$ , OR=4.39, 95% CI: 3.81-5.05). The prevalence of overweight was significantly higher in boys for each



**Figure 1.** Study samples. A consecutive sample was selected from five primary schools in Gao Hang Town, Shanghai with resident population of 110,420 people

**Table 1.** Questionnaire used in the study.

Did you approve the study: Yes  No .

If yes, go to the next step.

1. Child's name: \_\_\_\_\_ Gender: Boy  Girl  Grade \_\_\_\_\_

2. Child's siblings: Yes  No

3. Child's disease history: Yes  No

If yes, please state it (Such as congenital disease, hepatitis, tuberculosis, tumour, surgery history) \_\_\_\_\_

4. Birth date: \_\_\_\_\_ Birth weight \_\_\_\_\_ kg (based on birth certification)

5. Breastfeeding history: Breastfeeding  Artificial feeding  Both of all

6. Father: Body weight \_\_\_\_\_ kg Height \_\_\_\_\_ cm

7. Mother: Body weight \_\_\_\_\_ kg Height \_\_\_\_\_ cm

age group than girls, with the exception of the group aged 7 years old. Furthermore, the prevalence of overweight in boys showed an increasing trend upwards with increasing age, but remained stable in girls (Table 2).

#### **The relationship between parental BMI and their children overweight**

According to the BMI values, parents were further divided into four subgroups: I) both father and mother had a normal BMI; II) father overweight, mother normal weight; III) father normal weight, mother overweight; and IV) both father and mother are overweight. Group IV families showed a strong correlation with their children's overweight. Furthermore, when both of parents were overweight, the prevalence of the children overweight increased at even higher rates compared with groups in which only the father or mother were overweight. Maternal body weight was more closely correlated with children overweight than paternal body weight, but this was not statistically significant (Table 3).

Both the paternal and maternal BMI showed weak, but significant correlation with the BMI and WC values of

their children (Table 4). Gender, paternal BMI, and maternal BMI were chosen as risk factors for children overweight in a step forward procedure for binary logistic regression in 2,025 school students born at full-term with a normal weight.

#### **DISCUSSION**

As a result of the lack of standard diagnostic criteria, the prevalence of childhood overweight and obesity has varied considerably among studies. Now, age- and gender-specific BMI percentiles are the most widely used tools to assess whether school-aged children are overweight or obese. According to the definition produced by the Working Group on Obesity in China,<sup>11</sup> the overall prevalence of overweight (including obesity) in this study population was 27.2% (35.5% for boys and 19.5% for girls). The prevalence of overweight increased dramatically during the rapid growth period after transitional society and a slow increase has occurred in recent decades (Table 5). Furthermore, boys in China are more likely to be overweight and obese than girls,<sup>13-17</sup> which is a trend that persists in adulthood.<sup>18</sup>

**Table 2.** BMI, WC, and the prevalence of overweight in 2,025 school students

Age	Boys				Girls			
	n	BMI, kg/m <sup>2</sup>	WC, cm	%	n	BMI, kg/m <sup>2</sup>	WC, cm	%
7 y	206	16.5±2.69	57.5±7.2	26.2	262	15.7±2.20	53.8±5.4	21.8
8 y	225	17.5±3.17	60.5±8.3	36.9	195	16.5±2.81	56.4±7.0	24.6*
9 y	137	18.2±3.55	63.1±9.4	40.9	158	16.5±2.71	57.2±6.9	19.0*
10 y	123	19.1±3.56	66.3±9.5	39.8	142	17.3±2.73	59.6±7.2	12.0*
11 y	106	19.6±3.37	68.9±9.0	41.5	106	18.4±4.00	62.0±9.2	17.9*
12 y	95	20.4±4.30	70.9±11.6	33.7	90	19.1±3.37	65.2±8.4	17.8*
13 y	89	20.5±4.15	71.2±10.6	33.7	91	19.8±2.95	66.9±6.9	16.5*
Sum	981	-	-	35.5	1044	-	-	19.5*

BMI: body mass index; WC: waist circumference; %: the prevalence of overweight in each age group; \*: compared with boys,  $p < 0.01$

**Table 3.** Comparison of children overweight in different groups in 2,025 school students

Group	Children group	Number	Prevalence of overweight (%)	Chi square $p$	OR 95% CI
I	Normal	699	16.7	-	-
	Overweight	140			
II	Normal	553	31.1*	47.3	2.26
	Overweight	250			
III	Normal	105	35.2 <sup>+</sup>	29.4	2.71
	Overweight	57			
IV	Normal	118	46.6	88.6	4.36
	Overweight	103			

Group I: weights of both father and mother were normal; group II: father overweight while mother normal weight; group III: father normal weight while mother overweight; group IV: both father and mother were overweight. Group I served as the standard. \*, compared with group IV,  $\chi^2=18.4$ ,  $p < 0.001$ ; OR: 1.93 (95% CI: 1.43-2.62). <sup>+</sup>, compared with group IV,  $\chi^2=5.01$ ,  $p=0.025$ ; OR: 1.61 (95% CI: 1.06-2.44).

**Table 4.** Partial correlation between parental BMI and the BMI and WC values of their children

Control factors		BMI	Children's WC
Maternal BMI, birth weight and breastfeeding	Paternal BMI	$r=0.24$	$r=0.21$
		$p < 0.001$	$p < 0.001$
Paternal BMI, birth weight and breastfeeding	Maternal BMI	$r=0.23$	$r=0.20$
		$p < 0.001$	$p < 0.001$

BMI: body mass index; WC: waist circumference.

**Table 5.** The prevalence of overweight (including obesity) in school students in China

Region	Year	Age, y	n	Prevalence of overweight, %	
				Boys	Girls
Guangzhou <sup>13</sup>	2007	5-18	27944	21.1	11.5
	2011		38284	22.5	12.7
Shandong province <sup>14</sup>	1985	7-18	14687	2.2	3.3
	1995		7199	10.4	6.6
	2000		8496	22.1	12.6
Shanghai <sup>15</sup>	2006	7-18	6965	28.1	15.3
Tianjin <sup>16</sup>	2010	6-13	5374	29.2	24.7
Yangze river delta region <sup>17</sup>	2009-2011	7-18	7300	28.6	14.8

Overweight for children, including obesity, was defined as the children's BMI scale of  $\geq P_{85}$  for age- and gender-specific percentiles.

In addition to confirming these previous results, this current study also pinpointed familial aggregation of overweight or obese. Both the parental and maternal body weight status was close related to whether their children were overweight. When both sets of parents were overweight, the prevalence of their children overweight was even higher compared with the group in which either the father or mother was overweight. This finding supports the hypothesis that parental body weight imposes important effects on childhood body weight, which has been reported by other studies in different countries.<sup>19-21</sup> The potential mechanisms that exist between parental body weight and childhood overweight include the following: 1) low familial socioeconomic status and reduced levels of parental education;<sup>22,23</sup> 2) parental obesity-related behaviours (physical activity, screen time, sugar-sweetened beverages, sleep duration, fast food) are factors that may affect their confidence to support behavioural changes in their children;<sup>24</sup> and 3) altered family structure, where children without siblings are at an increased risk of being overweight than those with siblings.<sup>25</sup> A typical Chinese family is made up of parents and just one child, which may be one reason for the high prevalence of childhood overweight and obesity in China.

### Conclusions

High parental BMI is a risk factor for overweight in their children in Chinese school students in Gao Hang Town, Shanghai. Behaviour change and education in managing overweight or obese should be performed in parents and their children together.

### AUTHOR DISCLOSURES

The paper was fully completed by Department of Clinical Nutrition, Ren Ji Hospital, School of Medicine, Shanghai Jiao Tong University. There is no conflict of interest.

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### 上海市高行镇父母体重与其子女超重和肥胖有关吗？

**目的：**以上海市高行镇在校学生为研究对象，观察父母体重与儿童超重和肥胖之间的关系。**方法：**采用横断面研究方法对上海市高行镇 5 所小学学生进行调查。总共 2025 名在校学生（7-13 岁,男生 981/女生 1044）和他们的父母纳入本研究。每位学生均测量身高、体重和腰围。学生年龄、性别、出生体重、母乳喂养史和父母身高、体重由调查问卷获得。体质指数（Body mass index, BMI）=体重（kg）/身高（m）<sup>2</sup>。父母超重（包括肥胖）的诊断标准为：BMI≥24.0 kg/m<sup>2</sup>；小学生超重（包括肥胖）的诊断标准则为：BMI≥同龄同性别第 85 百分位值。**结果：**男生超重发生率明显高于女生（35.5% vs 19.5%）。与之相类似，父亲超重发生率也明显高于母亲（50.6% vs 18.9%）。男生超重发生率随着年龄增高而逐步升高，女生超重发生率则保持稳定。依据父母的 BMI 将 2025 名在校学生分为四组：I) 学生父母双方 BMI 都处于正常范围；II) 学生父亲超重，母亲 BMI 处于正常范围；III) 学生父亲 BMI 处于正常范围，母亲超重；IV) 学生父母双方均超重。同第一组儿童相比，第二、三、四组儿童发生超重的风险因素分别为 2.26、2.71 和 4.36。Logistic 回归分析显示性别、父亲和母亲的 BMI 是儿童发生超重的危险因素。**结论：**以上海在校学生为研究对象，结果显示父母双方的 BMI 均是子女发生超重和肥胖的风险因素。

**关键词：**超重、儿童、父母、体质指数、腰围