Published in final edited form as:

Prev Med. 2018 February ; 107: 1–7. doi:10.1016/j.ypmed.2017.09.014.

Parenting practices and overweight status of junior high school students in China: A nationally representative study of 19,487 students from 112 schools

Zhengqi Tan, MPH^{1,*}, Jungwon Min, PhD^{1,2,*}, Hong Xue, PhD^{1,2}, Weidong Wang, PhD^{3,^}, Youfa Wang, MD^{1,2,4,^}

¹Systems-oriented Global Childhood Obesity Intervention Program, Department of Epidemiology and Environmental Health, The State University of New York at Buffalo

²Systems-Oriented Global Childhood Obesity Intervention Program, Fisher Institute of Health and Well-being, College of Health, Ball State University, USA

³Department of Sociology, Renmin University of China

⁴Department of Nutrition and Health Sciences, College of Health, Ball State University, USA

Abstract

The study aimed to examine the level of parental responsiveness and demandingness for junior high students in China and its association with child weight status; assess if it differs by student socio-demographic characteristics; and to test the association between parenting and child physical activity.

Nationally representative survey data collected from 19,487 students in 112 middle schools across China in 2013-2014 academic year were analyzed in 2016. Children's anthropometrics and perceptions of parenting practices were accessed by self-administered questionnaire. Multilevel logistic regression models were fit to test the association controlling for child age, sex, school region, and parental education.

The majority of adolescents reported their parents were highly responsive in terms of emotional support and involvement (high: 64.1% vs. low: 9.2%), although more parents were not perceived as highly demanding (high: 21.4% vs. low: 35.5%). Children were more likely to be overweight or obese if their parents were highly responsive (OR= 1.4 [95%CI: 1.2, 1.6]) and demanding (OR= 1.1 [95%CI: 1.0, 1.3]) compared to those with medium parenting scores. Older children, boys, children with highly educated parents, or in urban schools had greater odds of being overweight or obese by receiving highly responsive parenting compared to their counterparts. Children with highly demanding or responsive parenting had longer physical activity duration and higher physical activity participation rates than their counterparts.

[^]**Co-corresponding authors:** Youfa Wang, MD, PhD, MS, John & Janice Fisher Endowed Chair of Wellness, Associate Director, Fisher Institute of Health and Well-being, Director, Systems-Oriented Global Childhood Obesity Intervention Program, Professor, Department of Nutrition and Health Sciences, College of Health, Ball State University, Office: HP 302, Muncie, IN 47306, USA, Phone: 765-285-8121, ywang26@bsu.edu; Weidong Wang, PhD, Associate Professor, Executive Vice Director, National Survey Research Center, Department of Sociology, Renmin University of China, Beijing 100872, China, wwd@ruc.edu.cn.

*Equal contribution

Conflict of interest: none

High responsiveness and demandingness among Chinese parents were associated with the risk of child overweight and obesity. Further research is needed to examine the causal relationship between parenting practices and childhood obesity in China.

Keywords

parenting; obesity; overweight; children; adolescent; China

INTRODUCTION

Childhood obesity has become a global epidemic and public health crisis.¹ In the past three decades, the prevalence of child overweight and obesity has increased substantially in high-income countries and as well as developing countries at an alarming rate.² From 1985 to 2010, the prevalence of child overweight and obesity has reached 9.9% and 5.1%, respectively, among school-aged children in China, representing an estimated 30.43 million individuals.³ Childhood obesity is associated with increased risk for multiple medical and psychosocial health problems in children,⁴ including cardiovascular diseases,^{5,6} type 2 diabetes,^{6,7} metabolic syndrome,⁸ depression,⁹ and reduced quality of life.¹⁰ Thus, actions to halt and reverse this public health crisis are urgently needed.¹

Research examining the association between parenting style and childhood obesity in developed countries has presented elevated overweight odds (OR: 4.88, [95% CI: 2.15, 11.10]) for children with highly demanding and less responsive parents compared with children with more responsive parents.¹¹ However, the association between parenting style and childhood obesity is not well-understood¹² in developing countries.¹³ Parenting behaviors such as support, appropriate limit-setting, and predictable routines may help children to decrease risk of childhood obesity by balanced dietary habits, high consumption of fruits and vegetables and less high-fat and calorie intake.^{14,15}

Parenting also associated with child's physical activity level in previous research presenting 6 min (95%CI: 3.2,8.9) more of moderate to vigorous intensity physical activity per day and 98.9 more accelerometer counts per minute (95%CI: 21.2,176.7) for children with highly responsive and highly demanding parents compared with children with less demanding parents.¹⁶ Parental education level (inversely associated to BMI, $\beta=-0.43$ [95%CI: $-0.64,-0.23$]) and school location (urban vs. rural, OR:1.5 [95%CI:1.1, 2.0]) may influence parenting style and their relationship with childhood obesity.^{17, 18} Families with low socio-economic status may experience challenges in parenting behaviors and children's health due to limited financial resources.

This study aimed to: examine 1) junior high school students' perceptions of their parents' parenting practices using recent nationally representative data in China; 2) the association between parenting practices and child weight status; 3) whether this association differed by students' socio-demographic characteristics; and 4) the association between parenting practices and children's physical activity level. We targeted junior high school students having undergone dynamic BMI changes and being able to describe diverse perspectives of parenting practices.

METHODS

Study Design and Population

The China Education Panel Survey--Junior-High Cohort (CEPS-JH) is a nationally representative longitudinal study. The present study used baseline data collected in the 2013-2014 academic year from 19,487 students (10,279 7th graders and 9,208 9th graders) in 438 classrooms of 112 schools. The information was collected through student questionnaires which included self-reported anthropometric measures as well as children's perception of their parents' parenting practices.

The CEPS-JH sample was drawn in four stages (Figure 1.). The first stage drew 28 sample districts/counties, which were the basic administrative/geographic units, where the Department of Education, the lowest administrative level, manages the primary and secondary education of the district or county. The second stage drew 4 sample schools per district/county from all schools that include 7th to 9th grades. The third stage drew 4 classrooms per school, 2 from the 7th grade and 2 from the 9th grade.

Two methods of stratified sampling were used. First, a city consists of multiple districts and a megacity may consist of as many as 18 districts (e.g., Shanghai). To grasp a complete picture of a megacity, we made the 18 districts of Shanghai a stratum, from which we drew three districts in order to oversample Shanghai. Second, a migrant stratum was defined with the number of inter-provincial migrants that exceeded the threshold of 196,000 or the number of intra-provincial migrants that exceeded the threshold of 222,000. A total of 120 districts/counties were in the migrant stratum, from which ten districts/counties were drawn as an oversample of the migrant stratum. The core sample of 15 districts/counties was drawn from the entire set of 2,870 districts/counties. Thus 28 primary sampling units PSUs were included in the total, with 15 PSUs for the core sample and 13 PSUs for the supplemental sample. More information on study sampling is documented elsewhere.¹⁹

Measures

Students' Weight Status—Childhood overweight and obesity was the outcome of interest. Height and weight were collected through self-administered questionnaire. Body mass index (BMI) was calculated and used to identify overweight and obesity based on the Asian cut-offs recommended by International Obesity Task Force.²⁰

Parental responsiveness and demandingness—Children's perceptions of parental responsiveness and demandingness were based on their self-reported interactions with their parents (see Appendix File A). All questions were selected from original questionnaire according to the methodology outlined by Chao and Willms²¹ and based on the characteristics provided by Baumrind²². Survey questions were pilot tested and validated. For example, parental responsiveness questions included: how frequently parents discussed with children the children's mood, things that the children worried about, the children's relationship with teachers, friends, and things that happened in school; answering 'often' was coded as one; 'sometimes' and 'never' were coded as zero. For questions about the frequency of eating dinner with parents or watching TV with parents, 'at least once per

week' was coded as one and lower frequency options as zero; for questions about activities (reading, doing physical activity, going to the museum and watching movies), answering 'never' was coded as zero and higher frequency options other than 'never' were coded as one.

Parental demandingness was defined as whether parents imposed strict rules for the following eight behaviors: academic/behavioral performance and attendance at school, TV viewing, Internet use, dress code, making friends and time to go home (i.e., curfew). The answer 'yes' was coded as one and 'no' as zero.

Separate scores for responsiveness and demandingness were computed by summing the scores for each parenting style, with higher subtotals indicating greater intensity of emotional support and involvement (potential range: 0-16) and demanding practices (potential range: 0-8) by parents. For purposes of analysis, participants were divided into three groups based on parental responsiveness (0-5 as low, 6-10 as medium, 11-16 as high) and demandingness (0-2 as low, 3-5 as medium, 6-8 as high).

Socio-demographic characteristics and child behaviors—Child's gender, age (older than 14 years or not), single child status, parental education level (No schooling completed, elementary to high school, college and above), TV viewing and Internet use time (how many hours per day) were considered as related factors in the analysis. TV viewing and Internet use time (hour per day) was self-reported by students as in average for the weekdays and weekend of the past week. They were then summed up as TV viewing and Internet use time per day for the past week. Physical activity duration was self-reported by students as the time duration (hour and minute) of any kind of physical activity they have in average for the weekdays and weekend of the past week. They were then summed up as total physical activity hour of the past week and percentage of those students who had physical activity at least 1h for the past week.

Statistical Analyses

First, we described the socio-demographic characteristics of participants, and used Mann-Whitney U-tests and Kruskal-Wallis H-tests according to the distribution of variables to compare mean age, weight, height, BMI, TV viewing and Internet use time, and parenting scores between boys and girls and between students from rural and urban areas. Then, chi-square tests were used to examine the differences in parental responsiveness and demandingness by child age, sex, weight status, parent education level, and school region. Physical activity duration was examined among different parenting and students' weight status groups.

To examine the association between parental responsiveness and demandingness and child obesity status, multilevel logistic regression models were used to consider hierarchical sampling and adjust for covariates in analysis. Statistical significance was based on $p < 0.05$. All analyses were conducted in 2016 using SAS Version 9.4 software (SAS Institute, Cary, NC).

RESULTS

Among the participants, 51.5% were boys, and 36.4% were from schools in rural areas (Table 1). Compared to girls, boys had significantly higher mean BMI (0.5 kg/m^2 [95%CI: 0.4,0.6]) and higher prevalence of overweight or obese (5.5% [95%CI:4.8%,6.4%]), and spent more time daily on TV viewing (0.3h/d [95%CI: 0.2,0.4] and Internet use (1.1h/d [95%CI:1.0,1.2]).

Rural and urban schools had similar sex ratios of students. Compared to children from rural schools, children from urban schools had a higher BMI (0.5 kg/m^2 [95%CI:0.4,0.7]), higher prevalence of overweight or obesity (4.5% [95%CI:3.7%,5.3%]), and their parents had a higher education level. Rural students watched more TV daily (0.9h/day [95%CI:0.8,1.0]) than urban children (Table 1).

Regarding parenting style, 64.1% of students reported their parents were highly responsive to them, while only 9.2% of students described their parents as low in responsiveness. Younger children (67.8%), girls (65.4%), overweight or obese children (68.7%), children with highly educated parents (73.1%), or children attending urban schools (68.8%) were more likely to report that they received highly responsive parenting compared to their counterparts.

In contrast, only 21.4% of students indicated their parents were highly demanding of them, and 35.5% thought their parents raised them with a low level of demandingness. In particular, older children (40.1%), boys (37.3%), overweight or obese children (36.1%), children with highly educated parents (34.4%), or children attending rural schools (37.2%) were more likely to describe their parents as less demanding than were their counterparts (Table 2).

Table 3 shows the association between the degree of parental responsiveness and children's overweight or obese status. Children who reported receiving highly responsive parenting had 1.4 times greater odds of being overweight or obese (95%CI: 1.2-1.6) compared to those with a medium level of parenting responsiveness.

Older children (OR=1.5 [95%CI: 1.2,1.8]), boys (OR=1.5[95%CI: 1.2,1.9]), children with highly educated parents (OR=1.3[95%CI: 1.0,1.6]), or in urban schools (OR=1.4[95%CI: 1.1,1.7]) had greater odds of being overweight or obese by receiving highly responsive parenting compared to their counterparts. Child age modified the association (OR=1.29[95%CI:1.02,1.62]).

Children who reported highly demanding parents were 10% more likely to be overweight or obese (OR=1.1[95%CI: 1.0,1.3]) than those with medium parenting demandingness (Table 4). Stratified analysis showed that compared to their counterparts, younger students (OR=1.2[95%CI: 1.0,1.5]), children with uneducated parents (OR=1.5[95%CI: 1.0,2.3]) or attending an urban school (OR=1.1[95%CI: 1.0,1.4]) had greater odds of being overweight or obese by receiving less demanding parenting. No significant differences were found in subgroup analyses by child age and sex.

Furthermore, we examined the relationship between parenting style and children's self-reported physical activity level (Appendix Table B.1). Children had longer physical activity duration and higher physical activity participation rates with highly demanding parents (6.1 vs. 7.1 h/week and 69.2% vs. 75.6%, between low and high demandingness; both p values for trend < 0.05) and highly responsive parenting (4.9 vs. 7.0 h/week and 56.6% vs. 79.5%, between low and high responsiveness, both p values for trend < 0.05) than their counterparts. These associations did not differ by child age, sex and weight status.

DISCUSSION

Using nationally representative data collected from the China Education Panel Survey, this study is the first to examine the association between parenting practices and children's risk of being overweight or obese in China. Based on student report, 64.1% of parents were highly responsive, but only 21.4% of parents were highly demanding of their children. While younger children, girls, or children attending urban schools were more likely to perceive their parents as highly responsive; older children, boys, or children attending rural schools were more likely to describe their parents as highly demanding.

Parenting and child obesity status were associated, although this study could not test causality as cross-sectional data were used. Highly responsive and demanding parenting was more likely to be reported among overweight or obese children and children with highly educated parents compared to their counterparts. Children with highly responsive (OR=1.4 [95% CI:1.2, 1.6]) or demanding (OR=1.1 [95% CI:1.0, 1.3]) parents were 1.1 to 1.4 times more likely to be overweight or obese than those with a medium level of parental responsiveness or demandingness. Older children, boys, children with highly educated parents, or children attending an urban school had greater odds of being overweight and obese when their parents were highly responsive to them than were younger children, girls, children with less educated parents, or children attending a rural school. Our findings indicate highly responsive and demanding parenting are significantly related with childhood obesity in China and this association differs by students' socio-demographic characteristics.

Parenting is a comprehensive term that refers to the entirety of attitudes, values, beliefs, and behaviors that parents demonstrate in their interactions with their child or children.²³ Over the past 60 years, the assessment of parenting has mainly focused on three categories: centrality of parental warmth and caring, provision of structure, and autonomy support. These categories were conceptualized into six dimensions when their relationship with children's development was examined, including warmth, rejection, structure, chaos, coercion and autonomy support. In order to capture the complexity of parenting style and understand its influence on children's development, Diana Baumrind^{24, 25} defined several general types of parenting styles (Authoritative, Permissive, Authoritarian and Neglectful) based on the two dimensions of parental demandingness and responsiveness,²⁶ and several studies facilitated this classification to address the association between parenting style and child obesity^{27,28}. To examine the dose-response relationship between parenting characteristics and childhood obesity, we followed Baumrind's methodology of parenting occurring along parental responsiveness and demandingness and extracted related information from the China Education Panel Survey: Junior-High Cohort (CEPS: JH).

The association between parental responsiveness and demandingness and the adolescents' risk of being overweight or obese could be bidirectional. Parents' highly responsive and demanding attitudes may result from their awareness of their children's overweight or obese weight status. Once they realize the risk of childhood obesity in their children, parents may be more willing to ask their children to be more physically active and to choose healthier snacks and meals.²⁹ Also as indicated in our study, those children whose parents were intensively responsive and demanding had a significantly longer duration and a higher participation rate for physical activity, which is consistent with previous reviews findings.^{30, 31} Future waves of data collection in this study will be better to facilitate to examine the temporal relationship between parenting style and child weight status.

On the other hand, the excessive attention and involvement from parents may result in higher risk of overweight and obesity among their children due to increased mental stress.^{32, 33} The mechanism of stressful emotions, excessive food consumption/energy intake and overweight and obesity has been well established in the research literature.^{34, 35, 36} However, in our results, low parental demandingness also conferred a greater risk of childhood overweight and obesity in younger students, children with uneducated parents or children from urban areas. An adequate level of parental demandingness needs to be secured for children's mental and physical development through intervention programs to help prevent childhood obesity in China. Further longitudinal studies are needed to understand the nature of the causal relationship between parenting practices and child weight status.

Parental responsiveness and demandingness were different by child age, gender, weight status, school region and parental education level. In particular, the association between parental responsiveness and the risk of childhood obesity were significantly different by parental education level. Although the association between parent education level and childhood obesity has not received much attention in China, it may be that parents with college educations or above are more responsive to their children and better able to guide their children's health behaviors.³⁷

Children from urban schools had greater odds of being overweight when they reported highly responsive and low demanding parenting. Considering differences in the food and built environments between rural and urban areas, this finding may suggest that in order to reduce the risk of overweight and obesity, parents in urban areas may not only need to adjust the level of autonomy they permit their children, but also need to limit their children's screen time to prevent them from adopting a sedentary lifestyle.^{38, 39}

To access parenting style, we included frequencies for having dinner with parents and having strict rules on TV viewing time, etc., which were related to adolescents' eating habits and sedentary lifestyle.^{40, 41} Thus, the parenting styles we measured in this study potentially played vital roles in these children's energy intake and expenditure which determined the direction of energy balance. However, information beyond the frequency of those behavior, such as child temperament and personality was not assessed in the survey, thus we were not able to observe the potential interaction between that and parenting style.²⁸ Although all questions regarding parenting were selected from original questionnaire according to the methodology outlined by Chao and Willms²¹ and based on the characteristics provided by

Baumrind,²² the overall parenting may be more complicated than the responsiveness and demandingness that we measured here.

Previous studies regarding self-report anthropometric measures indicate that self-report data tend to underestimate BMI.⁴² The bias due to self-report is likely to be introduced into this study, but it is less likely to misclassify normal weight child as overweight or obesity. While this bias likely attenuates the association toward null, misclassification of overweight or obesity as normal-weight is still a concern. Objective measurement on height and weight is needed in the future study. However, self-reported anthropometric measures could potentially cause bias towards the null in this study, which made our estimates more conservative.

The study has several key strengths, including a large sample size, nationally representative sample, and rich measures regarding students' perceptions of their parents' parenting practices. The large sample provided good power to detect even small effect sizes.

CONCLUSIONS

This nationally representative study indicates that many Chinese parents demonstrated highly responsive parenting behaviors on their children. Chinese children who reported having highly responsive and demanding parenting practices were more like to be overweight or obese than the other children. Further research is needed to examine the causal relationship between parenting and childhood obesity in China.

ACKNOWLEDGEMENTS

We thank all of the study participants and school personnel who participated in the data collection and team member Dr. Paula Vincent for her assistance in helping edit the manuscript. The content of the paper is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

Funding

The present study is funded by the National Institute of Health [NIH, U54 HD070725]. The U54 project [U54 HD070725] is funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) and the Office of the Director (OD), NIH. The data collection was funded by the Renmin University of China.

Appendices

File A: Parenting questionnaires and scoring methods: China Education Panel Survey-Junior High Cohort (CEPS-JH), 2013-2014

A.1.

Parental Responsiveness: Emotional Support

Question No.	Item
1	How often do you talk with your father about your mood
2	How often do you talk with your mother about your mood
3	How often do you talk with your father about what you worried about

Question No.	Item
4	How often do you talk with your mother about what you worried about
5	How often do you talk with your father about your teachers
6	How often do you talk with your mother about your teachers
7	How often do you talk with your father about your friends
8	How often do you talk with your mother about your friends
9	How often do you talk with your father about school
10	How often do you talk with your mother about school

Answering 'often' was coded as one; 'sometimes' and 'never' were coded as zero.

A.2.

Parental Responsiveness: Involvement

Question No.	Item
1	How often do you watch movies, shows or sports matches outside with your parents
2	How often do you go to museums or zoos with your parents
3	How often do you engage in physical activity with your parents
4	How often do you read books with your parents
5	How often do you have dinner with your parents
6	How often do you watch TV with your parents

For question 1 and 2, 'never' was coded as zero and higher frequency options as one; for question 3 and 4, choosing higher frequency options than 'once six months' were coded as one and others as zero; for question 5-6, answering 'at least once per week' was coded as one and lower frequency options as zero.

A.3.

Parental Demandingness: Family Rules

Question No.	Item
1	Do your parents impose strict rules on your behavioral performance at school?
2	Do your parents impose strict rules on when you go home (i.e., curfews)?
3	Do your parents impose strict rules on your Internet use time?
4	Do your parents impose strict rules on your academic performance?
5	Do your parents impose strict rules on your attendance at school?
6	Do your parents impose strict rules on your TV viewing time?
7	Do your parents impose strict rules on how you dress (i.e., dress code)?
8	Do your parents impose strict rules about who you make friends with?

Answering 'yes' was coded as one and 'no' as zero.

Table B.1.

Comparing percent and duration of children's physical activity by different levels of parental responsiveness and demandingness

	Parenting Style	Intensity	Having PA at least one hour per week, %	χ^2^a	p for trend	PA duration (hour/week), mean (SD)	χ^2^a	p for trend
All	Demandingness	Low	69.2	72.2	<0.01	6.1(8.7)	75.2	<0.01
		Medium	74.6			6.5(8.6)		
		High	75.6			7.1(10.0)		
	Responsiveness	Low	56.6	522.7	<0.01	4.9(7.9)	418.4	<0.01
		Medium	66.4			5.8(9.0)		
		High	79.5			7.0(8.5)		
Child age								
14 years	Demandingness	Low	68.5	30.3	<0.01	6.0(8.3)	44.2	<0.01
		Medium	73.5			6.4(8.0)		
		High	74.2			7.2(9.6)		
	Responsiveness	Low	53.2	323.9	<0.01	4.6(7.4)	255.8	<0.01
		Medium	64.2			5.7(8.7)		
		High	78.8			7.1(8.3)		
>14 years	Demandingness	Low	68.3	39.7	<0.01	6.2(8.9)	28.9	<0.01
		Medium	74.7			6.6(9.4)		
		High	75.2			7.0(10.6)		
	Responsiveness	Low	60.8	202.3	<0.01	5.3(8.5)	159.8	<0.01
		Medium	67.9			6.1(9.6)		
		High	78.7			6.9(8.7)		
Child Sex								
Boy	Demandingness	Low	70.0	52.9	<0.01	6.9(9.4)	46.1	<0.01
		Medium	77.3			7.6(9.9)		
		High	76.0			8.1(11.5)		
	Responsiveness	Low	60.6	266.9	<0.01	5.8(9.1)	226.8	<0.01
		Medium	69.6			6.8(10.4)		
		High	81.3			8.1(9.7)		
Girl	Demandingness	Low	66.1	29.8	<0.01	5.1(7.2)	42.5	<0.01
		Medium	70.3			5.3(7.0)		
		High	72.9			6.1(7.7)		
	Responsiveness	Low	53.6	273.0	<0.01	4.0(6.5)	214.3	<0.01
		Medium	61.7			4.8(7.2)		
		High	76.2			5.8(6.5)		
Weight Status								
Non-overweight	Demandingness	Low	72.7	71.8	<0.01	6.2(8.6)	72.5	<0.01
		Medium	74.0			6.5(8.4)		

	Parenting Style	Intensity	Having PA at least one hour per week, %	χ^2^a	p for trend	PA duration (hour/week), mean (SD)	χ^2^a	p for trend
Overweight	Responsiveness	High	78.0	472.3	<0.01	7.1(9.7)	389.4	<0.01
		Low	58.7			4.9(7.2)		
		Medium	67.4			5.8(8.6)		
		High	80.0			7.0(8.2)		
	Demandingness	Low	69.2	3.5	<0.01	6.2(9.1)	4.4	<0.01
		Medium	74.6			6.3(7.6)		
		High	75.6			7.1(9.8)		
		Low	53.7	49.6	<0.01	5.9(11.6)	30.9	<0.01
	Responsiveness	Medium	68.2			6.1(10.7)		
		High	81.0			6.9(8.1)		

^a. Chi-square tests (df=2) were used to test the difference of child physical activity by intensity of parental responsiveness and demandingness.

REFERENCES

1. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes*. 2006; 1(1):11–25. DOI: 10.1080/17477160600586747. [PubMed: 17902211]
2. Lobstein T, Jackson-Leach R, Moodie ML, et al. Child and adolescent obesity: part of a bigger picture. *Lancet* (London, England). 2015;385(9986):2510–2520. DOI: 10.1016/S0140-6736(14)61746-3.
3. Ji CY, Chen TJ, Working Group on Obesity in China (WGOC. Empirical changes in the prevalence of overweight and obesity among Chinese students from 1985 to 2010 and corresponding preventive strategies. *Biomed Environ Sci*. 2013; 26(1):1–2. [PubMed: 23294610]
4. Gupta N, Goel K, Shah P, Misra A. Childhood obesity in developing countries: epidemiology, determinants, and prevention. *Endocr Rev*. 2012; 33(1):48–70. DOI: 10.1210/er.2010-0028. [PubMed: 22240243]
5. Freedman DS, Khan LK, Dietz WH, Srinivasan SR, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. *Pediatrics*. 2001; 108(3):712–8. DOI: 10.1542/peds.108.3.712. [PubMed: 11533341]
6. Reilly JJ, Methven E, McDowell ZC, et al. Health consequences of obesity. *Arch Dis Child*. 2003; 88(9):748–52. DOI: 10.1136/adc.88.9.748. [PubMed: 12937090]
7. Fagot-Campagna A Emergence of type 2 diabetes mellitus in children: epidemiological evidence. *J Pediatr Endocrinol Metab*. 2000; 13(Supplement):1395–402. DOI: 10.1515/jpem-2000-s613. [PubMed: 11202215]
8. Daniels SR. The consequences of childhood overweight and obesity. *Future Child* 2006; 47–67. DOI: 10.1353/foc.2006.0004. [PubMed: 16532658]
9. Kalra G, De Sousa A, Sonavane S, Shah N. Psychological issues in pediatric obesity. *Industrial Psychiatry Journal*. 2012;21(1):11–17. doi:10.4103/0972-6748.110941. [PubMed: 23766572]
10. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents pathophysiology, consequences, prevention, and treatment. *Circulation*. 2005; 111(15):1999–2012. DOI: 10.1161/01.cir.0000161369.71722.10. [PubMed: 15837955]
11. Rhee KE. Parenting styles and overweight status in First grade. *Pediatrics*. 2006;117(6):2047–2054. DOI: 10.1542/peds.2005-2259. [PubMed: 16740847]

12. Wake M, Nicholson JM, Hardy P, Smith K, 2007 Preschooler obesity and parenting styles of mothers and fathers: Australian National Population Study. *Pediatrics* 120, e1520–e1527 [PubMed: 18055667]
13. Agras W, Hammer LD, Mcnicholas F, Kraemer HC, 2004 Risk factors for childhood overweight: a prospective study from birth to 9.5 years. *J. Pediatr.* 145, 20–25. [PubMed: 15238901]
14. Gunnar MR, Quevedo KM. Early care experiences and HPA axis regulation in children: a mechanism for later trauma vulnerability. *Prog Brain Res.* 2007; 167:137–49. DOI: 10.1016/S0079-6123(07)67010-1.
15. Grolnick WS, Farkas M. Parenting and the development of children's self-regulation In: Bornstein MH, ed. *Handbook of parenting: Practical issues in parenting.* 2nd ed. Mahwah, NJ: Lawrence Erlbaum Associates Publishers; 2002; 5:89–110.
16. Jago R, Davison KK, Brockman R, Page AS, Thompson JL, Fox KR. Parenting styles, parenting practices, and physical activity in 10- to 11-year olds. *Preventive Medicine.* 2011;52(1-3):44–47. doi:10.1016/j.ypmed.2010.11.001. [PubMed: 21070805]
17. Fernández-Alvira JM, Velde SJT, Bourdeaudhuij ID, et al. Parental education associations with children's body composition: mediation effects of energy balance-related behaviors within the ENERGY-project. *International Journal of Behavioral Nutrition and Physical Activity.* 2013;10(1): 80. doi:10.1186/1479-5868-10-80. [PubMed: 23800170]
18. Wang Y Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. *International Journal of Epidemiology.* 2001;30(5): 1129–1136. doi:10.1093/ije/30.5.1129. [PubMed: 11689534] Wang W, China Education Panel Survey Baseline Report. Beijing: China Society Press, 2016.
19. Wang WD, Zhang X. User Manual for CEPS Baseline Wave Data. <http://ceps.ruc.edu.cn/>. Beijing: Nation Survey Research Center, Renmin University of China 2015 Accessed January, 2017.
20. Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. *Pediatr Obes.* 2012;7(4):284–294. DOI: 10.1111/j.2047-6310.2012.00064.x. [PubMed: 22715120]
21. Chao and Willms, 2002. Chao R, and Willms JD: The effects of parenting practices on children's outcomes *Vulnerable Children: Findings from Canada's National Longitudinal Study of Children and Youth.* University of Alberta Press, 2002.
22. Baumrind, 1966. Baumrind D: Effects of authoritative parental control on child behavior. *Child Dev.* 1966; 37: pp. 887–907
23. Baumrind D The influence of parenting style on adolescent competence and substance use. *J Early Adolesc.* 1991;11(1):56–95.
24. Baumrind D Effective parenting during the early adolescent transition Cowan P, Hetherington EM, ed. *Family Transitions.* Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc, xi, 319 pp; 1991: 111–163.
25. Alwin D Parenting Practices In: Scott J, ed. *The Blackwell Companion to the Sociology of Families.* USA: Blackwell Publishing Ltd; 2004:142–157.
26. Kakinami L, Barnett T, Séguin L, Paradis G. Parenting style and obesity risk in children. *Prev Med.* 2015;75:18–22. DOI: 10.1016/j.ypmed.2015.03.005. [PubMed: 25797329]
27. Sleddens EFC, Gerards SMPL, Thijs C, de Vries NK, Kremers SPJ. General parenting, childhood overweight and obesity-inducing behaviors: A review. *Int J Pediatr Obes.* 2011;6(2-2):e12–e27. DOI: 10.3109/17477166.2011.566339. [PubMed: 21657834]
28. Rhee K Childhood overweight and the relationship between parent behaviors, parenting style, and family functioning. *Ann Am Acad Pol Soc Sci.* 2008;615(1):11–37. DOI: 10.1177/0002716207308400.
29. Dallman MF. Stress-induced obesity and the emotional nervous system. *Trends Endocrinol Metab.* 2010;21(3):159–165. DOI: 10.1016/j.tem.2009.10.004. [PubMed: 19926299]
30. Blair C, Granger D, Willoughby M, Kivlighan K. Maternal Sensitivity Is Related to Hypothalamic-Pituitary-Adrenal Axis Stress Reactivity and Regulation in Response to Emotion Challenge in 6-Month-Old Infants. *Ann N Y Acad Sci.* 2006; 1094(1):263–7. DOI: 10.1196/annals.1376.031. [PubMed: 17347358]

31. Meaney MJ, Szyf M. Environmental programming of stress responses through DNA methylation: life at the interface between a dynamic environment[†] and a fixed genome. *Dialogues Clin Neurosci*. 2005;7(2):103–123. [PubMed: 16262207]
32. Foss B, Dyrstad SM. Stress in obesity: Cause or consequence? *Med Hypotheses*. 2011;77(1):7–10. DOI: 10.1016/j.mehy.2011.03.011. [PubMed: 21444159]
33. Francis LA, Susman EJ. Self-regulation and rapid weight gain in children from age 3 to 12 years. *Arch Pediatr Adolesc Med*. 2009;163(4):297 DOI: 10.1001/archpediatrics.2008.579. [PubMed: 19349557]
34. Hubacek K, Guan D, Barua A. Changing lifestyles and consumption patterns in developing countries: A scenario analysis for china and India. *Futures*. 2007;39(9):1084–1096. DOI: 10.1016/j.futures.2007.03.010.
35. Czaja J, Rief W, Hilbert A. Emotion regulation and binge eating in children. *Int J Eat Disord*. 2009;42(4):356–362. DOI: 10.1002/eat.20630. [PubMed: 19040265]
36. van den Berg L, Pieterse K, Malik JA, et al. Association between impulsivity, reward responsiveness and body mass index in children. *Int J Obes (Lond)*. 2011;35(10):1301–1307. DOI: 10.1038/ijo.2011.116. [PubMed: 21694699]
37. Yau YHC, Potenza MN. Stress and Eating Behaviors. *Minerva endocrinologica*. 2013;38(3):255–267. [PubMed: 24126546]
38. Li M, Xue H, Wang W. Parental expectations and child screen and academic sedentary behaviors in china. *Am J Prev Med*. 2017 DOI: 10.1016/j.amepre.2016.12.006.
39. Ren L, Pope Edwards C. Pathways of influence: Chinese parents' expectations, parenting styles, and child social competence. *Early Child Dev Care*. 2014;185(4):614–630. DOI: 10.1080/03004430.2014.944908.
40. Wang Y, Beydoun MA, Li J, Liu Y, Moreno LA. Do children and their parents eat a similar diet? Resemblance in child and parental dietary intake: Systematic review and meta-analysis. *J Epidemiol Community Health*. 2010;65(2):177–189. DOI: 10.1136/jech.2009.095901. [PubMed: 21051779]
41. Wang HJ, Su C, Zhang B, et al. Epidemics of overweight and obesity among growing childhood in china between 1997 and 2009: Impact of family income, dietary intake, and physical activity dynamics. *Chin Med J (Engl)*. 2015;128(14):1879 DOI: 10.4103/0366-6999.160648. [PubMed: 26168826]
42. Flood V, Webb K, Lazarus R, Pang G. Use of self-report to monitor overweight and obesity in populations: some issues for consideration. *Australian and New Zealand Journal of Public Health*. 2000;24(1):96–99. doi:10.1111/j.1467-842x.2000.tb00733.x. [PubMed: 10777989]

Figure 1.

Sampling Procedure: China Education Panel Survey-Junior High Cohort (CEPS-JH), 2013-2014

a. Migrant Counties were defined with the number of inter-provincial migrants that exceeded the threshold of 196,000 or the number of intra-provincial migrants that exceeded the threshold of 222,000.

Table 1.

Characteristics of adolescents in the China Education Panel Study, the Junior-High Cohort (CEPS-JH), 2013-2014 (n=19,487)

	All (n=19,487)	Boys (n=10,042)	Girls (n=9,445)	Gender difference p-value	Rural (n=7,095)	Urban (n=12,392)	School area difference p-value
Boys (%)	51.5				51.1	51.8	
Rural residence (%)	36.4	36.1	36.7	0.37			
Age(year)	14.0(1.2)	14.0(1.2)	13.9(1.2)	<0.01	14.1(1.3)	13.9(1.2)	<0.01
Weight(kg)	49.8(11.3)	52.3(12.8)	47.2(8.7)	<0.01	47.9(10.5)	50.9(11.6)	<0.01
Height (cm)	161.6(8.7)	164.4(9.6)	158.7(6.5)	<0.01	160.1(8.9)	162.5(8.6)	<0.01
BMI(kg/m ²)	18.9(3.4)	19.2(3.7)	18.7(3.0)	<0.01	18.6(3.2)	19.1(3.5)	<0.01
Overweight or obese (%)	8.7	11.3	5.9	<0.01	5.8	10.3	<0.01
Single child status (%)	43.4	47.0	39.6	<0.01	24.1	54.5	<0.01
Parental education level (%)							
No schooling completed	9.5	9.9	9.0	0.57	13.61	7.1	<0.01
From elementary to high school	44.0	43.6	44.5		59.6	35.1	
College and above	46.5	46.5	46.5		26.8	57.8	
TV viewing (hr/day)	2.8(0.03)	2.9(0.04)	2.6(0.03)	<0.01	3.4(0.05)	2.4(0.03)	<0.01
Internet use (hr/day)	2.1(0.03)	2.7(0.04)	1.6(0.03)	<0.01	2.1(0.05)	2.2(0.03)	<0.01

Note: Values were presented as mean (standard deviation) or frequency (%). Mann-Whitney U test, Kruskal-Wallis H test and chi-square test were used to examine differences of characteristics by child gender and school region.

Table 2.

Distribution of parental responsiveness and demandingness by child age, sex, weight status, parental education, and school region in China Education Panel Survey-Junior High Cohort (CEPS-JH), 2013-2014

	Responsiveness, %			Demandingness, %		
	Low (0-5)	Medium (6-10)	High (11-16)	Low (0-2)	Medium (3-5)	High (6-8)
All	9.2	26.7	64.1	35.5	43.1	21.4
Child age						
14 years	7.4	24.8	67.8	31.1	44.5	24.4
>14 years	11.2	28.7	60.1	40.1	41.7	18.2
p-value ^a	<0.01			<0.01		
Child sex						
Boy	10.3	27.1	62.6	37.3	42.8	19.9
Girl	8.4	26.3	65.4	33.7	43.4	22.9
p-value ^a	<0.01			<0.01		
Child weight status						
Overweight or obese	8.4	22.9	68.7	36.1	41.4	22.5
Non overweight or obese	9.4	27.1	63.5	35.5	43.2	21.3
p-value ^a	<0.01			<0.01		
Parental education level						
College and above	6.2	20.7	73.1	34.4	42.5	23.1
Elementary to high school	11.0	31.1	57.9	35.7	44.0	20.3
No schooling completed	18.7	38.6	42.7	40.2	42.2	17.6
p-value ^a	<0.01			<0.01		
School region						
Urban	7.9	23.3	68.8	34.6	42.2	23.2
Rural	11.9	32.9	55.2	37.2	44.7	18.1
p-value ^a	<0.01			<0.01		

Note: Parenting scores were based on child responses in the CEPS survey. Parenting responsiveness was based on 16 questions (potential range: 0-16), and demandingness was based on 8 questions (potential range: 0-8) in Appendix File A.

^a Chi-square tests were used to test the differences in parenting by socio-demographic characteristics.

Table 3.

Comparing odds ratios of overweight and obesity in the low and high intensity vs. medium parental responsiveness categories by child age, gender, parental education and school region: China Education Panel Survey-Junior High Cohort (CEPS-JH), 2013-2014

Responsiveness	Low (score ranged:0-5)			Medium (score ranged:6-10)			High (score ranged:11-16)			Interaction Term Adjusted OR (95%CI) ^b
	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	
All	(n=1671)	134	1.0(0.8,1.4)	(n=4868)	375	1[Reference]	(n=10367)	988	1.4(1.2,1.6)	
Child age										
14 years	686	55	1.3(0.9,1.9)	2262	161	1[Reference]	5587	461	1.2(1.0,1.6)	1.3(1.0,1.6)
>14 years	936	79	1.0(0.6,1.4)	2498	214	1[Reference]	4566	527	1.5(1.2,1.8)	
Child sex										
Boy	931	98	1.2(0.9,1.5)	2457	238	1[Reference]	5149	666	1.5(1.2,1.9)	1.2(1.0,1.5)
Girl	740	36	0.8(0.5,1.4)	2411	137	1[Reference]	5218	322	1.1(0.9,1.5)	
Parental education level										
College and above	544	55	1.1(0.7,1.6)	1869	178	1[Reference]	5770	644	1.3(1.0,1.6)	1.0(0.8,1.2)
Elementary to high school	851	66	1.1(0.7,1.6)	2424	170	1[Reference]	4011	311	1.3(1.0,1.7)	
No schooling completed	272	12	0.9(0.4,2.0)	567	27	1[Reference]	569	32	0.9(0.5,1.8)	
School region										
Urban	928	97	1.2(0.9,1.7)	2746	257	1[Reference]	7257	776	1.4(1.1,1.7)	0.9(0.8,1.1)
Rural	743	37	0.7(0.5,1.2)	2122	118	1[Reference]	3110	212	1.1(0.9,1.3)	

Note: Higher scores indicated greater intensity of parental responsiveness.

^a. Multilevel logistic regression models were adjusted for child's age, gender (first level) and school (second level).

^b. Interaction term was tested in multilevel logistic regression models adjusted for child's age, gender, single child status, parental education, household income level and school region (first level) and school (second level).

Comparing odds ratios of overweight and obesity in the low and high intensity vs. medium parental demandingness by child age, gender, parental education and school region: China Education Panel Survey-Junior High Cohort (CEPS-JH), 2013-2014

Table 4.

Demandingness	Low (score ranged: 0-2)			Medium (score ranged: 3-5)			High (score ranged: 6-8)			Interaction Term Adjusted OR (95%CI) ^b
	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	No. of Participants	No. of Cases of overweight and obesity	Adjusted OR (95%CI) ^a	
All	(n=6751)	604	1.1(0.9,1.2)	(n=8184)	694	1[Reference]	(n=4061)	377	1.1(1.0,1.3)	
Child age										
14 years	2933	249	1.2(1.0,1.5)	4195	308	1[Reference]	2298	190	1.3(0.9,1.7)	1.1(0.8,1.3)
>14 years	3666	355	1.0(0.8,1.2)	3808	386	1[Reference]	1659	187	1.0(0.8,1.3)	
Child sex										
Boy	3649	408	1.0(0.8,1.2)	4191	473	1[Reference]	1954	245	1.1(0.9,1.3)	1.1(0.8,1.3)
Girl	3102	196	1.2(0.9,1.5)	3993	221	1[Reference]	2107	132	1.2(0.8,1.7)	
Parental education level										
College and above	3062	330	1.1(0.9,1.3)	3777	397	1[Reference]	2058	217	1.0(0.8,1.3)	0.9(0.8,1.2)
Elementary to high school	2975	233	1.0(0.7,1.3)	3663	260	1[Reference]	1690	140	1.1(0.8,1.4)	
No schooling completed	697	40	1.5(1.0,2.3)	733	36	1[Reference]	306	20	1.6(0.8,3.5)	
School region										
Urban	4196	461	1.1(1.0,1.4)	5121	519	1[Reference]	2823	287	1.0(0.8,1.2)	1.2(0.9,1.6)
Rural	2555	143	0.9(0.6,1.2)	3063	175	1[Reference]	1238	90	1.2(0.9,1.7)	

Note: Higher scores indicated greater intensity of parental demandingness.

^a. Multilevel logistic regression models were adjusted for child's age, gender (first level) and school (second level).

^b. Interaction between parental demandingness with child's age, gender, single child status, parental education, household income level and school region (first level) and school (second level).