The Association between Frequency of Eating Out with Overweight and Obesity Among Children Aged 6-17 in China: A National Cross-Sectional Study

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Abstract

Background: In parallel with the increased prevalence of childhood overweight and obesity, the rate of eating out in China has increased dramatically in recent years. The purpose of the study was to explore the association between frequency of eating out with overweight and obesity among Chinese children.

Methods: The representative sample of Chinese children aged 6-17 years (7685 boys; 7576 girls) was recruited from Chinese National Nutrition and Health Survey (CNNHS) in 2010-2012. Frequency of eating out was collected by interview-administered questionnaire and categorized as: less than once per week, once and twice per week, and three times or more per week. Height and weight were measured (body mass index was consequently calculated).

Results: The prevalence of eating out among Chinese children aged 6-17 years old was 23.2%. Children who ate out 0, 1-2, ≥ 3 times per week were accounted for 76.8%, 10.9% and 12.3% respectively. Findings revealed that eating out three times per week or more was statistically significant associated with higher prevalence of overweight and obesity among boys (OR=1.20, 95CI:1.04-1.38) compared with those ate out less than three times per week. However, no significantly association was observed among girls (OR=0.91, 95CI:0.78-1.01). In addition, Younger children, rural children, children from high income family, those with leisure exercises, leisure SB(>2h/d) were relatively more likely to eat out.

Conclusions: The results illustrated that eating out three times or more had a significantly positive effect on overweight and obesity among boys in China.

Background

The worldwide prevalence of overweight and obesity among children is becoming a global health problem[1][1, 2]. Between 1980 and 2013, the prevalence of overweight and obesity among children has increased by 47.1 percent globally[3]. Increases were observed in both developed countries and developing societies [4]. The number of childhood overweight and obesity also increased dramatically over the past decades in China[5]. A recently report among Chinese students aged 7–18 years old showed that the nationwide prevalence of overweight and obesity increased from 2.1–12.2%, 0.5–7.3% from 1985 to 2014, respectively, and this proportion was expected to reach 28% or affected 3496 million children by 2030[6]. The previous studies suggested that overweight and obesity children had an risk of adult obesity[7], which will result to an increased morbidity and mortality[8, 9]. Childhood overweight and obesity correlate with heart disease, high blood pressure and other chronic disease[10]. Childhood overweight and obesity is attributed to complex interaction of genetic, environmental, social and behavior factors[11–12].

With rapid economic development, the dietary structure and eating behaviors have undergone great changes[13, 14], eating out has become a continuously growing part of the Chinese dietary pattern. According to the statistics released by China's National Bureau of Statistics, catering revenue increased from 74.03 billion RMB in 2002 to 441.99 billion RMB in 2012, which raised almost 5 times[15]. In terms

of eating out associate with higher intake of total energy, total fat, sodium, and sugar and lower intakes of fiber, vitamins, and minerals [16, 17], the available data have suggested that eating at restaurant may increase the consumption of meat, sweet while reducing the intake of grains, vegetables and fruits [18]. Furthermore, a large numbers of literatures have indicated that eating out was associated with higher intake of energy [16–19], the increasing energy intake from restaurant drove overall increase in daily energy [20]. thus it may contribute to energy unbalanced that cause weight gain [16]. As number of eating out occasion continues to increase, more attention are paid to the relationship between eating out with overweight and obesity.

Aristides [21] et al demonstrated that children who ate at restaurant had a 21% higher risk of being overweight than those who did not eat at restaurant. A research [22] of 3–12 years children in 9 areas of China found the positive relationship between eating out and risk of overweight and obesity or BMI, mainly due to the substantial contribute of eating out to increase the energy intake [23]. These studies were conducted by nationally representative or large cohort data from West countries. However, available data on the association between eating out and overweight and obesity among Chinese children are far from conclusive. A study [24] of Guangzhou middle school students reported that those consuming restaurant food once a week or more was associated with a 38% higher prevalence, compared with those who never ate at restaurant after adjusting for age, single child family structure, household income, and culture of students' parents. The data of previous published was not representative of the national children population. The objective of the current study was to examine the association between frequency of eating out with overweight and obesity in a nationally representative sample of children using the data of Chinese Nutrition and Health Surveillance (CNNHS) in 2010–2012., then to provide basic information to aid in developing eating out intervention strategies.

Method

Study participants

Data used in this study were from the Chinese Nutrition and Health Surveillance (2010–2012). The method of multi-stage stratification and population proportional cluster random sampling was adopted. In accordance with economic development, all county-level administrative units were divided into four categories: big cities, small and medium-sized cities, ordinary rural areas and poor rural areas. A total of 150 counties (districts) were selected from four categories of areas as study sites, including 34 big cities, 41 small and medium-sized cities, 45 ordinary rural areas and 30 poor rural areas, respectively. The study selected 25 households randomly from each village/community and children aged 6 to 17 years in each family were involved. The specific sampling method can be referred in the published literature [25]. A total of 15261 participants (7685 boys, 7576 girls) aged 6 to 17 years were recruited. This study was approved by the ethics review committee of the National Institute for Nutrition and Food Safety, Chinese Center for Disease Control and Prevention (No. 2013-018). All participants' parents or legal guardian were fully informed the purpose and procedures of the study before enrolling and signed the informed consent.

Data collection

The interview-administered questionnaire was used to collect the information of basic socio-economics, sedentary duration and leisure exercise. The food frequency questionnaire (FFQ) was used to collect eating behaviors over the past week. Participants were asked “How many times have you had breakfast, lunch, or dinner in the past week (seven days)?” and subsequently “How many times in the past week have you had breakfast, lunch, or dinner at a restaurant or school canteen?”. All the questionnaires were collected by trained investigator. The children younger than 12 years old finished the questionnaire with the help of their parents.

Categories of Frequency of Eating Out

In the current study, eating out was defined as eating a meal or more prepared by restaurants. Frequency of eating out was categorized as three levels: 0 time, 1–2 times, or 3 times and over per week.

Anthropometric Measurements

The height was measured with an accuracy of 0.1 cm and the fasting weight was measured with an accuracy of 0.1 kg. All measurements were conducted by well-trained investigators under standard operation procedure. Body mass index (BMI) was calculated as a division of weight in kilograms by the square of height in meters.

Definition of Overweight and Obesity

Overweight and obesity was classified based on age- and gender-specific BMI cutoff points among Chinese children[26]. In the meantime, national health standard of Screening standard for malnutrition of school-age children and adolescents was devoted to screen for underweight children[27].

Assessment of Sociodemographic Determinants

Age groups were divided into two categories (6–12, 13–17 years). Participants were divided into four residency groups according to location (urban, suburban, rural and poor rural). Family income was classified into four levels (< 20,000 RMB/person, 20,000–40,000 RMB/person, > 40,000 RMB/person, and unknown). Leisure exercise was defined as two levels (No/Yes). Sedentary duration status was grouped into two levels (≤ 2 h/d and > 2 h/d).

Statistical Analysis

All statistical analyses were conducted using SPSS 22.0. The univariate descriptive statistics were conducted for each variable (frequency and percentage). The frequency of eating out was expressed as a percentage. Data were run to test the association of these demographic variables with eating out using Chi-square tests. After adjusting for age, region, logistic regression was employed to examine the association of eating out with overweight and obesity, where dependent variable was BMI status (obesity, overweight, normal weight and underweight), and adjusted odds ratios (OR) with 95% confidence intervals (CI) were obtained. Statistical significance was considered at $p < 0.05$.

Result

The distribution of the characteristics among participants

The characteristics of participants were presented in Table 1. Children who ate out 0, 1–2 and ≥ 3 times per week were accounted for 76.8%, 10.9% and 12.3%, respectively. Although no significant gender difference in frequency of eating out was observed, we found that there was a trend that children from economic developed region and high income family eat out more often ($P < 0.05$). Compared with their counterparts, younger children, those with leisure exercise, leisure SB (> 2 h/d) were more likely to eat out ($P < 0.05$). In additional, Table 1 shows the frequency distribution of eating out is significantly different among children with different weight status ($P < 0.05$).

Table 1
Demographic characteristics of participant

Variables	Total	Eating-out(times/ week)			χ^2	<i>P</i>
		0	1–2	≥ 3		
		N	N(%)	N(%)		
Total	15261	11724(76.8)	1668(10.9)	1869(12.3)		
Gender					3.47	0.177
Boys	7685	5887(50.2)	822(49.3)	976(52.2)		
Girls	7576	5837(49.8)	846(50.7)	893(47.8)		
Age(years)					98.52	< 0.05
6–12	9436	7491(63.9)	956(57.3)	989(52.9)		
13–17	5825	4233(36.1)	712(42.7)	880(47.1)		
Region					1127.52	< 0.05
Urban	3987	2455(20.9)	696(41.7)	838(44.7)		
Suburban	4164	2996(25.6)	551(33.0)	617(33.0)		
Rural	5053	4455(38.0)	253(15.2)	345(18.5)		
Poor rural	2057	1818(15.5)	168(10.1)	71(3.8)		
Family income					362.46	< 0.05
Low	9156	7469(63.7)	773(46.4)	914(48.9)		
Medium	2348	1645(14.0)	331(19.8)	372(19.9)		
High	672	386(3.3)	147(8.8)	139(7.4)		
Unknown	3085	2224(19.0)	417(25.0)	444(23.8)		
Leisure exercise					285.49	< 0.05
No	8831	7219(61.6)	767(46.0)	845(45.2)		
Yes	6430	4505(38.4)	901(54.0)	1024(54.8)		
Leisure SB					150.01	< 0.05
≤ 2 h/d	5880	4824(41.2)	526(31.5)	530(28.4)		
> 2 h/d	9381	6900(58.8)	1142(68.5)	1339(71.6)		
BMI status					35.34	< 0.05
Obesity	1622	1212(10.3)	189(11.3)	221(11.8)		

Variables	Total	Eating-out(times/ week)			χ^2	<i>P</i>
		0	1–2	≥ 3		
		N	N(%)	N(%)		
Overweight	2015	1499(12.8)	231(13.9)	285(15.3)		
Normal	10692	8238(70.3)	1181(70.8)	1273(68.1)		
Underweight	932	775(6.6)	67(4.0)	90(4.8)		

Logistic regression analysis of the relationship between frequency of eating out with overweight and obesity

The relationship between frequency of eating out with overweight and obesity are presented in table 2. In logistic regression model ,after adjustment for age, gender, region, family income, leisure exercise and leisure SB, those who ate out 3 times or more per week had a higher risk of overweight and obesity (OR = 1.21, 95% CI: 1.03–1.41) in boys group, compared to those who ate out less than 3 times a week. No significant relationship was observed among girls(OR = 0.91,95 CI: 0.78–1.01).

Table 2
Logistic regression analysis of frequency of eating out and overweight and obesity

Variables	Total		Boys		Girls	
	OR(95%CI)	P	OR(95%CI)	P	OR(95%CI)	P
Eating-out(freq./ week)						
0	Reference					
1–2	1.04(0.92–1.18)	0.54	1.15(0.97–1.37)	0.10	0.96(0.74–1.11)	0.32
≥ 3	1.09(0.96–1.23)	0.19	1.21(1.03–1.41)	< 0.05	0.92(0.76–1.12)	0.41
Age(years)						
6–12	Reference					
13–17	0.62(0.57–0.68)	< 0.05	0.56(0.50–0.63)	< 0.05	0.69(0.60–0.79)	< 0.05
Region						
urban	Reference					
suburban	0.88(0.79–0.98)	< 0.05	0.78(0.68–0.89)	< 0.05	1.03(0.88–1.22)	0.72
rural	0.73(0.65–0.81)	< 0.05	0.64(0.56–0.74)	< 0.05	0.84(0.71–0.99)	< 0.05
Poor rural	0.65(0.56–0.75)	< 0.05	0.54(0.44–0.66)	< 0.05	0.81(0.65–1.04)	0.07
Family income						
Low	Reference					
Medium	1.22(1.10–1.37)	< 0.05	1.32(1.14–1.53)	< 0.05	1.11(0.93–1.33)	0.23
High	1.26(1.05–1.51)	< 0.05	1.37(1.08–1.74)	< 0.05	1.07(0.79–1.45)	0.68
Leisure exercise						
No	Reference					
Yes	1.19(1.10–1.29)	< 0.05	1.16(1.04–1.30)	< 0.05	1.19(1.05–1.35)	< 0.05
Leisure SB						
≤ 2 h/d	Reference					

Variables	Total		Boys		Girls	
	OR(95%CI)	P	OR(95%CI)	P	OR(95%CI)	P
> 2 h/d	1.11(1.02–1.21)	< 0.05	1.08(0.96-1.21)	0.19	1.16(1.01–1.32)	< 0.05

Discussion

In parallel with an increase in the prevalence of overweight and obesity among children, the rate of eating out has increased rapidly in recent years. The current study clearly demonstrated the significant association between overweight and obesity with higher frequency of eating outside among boys, similar results were observed in previous researches: as in Brazilian children[28], and had been found among children from Etiology of Childhood Obesity (ECHO) study[29], in children and adolescents aged 11–14 years in London Borough[30], in Portugal children[21] and in US elementary schools students[31]. However, we did not observe a significant association between obesity and eating out in group of girls, which may due to boys' greater preference for fatty food and girls pay more attention to their weight[32–34]. whereas, the result of the UK National Diet and Nutrition Survey (NDNS) indicated that no association between energy intake and frequency of consumption of meals out in children[35]. The differences in research result may be partly due to the fact that lacking of uniform standard for the definition of eating out. The definition for our research was refer to restaurant only, not including take-away food, the scope is relatively limited. Moreover, the catering industry has developed rapidly in recent years. With the intensive distribution of restaurant and the convenience of online catering service, children have easy access to eat out. The frequency of eating out of children probably present a growing trend. Therefore, strategies and interventions are warranted to target children's overall eating-out behavior, to prevent unhealthy eating behaviors among children, such as nutrition and health education.

Consistent with previous studies [19, 36], 6–12 years children were more likely to be overweight and obesity compared with 13–17 years children, which may be related to the fact that younger children tended to eat out. One possible explanation from previous research[37, 38] suggested that the conception and behavior of healthy eating increases while children growing, older children tend to choose more healthy food. Thus, more researches are needed to provide dietary guidance of eating out on younger. Additionally, the study found that children from high-income household were associated with greater prevalence of overweight and obesity, the finding supported by previous researches [39, 40]. Li Miao found that children from high income family with more pocket money were more likely to be overweight and obesity [41]. Furthermore, The study showed that in comparison with children in rural regions, children from urban regions tended to be overweight and obesity, and this difference was also found in other domestic studies[42,43], which was likely due to the convenience of eating out in the urban regions[44]. Similar result was founded in a survey conducted among Mexican children found that urban children[45] consumed more energy daily than those in the rural regions. Therefore, dietary nutrition education and intervention about healthy eating is necessary. As seen in the current study, leisure exercise was positive associated with high rate of overweight and obesity, which may be related to the fact that

majority of childhood obesity prevention program conducted within obese rather than non-obese children [46], thus Obese children were more likely to participate in exercises[47]. We also found that children those had more leisure sedentary time tended to eat out. the similar result was found among Pakistan children aged 5 to 12 years showed that eating fast food had a significant association with sedentary behavior[48] and Matheson's study[49]. Sedentary lifestyle that included television viewing and playing video game, television advertising of restaurant foods were attractive for children, which was the possible explanation of the higher rate of eating out. Preventive strategies and practical approaches may need to reduce children's sedentary time.

The main advantages of this study were that the sample was nationally representative, which can reflect the nutrition and health status of Chinese children. The data gave a general description of eating out behavior of Chinese children aged 6–17 years, and the result provided a reference for further research with similar situation. Additionally, as eating out has become an integral part of the daily life, there are many studies on relationship between eating out and dietary patterns among children, while, insufficient guidance exists on the maximum recommended frequency of eating out. The result of this study provide reference times for eating out by genders. However, the present study had several limitations. Firstly, as the definition of eating out which including restaurant only. It is possible to underestimate the frequency of eating out; secondly, this study was cross-sectional study, the causal relationship between the eating out and overweight and obesity cannot be determined; finally, The calculated intake of nutrients such as energy is a lack, Only the data in the interview-administered questionnaire table are analyzed. Therefore, the conclusion of the study still has practical significance.

Conclusion

In conclusion, the result of this study demonstrated that the prevalence of eating out was 23.3% among Chinese children. Younger children, urban children and children from high income family were more likely to eat out. Thus, dietary nutritional education and intervention about healthy eating is necessary. Considering the higher risk overweight and obesity among boys, interventions regarding eating out should tailor messages appropriately to target specific subjects by genders. From a public health perspective, the result suggested that interventions are needed to strengthen the monitoring of the situation of children eating out, thus contributing to reduce the potential enormous economic costs that are associated with eating out behavior-related illnesses, such as overweight and obesity.

Abbreviations

Chinese National Nutrition and Health Survey(CNNHS); World Health Organization(WHO); National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention (NINH, China CDC); Confidence Intervals (95% CIs); Etiology of Childhood Obesity (ECHO) ;UK National Diet and Nutrition Survey(NDNS)

Declarations

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Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available because some results are still being analyzed but are available from the corresponding author on reasonable request.

Authors' Contributions

The authors' contributions were as follows: Y.M. participated in the data clean, data check and analysis, wrote the manuscript. A.L. designed the study and revised the manuscript.

W.G., C.D., C.S, F.Y., J.F.,G.F. and Z.C. collected and supervised the data. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The protocol of the 2010-2012 CHNHS was approved by the Ethical Committee of NINH, China CDC (2013-018).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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