

## Survey on the Morbidity of Obesity and Analysis of Related Factors among School Children in Shanghai, China

Mei-Qin Cai,<sup>†</sup> Shao-Mu Wang, Xiao-Min Zhang

*Department of Nutrition, Shanghai Second Medical University, Shanghai, China*

### ABSTRACT

**Objective :** To get a better understanding of obesity and etiological factors of obesity among school children. **Methods :** We have conducted a questionnaire survey of 4542 (2395male and 2147female) age from 7 – 15 in Shanghai School District to study their 24h nutrition intakes ; we have asked all our survey participating students to take a physical exam and body mass index measurement to determine the morbidity of obesity. Common statistic method was used in analyzing the data. **Results :** The result shows an over all morbidity (boys and girls) of 12.3% among the students we have studied. Our research shows that boys have a higher rate of morbidity of obesity 17.1% vs. 7.0% for girls. The morbidity for boys starts under age 10, reaches the peak at age 10 (24.3%), then declines after age 11 ; as for girls the morbidity starts at under age 9, reaches the peak at 9, and then declines after 10. Our study also indicates that the daily nutrition intake of protein, fat and carbohydrate by the students have satisfied Chinese Dietary Reference Intakes (DRIs), while the daily intakes of calcium, iron, zinc, and vitamin C are below the 80% of the DRIs suggested value. For students who are obese, our study shows that their average daily intakes of calories and protein have reached 90% of the suggested value by the RNI while the intakes of calcium, iron, and zinc are far below standards. Furthermore, our research shows that the obese students usually intake more calories, proteins and vitamin B<sub>1</sub>, but less for iron and calcium compared to the normal students. Some other factors such as the education and occupation of the parents, especially the mother, the family history of obesity and the eating habits are important factors that should be closely watched. **Conclusion :** The morbidity of obesity among boys is higher than girls. Obesity is closely related to the family history, the diet habits and the life styles. (*J Community Nutrition* 6(3) : 117~120, 2004)

**KEY WORDS :** schoolchildren · obesity · nutrition.

---

### Introduction

---

Obesity among school age children has become a serious health problem in recent years (Nicholas TA et al. 1993). It greatly affects both the mental and physical development of our children. The morbidity of children's obesity has reached 5 – 40% abroad, and 3 – 17% in our country ; and the rate has been continuously rising. Obesity in childhood not only can lead to many chronic diseases such as diabetes, heart disease and cerebral vessel disease, but also affects the children's self-confidence, activity, communication skills etc and many other problems. In order to understand the root cause of the morbidity of children's obesity today, and finding more useful and proper ways to prevent obesity among children,

---

<sup>†</sup> Corresponding author : Mei-Qin Cai, Department of Nutrition, Shanghai Second Medical University, Shanghai 200025, China  
E-mail : xyxy@shsmu.edu.cn

we have conducted the studies of the school age student in Shanghai School District in 2002.

---

### Subjective and Method

---

#### 1. Survey object

Multi-stage sampling was adopted to select survey object. We have randomly selected a total of 4542 voluntary students age from 7 to 15 from two elementary schools and two middle schools in Shanghai ; among them boys 2,395 and girls 2,147.

#### 2. Survey method

##### 1) This survey is composed of two parts

1) Physical examination : including height, body weight, waist circumference, hip circumference, upper arm circumference, skin fold, blood pressure, heart rate, etc.

2) Questionnaire survey : The questionnaire is composed of two parts, the first part is diet nutrient intake of 24h and

the other part is for students and their parents. The content includes food habits, time of exercise, parents' education levels and other general information.

Expert groups from Shanghai Second Medical University, with much iteration of checking and pre-testing, designed the survey questions.

We have identified 560 obese students (409 boys, 151 girls) according to the standards of height and weight for Chinese students age from 7 – 22 which is set by the branch of school Sanitation of Chinese Sanitation Supervising Department. We used case-control study to survey their diet habits, measuring the height, blood pressure and heart rate etc. to compare with the normal students.

### 3. Data analysis

Data were analyzed by software SPSS 10.0.

## Results

### 1. Morbidity of obesity

Mean morbidity of obesity is 12.3% (male 17.1%, female 7.0%). From Table 1 we can obviously see that morbidity of

obesity among boys is higher than girls at different growing stages. For boys under age 10, the morbidity of boys' obesity increases as age goes up, reaching its peak at 10 years old (24.3%), and then starts declining from 11. For girls under age 9, the morbidity of girls' obesity increases as age goes up, reaching its peak at 9 years old (8.8%), and starts declining from then on, but shows little increase around age 14 to 15.

### 2. Status of all kinds of nutrient intake in diet

From Table 2 we can see that the group of obesity's daily intake of calories and protein 90% of the value suggested by the Chinese Dietary Reference Intake (DRIs), while the calcium intake is far below the standard, the calcium intake of boys is only 37% of the standard, and the calcium intake of girls is 35.8% of the standard. Iron and zinc is also less than the standard, below 75% of the standard. Vitamin B<sub>1</sub> intake is higher than the standard, Vitamin B<sub>2</sub> intake matches the standard, and Vitamin C intake is between 60% and 75% of the standard.

The intake of calories, protein and Vitamin B<sub>1</sub> of the group of obesity is higher than the normal group. For students who are obese, our study shows that their average daily intakes of

Table 1. The morbidity of obesity among different age group

Age (year)	Boy			Girl			Total		
	N	Obesity (n)	Morbidity (%)	N	Obesity (n)	Morbidity (%)	N	Obesity (n)	Morbidity (%)
7	245	40	16.3	208	14	6.7	453	54	11.9
8	240	43	17.9	228	17	7.5	468	60	12.8
9	260	52	20.0	228	20	8.8	488	72	14.8
10	317	77	24.3	247	19	7.7	564	96	17.0
11	352	51	14.5	310	22	7.1	662	73	11.0
13	270	48	17.8	233	14	6.0	503	62	12.3
14	359	50	13.9	397	24	6.1	756	74	9.8
15	352	48	13.6	296	21	7.1	648	69	10.7
Total	2395	409	17.1	2147	151	7.0	4542	560	12.3

Table 2. The daily intakes of main nutrients

Nutrients	Obesity				Normal			
	Male	Rate (%)	Female	Rate (%)	Male	Rate (%)	Female	Rate (%)
Protein (g)	76.44 ± 21.50 <sup>1)</sup>	101.9	70.0 ± 21.9	93.3	65.28 ± 20.86	87.0	62.8 ± 17.5	83.7
Fat (g)	93.8 ± 26.8	—	87.2 ± 24.4	—	83.3 ± 27.1	—	76.7 ± 32.5	—
Carbohydrate (g)	261.6 ± 63.8	—	244.9 ± 56.5	—	241.6 ± 32.3	—	234.2 ±	—
Energy (kcal)	2197 ± 440	91.5	2045 ± 395	93.0	1966 ± 411	81.9	1878 ± 454	85.4
Calcium (mg)*	370.0 ± 185.1	37.0*	358.0 ± 167.4	35.8*	433.5 ± 450.4	43.4*	447.8 ± 360.7	44.8*
Iron (mg)*	12.0 ± 10.3	75.0*	11.0 ± 5.5	61.1*	17.5 ± 12.8	109.4*	15.9 ± 23.6	88.3*
Zinc (mg)	9.73 ± 3.01	54.1	8.87 ± 3.0	59.1	9.09 ± 6.01	50.5	8.91 ± 6.24	59.4
VB <sub>1</sub> (mg)	1.70 ± 0.48	133.3	1.53 ± 0.39	127.5	0.93 ± 0.43	77.5	0.92 ± 0.29	76.7
VB <sub>2</sub> (mg)	1.23 ± 0.52	102.5	1.12 ± 0.48	93.3	1.32 ± 0.63	110	1.21 ± 0.35	100.8
VC (mg)	60.56 ± 33.14	67.3	61.33 ± 31.93	68.1	58.06 ± 20.5	64.5	55.8 ± 25.2	62.0

1) mean ± SD

**Table 3.** The rate of protein, fat, carbohydrate and the rate of breakfast, lunch and dinner (%)

			Protein	Fat	Carbohydrate	Breakfast	Lunch	Dinner
Obesity	Primary school	Boy	13.4	38.5	48.1	21	42	37
		Girl	12.8	37.6	50.0	24	37	39
	Middle school	Boy	14.9	38.4	46.7	19	42	39
		Girl	15.0	40.0	45.3	21	39	41
Normal	Primary school	Boy	13	38	49	26	33	42
		Girl	14	40	46	27	37	36
	Middle school	Boy	15	37	48	36	33	42
		Girl	14	40	46	24	36	40

Recommended rate : protein : fat : carbohydrate = (10 – 15)% : (25 – 30)% : (60 – 70)% ; breakfast : lunch : dinner = 30% : 40% : 30%

calories and protein have reached 90% of the suggested value by the standard while the intakes of calcium, iron, and zinc are far below standards. Furthermore, our research shows that the obese students usually intake more calories, proteins and vitamin B<sub>1</sub>, but less for iron and calcium compared to the normal students. Those differences may be caused by obese students more likely to eat food with more fat and high protein.

Rate : actual daily intakes/RNI [4] criteria × 100% ; \* : actual daily intakes/AI [4] criteria × 100%.

### 3. The comparison of the calories intakes from the three calories-producing nutriments of the diet and the calories from the three daily meals

In the obese group, the student's protein intakes basically follow the value recommended by the DRIs, but they consume more fat and less carbohydrate according to the recommendation from DRIs ; this may be closely related to diet habits of those students ; the same problem also persists for the normal students group. Both groups, the calories intakes do not follow the ratio as 30 : 40 : 30 as recommended by the DRIs. The students do not get enough calories from breakfast, but they get too much from dinner. Our study also shows that the calories intakes from breakfast is lower in middle school age students compared to elementary school students ; those differences can be the results of more busy morning schedules for the middle school students that limits their time for breakfast.

### 4. Surrounding factors

Our research shows that about 45.7% of obese children have parents who are factory workers or store workers ; 36.1% whose parents are teachers, professional, or managers ; 6.8% of obese children whose parents work in healthcare industry, and 11.4% are small business owners (Table 4).

As our studies show, the education level of parents is also

**Table 4.** The rate of employment status of obese children's parents

Employment status	n	%
Workers	256	45.7
Teachers, professional, or managers	202	36.1
Healthcare industry workers	38	6.8
Small business owners	64	11.4
Total	560	100

**Table 5.** The rate of educational level of obese children's parents

Educational level	n	%
Middle school degree	49	8.8
High school or technical school degree	303	54.1
College or higher education	208	37.1
Total	560	100

an important factor ; our data shows that 8.8% of the obese children whose parents do not have a high school degree, as 54.1% of their parents carry some sort of degree from a technical school ; and 37.1% of our obese children whose parents received college or higher education (Table 5).

Another important factor that contributes to our children's obesity is the BMI value of their parents. In our studies, 46.1% of obese children whose fathers are overweight as 31.6% have overweight mothers.

Activity plays another important role in child obesity, among obese children, 21.1% spend more than 2 hours daily on activities, 44.5% spend 1 hour daily, and 34.5% spend less than half an hour.

We also have studies of the habit of eating late night snacks for obese children : 84.6% of our obese children eat late night snack, as 15.4 do not.

The analysis of the data above with logistic relative analysis showed that the formation of obesity is related with parents' vocation, education level, eating habits, BMI of the mother.

That is the higher the parents' vocation and education levels were, the lower the possibility of the formation of obesity was. Even if one of the parents were obese, the possibility of formation of obesity of the child would increase significantly. And the faster they ate, the higher the possibility was.

---

### Discussion

---

The survey on the morbidity of obesity in school age children of two elementary schools and two middle schools showed that morbidity of obesity among boys is higher than that of girls at different growing stages. The mean intakes of calories, protein, fat and carbohydrate of boys are higher than girls ; that difference may result by the girls wanting to be thin as a fashion. Furthermore, morbidities of obesity in all age groups are different significantly, and the morbidity of the group of 9 – 10 years old is the highest, then declining with adding age. It is because the students were in adolescence, in which they would grow fast and the need of nutrition would increase and they had to study hard. It also implied that we should have them as our main objects for defending from obesity. The causes of obesity of school children are agreed largely to the compound influences of inheritance, surrounding factors, individual behaviors and psychological factors (Siega-Riz et al. 1998 ; Xu et al. 2003) . Our survey also showed that the possibility of being obese may increase if one of the parents is obese. It implies the inherited tendency of obesity, which is related with the inheritance, eating habits in the family and the life styles, such as liking to eat meat and dessert, not willing to exercise, etc. So the nutrition education for the

people in all orientations may be significant. Our survey also showed that the morbidity of obesity of the school children may be lower in those whose parents' education degrees were relatively high. It showed that the parents' education of them, food selection, habit of exercising, and family surrounding factors influenced the children greatly. The obese school children's bad habits in diet and exercise are concerned with family surrounding factors and the parents' lifestyle (Ma 2002) . So it is very important to improve the family life styles when the obese children are treated. The survey also showed that the eating speed is related with the formation of obesity. The morbidity of obesity is higher in those who eat fast, because the full feeling in the stomach is not enough to limit eating more when eating fast. Furthermore, the energy proportion was not proper. The energy supplied by supper was higher and the exercise was less, which leads to body fat accumulating. So the poor diet habit and lifestyles are the risk factors for obesity, which should be realized by society

---

### References

---

- Ma GS, Hu XQ, Wu J (2002) : The effect on child food habit influenced by parents. *Chin J School Health* 23 (6) : 486-487
- Nicklas TA, Bao W, Webber LS, Berenson GS (1993) : Breakfast consumption affects adequacy of total daily intake. *Am Diet Assoc* 93 : 886-891
- Siega-Riz AM, Popkin BM, Carson T (1998) : Trends in breakfast consumption for children in the United States from 1965 to 1991. *Am J Clin Nutr* 67 (Supply) : 748-756
- Xu XX, Gu XF, Zhang QF (2003) : Comparison of children nutrition status and physical development in two surveys. *Chin J Clin Rehabilitation* 7 (24) : 3318-3319