Preplanned Studies

Energy and Macronutrient Intake Among Children Aged 6–11 Years Old — China, 2016–2017

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Summary

What is already known on this topic?

Low level energy and macronutrient intakes and dietary imbalances are still important issues and should be prioritized in children aged 6–11 years old in China.

What is added by this report?

Among children aged 6–11 years in China in 2016–2017, the average protein intake was 55.2 g/d in urban areas and was higher than the estimated 45.4 g/d in rural areas. The proportions of children whose protein intake were below the estimated average requirement (EAR) were about one-fifth in urban areas, and more than one-third in rural areas, respectively.

What are the implications for public health practice?

The undernutrition problem had changed into a nutritional imbalance problem among children aged 6–11 years in China. In addition to enriching the food supply and improving the dietary behavior, societies, schools, and families should make joint efforts to develop a feasible and appropriate dietary environment.

Proper intake of energy and macronutrients (including protein, fat, and carbohydrate) are vital factors for human nutrition and health, especially among children aged 6–11 years old. The fact that unhealthy diet is associated with non-communicable diseases (NCDs) and worsened quality of life has been recognized worldwide (*1*). Childhood is the key stage of growth over the whole lifetime and has higher nutrition requirements. Malnutrition consists of undernutrition and overnutrition. The latest data from the World Health Organization (WHO) showed that the prevalence of obesity among children and adolescents were 11.7%, and about 21.3% of children under the age of 5 were stunted (*2*). In 2010, the prevalence of malnutrition, including stunting, mild wasting, and moderate severe wasting in children aged 7–12 years were 13.29% and 12.55%, respectively (*3*). This study aimed to reveal the status of energy and macronutrient intake among children aged 6–11 years old in China using data from the China Nutrition and Health Surveillance conducted between 2016 and 2017.

Compared with Chinese Nutrition and Health Survey in 2002, a declining trend of the average energy intake was observed in 2010–2012, while the average fat intake was slightly increased with a narrowing gap between urban and rural areas. Carbohydrate intake decreased, and protein intake largely remained the same (*4*). No previous nationwide report about the intakes of energy and macronutrients among 6–11 years old children in China was published, and the intake levels of energy and macronutrients evaluated by dietary reference intakes (DRIs), including estimated average requirement (EAR) and recommended nutrient intake (RNI), were also rarely reported in this age group.

Data were obtained from the China Nutrition and Health Surveillance of Children and Lactating Mothers in 2016–2017. This study was a cross-sectional study, conducted in 31 provincial-level administrative divisions (PLADs). The survey used multistage stratified random sampling method and was nationally and provincially representative. The method of data collection included four parts: interviews to collect demographic information; physical examination to observe the indices of growth; laboratory tests to evaluate the health and dietary status among interviewees; and inquiring into the energy and nutritional intake. The information on energy and macronutrient intakes were drawn and assessed by 3 consecutive days of 24 h dietary recalls and weight records of edible oil, salt, and flavoring (*5*). The calculation of the energy was conducted by referring to China Food Composition (*6*–*7*). The protein intake of participants was evaluated using the criteria of EAR and RNI, and then were divided into <EAR, EAR–RNI, and ≥RNI groups (*8*). Study populations were allocated into different groups by sex and regions. SAS 9.4 (SAS Institute Inc., Cary, NC, USA) was used

to conduct all the analyses. The protocol of this study was evaluated and approved by the ethical committee China CDC (201614).

A total of 8,777 subjects were included for this report, including 4,145 in urban areas and 4,632 in rural areas. The number of males was 4,364, including 2,034 in urban areas and 2,330 in rural areas; the number of females was 4,413, including 2,111 in urban areas and 2,302 in rural areas.

Table 1 presented the data on energy and macronutrient intakes of two regions of the two sexes. The average intake of energy was 1,591.7±560.0 kcal/d, and the average intakes of protein, fat, and carbohydrate were 50.0±20.8 g/d, 69.6±37.5 g/d, and 196.3±81.6 g/d, respectively. All the intake of energy and macronutrients in urban area was higher than in rural area. Overall, the average protein intake in urban areas was approximately 10.0 g/d higher than in rural areas, and similar results were observed when grouped by regions and sexes. Although the carbohydrate intakes were higher in males than in females, which was similar to the results based on region.

The results of evaluating protein intake based on the value of EAR and RNI were illustrated in Table 2. Generally, the proportion of children whose protein intake were below the EAR criteria was about 19.5% in urban areas and more than 33.9% in rural areas. Protein intake of more than half of the total children were over the EAR criterion. Similar trends were observed in protein intake evaluated by RNI in the overall group of children aged 6–11 years old. All the proportions of protein intake that were below EAR in urban male and female groups remained around 20% and were higher in rural groups.

DISCUSSION

Energy and macronutrient intake are key indicators

TABLE 1. Energy and macronutrient intake among children aged 6–11 years old in China, 2016–2017.

Gender	Energy & macronutrients	Total	Urban	Rural
Male	Energy (kcal/d)	1,624.1±567.7	1,672.3±555.2	1,581.9±575.1
	Protein (g/d)	50.9±21.2	56.2±21.9	46.3±19.3
	Fat (g/d)	71.4±38.1	73.8±36.7	69.4±39.2
	Carbohydrate (g/d)	199.5±82.3	201.2±81.2	198±83.3
Female	Energy (kcal/d)	1,559.7±550.6	1,600.5±540.9	1,522.2±556.7
	Protein (g/d)	49.1±20.4	54.1±21.9	44.5±17.7
	Fat (g/d)	67.8±36.8	69.3±34.8	66.4±38.5
	Carbohydrate (g/d)	193.2±80.8	195.2±81.1	191.4±80.5
Both	Energy (kcal/d)	1,591.7±560.0	1,635.8±549.1	1,552.2±566.8
	Protein (g/d)	50.0±20.8	55.2±21.9	45.4±18.6
	Fat (g/d)	69.6±37.5	71.5±35.8	67.9±38.9
	Carbohydrate (g/d)	196.3±81.6	198.2±81.2	194.7±82.0

TABLE 2. Distributions of protein intakes among children aged 6–11 years old in China 2016–2017.

Gender	DRIs	Total (%)	Urban (%)	Rural (%)
Male	<EAR	26.9	19.8	33.2
	EAR–RNI	19.6	16.3	22.6
	≥RNI	53.4	64.0	44.3
Female	<EAR	27.3	19.1	34.7
	EAR–RNI	21.4	18.7	23.8
	≥RNI	51.4	62.2	41.5
Both	<EAR	27.1	19.5	33.9
	EAR–RNI	20.5	17.5	23.2
	≥RNI	52.4	63.0	42.9

Abbreviations: DRTs=dietary reference intakes; EAR=estimated average requirement; RNI=recommended nutrient intake.

that reflected the nutritional status of individuals and the overall population and are important to combatting undernutrition or malnutrition. Protein-energy malnutrition (PEM) has been a leading cause of child health problems, especially in developing countries. Assessing PEM is a vital procedure in nutrition surveillance.

In this study, higher intake of energy and macronutrients in urban populations as compared to rural populations were observed, and a disparity of protein intake between two area types was revealed. In general, the intake levels of energy and macronutrients were higher in urban populations than in rural population, and the intake levels were also higher in males than in females. Compared with the China Nutrition and Health Surveillance 2010–2013 (*4*), a large gap of protein intake between urban and rural 6–11 years old children still existed in the 2016–2017 surveillance. The discrepancy of carbohydrate intake between urban and rural areas nearly vanished in 2017, and the similar result was observed in analysis based on biological sex. Protein intakes of more than 30% of total children were under EAR, and no more than 50% of all children's protein intakes were over the RNI. Although the protein intake in urban children was better than in rural children, the overall intake was at a low level, which suggested an imbalance of macronutrients intake.

A previous study had shown that the prevalence of malnutrition had declined overall in recent years but had increased in some PLADs and became concentrated in undeveloped areas (*3*). To improve the nutritional status, food supply is an important factor. Another study suggested that the short supply of protein-rich food, such as eggs, soy products, and milk, was a serious challenge in rural China (*9*). The differences in energy and protein intake between urban and rural population drawn from this study might be a reasonable explanation.

Dietary behavior was also important to improving nutrition so that the dietary behaviors of vulnerable children could be changed by external influences. Therefore, the effects of government nutrition policies, environmental improvement, and nutrition education on improving dietary behavior and nutrition status had been recognized (*10*). The Nutrition Improvement Program for Rural Compulsory Education Students had been performed since November 2011; however, the problem of insufficient dietary habits for this population still needs to be solved (*9*). Enhancing school health education was emphasized in "Healthy China 2030" (*11*).

In general, low intake levels of energy and macronutrients in children aged 6–11 years in China were an important issue to be addressed. Dietary imbalance was another problem that should be prioritized. Communities, schools, and families should make joint efforts to develop a feasible and appropriate dietary environment for the target population.

This study was subject to at least two limitations. First, children aged 6–11 years old in this survey were a special group and information had to be collected, with difficulty, from the participants themselves or the family. Most of the data were collected from their schools or other units, which could, therefore, influence the randomness of the sampling to be not as ideal. Second, the profiles of fat and carbohydrate evaluated by the DRIs were not conducted because there were no recommended values.

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