

# Dietary pattern and physical development in China--based on the 1992 national nutrition survey

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Based on information gathered in the 1992 Chinese national nutrition survey, the energy consumption on average is about adequate for the whole population. Dietary protein and fat have increased, and now provide 11.8% and 22.0%, respectively, of the total dietary energy. The adequacy of nutrient intake, expressed as percentages of RDA, is higher for urban populations than for rural, and higher for high income groups than for low income groups. Child growth has improved substantially compared to ten years ago. However, there are still 32.6% of preschool children with stunted growth and 17.7% are underweight. Rural children have a higher incidence of chronic energy deficiency (CED) than their urban counterparts. The improvement in children's growth and the increase of overweight adults are in line with the country's overall food production and the average food consumption of the population. The difference between urban and rural nutritional status deserves more attention.

## Introduction

In association with open policy and economic reform in China, remarkable changes have occurred in the living conditions and dietary patterns of Chinese population in recent years<sup>1</sup>. A national nutrition survey was carried out in 1992 to examine the dietary and nutritional status of people in various areas in China. Its main focus was to identify the magnitude of existing problems related to food inadequacy and excessive consumption and also to investigate the possible linkage of nutritional problems with some socioeconomic factors. It was the third nationwide nutrition survey in China. The previous one took place in 1982<sup>2</sup>.

This survey was authorized by the Ministry of Public Health, and implemented by the Health Bureau of all provinces, autonomous regions and municipalities directly under the central government. It consisted of a survey of household food consumption, a survey of individual food intake, anthropometric measurements, hemoglobin analysis, household income, etc. The survey covered 225 primary sites, about 25,000 households and 100,000 individuals of various ages, of more than 20 nationalities.

This paper will discuss mainly the physical development of preschool children and adults in connection with their dietary patterns in various areas based on data collected in the survey.

## Method

### *Sampling*

A multistage stratified random cluster process was used to draw the sample. In each province/region/municipality 4-8 units (towns and counties) were selected in reference to their population size and economic situations. In each

selected town or county, 2 districts or townships were chosen, and in each district or township 2 communities or villages were sampled as the primary survey sites. In each site a cluster of 30 households was chosen as subject for the survey. In each of the 3 principle municipalities, 5 central districts and 3 suburbs were chosen at the first sampling stage. The sub-stage process was the same in the provinces. Thus, the sampling frame can be illustrated as follows:

- 30 provinces, autonomous regions, municipalities
- $30 \times 8 = 240$  towns, counties
- $240 \times 2 = 480$  districts, townships
- $480 \times 2 = 960$  communities, villages
- $960 \times 30 = 28,800$  households

This sample design was reviewed and was recognized by an expert committee as being reasonably representative of the population.

### *Dietary survey*

The household food consumption data were collected by an inventory change for three days, in combination with a method of food weighing. Household members who participated in each meal were recorded. Household average per capita food consumption was calculated, and household average of food consumption per reference person was also calculated taking into consideration age, sex, and labor intensity of the household members. Data on individual intake was obtained by 24-hour recall method over 3 consecutive days. The nutrient intakes were calculated based on the Chinese food composition table<sup>3</sup>.

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### Anthropometric measurements

Body weight, height and upper arm circumference were taken by trained personnel with standardized scales and measures. There was quality control during data collection in the field.

### Household income and community survey

The household income was reported by household leaders. The categorization was based only on reported income. Family properties were not taken into account. The community data were provided by community leaders and other knowledgeable inhabitants. Focus group discussions were often used for collecting community information.

## Results

### Nutrient intakes and dietary patterns

The national average intakes of energy, protein and fat are shown in Table 1. The overall daily consumption of energy was 2328 kcal per reference person. The urban inhabitants consumed about 100 kcal more than rural people. This difference was mostly due to higher income families. The low income group in both urban and rural areas consumed similar amounts of energy.

**Table 1.** National Average of Nutrients Intakes by Income Tertile (per reference person per day)

		Income Categories			
		Total	Low	Middle	High
Energy (kcal)	Urban	2395	2299	2384	2500
	Rural	2294	2292	2274	2315
	U + R	2328	2294	2285	2410
Protein (g)	Urban	75	65	76	84
	Rural	64	62	63	68
	U + R	68	62	65	77
Fat (g)	Urban	78	60	81	92
	Rural	48	38	46	61
	U + R	58	40	55	80

1992

The average protein consumption was 68g per reference person per day. The urban people consumed 11g/ day more than the rural, and the rich group consumed 15g/ day more than the poor. Protein consumption increased in line with household income for both urban and rural inhabitants, but

was more obvious in the urban communities.

Fat intake was positively correlated with income. The high income group consumed twice the amount of the low income group. Urban inhabitants had significantly higher fat intakes than rural people in all comparable groups.

The dietary patterns of urban and rural populations are shown in Table 2. Cereals provided 66.8% of the dietary energy on average. Food from animal sources provided only 9.3%. The urban population consumed fewer cereals but more animal food. Dietary fat contributed 28.4% and 18.6% of total energy for urban and rural people respectively. The urban population obtained 37.3% of their protein from animal food and legumes, but it was only 17.2% for rural people. Cereals provided 61.6% of the dietary protein on average.

**Table 2.** Dietary Pattern by Urban and Rural (% of dietary total)

		Urban	Rural	U + R
Energy by: food groups	Cereals	57.4	71.7	66.8
	Legumes	2.1	1.7	1.8
	Starch Tubers	1.7	3.9	3.1
	Animal Food	15.2	6.2	9.3
	Empty kcal	14.3	10.2	11.6
	Miscellaneous	9.4	6.4	7.4
Energy by nutrients:	Protein	12.7	11.3	11.8
	Fat	28.4	18.6	22.0
Protein by: food groups	Cereals	48.8	68.3	61.6
	Legumes	5.8	4.8	5.1
	Animal food	31.5	12.4	18.9
	Miscellaneous	14.0	14.6	14.1

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### Physical development of children

Height and weight of children under 15 years old are listed in Table 3. The urban children are taller and heavier than rural children of both genders. Taking 6-year old children as an example, urban boys were 3.3 cm taller and 1.6 kg heavier than their rural peers, and urban girls were 3.0 cm taller and 1.6 kg heavier than the rural. The data showed some differences in height and weight between boys and girls, although they are much less obvious in comparison with urban and rural differences.

Height for age, weight for age and weight for height of children below 6-years old were evaluated in reference to NCHS, (National Center for Health Studies, USA) data (Table 4). The national mean was -1.38 Z score for height

**Table 3.** Physical Development of Children

Age (yrs)	Height (cm)				Weight (kg)			
	Male		Female		Male		Female	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
0-	69.7	68.1	68.0	66.7	8.7	8.2	7.9	7.6
1-	80.1	77.8	78.7	76.4	11.0	10.3	10.5	9.7
2-	88.0	85.5	87.8	84.7	12.8	12.2	12.5	11.7
3-	95.2	92.0	94.3	91.1	14.8	13.8	14.4	13.2
4-	102.3	98.6	99.8	97.5	16.7	15.3	15.8	14.9
5-	108.1	104.9	106.9	103.8	18.3	17.2	17.5	16.5
6-	113.5	110.2	112.6	109.6	20.7	19.1	20.0	18.4
7-	120.8	116.1	118.7	114.7	23.1	21.1	22.0	20.2
8-	125.7	121.3	124.9	120.1	26.0	23.1	24.9	22.3
9-	130.7	126.0	130.7	125.5	29.3	25.3	28.3	24.6
10-	136.5	130.9	135.7	130.3	31.5	27.6	31.0	27.1
11-	141.3	135.1	141.9	135.5	34.8	30.1	34.2	30.0
12-	146.1	140.4	147.9	141.3	38.0	33.2	40.5	34.1
13-	154.3	147.6	152.0	146.7	44.1	38.7	43.2	39.1
14- <15	158.7	152.9	154.9	150.6	49.3	42.4	46.4	43.2

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for age, -0.89 for weight for age and -0.05 for weight for height. Using the  $< -2$  Z score as the cutoff for undernutrition, 19.8% of urban children and 35.7% of rural children were short of stature and 9.9% of urban and 19.6% of rural subjects were underweight.

**Table 4.** Evaluation of Physical Development of Chinese preschool children with reference to NCHS data

		Urban 1502	Rural 6479	U+R 7981*
Height for age	Z score mean	-0.80	-1.53	-1.38
	$< -2$ (**%)	19.8	35.7	32.6
	$> 2$ (%)	3.5	1.3	1.8
Weight for age	Z score mean	-0.44	-1.00	-0.89
	$< -2$ (%)	9.9	19.6	17.7
	$> 2$ (%)	3.7	1.7	2.1
Weight for height	Z score mean	0.09	-0.08	-0.05
	$< -2$ (%)	2.9	3.6	3.5
	$> 2$ (%)	5.8	4.1	4.4

\*number of total subjects \*\*percent of subjects in this category

Weight for height presented a different picture from the above statistics. The proportions of children exceeding the 2 Z score are bigger than those under the -2 Z score in both urban and rural groups.

#### Physical stature of adults

The weight and height of people over 20 years old are listed in Table 5 by 10 year groupings. The average heights of urban male groups were from 168.5cm in the youngest down to 162.2cm in the oldest, and the rural male groups were from 165.6cm to 159.1cm. The difference between urban and rural was about 3 cm in all the corresponding age groups. The comparisons within female groups were similar to those within the male groups, and urban groups were around 2.5 cm taller than their rural peer groups.

**Table 5.** Physical status of adults 1992

Age (Yr)	Urban			Rural		
	N	Ht (cm)	Wt (kg)	N	Ht (cm)	Wt (kg)
<b>Male</b>						
20-	1778	168.5	61.2	4601	165.4	58.1
30-	1820	168.1	63.9	3734	165.6	59.5
40-	1552	167.6	65.1	3161	164.5	59.4
50-	1465	166.0	64.4	2238	163.4	57.3
60-	1052	164.8	63.9	1500	162.2	55.6
70-	345	163.5	60.8	567	160.7	53.2
80-	69	162.2	56.3	101	159.1	50.0
<b>Female</b>						
20-	2061	157.2	53.0	5618	154.9	51.7
30-	2261	156.8	55.9	4436	154.5	52.6
40-	1858	156.3	58.1	3501	153.5	52.9
50-	1658	154.8	58.3	2223	152.1	51.0
60-	1013	152.8	56.6	1389	150.4	48.3
70-	345	150.5	52.5	525	148.0	44.8
80-	114	150.3	49.1	129	146.2	42.1

The distribution of body weight by age groups was different from height. The heaviest figures were presented

by the 40-49 year-old groups with the exception of the urban female 50-59 year-old group. The urban groups were heavier than rural by 3.1- 8.3kg for males and 1.3- 8.3kg for females. The largest difference was found in the 60-69 year-old groups of both male and female populations.

The mean values of body mass index (BMI) are shown in Table 6. The middle-age groups presented higher figures than the younger and elderly ones. This was true for both male and female but more obvious in urban populations. The mean BMI of urban people was higher than rural in all comparable age and gender groups except the 20-29 year-old females.

**Table 6.** Mean body mass index of Chinese populations (kg/m<sup>2</sup>) 1992

Age (year)	Urban		Rural	
	Male	Female	Male	Female
20-	21.5	21.4	21.2	21.5
30-	22.6	22.7	21.7	22.0
40-	23.2	23.8	21.9	22.5
50-	23.4	24.3	21.5	22.0
60-	23.5	24.2	21.1	21.3
70-	22.7	23.2	20.6	20.5
80-	21.4	21.7	19.7	19.7

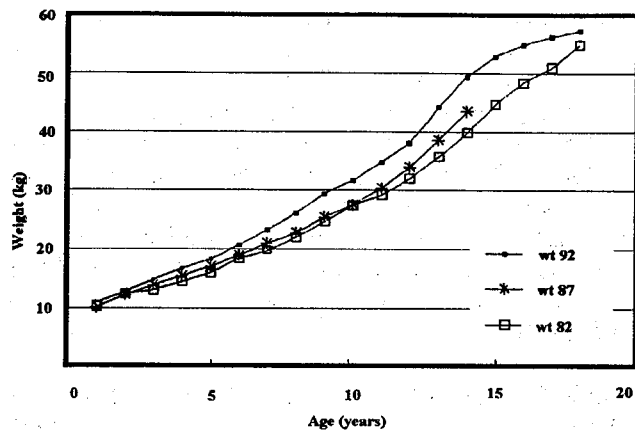
#### Discussion

Notable changes in dietary pattern have occurred in China during the last decade. The dietary energy from grains was reduced from 71% to 60% in urban and from 87% to 82% in rural. The energy from fat increased from 26% to as much as 30% in urban and from 13% to 15% in rural<sup>4</sup>. In 1992, the energy from cereals was further reduced to 57% in urban and 72% in rural and fat contributed 19% of the dietary energy for rural populations. The total grain consumption and the national average of dietary energy consumption per capita have remained at about the same levels since the mid- 1980s. It is recognized that the food security problem has been solved nationally<sup>5</sup>. The change of dietary pattern in recent years indicates improvement in people's living conditions.

In association with the dietary changes, the physical development of children showed improvement in both urban and rural populations. The average weight of a 10 year-old urban boy rose from 27.3 kg in 1982 to 31.5 kg in 1992. Figure 1 illustrates the changes in body weight of urban boys during these ten years. Girls present a similar picture to boys. The rural children showed the same trends although they were smaller in comparison to their urban peers. A 10 year-old rural boy averaged 25.4 kg in 1982 and 27.6 kg in 1992. The difference between urban and rural is substantial. Therefore, rural children should receive more attention in food supply and health care.

Based on data gathered between 1980 and 1992 in 79 developing countries, more than a third of the children under five years-old are affected by protein-energy malnutrition, and about 43% of children are stunted<sup>6</sup>. China is moderately affected. The prevalence of stunting was 32.6%, (urban 19.8%, rural 35.7%), and of being underweight was 17.7% (urban 9.9%, rural 19.6%) as observed in this survey.

Figure 1. Body weight changes of urban boys (1982-1992)



Data collected from African countries indicate that the estimated amount of food possessed by individual countries correlates with the prevalence of underweight children<sup>7</sup>. The continuous increase of food production and per capita food availability in China must be contributory to the better growth of children in the past ten years.

For assessing the health status of adults, BMI has long been used in connection with the risk of mortality<sup>8</sup>. The International Dietary Energy Consultative Group presented evidence for using BMI to define chronic energy deficiency (CED) and proposed 18.5 as the cutoff<sup>9</sup>. This has been further validated by Ferro-Luzzi et al. in 1992<sup>10</sup>. Based on the 1992 survey, we would say that BMI of young adults aged 20-45 years may well reflect the nutritional status of given populations, and reflect their dietary changes.

The mean BMI of urban young adults was 21.9 for male and 22.2 for female. In the rural population it was 21.4 and 21.7 respectively. The urban groups were significantly higher than the rural ( $p < 0.01$ ). Their dietary adequacy in energy and protein intake (percentage of RDA) is well in line with the BMI differences. Urban inhabitants consumed 99.8% of RDA for energy and 95.7% of RDA for protein. Rural people had 95.7% and 85.9% respectively. Fat calories accounted for 28.4% of total energy of the urban diet, and 18.6% of the rural diet.

Analysis of BMI distribution along with some dietary factors of individual provinces revealed that the increase in percentage of CED among rural inhabitants is inversely correlated with dietary energy ( $r = -0.449$   $p = 0.017$ ). The increase in percentage of overweight people is positively correlated with fat energy expressed as percentage of total dietary energy ( $r = 0.443$   $p = 0.018$ )<sup>11</sup>.

The overall urban percentage of CED (BMI < 18.5) was 11.6 in 1982 and declined to 10.1 in 1989. The percentages for rural were 12.9 and 7.7 respectively<sup>12</sup>. In 1992, it

was further reduced to 9.0 for urban and remained at 8.0 for rural people. The trend for overweightness (BMI > 25) was the reverse of the CED trend. The percentages increased from 9.7 in 1982 to 14.9 in 1992 for urban, and from 6.1 to 8.4 in the same period for rural. Again, these changes in BMI agree well with the trends in food production and average per capita food consumption during these years.

### Summary

Based on the information gathered in the 1992 Chinese national nutrition survey, the energy consumption on average is about adequate for the entire population. Dietary protein and fat have increased, and now provide 11.8% and 22.0%, respectively, of the dietary total energy. The adequacy of nutrient intake, expressed as percentages of RDA, is higher for urban population than for rural, and higher for high income groups than for poor.

Child growth has improved substantially compared to ten years ago. However, there are still 32.6% preschool children with stunted growth and 17.7% are underweight. Rural children have a higher incidence of chronic energy deficiency (CED) than their urban counterparts.

Chronic energy deficiency (BMI < 18.5) in adults was 9.0% for urban, 8.0% for rural, but overweight was 14.9% and 8.4% respectively.

The improvement in child growth and the increase of overweight adults are in line with the country's overall food production and the population average of food consumption. The differences in nutritional status between urban and rural deserve more attention.

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## 中国人群的膳食模式与体格发育

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### 摘要:

本文是根据1992年全国营养调查的资料所作的初步分析。该次调查涉及30个省、市、自治区的约2.5万户,共十万人。结果表明全国平均热量摄入已达适宜水平,蛋白质和脂肪摄入较1982年增加,分别占膳食总热能的11.8和22.0%。用占RDA百分比来表示营养素摄入量,则城市高于农村,高收入组高于较贫穷组。儿童生长情况与10年前相比已有明显改善,但仍有32.6%的6岁以下儿童身高不足,17.7%体重过低;城市与农村差别显著。成人中慢性热能缺乏(BMI<18.5)在城区占9.0%,农村占8.0%,但超体重者(BMI>25)城市和农村中分别占14.9%和8.4%。此种BMI的城乡差别与膳食热能和蛋白质的消费十分一致。儿童生长改善与成人中超体重者增多与国家食物生产总量增长,及平均每人食物消费量的增加趋势相一致。城乡间在膳食摄入、营养状况及体格发育方向的差别应受到重视。

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