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The Current Status, Trend, and Influencing Factors to Malnutrition of Infants and Children in China

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ABSTRACT

Children are the most nutrition sensitive sub-group of a population. The nutritional status of children should be especially emphasized at all levels. This study was performed to investigate the current status, trend, and influencing factors to malnutrition of infants and children in China. The study was mainly based on the China Health and Nutrition Survey which is a longitudinal study conducted in 8 provinces and the data on growth of children under 7 years of age in 9 cities in China. The result of this study showed that one fifth of the children under 5 years of age are still suffering from stunted growth and one tenth suffering from underweight. The nutrition intervention on children under 2 years of age, especially on those under 18 months should be emphasized. Better supplementary food can improve the nutritional status to decrease the prevalence of stunted children. Therefore, the development of supplementary food should be the priority and should be emphasized with breastfeeding. (*J Community Nutrition* 6(2) : 78~85, 2004)

KEY WORDS : infant and child · malnutrition.

Introduction

Children are the most nutrition sensitive sub-group of a population. It is generally accepted that there is a high death rate in children with severe forms of malnutrition. But data available from the WHO database indicated that even the moderate and mild forms of malnutrition also contribute to the high death rate in children and 55% of death are related to malnutrition. Malnutrition affects not only the physical growth, but also brain and mental development of children. The learning capacity and activity, and productivity in adulthood are all closely related to the nutritional status of childhood. Furthermore, malnutrition in childhood contributes to the increase of risks in non-communicable diseases such as cardiovascular diseases and diabetes mellitus in adulthood(Complementary food practice in developing countries 1996). Therefore, the nutritional status of children should be especially emphasized at all levels.

It should be mentioned that the more research work on child physical growths and mental developments have been done in recent years in China.

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Current Status of Growth and Development of Infants and Children in China

The China Health and Nutrition Survey is a longitudinal study being conducted in 8 provinces(Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou). The first round of surveys was conducted in 2000 and the results showed that the prevalence of underweight children under 5 years of age was 3.2% in urban areas and 7.4% in rural areas. Similarly, the prevalence of stunted children was 3.2% and 13.5% respectively. The WHO recommended reference in 1978 was used to define underweight and stunted children.

The data from a survey on physical fitness of children conducted in 1995 in China revealed that the heights and weights were higher in boys than in girls. There was an evidently statistical significance of differences on weight and height between urban and rural boys under 4 months and

above, and a similar result was observed in the girls under 5 months. The physical developmental of children in central China (Nanjing, Shanghai, and Wunan cities) and northern China (Habin, Beijing, and Xi'an cities) was similar. But averages of weight and height of children in these parts in China were obviously higher than those in southern China (Guangzhou, Fuzhou, and Kunming cities) (Union Publishing House of Beijing Medical University and Peking Union Medical University).

The comparison of weight-for-height data of children in nine cities in China in 1995 with WHO recommended reference showed that the weight of children under 70cm height groups were close to those of WHO reference, but were lower than the weight of children above 70cm height groups for 0.2 - 0.6kg (Table 1) (Union Publishing House of Beijing Medical University and Peking Union Medical University 1997).

The data from 1998 National Food and Nutrition Surveillance showed that there was no statistically significant difference between the mean of height of children under 0 - 3 months and that of WHO reference. But the prevalence of stunting of rural children under 0 - 3 months was 11.6%.

The Fig. 1 shows that in the rural area, the highest prevalence of stunting occurred in children from 18 to 21 months. The prevalence was 23.7% in children from 12 to 15 months, but the prevalence curve became flatter, and maintained between 20 - 25% when children reached 24 months. In urban areas, the highest prevalence of stunting occurred in children from 18 to 21 months, and then it became persistent afterward.

The Fig. 2. shows that the prevalence of underweight children under 0 - 3 months was low, being 1.2% for urban and 0.9% for rural. But there was a sharp increase of pre-valence of underweight children above 6 months, being 9.3% in children from 6 to 9 months and reaching the highest (17.9%) in children from 12 to 15 months, and then it became persistent in children after 18 months until 5 years of age, being between 12 - 15%. The prevalence of underweight of urban children in all age groups was within 1.2 - 3.5% in 1998 (Chang 2000).

It is noticed that there is a regional disparity in nutritional status of children in China. The individual prevalence in regions regarding severity in malnutrition in poor areas was used to be covered by their national average.

In poor areas such as Qingxi County in Guangxi Province and Guangnan County in Yunnan Province, the prevalence of underweight children under 5 years of age was at 30%, being twice the national average. The same prevalence in children under 5 years of age was at 30% and above, reaching as high as 65% in Wuning County in Jiangxi Province, Nanxiong County in Guangdong Province, Qingxi County in Guangxi Province, Menyuan County in Qinghai Province and Guangnan County in Yunnan Province. Therefore, the nutritional status of children in poor areas should be especially emphasized at all levels (Chang 2000).

Table 1. The comparison of weight-for- height standard of children in nine cities in China with WHO criteria

	Male		Female	
Height (cm)	WHO	Nine cities	WHO	Nine cities
50	3.3	3.3	3.4	3.3
60	6.0	6.2	6.0	6.0
70	8.8	8.8	8.6	8.4
80	11.0	10.7	10.8	10.3
90	13.3	12.8	12.9	12.5
100	15.7	15.3	15.4	15.1
110	18.7	18.1	18.2	17.9
119	21.8	21.4	21.4	21.2

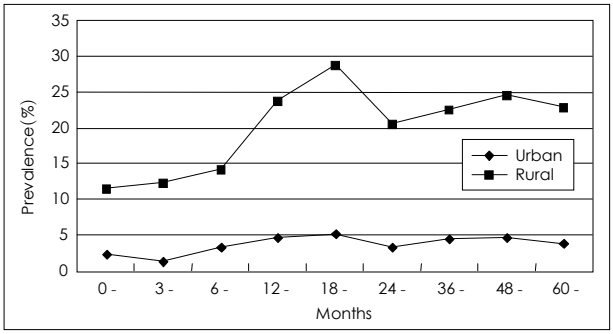

Fig. 1. The prevalence of stunting among children of different age group (1998).

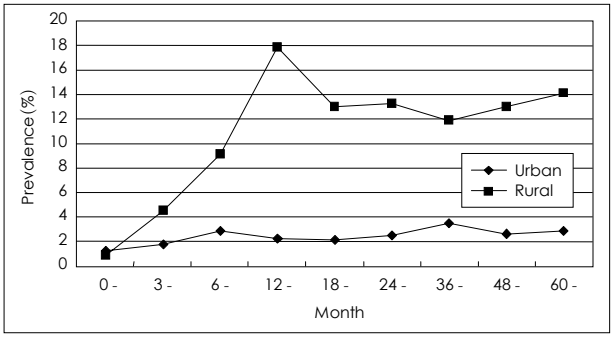

Fig. 2. The prevalence of underweight among children of different age groups (1998).

Trend of Malnutrition in Children Aged Under Five in China

The data from the China Health and Nutrition Survey conducted in 8 provinces in China in 1989, 1991, 1993, 1997 and 2000 provided the information on the trend of childhood growth and development in this study. Table 2 shows that there is a sustainable decrease in the prevalence of underweight of children under 5 years of age in 8 provinces, from 10.77% in 1989 to 3.20% in 2000 in urban areas and from 14.59% to 7.40% in rural areas. The Z-score in urban areas decreased from - 0.36 to 0.32 and from - 0.71 to - 0.35 in rural areas.

Table 3. shows the changes in the prevalence of stunting of children under 5 years of age in 8 provinces in China. The prevalence decreased from 16.94% in 1989 to 3.20% in 2000 in urban areas and from 29.85% to 13.50% in rural areas in the same period. Similarly, the Z-score decreased from - 0.72 to 0.54 and - 1.28 to - 0.27 respectively.

According to the data from the survey on physical fitness of children under 7 years of age in 9 cities in China in 1995, there was an increase in weight and height in all ages, in both sex groups and in both urban and rural areas in 1995 compared to those obtained from the survey in 1985. This change was characterized by the increase in weight and height consistent with the age increase.

Table 2. The prevalence of underweight(WAZ < - 2) of children under 5 in 8 provinces from 1989 to 2000

Year	Underweight(%)		Z score	
	Urban	Rural	Urban	Rural
1989	10.77	14.59	- 0.36	- 0.71
1991	9.80	17.78	- 0.54	- 0.87
1993	8.87	10.07	- 0.38	- 0.51
1997	4.58	10.38	- 0.14	- 0.55
2000	3.20	7.40	0.32	- 0.35

Table 3. The prevalence of stunting(HAZ < - 2) children under 5 in 8 provinces from 1989 to 2000

	Stunting(%)		Z score	
	Urban	Rural	Urban	Rural
1989	16.94	29.58	- 0.72	- 1.28
1991	18.92	31.37	- 0.89	- 1.36
1993	14.50	27.09	- 0.66	- 1.22
1997	12.88	20.38	- 0.54	- 1.08
2000	3.20	13.50	0.54	- 0.27

There was a continual increase in weight and height of children in 9 cities in China from 1975 to 1995 showing an upward-trend. The magnitude of increase in weight and height in the majority of age groups in the last 10 years was greater than was shown in the first 10 years, which is indicating much improvement in children's development in China between 1985 and 1995(Table 4).

Although there was a statistically significant difference in the weight and height of children in the majority of age groups between urban areas and outskirts, the difference became smaller in comparison with those in 1975 and 1985(Table 5)(Union Publishing House of Beijing Medical University and Peking Union Medical University).

The data on growth of children under 7 years of age in 9 cities in China in comparison with external data showed that development of children is in a persist increasing phase, approaching and catching up with the level of that of children in developed countries. At present, Chinese children are still shorter compared with those in the US and slimmer than those in Japan. Will the difference in physique in race disappear at last along with the changes in environment? To an individual nationality, will the regional and urban-outskirts differences be everlasting or disappear at last? The data from the survey in 9 cities showed a progressive reduction in differences. The urban-outskirts difference was very small in new-born babies. The difference between southern and northern China

Table 4. The increase in height and weight in children aged 6 - 7 yrs in two 10-year periods(1975 - 1985 and 1985 - 1995)

	Height(cm)		Weight(kg)	
	1975 - 1985	1985 - 1995	1975 - 1985	1985 - 1995
Urban male	1.5(1.31)	1.7(1.46)	0.56(2.90)	1.16(5.85)
Urban female	1.2(1.05)	2.0(1.74)	0.41(2.20)	1.28(6.70)
Rural male	2.0(1.82)	2.5(2.24)	0.23(1.27)	0.99(5.40)
Rural female	2.3(2.11)	2.2(1.98)	0.39(2.22)	0.82(4.58)

* : Increasing rate in the parentheses

Table 5. The comparison between city and suburb boys in height and weight in 9 cities in China from 1975 to 1995

	The difference of weight(kg)			The difference of height(cm)		
Age	1975	1985	1995	1975	1985	1995
0 - 3 day	0.05	- 0.01	0.03	0.4	0.0	0.1
6 - 8 month	0.43	0.34	0.28	1.3	1.1	0.9
12 - 15 month	0.69	0.53	0.44	1.9	1.6	1.2
3 - 3.5 year	0.52	0.52	0.57	3.3	2.6	2.5
5 - 5.5 year	0.8	0.93	1.17	3.3	3.3	3.0
6.0 - 7.0 year	1.14	1.47	1.64	4.9	4.4	3.6

was obvious in new-born babies. The reduction in urban-outskirts difference was obvious to that those living in the different regions. Therefore, we infer that the urban-outskirts difference will reduce further along with the improvement in living standards, but the regional difference will still persistently exist in a lengthy amount of time(Union Publishing House of Beijing Medical University and Peking Union Medical University 1997).

The Contributing Factors to the Children's Development

The nutritional status, socio-economic status and household factors are the main factors contributing to the children's development. But any single factor could not be used to explain the long-term change in the children's development because it resulted in a long-time effect of multiple factors combined.

1. Nutrition is the physical foundation and is crucial to the children's development

The following is the analysis on the breastfeeding rate in infants under 4 months, supplementary food practice in children from 4 months to 2 years of age, and the change in dietary pattern of children from 2 to 5 years of age showing the improvement in diet and nutritional status in Chinese infants and children.

1) Breastfeeding

The statistics on exclusive breastfeeding is shown in Table 6. The breastfeeding rate in urban infants under 4 months was increased from 19.3% to 50.4%. Similarly, it was increased from 33.5% to 56.9% in rural areas. The increase in breastfeeding rate exerts obvious impact on development of infants. According to the data from nutrition surveillance in 1998, the prevalence of stunting was 8% in rural infants under 4 months who were breastfed, while it was 15.73% in those not being breastfed($p < 0.05$).

Table 6. Breastfeeding rate of children within 4 months of age

	Urban		Rural	
Month	1992	1998	1992	1998
0	33.6	63.6	51.1	61.1
1	21.1	64.3	37.6	60.0
2	16.1	55.3	31.3	57.8
3	14.3	37.5	24.3	53.7
Average	19.3	50.4	33.5	56.9

2) Supplementary food

It is widely accepted that the first two years is the key period for the development of children. If careful feeding is available, children who were premature, underweight and malnourished could catch up to those that normally developed before reaching 2 years of age. Furthermore, the key periods for the brain development are the late pregnancy period and the first year after delivery. In these periods, the brain cells massively proliferate. Malnutrition in these periods would result in the massive reduction of brain cells and ir-reversible brain injury(Chief Edi : Ye 1999).

Children in these periods are usually susceptible to malnutrition because the growth can not be maintained by only breast feeding and supplementary semi-solid food should be provided for infants aged 4 - 6 months or more.

The data from food and nutrition surveillance showed that the rate of introducing semisolid foods in all-month groups in urban areas was greater than that in rural areas.

For infants 4 - 6 months old, the rate of introducing fruits and vegetables in the infant's diet in urban areas was 74.6%, but was 28% in rural areas, and the rate was even smaller in poor rural areas. The feeding rate of starchy food was greater in poor rural areas.

Further analysis showed that there was no correlation between the amount of starchy food fed and infants' growth. Within one year, data from each survey spots showed that the more infants on supplementary semi-solid was associated with higher HAZ and WAZ averages. The more infants fed semi-solid animal food showed positive height and weight gain(Table 7).

For infants, especially those living in rural and poor rural areas in China as an example the weight gain curve in children between 0 - 4 months was close to what WHO recommended, showing a sharp increase, but after 4 - 5 months, the curve became flattened. On the contrary, the same curve maintained showing a sharp increase in children after 4 - 5 months in developed countries. This is mainly due to the

Table 7. Correlation coefficient between HAZ/WAZ and complementary food rate of children

	HAZ		WAZ	
Month	Fruit/Veg.	Egg/Fish/Meat	Fruit/Veg.	Egg/Fish/Meat
4 - 6	0.40	0.42	0.31	0.37
6 - 12	0.45	0.47	0.30	0.35
12 - 18	0.25	0.45	0.06	0.25
18 - 24	0.26	0.47	0.24	0.40

poor quantity and quality of supplementary food practice in China.

The analysis on current status of development of children in all-age groups in China showed that the decrease in the prevalence of malnutrition in children of 6 - 18 months could, to a great extent, contribute to bringing them to the normal growth of children under 5 years of age, and those 6 - 18 months were just the period for supplementary food. Therefore, introducing semi-solid food on time is a key factor in reducing the prevalence of malnutrition of children from 6 to 18 months and those under 5 years of age in China.

3) The dietary intake of children of 2 - 5years of age

The results from many investigations showed that in both underdeveloped and developing countries, the energy intake plays an important role in the long-term development of children. If the nutritional status and energy intakes were improved, the increase in percentage of energy intake from animal protein then became a key contributor to the development of children. Takahashi(1966) observed that from early 1950s to the mid 1996s, the height gain in Japanese children was consistent with the consumption of milk and eggs and the correlation coefficient was 0.76 for male and 0.66 for female. In the recent 10 years, there was little change in total energy intake in Japanese children, but the percentage of energy from protein of animal origin increased many folds (Ye 1999).

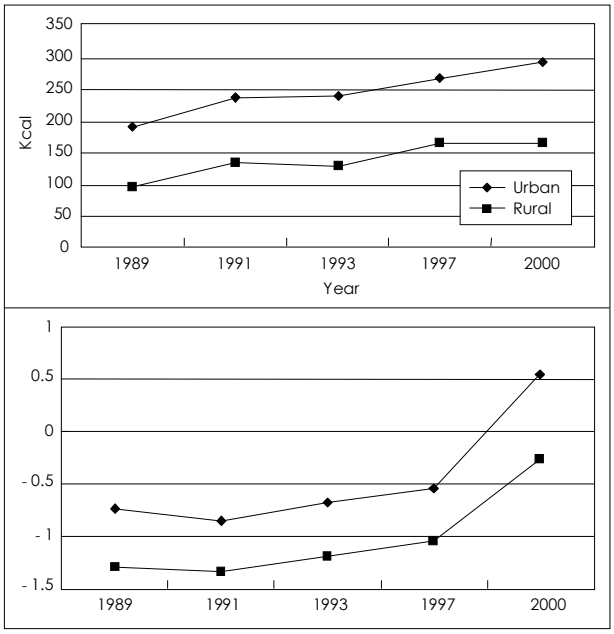

Fig. 3. Trends of Energy Supply from animal Sources and Mean Z Score of Children in 8 Provinces in China.

The data from the China Health and Nutrition Survey in China showed the height gain of children was positively correlated with the percentage of energy from animal food(Fig. 3).

The analysis of data from 1992 National Nutrition Survey on the status of development and dietary practice of children of 2 - 5 years of age showed that the intake of energy, protein, fat, retinal, flacon, calcium and zinc in group of children of WAZ < = - 2 and HAZ < = - 2 was lower than that in group of children of WAZ > - 2 and HAZ > - 2(Figs. 4 and 5).

2. The change in socio-economic status ranks the second important factor to child development.

It indirectly affects the children's development via adequate nutrition, supplying safe water, providing health service and managing diseases.

These all reflect the impact of GNP, productivity of industry and agriculture on the children's development.

Safe water supply is important for evaluating the households' environment and exerts some impact to the children's growth. The data from the China Health and Nutrition Survey showed that the percentage of population supplied with safe water was negatively correlated with the prevalence of malnutrition. The 1992 national nutrition survey revealed that the percentage of rural population that has access to safe water was 16%. The 1998 Food and Nutrition Surveillance revealed that the percentage of children who drank safe water which is 36%, was showing an evident improvement in safe water supply compared with that in 1992.

Diarrhea is one of the main contributing factors to the malnutrition and development of children in developing countries. Frequent diarrhea leads to the loss of appetite and disturbance of nutrient absorption. Long-term diarrhea that is usually

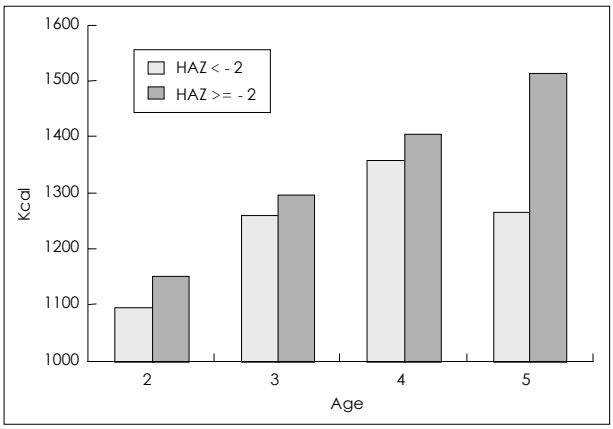

Fig. 4. The comparison of energy intakes between children of HAZ < - 2 and HAZ >= - 2 (2 - 5 years).

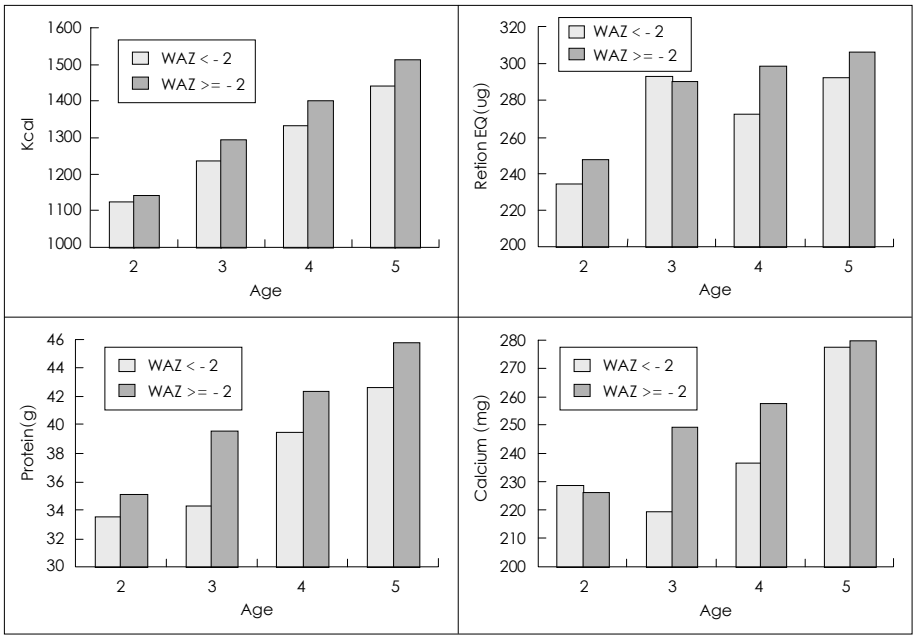

Fig. 5. The comparison of nutrients intake between children of WAZ < - 2 and WAZ >= - 2 (2 - 5 years).

Table 8. Diarrhea weeks and child growth

Month	Diarrhea	Weight	Height	WAZ	HAZ
<24	Yes	8.7	70.7	- 0.367	- 0.809
	No	9.43	73.9	- 0.187	- 0.531
24 - 72	Yes	14.14	94.6	- 0.981	- 1.163
	No	15.2	98.2	- 0.619	- 0.777

Table 9. Prevalence of diarrhea of children under 5 from 1990 - 1998(%)

Year	Urban	Rural
1990	9.4	13.0
1992	6.7	10.7
1995	6.4	9.0
1998	4.3	7.0

accompanied by fever causes a loss of many nutrients within the body and therefore hampers the growth and development of children. Robert(1984) once pointed out that the Z scores for height and weight of children under 2 years of age was a reliable anthropometric parameter in determining time length of diarrhea.

Wasted children had diarrhea for a relatively longer time period. The 1998 Food and Nutrition Surveillance revealed that the averages of weight and height, and the average of weight-for-age(WAZ) and height-for-age(HAZ) were all negatively associated with diarrhea. The average Z score in the group of children suffering from diarrhea was lower than that of children who did not(Table 8).

An obvious reduction in diarrhea onset between 1990 and 1998 is shown in Table 9.

3. Household factors contributing to the children's development

The household factors play an important role in children's development and they are usually indicated by social status. The social status is determined by many factors such as household income, profession of parents, literacy of parents, family system, number of children in the family, the attitude of family members to the health care, living conditions and dietary practice(Ebrahim et al. 1982). The data available showed that children from households with higher social status were taller than those from households with lower social status showing a statistically significance difference even excluding some confounding factors such as the height of mothers(Goldstein 1971).

1) Mothers' education levels

A survey conducted in 1987 revealed that even in the average income above 1000 renminbi(yuan), the prevalence of stunted children whose mothers are illiterate was higher than that in those whose mothers finished high school(Ge et al. 1990). The 1998 Food and Nutrition Surveillance in China showed that the prevalence of underweight or stunting in those children whose mothers have finished high school or above was 14.3% and 28.9% respectively, but the prevalence in those whose mothers have just finished primary school was 20.2% and 40.8% respectively. The difference was 40%

Table 10. The literacy of mothers and nutritional status of children in rural in 1992

Literacy	Underweight(%)	Stunting(%)
Illiterate	22.8	44.9
Primary	20.2	40.8
Junior High	15.2	33.4
Senior High	13.6	28.5
College	14.3	28.9

Table 11. The change of literacy of mothers during 1992 - 1998

Literacy	Rural		Urban	
	1992	1998	1992	1998
Illiterate	22.5	7.4	3.3	2.7
Primary	40.4	34.6	7.8	7.8
Junior High	31.6	49.5	27.9	27.9
Senior High	5.0	7.5	34.6	34.6
College	0.4	0.9	27.1	27.1

(Table 10) and was obviously statistically significant($p < 0.05$). It is noted that the literacy of mothers obviously increased in 1998 compared with that in 1992(Table 11).

The literacy of mothers increases along with the economic development and changes in living standard. The reduction of family size, resulting from the implementation of family planning in China, also had a positive effect on children's development because the children acquired better care(Ye 1999).

No matter the social status of a household, the larger the family size, the more problems were noted with children's growth. It is just because the limitation of expanding household income and the energy and time period parents spent for child care. The children in a household with a large family size can only acquire and share limited physical and psychological support, and this would unavoidably lead to the disturbance in children's development(Ebrahim 1982).

Many investigations carried out abroad showed that the more time the mother spent for the care of their children, the better the children developed. The data from the survey conducted in 8 provinces and cities in 1991 showed that the more time the mother spent for the care of their children, the worse the children's dietary practice and nutritional status were. This may be due to what the women's income occupied as a considerable proportion in household income. Those who have jobs spent less time with their children compared to those without a job and who stayed home on a regular basis. Furthermore, the officially allowed time for staying at home for lactating is relatively longer in China. When this period was over, mothers started working again and the baby care would be taken by, for instance, grandparents, relatives, caretaker, etc. The time for baby care did not decrease, but the household income increased.

2) The household income

From 1990 to 1998, the rapid economic development resulted in an increase of average income per capita in rural areas from 990 to 2338 in 1995 and 3132(Yuan) Ren Min Bi in 1998(Chang 2000). Many investigations revealed that the increase of household income in rural areas had a positive impact on the children's development. But data from the survey conducted in 1992 showed that the impact of increase of household income on children's development was not quite evident in comparison with that of the literacy of mother and access to safe water. The prevalence of malnutrition decreases by 10% while household income increases per 100(Yuan) Ren Min Bi(Chang et al. 1996). This indicates that in order to lower the prevalence, more complementary measures should be taken.

Along with the economic development and social progress in recent years and due to the efforts made by the governmental agencies at different levels, such as the increase of fund and gain of aids from various international organizations and the development and implementation of outline on the development for children and other projects such as the reconstruction projects of water supply, poverty-relief project, maternal and child care projects and nutrition education projects etc. there were a lot of changes in contributing factors to the children's health. There is a progressive decrease in the prevalence of underweight of children in China and the prevalence of stunting decreases sharply.

Conclusion

Although there has been much improvement in children's nutritional status in China in recent years, one fifth of children under 5 years of age still are suffering from stunting, one tenth suffering from underweight and the same situation is even more serious in the poor areas in China.

The nutrition intervention on children under 2 years of age, especially on those under 18 months should be emphasized. The analysis on different age groups showed that the growth and development of children under 5 years of age will be in a large extent if the prevalence of malnutrition in infants under

18 months decreases.

The quality of semi-solid food introduced to infants should be improved to decrease the prevalence of stunted children as having better nutrition. Therefore, the development of supplementary foods for infants should be the first priority and should be emphasized with the breastfeeding. The nutrition education work should be enforced with some guidelines. Manuals should be developed in a contextualized way to promote household supplementary food preparing which can be practiced more easily.

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