Original Article

Relationship between child feeding practices and malnutrition in 7 remote and poor counties, P R China

Hong Zhou PhD[1], Xiao-Li Wang PhD[1], Fang Ye BSc[1], Xiaopei Lily Zeng BSc[2], Yan Wang DrPH[1]

[1]*Department of Child, adolescent and women's health, School of Public Health, Peking University, Beijing, China*
[2] *Trinity College, Duke University, Durham, NC, USA*

The World Health Organization reported that inappropriate feeding in children is responsible for one-third of the cases of malnutrition. This cross-sectional study aimed to determine the prevalence of malnutrition and identify the relationship between feeding practices and malnutrition in children below 5 years, in 7 remote and poor counties of China. A sample of 2201 children and 1978 caregivers were obtained with multistage cluster random sampling. A survey about feeding practices among the caregivers was implemented using a structured questionnaire, and the health status of children was evaluated using anthropometric measurements. We found 5 problems: first, high prevalence of stunting, underweight and wasting in children below 5 years old (19.3%, 13.1% and 5.5%); second, short duration of breastfeeding for children below 36 months; third, low prevalence of exclusive breastfeeding among children below 6 months of age and continued breastfeeding to 1 year (17.5% and 32.2%). Fourth, although most of the infants (81.1%) between 6 and 8 months of age were given complementary foods, some of the 6- to 8-month-old infants did not receive any complementary foods. Last, a higher prevalence of stunting among Chinese children who had never been breastfed, who had been breastfed for less than 1 year, or had been fed with semi-solid foods of poor quality. Therefore, we suggest that more programs to increase caregivers' feeding knowledge and practices be conducted, to improve the health of children in remote and poor areas in China.

Key Words: malnutrition, stunting, feeding practice, breast milk, complementary food

INTRODUCTION

Malnutrition is a major public health problem worldwide. It affects all age groups and populations, especially the poor and vulnerable ones.[1] Of the 10.4 million children below 5 years of age who die of preventable causes in developing countries each year, over 50% die of malnutrition.[2] Moreover, many infectious illness, particularly acute respiratory infection and diarrhea, are related to malnutrition.[3,4]

The World Health Organization (WHO) estimated that inappropriate feeding of infants and young children was responsible for one-third of the cases of malnutrition worldwide.[5] It has been recognized that inappropriate feeding practices include absence of exclusive breastfeeding in children below 6 months old, premature ablactation after 6 months, and giving complementary foods too late. Nakamori reported that incidence of underweight among non-exclusively breastfed children in the first 4 months was nearly 5 times that of breastfed children in Vietnam.[6] Brown found that giving supplementary foods too late could increase the probabilities of nutritional stunting.[7,8] Therefore, some intervention studies aimed at improving feeding practices were conducted in some areas with high a prevalence of malnutrition.[9] Lartey found that infant growth improved significantly in Honduras after nutritionally adequate and hygienic complementary foods were added to the infants' diet.[10] These researches showed that exclusive breastfeeding in children below 6 months, continued breastfeeding up to 2 years of age, and timely introduction of complementary food were essential for decreasing malnutrition.

A recent research on malnutrition among Chinese children in rural areas showed that 40% of the children below 5 year of age had malnutrition,[11] caused by communicable diseases, especially diarrheal diseases and respiratory infections. As a result, China Representative Office of UNICEF implemented "Local Action of Rural Children (LARC) Project" in 7 counties during 2007-2010. Surveys and interventions on feeding practices were a very important part of the project. Our research used the data collected in the baseline survey of LARC Project to determine the prevalence of malnutrition and to identify risk factors in feeding practices related to malnutrition in children below 5 years of age.

Corresponding Author: Dr Yan Wang, Department of Child, adolescent and woman's health, School of Public Health, Peking University, Xueyuan Road 38, Haidian District, Beijing, 100191, China.
Tel: +86-10-82801621; Fax: +86-10-62023133
Email: wangyan@bjmu.edu.cn
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Methods

Study areas and subjects

This research was based on the data of the LARC Project, which was conducted in 7 counties in remote and poor areas of China: Rongshui County of Guangxi, Hailin County of Heilongjiang, Chengbu County of Hunan, Tongxin County of Ningxia, Mao County of Sichuan, Hutubi County of Xinjiang and Huzhu County of Qinghai, as shown in Figure 1. The project covered a total population of 1,903,176 residents, including 102,039 children below 5 years of age. The average annual income per resident in the 7 project counties was much lower than the national average annual income per rural resident (2213 RMB vs 3587 RMB) (National Bureau of Statistics of China, 2006).

A multistage cluster random sampling technique was used for selecting subjects. In each county, the townships were divided into three strata based on their distances to the county center, and one township in each stratum was selected randomly. In each sample township, about five villages with different distances to the township center were selected. From each sample village, 20 caregivers of children below 5 years of age were selected based on their time of arrival at the survey site. If the selected village did not have sufficient subjects (20 caregivers), we selected another village randomly from the same level. The mothers or primary caregivers of the children were considered primary respondents to the feeding practice questionnaire. The children's body weight and length were measured. If a couple had more than one child below 5 years of age, all of them were measured.

Measurements

Children were measured bareheaded and barefoot for body length (for children aged 0 to 23 months), height (for children aged 24 to 59 months) and weight by two trained interviewers in each village health centers sampled. Each measurement was performed twice and the average was used for analysis. Length was measured to the nearest 0.1cm with the WB-A Length Meter (Wujin Weighing Apparatus Factory, Changzhou, China). Height was measured to the nearest 0.1 cm with the SH-2B Stadiometer (Wujin Weighing Apparatus Factory, Changzhou, China). Weight was measured to the nearest 0.1 kg with the scale TH521 (TH Leaguer Sensory Technology company, Shenzhen, China).

Weight-for-age (WAZ), length/height-for-age (HAZ) and weight-for-height (WHZ) were recommended by UNICEF and WHO as indicators of child nutritional status.[12] New criteria of the three z-scores were recommended as reference values by the WHO (2006) to evaluate malnutrition status: a z-score of HAZ below -2 is defined as stunting, a z-score of WAZ below -2 is defined as underweight, and z-score of WHZ below -2 is defined as wasting. Malnutrition is defined as a z-score below -2.

Questionnaire

Items about feeding practices in the questionnaire were selected from "Multiple indicator cluster survey manual" published by UNICEF.[13,14] Data for analysis were from the questionnaire and interviews with caregivers. All the interviewers were female healthcare providers from the county health centers. They were fluent in the local language. Before doing the fieldwork, all the interviewers had been trained to the same standard. All caregivers were asked to describe their feeding practices in detail, including the types of food given to their children in the past 24 hours.

Evaluating indicators of feeding practice[13,14]

Duration of breastfeeding: duration of breastfeeding is the median duration of breastfeeding among children less than 36 months of age. Exclusive breastfeeding rate: exclusive breastfeeding refers to the consumption of only breast milk by the infant during the 24 hours before investigation. The denominator is the number of babies below 6 months of age investigated. The numerator is the number of those having only been breastfed in the 24 hours before investigation.

Predominant breastfeeding rate below 6 months: this is the proportion of infants less than 6 months of age who are predominantly breastfed. The denominator is the

Figure 1. The sites of seven counties located in different regions of China.

number of babies below 6 months in the investigation. The numerator is the number of those receiving breast milk as the predominant source of nourishment during the previous day. Predominant breastfeeding allows ORS, vitamin, mineral supplements, ritual fluids, water and fruit juice. Other liquids, including non-human milks and food-based fluids, are not allowed, and no semi-solid or solid foods are allowed.

Continued breastfeeding rate at 1 year: proportion of children between 12 and 15 months of age who are fed with breast milk. The denominator is the number of babies 12-15 months of age in the investigation. The numerator is the number of children 12–15 months of age who received breast milk during the previous day.

Introduction of solid, semi-solid or soft foods: proportion of infants between 6 and 8 months of age who receive solid, semi-solid or soft foods. The denominator is the number of babies between 6 and 8 months of age in the investigation. The numerator is the number of those having received solid, semi-solid or soft foods during the previous day.

The Ethics Committee of Peking University Health Science Center approved the study before it was implemented.

Statistical analysis

Epidata 3.0 software package was used to set up the database, including data input and verification. SPSS 10.0 for Windows statistical software package was used to carry out all statistical analyses. Frequencies were calculated and the chi-square test or Fisher's exact test was used to examine the differences between different groups. The significance level was set at $p<0.05$.

RESULTS

Prevalence of malnutrition in children below 5 years old

The baseline survey interviewed 1978 caregivers of children below 5 years of age in 2007, who were considered primary respondents to the feeding practice questionnaire. At the same time, the baseline survey also measured the body weight and length/height of 2201 children below 5 years of age of interviewed caregivers in 2007. Results indicated that the prevalence of malnutrition (according to the WHO standard) among the children was 24.3%. The prevalence of stunting was 19.3%, while the prevalence of underweight and wasting was 13.1% and 5.5%, respectively. Therefore, stunting was the most significant problem for malnourished children below 5 years of age. Figure 2 show the prevalence of stunting, underweight and wasting by age, in months. The prevalence of stunting was higher than those of underweight and wasting. The prevalence of stunting among the children from birth to 11 months increased slightly with age, and the prevalence of stunting among the children above 12 months increased significantly with age and peaked at 25.4% among children between 24 and 35 months, and then decreased to 22.7% among the children between 48 and 59 months. This shows that the children between 12 and 59 months of age had a higher risk of stunting. The prevalence of underweight shows a linear increase among children of 0-59 months of age, from 5.6% among children age 0-5 months to the peak prevalence of 16.8% among the children aged 36-47 months, with a slight decrease among the children aged 48-59 months. The prevalence of wasting is much lower, with a peak value (8.0%) among children aged 6-11 months and was lowest (2.0%) among the children of 24-35 months. All the statistical analysis confirmed that stunting is the most prominent problem for the children below five years old.

Feeding practices and malnutrition

We investigated feeding practices of caregivers of children below 5 years during the 24 hours preceding the survey. All indicators were calculated according to the UNICEF criteria, including duration of breastfeeding, exclusive breastfeeding rate, predominant breastfeeding rate, continued breastfeeding rate at 1 year, and proportion of introduction of solid, semi-solid or soft foods.

In our study, the median duration of breastfeeding among children below 36 months was 12 months. Results showed that 50% of the children of 0–35 months in the project areas were no longer breastfed (ablactation) at 12 months. Figure 3 shows the cumulative rate of ablactation for children below 36 months. The ablactation rate

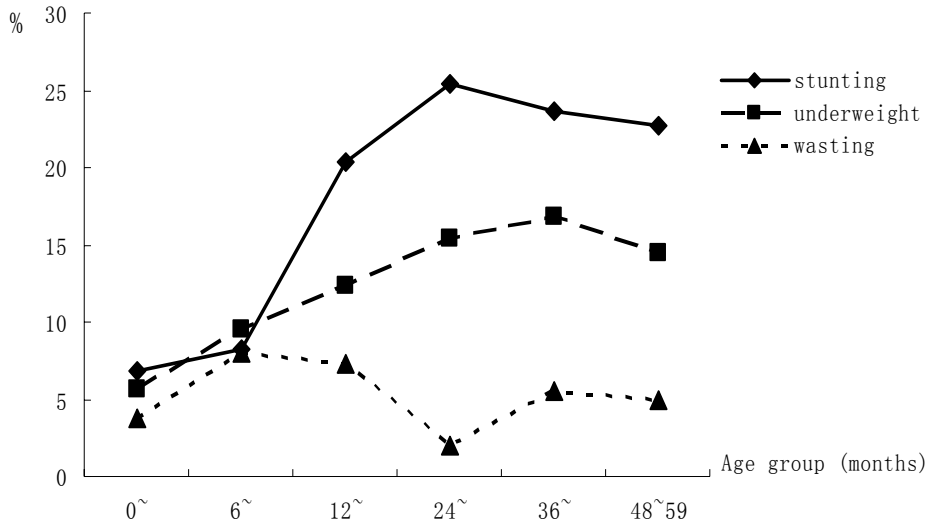

Figure 2. The prevalence of malnutrition in children (age in months)

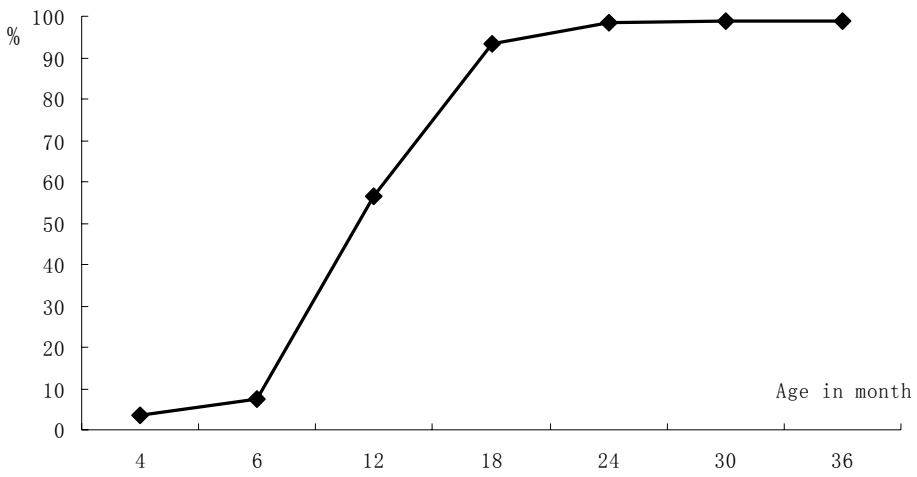

Figure 3. The cumulative ablactation rate of children below 36 months

Table 1. The breast feeding of the children below 6 months

Months	No of children below 6 months	Exclusive breastfeeding rate (%)*	Predominant breastfeeding rate (%)*
0-	4	50.0	75.0
1-	15	20.0	46.7
2-	26	34.6	69.2
3-	32	18.8	46.9
4-	40	15.0	30.0
5-6	49	6.1	16.3
Total	166	17.5	38.0

* p <0.05, the proportion decreased statistically significantly with increase of the age of children.

increased quickly among children from 6 to 18 months and leveled out at 93.3% among the children of 18 months.

This implies that the duration of breastfeeding was too short and ablactation was too early in the project areas. WHO and UNICEF's global recommendations for optimal duration of breastfeeding are: continued breastfeeding up to 2 years of age or beyond.[15]

The results showed that the percentage of exclusively breastfed babies was only 17.5% (Table 1). More women tend to exclusively breastfeed their baby after giving birth (50.0%). In contrast, among the babies aged from 5 to 6 months, the percentage of exclusive breastfeeding was much lower (6.1%). The proportion of exclusive breastfeeding decreased significantly with increase of the age of children (χ^2=8.549， p=0.003). The prevalence of stunting among the exclusive breastfed children below 6 months was lower than that of non-exclusively breastfed children (6.4% vs 9.1%), although the difference was not statistically significant (p=0.769). We further adjusted for the caregiver's age, sex, education level and economic status by multivariate analysis, but the difference in terms of the prevalence of stunting between the two groups did not change substantially (RR=0.713, 95%CI= 0.229-2.22).

The data also showed that the proportion of continued breastfeeding at 1 year was 32.2%. Children not receiving continued breastfeeding at 1 year had a higher prevalence of stunting (20.8%) compared to those receiving continued breastfeeding at 1 year (16.3%), although the difference was also not statistically significant (χ2=3.690, p=0.058).

Table 2 showed that the proportion of infants of 6-8 months receiving solid, semi-solid or soft foods was 81.1%. Further analysis found that the infants of 6-8 months receiving semi-solid food had a significantly higher prevalence of stunting (17.2%) compared to those not receiving semi-solid food (9.7%) (χ2=4.219, p=0.041). However, after adjusting for the caregiver's age, sex, education level and economic status by multivariate analysis, the difference of the prevalence of stunting between two groups became not statistically significant (RR=1.77, 95%CI= 0.799-3.06).

This indicates that there is a big problem with the quality of solid, semi-solid or soft foods received by the children in the remote and poor areas of China.

DISCUSSION

Many studies have shown that among the indicators measuring the growth of children, the stunting rate plays an important role in the growth and development of children. The sensitivity of this indicator reflects the state of growth in a timely and accurate manner. The results from this research showed high prevalence of stunting for children below 5 years of age (19.3%) and identified stunting as the main health problem for children in remote and poor areas of China. Stunting, mainly a consequence of long-term energy and protein absence, primarily reflects

Table 2. The complementary food of the children aged 6-8 months

Months	No. of children aged 6-8 months	The proportion of introduction of solid, semi-solid or soft foods (%)*	The proportion of non introduction of solid, semi-solid or soft foods (%)
6~	50	74.0	26.0
7~	61	80.3	19.7
8~9	54	88.7	11.3
Total	165	81.1	18.9

*P=0.052, the proportion did not increase statistically significantly with increase of the age of children.

the degree of chronic malnutrition in children.[16] Iron deficiency anemia and chronic malnutrition could seriously affect children's health. Chronic malnutrition reduces resistance and increases susceptibility to diseases, such as pneumonia and diarrhea. Moreover, it is more difficult for children with malnutrition to recover from illness. Even after survival, the children might suffer from poor health and a higher mortality rate. Therefore, future research should focus specifically on stunting.

During the first 6 months after birth, breast milk is the best food for children.[15] However, the percentage of exclusive breastfeeding during the first 6 months after birth in the project areas was quite low (17.5%). This situation may largely be related to cultural factors and educational factors.[17,18] A research study in Turkey showed a commonly held belief that colostrum, the "yellow, dirty milk", caused discomfort and jaundice for newborns, therefore removal of colostrum was considered as a tradition [19]. This misbelief on colostrum is also common in the project areas. Furthermore, the baseline survey also showed that the mothers in project areas, like mothers in other countries, introduced water too early to infants.[19-21] Water is unnecessary for early infants since pure breast milk consists of 90% water which can maintain water homeostasis of infants, even in summer when the temperature in the environment is high.[22] In fact, excessive water would reduce the intake volume of infants. Another important reason for low exclusive breastfeeding rates is that women experience both physical and emotional exhaustion shortly after giving birth. Some mothers found that bottle-feeding, which was manageable by other caregivers, gave them more free time and mobility.[23]

The present study observed a low prevalence of stunting (16.3%) among children who received continued breastfeeding. This suggests that breast milk could have a protective effect against stunting. This result is supported by other related research. An investigation conducted by Dewey showed that the growth rate among exclusively breastfed infants during the first 6 months in a low-income,[24] developing country was similar to that in developed countries. In addition, considering poor sanitation in the developing areas, complementary food could be polluted. Therefore, WHO suggest breastfeeding be greatly encouraged up to 2 years of age.

In addition, UNICEF recommends that in rural areas, apart from the mother's milk, nutritious complementary food should be added in the child's food from the sixth month. The benefits of appropriate complementary feeding for the child's nutritional status were reported in several studies. These studies showed that timely introduction of complementary foods at appropriate age might be the most cost-effective means of improving nutritional status in early childhood.[7,8] However, in the present study, the children receiving solid, semi-solid or soft food had higher prevalence of stunting and malnutrition. Moreover, the prevalence of stunting among children between 6 to 59 months increased, peaking at 25.4% between 24 and 35 months. This indicates that from the introduction of complementary food, the intake of calorie and protein of children is continuously insufficient, most prominent around the age of 2 years. The reason may be related to the poor quality of complementary foods, particularly in rural areas where complementary foods have traditionally been based on starchy gruels. Because the main food in rural China is grain, children are influenced by adult eating habits, also eat grain as the main food. Even though grain could provide most of the energy for children to grow and develop when there's not enough energy provided by grain, other food components, such as protein, will be transformed to energy as required by the body. However, these food components can not be used for anabolism and rebuilding of tissue, which results in low heights in children. Therefore, adding protein in the complementary food to a child's diet is the key intervention to improve child growth and development in the project areas.

The cross-sectional design limited the study to the analysis of association between malnutrition and duration, as well as the percentages of breastfed infants; and did not provide direct epidemiological inference for causality. Another limitation was the recall bias for collecting retrospective data in this study. Our data for feeding practices of children are based on caregivers' verbal reports of what they did, rather than observed behaviors. Under- or over-reporting of recommended practices in the field surveys cannot be excluded. However, our data present some useful information and urgent need for further nutritional study and interventions for children in the project areas, and other similar areas. Namely, high prevalence of stunting, underweight and wasting in children below 5 years old in project areas; short duration of breastfeeding for children below 36 months; low prevalence of exclusive breastfeeding among children below 6 months of age and continued breastfeeding to 1 year. In addition, some of the 6- to 8-month-old infants did not receive any complementary foods. Lastly, a higher prevalence of stunting among Chinese children who had never been breastfed, who had been breastfed for less than 1 year, or had been fed with semi-solid food of poor quality was observed. Therefore, we suggest that more programs to increase the caregivers' feeding knowledge and practices be conducted to improve the health of children in remote and poor areas in China.

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AUTHOR DISCLOSURES

None of the authors have a conflict of interest to disclose.

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Hong Zhou PhD[1], Xiao-Li Wang PhD[1], Fang Ye BSc[1], Xiaopei Lily Zeng BSc[2], Yan Wang DrPH[1]

[1] *Department of Child, adolescent and women's health, School of Public Health, Peking University, Beijing, 100191, China*
[2] *Trinity College, Duke University, Durham, NC, USA*

中国7个边远贫困县儿童的喂养行为与营养不良关系的研究

世界卫生组织报道大约有三分之一的儿童营养不良与不恰当的喂养行为有关。本研究通过现况调查了解中国 7 个偏远贫困地区的 5 岁以下儿童营养不良的发生情况，探索喂养行为与 5 岁以下儿童营养不良发生之间的关联。调查主要采用分层整群随机抽样方法获得样本，共完成了 1978 名 5 岁以下儿童看护人调查和 2201 名 5 岁以下儿童的身体检查。采用结构式问卷询问儿童看护人有关儿童的喂养行为，采用体格检查(身高、体重)来评价儿童的生长发育状况。调查主要发现了五方面的问题：第一，5 岁以下儿童中生长迟缓、低体重和消瘦的发生率较高(分别为 19.3%，13.1%和 5.5%)；第二，3 岁以下儿童中母乳喂养时间短；第三，6 个月以下儿童中纯母乳喂养率低(17.5%)、持续母乳喂养至儿童 1 周岁的比例较低(32.2%)；第四，6-8 月龄的儿童辅食添加率为 81.1%，说明被调查地区仍有接近五分之一的 6-8 个月龄儿童没有接受过任何辅食；第五，从未吃过母乳的、母乳喂养持续时间少于一年的、辅食添加质量有问题的儿童中出现生长迟缓的比例较高。因此，未来的项目干预应该重点关注儿童看护人的喂养知识和行为，以进一步改善中国偏远贫困地区儿童的健康状况。

关键词：营养不良、生长迟缓、喂养、母乳、辅食