Original Article

Comparison of Undernutrition Prevalence of Children under 5 Years in China between 2002 and 2013

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Abstract

Objective To describe the undernutrition status of children under 5-year in China, and study the trend between 2002 and 2013.

Methods The study was based on two national surveys. Undernutrition was determined against WHO's 2006 growth standards. The prevalence in 2013 and 2002 was weighted by China sixth National Population Census (2010). The relationship between undernutrition and gender/age groups/different areas use weighted logistic regression.

Results The results indicated the overall prevalence of stunting, underweight, and wasting of Chinese children under 5-year was 8.1%, 2.4%, and 1.9% in 2013, respectively. The prevalence of stunting was higher for children aged 12-47 month, while underweight was higher for children aged 48-59 month. The prevalence of undernutrition was higher in rural areas than in urban areas, especially in poor rural areas. There was a decline of stunting, underweight, and wasting between 2002 and 2013 among the children, with greater reduction in rural areas than in urban areas.

Conclusion The prevalence of undernutrition of children under 5-year remains high in rural areas especially in poor rural areas in China. It is urgent to take action to control undernutrition in the vulnerable areas and subgroups.

Key words: Undernutrition; Prevelence; Children under 5

Biomed Environ Sci, 2016; 29(3): 165-176 *doi: 10.3967/bes2016.021* *ISSN: 0895-3988*

www.besjournal.com (full text) *CN: 11-2816/Q*

INTRODUCTION

Undernutrition of children under five remains a public health challenge. Linear growth retardation (stunting) is highly prevalent worldwide[1]. Poor nutrition in the first 1000 days of life can lead to stunted growth, which is irreversible and associated with impaired cognitive development, and reduced school and work performance[2].

UNICEF, WHO, and the World Bank Group reported joint child malnutrition estimates in 2015. Child malnutrition is still a big global problem[2]. The *Lancet* series in 2013 presented a context of maternal and child underweight and overweight in low-income and middle-income countries. The prevalence of stunting is decreasing globally, but still affected at least 165 million children under 5 in 2011; while wasting affected at least 52 million children. It's estimated that undernutrition include fetal

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growth restriction, stunting, wasting, and deficiencies of vitamin A and zinc along with suboptimum breastfeeding may cause 3.1 million child deaths annually or 45% of all child deaths in 2011[1].

China has undergone a rapid society, economic, and culture changes during the past two decades. Under the framework of Millennium Development Goals (MDGs)[3] and other global initiatives, the Chinese government paid much attention to child health and development and issued a series of policies, notably the National Program of Action for Child Development in China (2011-2020) with goals for exclusive breastfeeding, prevalence of stunting, and prevalence of underweight[4]. Subsequently, the overall prevalence of stunting, underweight, and wasting among children younger than 5 years has decreased, while remaining high in children under 2 years old and in children living in rural, and especially in poor rural areas[5-9]. The studies demonstrated that undernutrition during childhood may increase susceptibility to disease, and adult obesity, reduce child survival, and ultimately lead to productivity loss[1]. One study estimated that the actual reduction in underweight between 1992 and 2001 (from 15.7% to 10.1%) resulted in saving 176,000 child lives in China. A further reduction of underweight prevalence from 10.1% to 8.0% could save an additional 62,000 lives[10]. Another study calculated that the reductions in child stunting from 1992 to 2001 in China would result in future economic productivity gains with the value of CNY 101 billion. While reducing stunting further over the next 10 years would gain CNY 20 billion[11].

To monitor the extent of nutritional problems in China's children, information from the national nutrition surveillance system on children younger than 5 years needs to be analysed and reviewed regularly. This study comparing undernutrition in children between 2002 and 2013 will provide the most recent national evidence for policy making on improving child nutrition in China.

METHODS

Data Resources

Chinese Nutrition and Health Surveillance in 2013 (CNHS 2013) Chinese Nutrition and Health Surveillance (2010-2013) was deigned to be a representative survey in China. In 2010-2012, a stratified multistage cluster sampling was used from 31 provinces, autonomous regions, and municipalities and selected 150 districts/counties. The study objects were people aged 6 and over. The sample was selected through the method of Probability Proportion to Size (PPS). As a part of the national nutrition surveillance in 2010-2013, Chinese Nutrition and Health Surveillance in 2013 was a cross-sectional survey which focus on children under 6 years and lactating women that covered 30 provinces, autonomous regions and the municipalities in Mainland China (Tibet Autonomous Region was not included).

Sampling The sample of surveillance in 2013 was selected through multi-stage stratified cluster sampling.

Stage 1: the 2865 districts/counties/ county-level cities in China were categorized into 4 strata (large cities, medium and small cities, general rural areas, and poor rural areas) based on the population size and the definition of urban or rural from National Bureau of Statistics of the People's Republic of China. The population size was more than 1000,000 can be defined as large cities, and other cities were belong to medium and small cities. The definition of poor rural areas and general rural areas was defined according to the framework for poverty alleviation and development for the next decade, 2011-2020. Finally a total of 55 districts/counties/county-level cities were selected as the national representative survey sites. The 55 survey sites included 12 large cities, 15 medium and small cities, 18 general rural areas, and 10 poor rural areas.

Stage 2: three sub-districts/townships were selected using systematic sampling in each survey site. Totally 165 sub-districts/townships were selected in this stage.

Stage 3: three neighborhood/village committees were randomly selected in each sub-districts/ townships. There were 495 neighborhood/village committees in this stage.

Stage 4: finally 70 children were selected through the local planned immune system using a cluster sampling method in each neighborhood/ village committees. There were 10 children in each age group (0-5, 6-11, 12-23, 24-35, 36-47, 48-59, and 60-71 months) with equal number of boys and girls. The lactating women were defined as the mother of children younger than 2 years. A total of 200 mothers included lactating women and non-lactating women. A total of 34,650 children under 6 and 11,000 mothers were sampled.

Survey Contents and Methods The surveillance in 2013 included interview survey, dietary survey, and anthropometric measurements.

Interview survey The information of household and individuals' demographic, socioeconomic, feeding practice (infant and young child feeding, IYCF), gross motor milestones, and health-related questions of the sample children and mothers was collected using questionnaires.

Dietary survey 62 households were selected in each survey site. The children under 6 years and mothers younger than 2 years in these households finished 24-hour dietary recall in 3 consecutive days (2 weekdays and 1 weekend day). Meantime, consumption data of edible oil, salt, and other condiments for a household was collected from 3 day food weighted record. The other children and mothers in each site finished food frequency questionnaire (FFQ).

Anthropometric measurements Length of children under 2 years was measured using an infant scale with accuracy of 0.1 cm; height was measured using a stadiometer for children of 24-71 months with accuracy of 0.1 cm. Body weight was measured shoe-less and underwear using electric scale for children with accuracy of 0.01 kg. The scales in the survey sites were calibrated using 1 kg standard test weight before every examination or when the scale was moved. National project group provided all the equipments for survey sites. Physical examination of sample mothers included height, weight, waist circumference, and blood pressure.

All the investigation was finished by strictly trained field workers from provinces, cities, and counties Center for Disease Control and Prevention (CDC). Trained interviewers administered the questionnaires and dietary survey among the sample participants.

This project was approved by the Ethical Committee of National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention (Number: 2013-018). The parents of the children signed an informed consent before the survey.

China National Nutrition and Health Survey in 2002 (CNNHS 2002)

CNNHS 2002 is a nationally representative cross-sectional survey covered 31 provinces, autonomous regions and the municipalities (Hong Kong, Macao and Taiwan not included). The sampling used multistage cluster sampling method. A total of 132 sites were selected and classified into 6 types (large cities, medium and small cities, rural 1 areas, rural 2 areas, rural 3 areas, and rural 4 areas) based on the level of economic development[12].

Subjects

In this paper, data was from CNNHS 2002 and CNHS 2013. The children younger than 5 years old (0-59 months) in 2002 and 2013 were used, with a focus on questionnaire data and anthropometric measurements.

The sample size of children younger than 5 years in 2013 was 28,840, of whom 14,821 were boys and 14,019 were girls, of whom 14,264 were in urban area and 14,576 were in rural area. The number of children in six groups (0-5, 6-11, 12-23, 24-35, 36-47, and 48-59 months) was 4246, 4515, 5513, 4719, 4947, and 4900, respectively.

The sample size of children younger than 5 years in 2002 was 15,248, of whom 8275 were boys and 6973 were girls, of whom 6520 were in urban area and 8728 were in rural area. The number of children in six groups (0-5, 6-11, 12-23, 24-35, 36-47, and 48-59 months) was 1291, 1649, 2798, 1957, 3494, and 4059, respectively.

Statistical Analysis

Data were analyzed using SAS 9.3 software (SAS Institute Inc, Cary, NC). Undernutrition in 2002 and 2013 in children under-5 was determined against WHO's 2006 growth standards. Once a child's height and weight have been correctly measured, we can assess the child's growth and general nutritional status by using a standardized age- and sex-specific growth reference to calculate height-for-age Z-scores (HAZ), weight-for-age Z-scores (WAZ), and weight-for-height Z-scores (WHZ). Stunting was defined as HAZ (LAZ)<-2. Underweight was defined as WAZ<-2. Wasting was defined as WHZ<-2[13].

To represent all Chinese children under 5 better, prevalences in 2013 were weighted against China's sixth National Population Census in 2010. Because there were some differences of sampling methods between the two surveys in 2013 and 2002, we selected the same consensus data when comparing the two survey's undernutrition prevalences. The relationship between undernutrition and gender/age groups/4 areas was determined by using weighted logistic regression. Comparisons in prevalence of undernutrition in 2002 and 2013 were described distinguishing categories of national/ urban/ rural and gender, which are commonly used in China's

national policy documents.

RESULTS

Stunting

The overall prevalence of stunting of Chinese children younger than 5 years was 8.1% in 2013 (8.8% for boys and 7.2% for girls) (Table 1). The prevalence of stunting in girls was significantly lower (OR=0.81, 95% CI=0.71-0.92) than that of boys (Table 2). The prevalence of stunting was higher in children aged 12-23 months (OR=2.01, 95% CI=1.38-2.94), 24-35 months (OR=1.86, 95% CI=1.24-2.77), and 36-47 months (OR=1.70, 95% CI=1.15-2.50) groups compared to the 0-5 month group. There was no difference in children aged 6-12 months and 48-59 months compared to 0-5 months. It showed that the prevalence of stunting among children under 5-year was 2.4%, 4.6%, 7.5%, and 18.7% in 4 type areas (large cities, medium and small cities, general rural areas, and poor rural areas), respectively. Compared to large cities, the prevalence of stunting was significantly higher in medium and small cities (OR=1.95, 95% CI=1.12-3.41), general rural areas (OR=3.30, 95% CI=2.07-5.25), and poor rural areas (OR=9.44, 95% CI=4.75-18.78) (Table 2).

Age-standardized prevalence of stunting among children decreased from 17.2% in 2002 to 8.1% in 2013 (Table 3). In comparison to 2002, the prevalence of stunting decreased nationally regardless of gender or urban/rural residence. From 2002 to 2013, the prevalence of stunting decreased by 9.1% in boys and by 9.1% in girls, and decreased by 3.6% in urban areas and by 13.6% in rural areas. The prevalence of stunting decreased by 6.5%, 7.2%, 9.7%, 11.6%, 8.9%, and 8.2% in six age groups, respectively.

Underweight

The overall prevalence of underweight of Chinese children younger than 5 years was 2.4% (2.5% for boys and 2.2% for girls) (Table 4). There was no significant difference in girls compared to boys. The prevalence of underweight was highest for 48-59 month group (2.9%). After controlling for gender and area, the OR for 48-59 month group was 1.76 (95% CI: 1.12, 2.75) comparing to 0-5 month group (Table 5). The prevalence of underweight was 1.5% in urban areas and 3.1% in rural areas. Compared to large cities, the OR of underweight in poor rural areas was 5.02 (95% CI: 2.79, 9.03) (Table 5). It's highest in poor rural areas.

Age-standardized prevalence of underweight among children decreased from 5.3% in 2002 to 2.4% in 2013. The national prevalence of underweight decreased from 2002 regardless of gender or urban/rural areas (Table 6). The prevalence of underweight decreased by 3.0% in boys and 2.9% in girls, and decreased by 0.8% in urban and 4.7% in rural. The prevalence of underweight decreased by 2.1%, 1.9%, 2.3%, 3.4%, 3.1%, and 3.5% in children aged 0-5, 6-11, 12-23, 24-35, 36-47, and 48-59 months, respectively.

Wasting

The overall prevalence of wasting in Chinese children younger than 5 years was 1.9% (Table 7). There was no significant difference in girls compared to boys. The prevalence of wasting was lower in children aged 6-11 months (OR=0.51, 95% CI=0.33-0.80), 12-23 months (OR=0.53, 95% CI=0.31-0.89), 24-35 months (OR=0.5, 95% CI=0.30-0.83), and 36-47 months (OR=0.52, 95% CI=0.33-0.81) groups compared to the 0-5 month group. There was no difference of the prevalence of wasting among large cities, medium and small cities, general rural areas, and poor rural areas (Table 8).

The prevalence of wasting decreased from 2002 regardless of national level, gender, or urban/rural areas (Table 9). Age-standardized prevalence of wasting among children decreased from 2.7% in 2002 to 1.9% in 2013. The prevalence of wasting decreased by 1.0% in boys and 0.4% in girls; decreased by 0.8% in urban and 0.7% in rural; decreased by 1.8% in 0-5 month, 1.2% in 6-11 month, and 1.6% in 12-23 month.

DISCUSSION

Our analyses indicate that the overall prevalence of stunting, wasting, and underweight of Chinese children younger than 5 years was 8.1%, 1.9%, and 2.4% in 2013, respectively. The prevalence of stunting was higher for children aged 12-47 month. The prevalence of underweight was higher for children aged 48-59 month. The prevalence of stunting and underweight was higher in rural areas than in urban areas, especially in poor rural areas. But there was no significant difference of the prevalence of wasting among large cities, medium and small cities, general rural areas, and poor rural areas. China is experiencing the nutrition transition[14-15]. Our study shows a decline of stunting,

Table 1. The Weighted Prevalence of Stunting of Children under 5 Years by Gender and Age Groups across Various Areas in China in 2013 (%)

Age Group (month)	Total		Urban		Rural		Large Cities		Medium and Small Cities		General Rural Areas		Poor Rural Areas	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Total (0-59)	8.1	5.6-10.6	4.3	2.6-6	11.2	7.1-15.3	2.4	1.4-3.4	4.6	2.6-6.6	7.5	5.3-9.7	18.7	8.2-29.2
Boys	8.8	5.9-11.7	4.6	2.7-6.5	12.2	7.6-16.8	3.3	1.8-4.8	4.8	2.5-7	8.6	5.6-11.6	19.5	7.6-31.5
Girls	7.2	5.1-9.4	4	2.4-5.6	9.9	6.3-13.5	1.4	0.9-1.9	4.3	2.5-6.2	6.1	4.7-7.5	17.6	8.9-26.4
0-5														
Subtotal	5.3	3.8-6.9	2.7	2-3.4	7.5	4.9-10.1	3.5	1-6.1	2.6	1.8-3.4	6.6	2.8-10.4	9.4	5.9-12.8
Boys	6.1	3.9-8.2	3.7	2.6-4.7	8.1	4.2-12	4	0.2-7.9	3.6	2.5-4.7	7.4	1.7-13	9.5	4.4-14.7
Girls	4.5	3-6	1.6	2.6-4.7	6.8	4.6-9.1	3	1.2-4.7	1.4	0.2-2.5	5.8	2.7-8.8	9.1	5-13.3
6-11														
Subtotal	4.9	3-6.8	2.5	0.9-4.2	6.8	3.8-9.9	0.9	0-1.8	2.7	0.8-4.6	6.5	2.5-10.5	7.5	2.4-12.6
Boys	6.3	3.1-9.5	3.4	0.8-5.9	8.5	3.4-13.7	1	0-2.4	3.6	0.6-6.6	8.8	1.5-16	8	2-14.1
Girls	3.3	2.1-4.4	1.6	0.5-2.7	4.7	2.8-6.6	0.8	0-1.8	1.7	0.4-3	3.6	2-5.2	6.9	1.8-12
12-23														
Subtotal	9.9	6.8-13	6.1	4.3-8	13.1	8-18.1	3.6	2.2-5.1	6.5	4.3-8.6	9	5.7-12.3	21.4	9.9-33
Boys	11.9	7.8-16.1	6.7	5.1-8.3	16.2	9.7-22.7	4.8	2.4-7.2	6.9	5.1-8.8	11.7	5.4-18	25.5	11.6-39.4
Girls	7.5	4.9-10.1	5.5	3-8	9.2	4.8-13.7	2.3	1.2-3.4	5.9	3.1-8.8	5.7	3.1-8.3	16.4	7.2-25.7
24-35														
Subtotal	9.3	5.6-12.9	4.1	2.1-6.2	13.5	7.5-19.4	2.5	0.7-4.3	4.4	2-6.8	8.5	6.2-10.7	23.7	9.3-38.2
Boys	9.8	5.6-14.1	4.2	1.7-6.7	14.4	7.6-21.2	3.8	1-6.5	4.3	1.4-7.2	9	5.6-12.5	25.3	9.6-41.1
Girls	8.6	5.5-11.6	4	2.1-5.9	12.4	7.3-17.4	1	0-2	4.4	2.2-6.7	7.8	6.4-9.2	21.8	9.1-34.6
36-47														
Subtotal	8.5	5.9-11.1	4.8	2.2-7.4	11.6	7.4-15.8	2.2	0.7-3.7	5.2	2.2-8.3	7.9	5.1-10.7	19.2	8.4-30
Boys	8.3	5.6-11	4.9	1.5-8.3	11.2	7.1-15.3	3.6	1.2-6.1	5.1	1.1-9.1	8.2	5.1-11.3	17.2	6-28.4
Girls	8.7	6-11.4	4.7	2.5-7	12.1	7.5-16.7	0.5	0-1.2	5.3	2.7-7.9	7.5	4.8-10.1	21.7	10.5-32.9
48-59														
Subtotal	7.2	4.8-9.7	3.7	1.9-5.4	10.1	5.8-14.3	1.4	0.5-2.3	4	2-6	5.4	3-7.8	19.4	9.6-29.3
Boys	7.3	4.6-10	3.5	1.1-5.9	10.3	5.5-15.1	1.4	0-3	3.8	1-6.5	5.7	2.9-8.6	19.5	7.8-31.2
Girls	7.2	4.8-9.5	3.9	2.2-5.6	9.8	5.9-13.7	1.5	0.2-2.8	4.2	2.2-6.2	5	2.7-7.4	19.3	11.2-27.5

Table 2. Factors Associated with the Prevalence of Stunting of Children under 5 in China

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr>Chi-Sq	Point Estimate	95% Wald Confidence Limits	
Gender							
Girls *vs.* Boys	-0.2146	0.0676	10.0692	0.0015	0.81	0.71	0.92
Age group (month)							
6-11 *vs.* 0-5	-0.0877	0.1258	0.4859	0.4858	0.92	0.72	1.17
12-23 *vs.* 0-5	0.6989	0.194	12.9832	0.0003	2.01	1.38	2.94
24-35 *vs.* 0-5	0.6176	0.2051	9.0652	0.0026	1.86	1.24	2.77
36-47 *vs.* 0-5	0.5276	0.1975	7.1333	0.0076	1.70	1.15	2.50
48-59 *vs.* 0-5	0.3267	0.2112	2.3926	0.1219	1.39	0.92	2.10
Area							
Medium and small city *vs.*Large city	0.6696	0.2841	5.5539	0.0184	1.95	1.12	3.41
General rural area *vs.*Large city	1.1941	0.2372	25.3520	<0.0001	3.30	2.07	5.25
Poor rural area *vs.*Large city	2.245	0.3509	40.9224	<0.0001	9.44	4.75	18.78

Table 3. Comparison of Prevalence of Stunting in Children under 5 between 2013 and 2002 (%)

Age Group (month)	2013			2002		
	Total	Urban	Rural	Total	Urban	Rural
Total (0-59)	8.1	4.3	11.2	17.2	7.9	24.8
Boys	8.8	4.6	12.2	17.9	8.8	25.4
Girls	7.2	4	9.9	16.3	7.0	24.1
0-5						
Subtotal	5.3	2.7	7.5	11.8	5.3	18.8
Boys	6.1	3.7	8.1	13.5	7.9	19.3
Girls	4.5	1.6	6.8	9.8	2.2	18.3
6-11						
Subtotal	4.9	2.5	6.8	12.1	5.3	16.5
Boys	6.3	3.4	8.5	12.9	6.1	17.3
Girls	3.3	1.6	4.7	11.3	4.4	15.6
12-23						
Subtotal	9.9	6.1	13.1	19.6	11.8	26.0
Boys	11.9	6.7	16.2	21.7	14.5	27.6
Girls	7.5	5.5	9.2	17.1	8.6	24.1
24-35						
Subtotal	9.3	4.1	13.5	20.9	11.5	28.7
Boys	9.8	4.2	14.4	21.0	11.6	28.6
Girls	8.6	4	12.4	20.9	11.5	28.7
36-47						
Subtotal	8.5	4.8	11.6	17.4	5.4	27.6
Boys	8.3	4.9	11.2	17.9	5.2	28.5
Girls	8.7	4.7	12.1	16.9	5.6	26.6
48-59						
Subtotal	7.2	3.7	10.1	15.4	5.2	23.5
Boys	7.3	3.5	10.3	15.2	5.1	23.3
Girls	7.2	3.9	9.8	15.6	5.4	23.8

Table 4. The Weighted Prevalence of Underweight of Children under 5 by Gender and Age Groups across Various Areas in China in 2013 (%)

Age Group (month)	Total		Urban		Rural		Large Cities		Medium and Small Cities		General Rural Areas		Poor Rural Areas	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Total (0-59)	2.4	1.6-3.2	1.5	0.5-2.5	3.1	1.8-4.3	1.1	0.6-1.6	1.6	0.4-2.7	2	0.8-3.3	5.2	2.7-7.6
Boys	2.5	1.5-3.4	1.5	0.5-2.5	3.2	1.8-4.7	1.2	0.7-1.8	1.6	0.4-2.7	2.1	0.7-3.6	5.5	2.6-8.4
Girls	2.2	1.5-3	1.5	0.5-2.5	2.9	1.9-3.9	0.9	0.4-1.4	1.6	0.4-2.8	1.9	0.9-2.9	4.8	2.7-6.9
0-5														
Subtotal	1.7	1-2.4	0.9	0.2-1.5	2.4	1.3-3.5	1.7	0.1-3.4	0.7	0-1.5	1.6	0.7-2.5	4.8	2.3-7.3
Boys	2	0.9-3.1	0.9	0.1-1.8	3	1.1-4.9	1.5	0.2-2.8	0.8	0-1.8	1.9	0.3-3.5	5	0.1-9.8
Girls	1.3	0.6-2	0.8	0.1-1.5	1.7	0.6-2.8	2	0-4.1	0.6	0-1.4	1.3	0.3-2.3	2.6	0-5.5
6-11														
Subtotal	1.6	1-2.2	0.8	0-1.5	2.2	1.3-3.1	0.3	0-0.8	0.8	0-1.7	1.4	0.5-2.3	3.9	2.1-5.6
Boys	2.2	1.2-3.2	1.4	0-2.9	2.9	1.5-4.3	0.1	0-0.4	1.5	0-3.3	1.8	0.5-3.1	5.3	2.3-8.3
Girls	0.8	0.3-1.2	0.1	0-0.2	1.4	0.5-2.2	0.6	0-1.4	0	0-0	0.9	0-1.8	2.2	0.3-4.2
12-23														
Subtotal	1.9	1-2.7	1.1	0.7-1.5	2.4	0.9-4	1.6	0.9-2.4	1.1	0.6-1.5	0.7	0-1.4	6	2.9-9.1
Boys	1.8	1-2.7	1.1	0.5-1.8	2.4	0.9-3.9	2.1	1-3.2	1	0.2-1.8	1	0-2.1	5.4	3.1-7.6
Girls	1.9	0.8-3	1.1	0.4-1.9	2.5	0.5-4.5	1.1	0.3-1.8	1.1	0.3-2	0.4	0-0.8	6.8	1.6-11.9
24-35														
Subtotal	2.6	1.2-4	1.8	0.3-3.4	3.2	1-5.5	0.7	0.1-1.4	2	0.2-3.8	2	0-4.8	5.7	2.1-9.2
Boys	2.8	1.1-4.4	2.2	0.4-4	3.3	0.7-5.9	1.1	0-2.3	2.3	0.2-4.4	2	0-5	6	1.8-10.3
Girls	2.3	1-3.7	1.4	0-3.2	3.1	1.1-5.1	0.3	0-0.8	1.6	0-3.7	2.1	0-4.7	5.2	1.2-9.2
36-47														
Subtotal	2.8	1.8-3.8	1.9	0.4-3.5	3.5	2.2-4.8	1.3	0.5-2.1	2	0.2-3.9	2.8	1.1-4.5	4.9	3.2-6.7
Boys	3.1	1.8-4.3	2.1	0-4.5	3.8	2.5-5.1	1.4	0.6-2.1	2.3	0-5.1	3	1.6-4.5	5.5	3.3-7.6
Girls	2.5	1.5-3.4	1.7	0.5-2.8	3.1	1.6-4.6	1.2	0-2.4	1.7	0.3-3.1	2.6	0.5-4.7	4.3	2.4-6.2
48-59														
Subtotal	2.9	1.8-4.1	1.8	0.2-3.4	3.8	2.3-5.4	0.6	0-1.4	2	0.1-3.8	3.1	1.5-4.8	5.2	1.5-9
Boys	2.5	1.3-3.8	1	0.1-1.9	3.8	1.7-5.9	0.6	0-1.3	1	0-2.1	3	0.7-5.2	5.4	0.3-10.5
Girls	3.4	2.1-4.7	2.7	0.2-5.3	3.9	2.7-5	0.7	0-1.7	3	0-6.1	3.3	2.1-4.5	5	2.1-8

Table 5. Factors Associated with the Prevalence of Underweight of Children under 5 in China

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr>Chi-Sq	Point Estimate	95% Wald Confidence Limits	
Gender							
Girls *vs.* Boys	-0.1032	0.0821	1.5814	0.2086	0.90	0.77	1.06
Age group (month)							
6-11 *vs.* 0-5	-0.0727	0.2196	0.1095	0.7407	0.93	0.61	1.43
12-23 *vs.* 0-5	0.1016	0.2012	0.2547	0.6138	1.11	0.75	1.64
24-35 *vs.* 0-5	0.4437	0.2989	2.2044	0.1376	1.56	0.87	2.80
36-47 *vs.* 0-5	0.5283	0.2719	3.7743	0.052	1.70	1.00	2.89
48-59 *vs.* 0-5	0.5631	0.2280	6.1023	0.0135	1.76	1.12	2.75
Area							
Medium and small city *vs.* Large city	0.3850	0.4033	0.9112	0.3398	1.47	0.67	3.24
General rural area *vs.* Large city	0.6493	0.3648	3.1672	0.0751	1.91	0.94	3.91
Poor rural area *vs.* Large city	1.6136	0.2995	29.0323	<0.0001	5.02	2.79	9.03

Table 6. Comparison of the Prevalence of Underweight of Children under 5 between 2013 and 2002 (%)

Age Group (month)	2013			2002		
	Total	Urban	Rural	Total	Urban	Rural
Total (0-59)	2.4	1.5	3.1	5.3	2.3	7.8
Boys	2.5	1.5	3.2	5.5	2.8	7.7
Girls	2.2	1.5	2.9	5.1	1.7	7.9
0-5						
Subtotal	1.7	0.9	2.4	3.8	2.9	4.8
Boys	2	0.9	3	4.9	4.1	5.7
Girls	1.3	0.8	1.7	2.5	1.5	3.7
6-11						
Subtotal	1.6	0.8	2.2	3.5	2.6	4.1
Boys	2.2	1.4	2.9	3.9	3.1	4.4
Girls	0.8	0.1	1.4	3.0	2.0	3.7
12-23						
Subtotal	1.9	1.1	2.4	4.4	2.6	5.9
Boys	1.8	1.1	2.4	4.8	3.0	6.2
Girls	1.9	1.1	2.5	4.0	2.2	5.5
24-35						
Subtotal	2.6	1.8	3.2	6.0	2.4	9.0
Boys	2.8	2.2	3.3	6.9	4.0	9.3
Girls	2.3	1.4	3.1	4.9	0.5	8.6
36-47						
Subtotal	2.8	1.9	3.5	5.9	1.2	9.9
Boys	3.1	2.1	3.8	5.8	1.3	9.6
Girls	2.5	1.7	3.1	6.0	1.1	10.2
48-59						
Subtotal	2.9	1.8	3.8	6.4	2.5	9.5
Boys	2.5	1	3.8	5.6	2.3	8.3
Girls	3.4	2.7	3.9	7.3	2.9	11.0

Table 7. Weighted Prevalence of Wasting in Children Under 5 in China in 2013 (%)

Age Group (month)	Total		Urban		Rural		Large Cities		Medium and Small Cities		General Rural Areas		Poor Rural Areas	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Total (0-59)	1.9	1.4-2.3	1.3	0.6-1.9	2.4	1.9-3	1.9	0.7-3.1	1.2	0.4-1.9	2.1	1.4-2.8	3	1.8-4.3
Boys	1.9	1.4-2.3	1.1	0.6-1.6	2.5	1.9-3.1	1.6	0.6-2.7	1	0.5-1.6	2.1	1.3-2.8	3.5	2.3-4.7
Girls	1.9	1.4-2.4	1.4	0.6-2.3	2.3	1.6-2.9	2.1	0.7-3.6	1.3	0.3-2.4	2.2	1.4-2.9	2.5	0.9-4
0-5														
Subtotal	3.1	2-4.3	1.3	0.5-2	4.7	2.7-6.7	2.4	0.8-4	1.1	0.3-2	4.1	1.3-6.9	6	3.4-8.5
Boys	2.8	1.6-4.1	0.8	0.2-1.5	4.6	2.2-6.9	2	0.5-3.6	0.7	0-1.4	3.4	0.5-6.2	6.9	3-10.7
Girls	3.5	2.2-4.8	1.8	0.8-2.8	4.8	2.6-7.1	2.8	0.9-4.8	1.7	0.5-2.8	4.9	1.8-7.9	4.8	1.7-7.9
6-11														
Subtotal	1.7	1.1-2.2	0.6	0.2-1.1	2.4	1.5-3.4	0.6	0.1-1.1	0.6	0.1-1.2	1.6	0.8-2.5	4.2	1.9-6.5
Boys	1.9	1.1-2.8	0.7	0.1-1.4	2.8	1.4-4.3	0.4	0-0.9	0.8	0-1.5	1.7	0.5-3	5.3	1.4-9.2
Girls	1.3	0.8-1.8	0.5	0-1.1	2	1.2-2.8	0.9	0-1.8	0.5	0-1.1	1.5	0.6-2.4	2.9	1.2-4.7
12-23														
Subtotal	1.7	1-2.3	1	0.4-1.6	2.2	1.1-3.3	1.3	0.7-2	1	0.3-1.7	1.8	0.4-3.2	3.1	1.2-5.1
Boys	1.9	0.8-2.9	1.1	0.2-2	2.5	0.7-4.4	1.4	0.6-2.2	1	0-2.1	2	0-4.6	3.6	2.2-5
Girls	1.4	0.7-2.2	1	0.2-1.8	1.8	0.7-3	1.2	0.5-1.9	0.9	0-1.9	1.5	0.3-2.7	2.6	0-5.8
24-35														
Subtotal	1.6	1-2.2	1.3	0.3-2.2	1.9	1.2-2.6	1.3	0-3.2	1.3	0.2-2.3	1.4	0.9-1.9	2.9	0.4-5.3
Boys	1.7	1-2.3	1.3	0.3-2.3	1.9	1-2.9	1.5	0-4.3	1.3	0.1-2.4	1.1	0.3-1.9	3.7	0.6-6.8
Girls	1.5	0.7-2.4	1.2	0-2.6	1.8	0.7-2.9	1.2	0-2.3	1.2	0-2.8	1.8	0.5-3.1	1.9	0-4.2
36-47														
Subtotal	1.7	1.1-2.2	1.3	0.3-2.2	2	1.3-2.6	2.4	1.2-3.7	1.1	0-2.1	1.9	1-2.7	2.2	1-3.4
Boys	1.7	1.1-2.3	1.1	0.2-2	2.2	1.5-2.9	1.9	0.4-3.4	1	0-2.1	2	1.2-2.7	2.6	1.1-4.2
Girls	1.6	0.8-2.4	1.5	0.3-2.6	1.7	0.7-2.8	3.1	1.5-4.7	1.2	0-2.6	1.7	0.4-3.1	1.7	0-3.7
48-59														
Subtotal	2.2	1.4-3.1	1.7	0.4-3.1	2.6	1.6-3.7	2.8	0-6	1.6	0.1-3.1	2.9	1.4-4.3	2.1	0.9-3.3
Boys	1.9	0.7-3.1	1.2	0.3-2	2.5	0.5-4.5	2.3	0-4.8	1	0.1-2	2.9	0.1-5.7	1.7	0-3.4
Girls	2.6	1.6-3.6	2.4	0.3-4.5	2.7	1.9-3.5	3.5	0-7.9	2.3	0-4.7	2.8	1.7-3.9	2.6	1.3-3.8

Table 8. Factors Associated with the Prevalence of Wasting of Children under 5 in China

Parameter	Estimate	Standard Error	Wald Chi-Square	Pr>Chi-Sq	Point Estimate	95% Wald Confidence Limits	
Gender							
Girls *vs.* Boys	0.0022	0.1052	0.0004	0.9831	1.00	0.82	1.23
Age group (month)							
6-11 *vs.* 0-5	-0.6648	0.2248	8.7450	0.0031	0.51	0.33	0.80
12-23 *vs.* 0-5	-0.6423	0.2670	5.7855	0.0162	0.53	0.31	0.89
24-35 *vs.* 0-5	-0.6944	0.2588	7.1983	0.0073	0.50	0.30	0.83
36-47 *vs.* 0-5	-0.6586	0.2269	8.4258	0.0037	0.52	0.33	0.81
48-59 *vs.* 0-5	-0.3600	0.2106	2.9213	0.0874	0.70	0.46	1.05
Area							
Medium and small city *vs.* Large city	-0.4854	0.4175	1.3514	0.2450	0.62	0.27	1.40
General rural area *vs.* Largecity	0.1193	0.3417	0.1220	0.7269	1.13	0.58	2.20
Poor rural area *vs.* Large city	0.4860	0.3548	1.8761	0.1708	1.63	0.81	3.26

Table 9. Comparison of the Pprevalence of Wasting of Children under 5 between 2013 and 2002 (%)

Age Group (month)	2013			2002		
	Total	Urban	Rural	Total	Urban	Rural
Total (0-59)	1.9	1.3	2.4	2.7	2.1	3.1
Boys	1.9	1.1	2.5	2.9	2.4	3.3
Girls	1.9	1.4	2.3	2.3	1.8	2.8
0-5						
Subtotal	3.1	1.3	4.7	4.9	5.5	4.2
Boys	2.8	0.8	4.6	5.9	6.0	5.7
Girls	3.5	1.8	4.8	3.6	4.8	2.3
6-11						
Subtotal	1.7	0.6	2.4	2.9	2.4	3.3
Boys	1.9	0.7	2.8	3.4	3.4	3.4
Girls	1.3	0.5	2	2.3	1.2	3.0
12-23						
Subtotal	1.7	1	2.2	3.3	3.3	3.2
Boys	1.9	1.1	2.5	3.9	3.7	4.1
Girls	1.4	1	1.8	2.5	2.8	2.2
24-35						
Subtotal	1.6	1.3	1.9	2.2	0.7	3.5
Boys	1.7	1.3	1.9	2.3	0.9	3.5
Girls	1.5	1.2	1.8	2.1	0.5	3.5
36-47						
Subtotal	1.7	1.3	2	1.8	1.2	2.3
Boys	1.7	1.1	2.2	1.9	1.3	2.5
Girls	1.6	1.5	1.7	1.6	1.1	2.1
48-59						
Subtotal	2.2	1.7	2.6	2.3	1.8	2.7
Boys	1.9	1.2	2.5	2.0	1.7	2.1
Girls	2.6	2.4	2.7	2.6	1.8	3.3

underweight, and wasting between 2002 and 2013 among the children under 5-year, with greater reduction in rural areas than urban areas.

The target of Millennium Development Goal 1 (MDG 1) was to halve the prevalence of underweight between 1990 and 2015 or reaching a prevalence of 2.3% or lower among children under 5[3]. There has been a downword trends for the prevalence of stunting and underweight in children under 5 in many countries[1]. With underweight prevalence reduced to 2.2% in girls and overall reductions of 54.7%, our study confirms earlier reports[17] that China achieved MDG 1 ahead of time. WHO-UNICEF-World Bank reported the child malnutrition estimates by countries[18]. In Asia, South Asia has higher undernutrition prevalence than East Asia.

The prevalence of stunting, wasting, and underweight was 2.5%, 1.2%, and 0.7% in Republic of Korea (2008-2011); 19.4%, 5.7%, and 12.1% in Viet Nam (2013); 7.1%, 2.3%, and 3.4% in Japan (2010); 30.3%, 7.9%, and 19.9% in Philippines (2013-2014); 38.7%, 15.1%, and 29.4% in India (2013-2014); 7.1%, 1.6%, and 2.2% in Brazil; 16.3%, 6.7%, and 9.2% in Thailand (2012). The prevalence of stunting, wasting, and underweight was 2.1%, 0.5%, and 0.5% in United States of America (2011-2012); 2%, 0%, and 0.2% in Australia (2012). The prevalence of undernutrition of children under 5 in China is better than neighboring Asian countries, and higher than that of selected established market economies.

National Program of Action for Child Development in China (2011-2020) set the national goal for stunting at 7% and underweight at 5% by 2020[4]. While the overall goal for underweight prevalence in 2013 was achieved ahead of the 2020 target, the ambitious goal of stunting has not been reached yet with four more years to go. In poor rural areas, there is still a difficult challenge. The undernutrition prevalence in current study was similar to the other nationwide survey. Based on the project of China Food and Nutrition Surveillance System, the percentages of stunting and underweight have been reduced and the highest also in poor rural areas. The age groups of 12-23 months, 24-35 months, and 36-47 months were needed to be paid much attention. And for stunting, the peak seems to be at an early age of 12-23 months[5,18]. A previous study in rural showed that the prevalence of stunting in boys was higher than girls[9]. With respect to the prevalence of wasting in children under 5 years old, it's not a main undernutrition problem in Chinese children. The results showed that the wasting was halved after 6 months. There was no significant difference of the prevalence of wasting among large cities, medium and small cities, general rural areas, and poor rural areas. This finding indicated that overall Chinese chidren under 5 is food secure. This has been found by United Nations World Food Programme (WFP) as well.

Stunting has been considered recently as a more critical indicator for assessing overall child health and nutritional status. Stunting reflects long-term nutritional deficiencies and morbidity. MDG did not include stunting as a target[19]. WHO adopted a resolution on maternal, infant and young child nutrition that included a global target to reduce by 40% the number of stunted under 5 children by 2025[16]. In order to reach the target for reducing childhood stunting, it needed to decrease to 5.9% in China by 2025. Greater efforts are needed to improve stunting in general rural and poor rural areas.

With the developing of society, economic, people's living standard, and care giver's feeding knowledge, the nutrition status of Chinese children younger than 5 years has dramatically improved during the past 10 years. Even though the nutritional status of children improved significantly at the national level, the prevalence of undernutrition remains high in rural areas especially in poor rural areas. Meanwhile, the gap still existed comparing to other countries such as Republic of Korea, Japan, United States of American, and Australia[18]. The relevant action and comprehensive intervention must be taken immediately to improve the nutritional study of the most vulnerable children and to minimize the gap between rural areas and urban areas. These measures include improved maternal nutrition, early initiative of breastfeeding, exclusive breastfeeding for the first six months of life, and timely, adequate, safe, and appropriate complementary feeding, and in-home fortification for complementary feeding under 2 years old among others[2,5,7]. For instance, 'Ying Yang Bao' has improved the growth and anemia of children younger than 5 years in rural area in China[20-23]. Child undernutrition is a multifactorial public health problem which requires focused attention and coordination across sectors. Further studies are necessary to evaluate the growth monitoring and socio-demography related factors.

CONCLUSION

The prevalence of stunting of children under 5

year remains high in rural areas especially in poor rural areas in China. The first 2 years of life is a vulnerable period for rapid increasing in stunting of children. It is urgent to take action to control undernutrition in the vulnerable areas and subgroups in China.

Received: February 18, 2016;
Accepted: March 10, 2016

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