World Journal of Nutrition and Health, 2013, Vol. 1, No. 1, 13-17
Available online at http://pubs.sciepub.com/jnh/1/1/3

DOI:10.12691/jnh-1-1-3

Socio-economic Inequity of Malnutrition among Under-Five Children and Women at Reproductive Age in Bangladesh

Sayem Ahmed[1,*], Md. Mehedi Hasan[2], Wahid Ahmed[1], Md. Atiqul Hoque Chowdhury[3]

[1]Health Economics & Financing Research Group, Centre for Equity and Health Systems, International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, Bangladesh
[2]Food Security Nutritional Surveillance Project, Helen Keller International, Bangladesh
[3]Department of Public Health, University of South Asia, Dhaka, Bangladesh
*Corresponding author: sayemahmed@icddrb.org

Received November 22, 2013; Revised December 10, 2013; Accepted December 24, 2013

Abstract Poor nutritional status of children is a major public health problem throughout the developing world and is the underlying cause for 35% of child deaths and 11% of the total global disease burden. The global burden of childhood mortality, morbidity, and under nutrition is now increasingly concentrated in the most deprived and underserved populations within countries. The aim of this study was to investigate the socioeconomic differences of malnutrition of the under-five children and women at reproductive age in Bangladesh. Bangladesh Demographic Health Survey data 2011 were used for this study. Three of the most commonly used anthropometric indicators (weight-for-height, height-for-age, and weight-for-age) have been constructed for under five children. Asset quintiles have been constructed using principal component analysis technique. The concentration index (CI) has been estimated to show the direction of nutritional status across asset quintiles. Using concentration index it is found that child and mother malnutrition were more common in poor quintiles compared to rich quintiles. Stunting (CI = −30.127) and underweight (CI = −0.163) among child and thin/malnutrition condition (CI = −0.241) among women were highly pro-poor. On the other hand overweight condition (CI = −0.376) among women was highly pro-rich. Beside this urban and rural differential showed that rural area was better-off than urban area in terms of inequity in nutritional indicators of children and women. Even stunting and wasting is more prevalent among poorest children in urban area than children of same economic group in rural area. The community level nutritional intervention strategies aiming at reducing socioeconomic inequality should be taken for addressing large inequity in nutritional status of children and women in Bangladesh.

Keywords: *Inequality in health, child nutrition, Women nutrition, concentration index, stunting, underweight, wasting, Bangladesh*

Cite This Article: Sayem Ahmed, Md. Mehedi Hasan, Wahid Ahmed, Md. and Atiqul Hoque Chowdhury, "Socio-economic Inequity of Malnutrition among Under-Five Children and Women at Reproductive Age in Bangladesh." *World Journal of Nutrition and Health* 1, no. 1 (2013): 13-17. doi: 10.12691/jnh-1-1-3.

1. Introduction

Poor nutritional status of children is a major public health problem throughout the developing world and is the underlying cause for 35% of child deaths and 11% of the total global disease burden [1]. Child malnutrition remains a highly prevalent condition in low and middle income countries and a major portion of the global burden of childhood malnutrition is found in South Asia with an estimated 74 million children living with chronic malnutrition (stunted growth). This burden of malnutrition accounts for approximately 50% of under-five child deaths in developing countries [2]. The Bangladesh Demographic and Health Survey 2011 showed that among under-five children 36% are underweight, 41% are stunted, and 16% are wasted [3]. Anaemia still affects 68% of pre-school children and 50% of pregnant women [4]. Malnutrition that manifests early in life among young children carries both short and long term consequences. Wasted children have a 5-20 times higher risk of dying from common diseases like diarrhoea or pneumonia compared to normally nourished children [5], and there are long term consequences of chronic malnutrition or stunting that have impacts on intellectual development [1]. Iron deficiency, a major cause of anemia, is one of the top 10 risk factors in developing countries for "lost years of healthy life" [6].

Substantial recent global progress in reducing childhood mortality and under nutrition has been accompanied by increasing within-country inequities [7]. The global burden of childhood mortality, morbidity, and under nutrition is now increasingly concentrated in the most deprived and underserved populations within countries, [7,8] partly as a result of inequitable coverage of key maternal and child health and nutrition interventions [9,10].

In developing countries, gaps in health-related outcomes between the rich and the poor are large [11,12,13,14]. These gaps limit poor peoples' potential to contribute to the economy by reducing their capacity to function and live life to the fullest - and even to survive. Malnutrition is highly associated with poverty [15]. The aim of this paper was to investigate the economic differences of malnutrition of the under-five children and women at reproductive age in Bangladesh.

2. Materials and Methods

2.1. Data

The data for this study were derived from the Bangladesh Demographic and Health Survey (BDHS) 2011. A total of 5,419 children aged under-five years and 17,749 women of reproductive age were included in the analysis. Anthropometric measures for each child and women of reproductive age were obtained in the survey. Household assets information was used to construct asset quintiles.

2.2. Measurements of Nutritional Indicators

Three of the most commonly used anthropometric indicators for infants and children weight-for-height, height-for-age, and weight-for-age have been constructed and compared with the World Health Organization (WHO) Child Growth Standards which are based on an international sample of ethnicity, culturally and genetically diverse healthy children living under optimal conditions that are conducive to achieving a child's full genetic growth potential [16]. Weight-for-height commonly referred as wasting, measures body weight relative to height and has the advantage of not requiring age data. Normally, W/H is used as an indicator of current nutritional status and can be useful for screening children at risk and for measuring short-term changes in nutritional status. Wasting may be the consequence of starvation or severe disease (in particular, diarrhea). Height-for-age (H/A) reflects cumulative linear growth. H/A deficits indicate past or chronic inadequacies of nutrition and/or chronic or frequent illness, but cannot measure short-term changes in malnutrition. Extreme cases of low H/A, in which shortness is interpreted as pathological, are referred to as "stunting". Weight-for-age (W/A) is a composite measure of weight-for-height and height-for-age and it reflects body mass relative to age. Estimation of these indicators was performed using the WHO child growth standards, adopted in 2006, as reference standards. Stunting, underweight and wasting were defined as being the Z-scores less than -2 SD below the median value for HAZ, WAZ and WHZ, respectively. Body mass index (BMI) is a measure used to define overweight and thinness. The nutritional status of mother has been estimated using Body Mass Index (BMI). BMI is defined as the weight in kilos divided by the square of height in meters. The age-independent cutoffs of BMI were used to identify chronic energy deficiencies (or obesity) in mother. A BMI of less than 18.5 was used to define thinness or chronic energy deficient whereas BMI within 25-29.9 was for overweight and BMI of 30 or above was for obesity as used in BDHS 2011 [3]. Anemia, a result of iron deficiency, is an important health indicator for maternal health measured by hemoglobin level. The BDHS 2011 collected data on hemoglobin levels adjusted for pregnancy status and altitude. The Centre for Disease Control and Prevention (CDC) recommended formulas were used for the adjustment of hemoglobin levels by altitude and smoking status [17]. The BDHS 2011 considered a woman as mild anemic if hemoglobin level ranges from 10.0-11.9 g/dl (for non-pregnant) or 10.0-10.9 g/dl (for pregnant) whereas the ranges of hemoglobin level used to define moderate and severe anemia of women, irrespective of their pregnancy status, were 7.0-9.9 g/dl and < 7.0 g/dl respectively [3].

2.3. Measurement of Inequality

The concentration index (CI) has been estimated to show the direction of nutritional indicator across socioeconomic groups of households. In calculating CI, households were ranked according to their socio-economic condition, starting with the least wealthy ones. The socio-economic condition of each household was measured by asset index, based on the ownership of durable assets in the households. The households were placed into five quintiles. Distribution of nutritional indicator has been measured by plotting a concentration curve representing the cumulative proportion of healthcare utilization ranked by socioeconomic condition of the households (starting with the households placed into lowest asset quintile) against cumulative proportions of population (P_i) in the corresponding groups of households.

If nutritional indicator is evenly distributed across socioeconomic groups the concentration curve will coincide with the diagonal. By contrast, if there are inequalities in nutritional status the concentration curve will deviate from the diagonal. The further the curve lies above the diagonal the greater is the degree of inequality. Households are ranked from least wealthy to wealthiest according to the asset index.

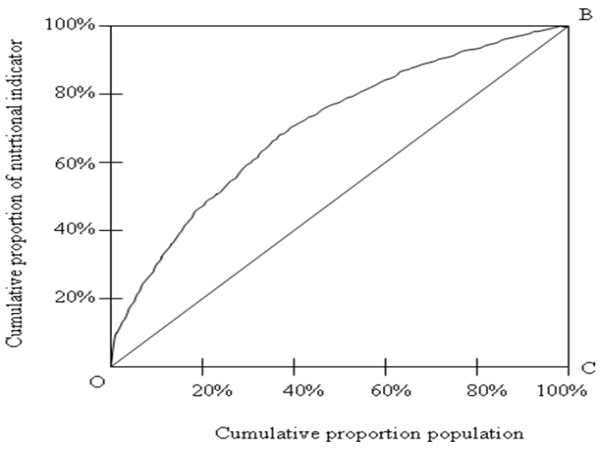

Figure 1. Illustration of concentration curve for nutritional status

The concentration index CI_R of nutritional indicator is defined as twice the area between the concentration curve and the diagonal. The index value can range between – 1 and + 1, and measures the distribution of healthcare utilization across the population. A simpler formula for calculating CI is used [18]. When employing this method, with p_i denoting the population share of group *i*, and $W_i = p_i r_i / r$,

$$CI_R = 1 - \sum_{i=1}^{n} P_i (2S_i^R - W_i) \quad (1)$$

Where $S_i^R = \sum W_i$ is the cumulative share of healthcare utilization up to *i*. The sums of P_i and W_i both come to unity. In this context, a positive value signifies distribution of nutritional indicator in relation to socioeconomic condition, with CI_R attaining its maximum value of + 1 when all healthcare utilization is concentrated to the highest socioeconomic group. The CI provides a measure of relative differences between socioeconomic groups, and has the important property that measured differences are independent of the scale on which r_i is measured. This means that an equi-proportional increase or decrease in nutritional indicator across all socioeconomic groups does not affect the inequality measure. Standard error of have been presented.

3. Results

3.1. Inequity in Child Malnutrition

The nutritional indicators of under five children across socioeconomic quintiles and urban, rural area are presented in Table 1. We found that 41.2% under five children were stunted. Across socioeconomic quintiles 53.5% poorest child found to be stunted compare to 25.7% richest child. This showed a large disparity between poor and rich in terms of child nutrition. Similar pattern was observed for underweight indicator. The percentage of underweight child was increasing from socioeconomically better off child to socioeconomically worse off child. However, for wasting there were higher incidence in poor than rich but the difference was not as much as stunting and underweight. The negative values of concentration indices for incidence of stunting, wasting and underweight indicated more suffering among the poor. The incidence of malnutrition found higher in rural areas. But the concentration indices showed that urban population is more inequitable than rural population. Therefore, the poor child in urban areas has more malnourished than the poor child in rural areas.

3.2. Inequity in Nutritional Status of Women in Reproductive Age

The nutritional status of women in reproductive age was estimated using BMI and women are categorized into thin, normal and overweight. The incidence of thin, normal and overweight women across socioeconomic quintiles is presented in Table 2. We found incidence of Thin, normal and overweight women are 23.5%, 60.2% and 16.3% respectively. The incidence of thinness was approximately 5 times higher in poorest women (38.8%) than the richest women (8.3%). On the other hand, the incidence of overweight was approximately 7 times higher in the richest women (36.3%) than the poorest women (5.0%). The concentration indices for thinness and overweight were in opposite sign and high value which means thinness was highly concentrated among poor and overweight was highly concentrated among rich. The incidence of thinness was found higher in rural areas and the incidence of overweight was found higher in urban areas. However, the incidence of normal BMI was not varied much across socioeconomic quintiles and urban and rural areas.

Table 1. Nutritional status of under five children across socioeconomic quintiles and urban and rural areas

SES quintile	Stunting			Wasting			Underweight		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Poorest	53.4%	55.3%	53.5%	18.2%	12.9%	17.8%	50.7%	43.6%	50.3%
Poorer	45.5%	51.5%	45.9%	15.6%	17.5%	15.7%	41.8%	40.9%	41.8%
Middle	39.0%	48.0%	40.1%	17.4%	18.6%	17.6%	34.7%	40.1%	35.4%
Richer	34.2%	40.6%	36.1%	12.7%	14.9%	13.4%	26.3%	31.1%	27.7%
Richest	24.1%	26.7%	25.7%	12.8%	11.7%	12.1%	22.8%	19.3%	20.6%
Total	42.5%	36.4%	41.2%	16.0%	13.8%	15.5%	38.5%	27.8%	36.2%
CI	−0.116	−0.152	−0.127	−0.060	−0.079	−0.070	−0.142	−0.177	−0.163
SE(CI)	0.009	0.015	0.008	0.017	0.028	0.015	0.009	0.018	0.008

Table 2. Nutritional status of 15 to 49 years old women across socioeconomic quintiles and urban and rural area

SES quintile	Thin			Normal			Overweight/Obese		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Poorest	38.9%	37.3%	38.8%	56.2%	56.4%	56.2%	4.9%	6.3%	5.0%
Poorer	29.2%	27.0%	29.0%	64.1%	64.5%	64.1%	6.7%	8.5%	6.8%
Middle	25.4%	18.9%	24.6%	63.4%	68.2%	64.0%	11.2%	12.9%	11.4%
Richer	20.1%	16.0%	18.9%	59.8%	64.3%	61.2%	20.1%	19.7%	20.0%
Richest	10.0%	7.5%	8.3%	60.0%	53.3%	55.4%	30.1%	39.2%	36.3%
Total	27.0%	13.3%	23.5%	60.9%	58.2%	60.2%	12.1%	28.5%	16.3%
CI	−0.170	−0.291	−0.241	0.008	−0.044	−0.008	0.337	0.227	0.376
SE(CI)	0.008	0.017	0.007	0.004	0.006	0.004	0.013	0.009	0.008

Table 3 shows the percentage of women at reproductive age with anemia across their socioeconomic quintiles and urban and rural areas. We found a high rate of anemia (42.4%) among women of reproductive age. The anemia incidence is decreasing when we move from socioeconomically worse off to socioeconomically better off quintiles. Rural people suffer more in anemia than urban areas. However, the disparity among socioeconomic quintiles is higher in urban area (CI -0.077) than rural area (CI -0.061).

Table 3. Anemia status of 15 to 49 years old women across socioeconomic quintiles and urban and rural area

SES quintile	Percentage of women with anemia		
	Rural	Urban	Total
Poorest	50.0%	46.9%	49.8%
Poorer	48.5%	42.5%	48.1%
Middle	42.6%	42.6%	42.6%
Richer	40.8%	40.2%	40.6%
Richest	33.9%	31.4%	32.2%
Total	44.7%	36.1%	42.4%
CI	−0.061	−0.077	−0.081
SE(CI)	0.010	0.016	0.009

4. Discussion

The aim of the study was to estimate the inequity in malnutrition condition in Bangladesh. Using concentration index we showed that child and mother malnutrition were more common in poor quintiles compared to rich quintiles. Stunting (CI = −0.127) and underweight (CI = −0.163) among child and thin/malnutrition condition (CI = −0.241) among women were highly pro-poor. On the other hand overweight condition (CI = −0.376) among women was highly pro-rich. Beside this urban and rural differential showed that rural area is better-off than urban area in terms of inequity in nutritional indicators of children (stunting and underweight) and women (Thin condition). Even stunting and wasting is more prevalent among poorest children in urban area than children of same economic group in rural area.

The results conform to earlier inequality studies [19,20,21]. In 2005 Giasuddin et al. found high pro-poor distribution of stunting (CI = −0.155) and under-weight (CI = −0.138) and higher disparity in urban area than rural area for both stunting and underweight [19]. Gwatkin et al. 2007 also found that high inequity in severe stunting (CI = −0.229), severe underweight (CI = −0.201) among children and malnutrition (CI = −0.184) among women in 2004 [11]. In India high rate of inequity was observed in stunting (CI = −0.21) and underweight (CI = −0.28) [21]. This study also showed higher pro-poor inequity in urban area than in rural area in terms of stunting and underweight.

Cause of nutritional inequity in Bangladesh has not been studied yet. However, studies in Vietnam [22] and India [21] identified a number of factors that associated with inequity in child nutrition. In Vietnam Wagstaff et al., 2003 identified household consumption, access to sanitation and safe water and parents education attainment as main factors of inequity in child malnutrition [22]. Similar factors may applicable for large inequity in nutritional status of children in Bagladesh. Other factors of inequity include the growth of the private health sector and price hike of basic food items.

Further studies on changes of inequity in child and women malnutrition over time and socio-demographic factors that influence inequity will be appreciated for better understanding the underlying cause.

5. Conclusions

Inequity in nutritional status of children and women is large in Bangladesh. Nutritional intervention strategies aiming at reducing socioeconomic inequality should be undertaken by government and non-government organizations for addressing this inequity. Quayyum et al., 2013 showed that community level interventions have a positive impact on equity of utilizing maternal health care [23]. Similar approach can be taken and tested for increasing access to micronutrients powder and nutritional intervention. Finally, intensive community analysis is required to understand the factors inequalities in nutritional status of child and women in Bangladesh.

Acknowledgements

The authors would like to thank MEASURE DHS for providing access to BDHS 2011 dataset.

Statement of Competing Interests

We declare that we have no competing interest.

List of Abbreviations

BDHS- Bangladesh Demographic and Health Survey
BMI- Body Mass Index
CI- Concentration Index
CDC- Centre for Disease Control and Prevention
HAZ- Height-for-Age Z-score
SD- Standard Deviation
WAZ- Weight-for-Age Z-score
WHO- World Health Organization
WHZ- Weight-for-Height Z-score

References

[1] R. E. Black, L. H. Allen, Z. A. Bhutta, L. E. Caulfield, M. de Onis, M. Ezzati, C. Mathers, and J. Rivera, "Maternal and child undernutrition: global and regional exposures and health consequences.," *Lancet*, vol. 371, no. 9608, pp. 243-60, Jan. 2008.

[2] L. E. Caulfield, M. de Onis, M. Blössner, and R. E. Black, "Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles.," *Am. J. Clin. Nutr.*, vol. 80, no. 1, pp. 193-8, Jul. 2004.

[3] National Institute of Population Research and Training (NIPORT); Mitra and Associatesa and Macro International, "Bangladesh Demographic and Health Survey 2011," Dhaka, Bangladesh and Calverton, Maryland, USA, 2013.

[4] HKI and IPHN, "Nutritional Surveillance Project," Dhaka, 2004.

[5] G. Finnigan, "Climate Change Threats to Health," Australia, 2009.

[6] B. D. Benoist, E. McLean, I. Egli, and M. Cogswell, "Worldwide Prevalence of Anaemia 1993-2005: WHO Global Database on Anaemia," Geneva, 2008.

[7] D. You, G. Jones, and T. Wardlaw, "United Nations Inter-agency Group for Child Mortality Estimation 2011. Levels and trends in child mortality," New York, 2011.

[8] UNICEF, "Progress for children: achieving the MDGs with equity (No. 9)," 2010. [Online]. Available: http://www.unicef.org/publications/index_55740.html. [Accessed: 07-May-2012].

[9] A. J. D. Barros, C. Ronsmans, H. Axelson, E. Loaiza, A. D. Bertoldi, G. V. A. França, J. Bryce, J. T. Boerma, and C. G. Victora, "Equity in maternal, newborn, and child health interventions in Countdown to 2015: a retrospective review of survey data from 54 countries.," *Lancet*, vol. 379, no. 9822, pp. 1225-33, Mar. 2012.

[10] A. R. Hosseinpoor, C. G. Victora, N. Bergen, A. J. D. Barros, and T. Boerma, "Towards universal health coverage: the role of within-country wealth-related inequality in 28 countries in sub-Saharan Africa.," *Bull. World Health Organ.*, vol. 89, no. 12, pp. 881-90, Dec. 2011.

[11] D. R. Gwatkin, "Health inequalities and the health of the poor: what do we know? What can we do?," *Bull. World Health Organ.*, vol. 78, no. 1, pp. 3-18, Jan. 2000.

[12] J. Baker and J. van der Gaag, "Equity in health care and health care financing: evidence from five developing countries. In Equity in the Finance and Delivery of Health Care: An International Perspective. Edited by: van Doorslaer E, Wagstaff A and Rutten F," New York, 1993.

[13] D. Leon and G. Walt, "Poverty, inequality and health: an international perspective," Oxford, 2001.

[14] A. Wagstaff, "Inequalities in health in developing countries: swimming against the tide?" Washington DC, 2002.

[15] World Bank, "bank development indicators 2000," Washington DC, 2000.

[16] WHO, "WHO Child Growth Standards based on length/height, weight and age.," *Acta Paediatr. Suppl.*, vol. 450, pp. 76-85, Apr. 2006.

[17] CDC, "Recommendations to prevent and control iron deficiency in the United States. Centers for Disease Control and Prevention.," *MMWR. Recomm. Rep.*, vol. 47, no. RR-3, pp. 1-29, Apr. 1998.

[18] S. Yao, "On the decomposition of Gini coefficients by population class and income source: a spreadsheet approach and application," *Appl Econ*, vol. 31, no. 12, pp. 49-64, 1999.

[19] M. S. Giashuddin, M. Kabir, and M. Hasan, "Economic disparity and child nutrition in Bangladesh.," *Indian J. Pediatr.*, vol. 72, no. 6, pp. 481-7, Jun. 2005.

[20] D. R. Gwatkin, S. Rutstein, K. Johnson, E. Suliman, A. Wagstaff, and A. Amouzou, "Socio-economic differences in health, nutrition, and population within developing countries: an overview.," *Niger. J. Clin. Pract.*, vol. 10, no. 4, pp. 272-82, Dec. 2007.

[21] S. Chalasani, "Understanding wealth-based inequalities in child health in India: a decomposition approach.," *Soc. Sci. Med.*, vol. 75, no. 12, pp. 2160-9, Dec. 2012.

[22] A. Wagstaff, E. van Doorslaer, and N. Watanabe, "On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam," *J. Econom.*, vol. 112, pp. 207-223, 2003.

[23] Z. Quayyum, M. N. U. Khan, T. Quayyum, H. E. Nasreen, M. Chowdhury, and T. Ensor, "'Can community level interventions have an impact on equity and utilization of maternal health care' - evidence from rural Bangladesh.," *Int. J. Equity Health*, vol. 12, no. 1, p. 22, Jan. 2013.