Differences in the socio-demographic determinants of undernutrition in children aged <5 years in urban and rural areas of Bangladesh measured by the Composite Index of Anthropometric Failure

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Title: Differences in the socio-demographic determinants of undernutrition in children aged <5 years in urban and rural areas of Bangladesh measured by the Composite Index of Anthropometric Failure

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Abstract

Objectives: This study investigates the prevalence and determinants of undernutrition among children <5 years living in Bangladesh using the Composite Index of Anthropometric Failure (CIAF) andhighlights the differences between urban and rural areas.

Study design: Data are drawn from threecross-sectional Bangladesh Demographic Health Surveys (BDHS) conducted from 2007 to 2014.

Methods: A Chi-square test was used to assess the prevalence of under-5 child undernutrition. Logistic regression analysis was performed to identify various socio-demographic risk factors.

Results: The prevalence of undernutritionbased on the CIAF was 52% among children under-5 in Bangladesh. The prevalence of undernutrition in children living in urban areas was found to be 45% and 54% in rural areas. As per the CIAF, undernutrition was highly prevalent among children in the older age group, children of uneducated and currently working mothers, those of underweight mothers, were fourth and above in the birth order, had fathers who were manual labourers, where households had no access to television and those in thepoorest householdswhether in urban or rural areas. Children in the older age group, children of uneducated mothers, those with underweight mothers and from the poorest householdsprovided common key risk factors for undernutrition in both urban and rural areas. Children of fourth and above birth order, and not watching television at all were additional risk factors of child undernutrition in rural areas.

Conclusion: Half of the children in rural areas and two-fifth of them in urban areas are suffering undernutrition in Bangladesh and severalsocio-demographic factors heighten the risks. Also, birth order and watching television were identified as the differential risk factors.This study therefore concludes that evidence-based interventions are needed to reduce the burden ofundernutrition in children in the country.

Keywords: Children, malnutrition, under five years, risk factors, Bangladesh.

Introduction

The undernutrition of children is a major global public health problemthat is responsible foraround 50% of deaths worldwide of those aged 5 and under.[1]Approximately 195 million childrenworldwide aged under-5 are suffering from some form of undernutrition that is associated with an increased risk of child morbidity and mortality.[2]Undernutrition is defined as micronutrient and/or macronutrient deficiency, infectious disease, or a combination of boththat reduces the ability of the body's immune system to defend against disease that leads to inconsistent growth and development of children both mentally and physically.[3,4] Malnourished children are physically, emotionally and intellectually less productive than well-nourished children.[5]Since the 1990sthere has been a marked decline in malnutrition rates in Bangladesh, yet the current rate (over 40%) is one of the highest in the world.[2]

Identification of risk factors of undernutrition using conventional or disaggregated indicators are common in developing countries, such as, Nepal, Pakistan, Paraguay, Ecuador, and Sub-Saharan Africa.[11-15]The prevalence and determinants of undernutrition in children agedunder-5 by means of theComposite Index of Anthropometric Failure (CIAF) in urban-rural context have not been widely investigated in Bangladesh. However, Akram et al. (2018) in Bangladesh examined the urban-rural disparity of the effects (using odds ratio) of various socio-demographic factors of undernutrition in children under-5 by using a conventional/disaggregated indicator, for example, stunting.[10]The approach, CIAFhas beenadopted from a study conducted by Nandy et al. (2005) where they claimed that conventional/disaggregatedindicators are not sufficient for quantifying the overallprevalence.[6]Consequently, a number of studies conducted in Bangladesh, India and Ethiopia used the CIAF and identified that various socio-demographic factors, for example, maternal education, socioeconomic status, birth order, mother's nutritional status, child

morbidity, water and sanitation and ethnicityareassociated with undernutrition among children under-5regardless of urban-rural context.[7,8,9]This study explores the socio-demographic risk factors for undernutrition among Bangladeshi children using the CIAF and three waves of large representative sample and identifies differences between those living in urban and rural areas. In a similar studyin India, Khan & Raza (2014) investigated urban-rural differencesin determining socio-demographic risk factors(using marginal mean effect) forundernutrition measured by theCIAF.[16]

The findings of thisstudy differ from the findings of previous studiesin Bangladeshconducted on this topic by highlighting the differences, prevalence and variation of effects (using odds ratio) of several socio-demographic factors between urban and rural areasthat can causeundernutrition in children under-5 based on the CIAF. In doing so, this study providesimportant insightsfor policy making purposes.

Methods

Data source

A total of 19,874 children under-5 andborn in January 2002 or later were included in this study after combining three waves of Bangladesh Demographic Health Surveys (BDHS) conducted from 2007 to 2014 (Appendix I). The BDHS sampleswere drawn from Bangladeshi adults (both male and female) residing in non-institutional dwellingsthat includedsocial and demographic data and health and nutritionaldata covering a wide range of the population. The surveys were based on multistage stratified sampling techniques of households. At the first stage, primary sampling units (PSUs) were selected using a probability proportional to size technique and samples of households were selected at the second stage using an equal probability systematic sampling technique. Enumeration areas

(clusters) were extracted from the census surveys of 2001 and 2011 that were carried outby the Bangladesh Bureau of Statistics and were considered as the PSUs. Each wave of the three BDHS surveys had a response rate of around 98%. In the combined dataset (N=19,874), contributions from children in the 2007, 2011 and 2014 surveys were 27%, 38% and 35% respectively. Each wave used a standard DHS questionnaire anddetails of this plus sample design, data collection procedure and all other issues are discussed elsewhere.[17-19]

Outcome measure and operational definations

The primary outcome of the study was under-5 child undernutrition as measured by the CIAF. A child was considered to be stunted (short stature for age), wasted (dangerously thin) and underweight (low weight for age) if the height-for-age, weight-for-height, and weight-for-age indices were 2 standard deviations (SDs) or more below the respective median of the WHO reference population.[20]Nutritional indicators for children were categorized into seven groups: (A) no failure; (B) wasting only; (C) wasting and underweight; (D) wasting, stunting and underweight; (E) stunting and underweight; (F) stunting only; and (Y) underweight only.[6]A child was considered to be undernourished, if he or she had any anthropometric failure from B to Y. The prevalence of the indicators from B to Y of the CIAF is presented in Figure 1.

(Figure 1 to be placed here)

Fig.1 - Prevalence of under-5 child undernutrition based ontheCIAF

Independent variables

The selected socio-demographic variables in this study were extracted from relevant literature.[2,9,21]The variables were children's age (0–11 months, 12–23 months, 24-35 months,

36-47 months, 48-59 months); sex of child (male, female); mother's education (no education, primary, secondary, higher); mother's working status (currently not working, currently working); underweight mother (underweight, healthy weight, overweight); birth order (first, second, third, fourth and above); father's employment status (currently not working: unemployed, students etc; manual labourer: farmers, agricultural workers, fishermen and rickshaw operators; service holder: doctors, lawyers, accountants, teachers; businessmen); watching television (not at all and do not know, less than once a week, at least once a week, almost every day); wealth index (poorest, poorer, middle, richest, richer) and birth cohorts (in 2005 and before, 2006-2008, 2009-2011, 2012-2014).[17-19]

Statistical analysis

The socio-demographic background characteristics of the children in an urban and rural context were calculated by the use of descriptive statistics. A Chi-square test was used for assessing the relationships between socio-demographic characteristics and undernutrition as per theCIAF for both urban and rural areas. In all analyses, the significance level was set at $P<0.05$ (2-tailed). Both unadjusted and adjusted models were carried out to analyze the appropriate binary value for undernutrition measured by theCIAF. In the case of both the urban and rural contexts, all independent variables found to be significant in bivariate analysis were simultaneously entered into the multiple regression models (fixed effect) for adjustment. Multilevel binary logistic regression models with a random intercept at community and household level were performed to assess the risk factors (Appendix II).Stata version 14.2 (StataCorp LP, College Station, Texas) was used for all analyses taking into accountthe complex nature of the sampling weights of the BDHS surveys.

Results

Around 68% of the children were living in rural areas and more than half (51%) of themwere male (Table 1).The frequency of uneducated mothers was higher in rural areas (22%)compared to those in urban areas (15%).In urban areas, approximately 70% of the children belonged to rich socioeconomic households whereas around 53% of themwere frompoor socioeconomichouseholds in rural areas (Table 1). The detailed background characteristics of the respondents are shown in Table 1.

(Table 1 to be placed here)

Table 1 - Background characteristics of the children under-5

Prevalence of under-5 child undernutrition for urban and rural areas measured by theCIAF

The prevalence of undernutrition as per the CIAF among under-5 children was 51%.The prevalence of under-5 child undernutrition was 45% (n=2,871)in urban areasand54%(n=7,367)in rural areas. In urban areas, the prevalence was significantly higher among children aged 36-47 months (49%, n=647)whereasit was 60% (n=1,576) in the same age group in rural areas. A very high prevalence of undernutrition was found among children of uneducated mothers (urban: 60%, n=585 and rural: 63%, n=1,914), those of currently working mothers (urban: 51%, n=640 and rural: 58%, n=1,384) and underweight mothers (urban: 61%, n=779 and rural: 63%, n=2,588),fourth and above birth order children (urban: 59%, n=518 and rural: 63%, n=1,788),children of fathers who were manual labourers(urban: 50%, n=1,910 and rural: 57%, n=5,687), and children of households with no access to television at all (urban: 56%, n=746 and rural: 59%, n=4,292). Children from the poorest households were found to have asignificantly higher prevalence of undernutritionin both urban (63%, n=329) and rural (64%, n=2,435) areas. Finally, a higher prevalence was observed among children born in 2005 and earlier (urban: 52%, n=677 and rural: 63%,

n=1,578) (Table 2). Importantly, in all cases the prevalence of undernutrition was relatively higher in rural areas.

(Table 2 is to be placed here)

Table 2 - Prevalence of undernutrition based on theCIAF among under 5 children in urban rural context

Determinants of undernutrition

The results of logistic regression analysis (from fixed effect models) were presented in Table 3 and 4.In urban areas, the key risk factors of undernutrition as measured by the CIAF were children of uneducated mothers (Adjusted Odds Ratio (AOR): 2.54, 95% Confidence Interval (CI): 2.00, 3.23); children in the age group of 24-35 months (AOR: 2.15,95% CI: 180, 2.57); children of underweight mothers (AOR: 1.67, 95% CI: 1.46, 1.91); and children from the poorer households (AOR: 1.74, 95% CI: 1.37, 2.20) (Table 3).

(Table 3 is to be placed here)

Table 3 –Risk factor of undernutrition among urban children

Similarly,in rural areas,the key risk factors were the poorer households (AOR: 2.33, 95% CI: 1.98, 2.75);children in the age group 24-35 months (AOR: 2.32, 95% CI: 2.06, 2.61);those withchildren of underweight mothers (AOR: 1.48, 95% CI: 1.36, 1.60)as didchildren of uneducated mothers (AOR: 1.44, 95% CI: 1.17, 1.76); and children that were fourth and above in the birth order (AOR: 1.13,95% CI: 1.01, 1.26) (Table 4).In households where television had been watched almost every day, the children had 18%(AOR: 0.82, 95% CI: 0.68, 0.99)less chance of having undernutrition than those in households that had poor access totelevision. In addition, those in the2012-2014 birth cohorts had less chance of having

undernutritionthan children born in 2005 or earlier in both urban and rural areas (Table 4). To compare the odds of fixed effect models from random effects models, multilevel analysis was performed (Appendix II).

(Table 4 is to be placed here)

Table 4 -Risk factors of undernutrition among rural children

Discussion

The prevalence of undernutritionamong under-5 children based on the CIAF was found to be very high and was recorded in urban areas at45%and at54% in rural areas. In India, the prevalence of undernutritionbased on the CIAFwas 54% in urban areas and 64% in rural areas.[16]This prevalence has not beensimilarly recorded for urban-rural places of residence in other developing nationsapart from India and Bangladesh.[9,16]However, the prevalence of undernutrition based on conventional/disaggregated indicatorswas higher in Pakistan, Nepal and Ethiopia while assessing urban-rural differences.[22-24]Notably, the prevalence of anthropometric failure was found to be higher in rural areas than in urban areas andthis study indicates that child undernutrition has not been adequately addressed in Bangladesh, especially in rural areas. One reason could be that children suffer from undernutrition and ill health, not only due to various factors such as poor diet, household air pollution, polluted drinking water, poor hygiene and sanitation,poor level of knowledge but also from a lack of coordination among key sectors.[25] These sectorsinclude health, agriculture, education, urban development and local development that are needed to help address the issue of nutrition particularly in rural areas and help provoke necessary coordination between key institutions, for example, government institutions, academic, research and training institutions, and national/international non-governmental organizations.[25]

This study showed that children age three years old and above, children of uneducated mothers, those of underweight mothers and socio-economically poorest family were the key risk factors of undernutrition in both urban and rural areas when using the CIAF as a measure of undernutrition. After thesecond year of life, children tend to have the same diet as their family and are often allowed to eat food by themselves but have inadequate access to solid foodsthat leads to poor nutritional status.[26]Empowerment of women is deeply associated with their educational attainment that in turn helps them to decide on their own and their children's health needs.[27] On the other hand, women with poor nutritional status isrelated to inadequate distribution of food within the family, food insecurity, poverty and micronutrient deficiencies that often tend to coexist with children's nutritional deficiencies.[28]One out of five people in Bangladesh living in below national poverty line (population below $1.90 purchasing power parity/day), most of them are living in rural areas,and such concern might hinder the improvements of nutritional status.[29,30]Children at fourth and above birth order and households without access to mass media were also identified as risk factors of undernutrition as measured by the CIAF in rural areas. In rural areas, parents tend tofavour older children when they cannot afford sufficient food to feed everyone due to their early engagement in the economy that indicates that children with a higher birth order have a greater chance of being malnourished.[31]Children's age,[12] maternal education,[10,13,15] maternal nutritional status[12] and socio-economic status[11,12,13,14,15] have been thoroughly assessed in previous studies that used conventional indicators and looked at the urban-rural gap in Bangladesh, Nepal, Pakistan, Paraguay, Ecuador and Sub-Saharan Africa.For all selected variables, the prevalence of undernutrition for vulnerable children in both urban and rural areas was more than 50% that indicates it should bea greater public health concern.[32]

This study identified, at leasttheoretically,an important insight intothe effects of education level on undernutrition measured by theCIAF in that it is less likely to vary between children

of higher educated mothers and uneducated mothers in rural areas than it is in urban areas. This finding indicates therefore that educational attainment is not particularly successful for helping to reduceundernutrition in children in rural areas. A lack of attention in accessing themodern or standard educational system available to women in rural areas prevents them from gaining the equivalent knowledge ofwomen in urban areas.Also, the impactof socio-economic status is more likely to vary between children inthe poorest parts and the richest partsin rural areas than is apparent in urban areas and therefore means that greatersocio-economic inequality exists in rural areas. Increasing numbers of rural labouring, low pay, irregular hours could be causing socio-economic inequality in rural areas.

This study recommends that maternal and child nutrition should be given top priority, not only at district level but also in remote areas through revising and updating existing nutritional policiesand programmes.[33] Women's increased participation in education has been appreciableover the last decade in both urban and rural areas, however, the distribution of quality education is still an issue underdebate.[2]This study also recommends that the state should make knowledge based empirical education available and accessiblefor all women in both urban and rural areas. Also, well facilitated healthcare should be accessible for all women in both urban and rural areas.In order to help reduce socio-economic inequality, the government should increase income generating activities aimed at the mostdeprived and more vulnerable people and ensure their participation with a standard wage structure under the national nutritional security system.[21]

This study does havelimitations. For example, although a large nationally representative sample has been used for analysis, the cross-sectional nature of the study did not establish a causal relationship between risk factors and child undernutrition. This study did not control some important indicators, such as water, sanitation and environment, diet pattern,

behaviouralfactors, adverse health outcomes, place of birth, or childhood life, nor have control over theunavailability of information about ethnicity and wide range of other missing information. This study can thereforenot explore the current situation due to lack of suitable recent data. Another limitation involves problems of recallor information bias from respondents to the surveys that were analyzed thatcould serve to skew information by a reliance on self-reporting of age, education, occupation, and household assets etc.

Conclusion

In Bangladesh, the prevalence of under-5 child undernutritionbased on the CIAF was 52%. Half of the children in rural areas and two-fifth of them in urban areas are suffering undernutrition. Children in the older age group, children of uneducated mothers, those with underweight mothers and from the poorest households provided common key risk factors for undernutrition in both urban and rural areas. Also, birth order and watching television were identified as the differential risk factors.This study shows the high educational and socio-economic inequalities that exist in rural areas compared to urban areas. Therefore, in order tohelp reduce child undernutrition, it is essential that an evidence-based strategy and policyisformulated and then implemented. This study recommends that further research is conductedon this topic.

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Ethical approval

The data was collected from secondary sources that does not need ethical approval (available at: https://dhsprogram.com/data/available-datasets.cfm). Informed consent was obtained verbally from each participant (every married woman aged 15–49 years old) prior to being enrolled on to the study.

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Conflict of interest

There are no conflicts of interest to declare.

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