Socio-economic Correlates of Malnutrition among Married Women in Bangladesh

Mostafa Kamal SM[1]* & Md Aynul Islam[2]

[1] *Department of Mathematics, Islamic University, Kushtia-7003, Bangladesh*
[2] *Department of Economics, Islamic University, Kushtia-7003, Bangladesh*

ABSTRACT

This paper examines the prevalence and socio-economic correlates of malnutrition among ever married non-pregnant women of reproductive age of Bangladesh using a nationally representative weighted sample of 10,145. Body mass index was used to measure nutritional status. Both bivariate and multivariate statistical analyses were employed to assess the relationship between socio-economic characteristics and women's nutritional status. Overall, 28.5% of the women were found to be underweight. The fixed effect multivariate binary logistic regression analysis yielded significantly increased risk of underweight for the young, currently working, non-Muslim, rural residents, widowed, divorced or separated women. Significant wide variations of malnourishment prevailed in the administrative regions of the country. Wealth index and women's education were the most important determinants of underweight. The multivariate logistic regression analysis revealed that the risk of being underweight was almost seven times higher (OR=6.76, 95% CI=5.20-8.80) among women with no formal education as compared to those with higher education and the likelihood of underweight was significantly (p<0.001) 5.2 times (OR=5.23, 95% CI=4.51-6.07) in the poorest as compared to their richest counterparts. Poverty alleviation programmes should be strengthened targeting the poor. Effective policies, information and health education programmes for women are required to ensure adequate access to health services and for them to understand the components of a healthy diet.

Keywords: Bangladeshi women, body mass index, logistic regression, malnutrition, wealth

INTRODUCTION

Hunger and malnutrition are devastating problems in developing countries like Bangladesh. Bangladesh is the most densely populated and one of the poorest countries in the world. In 2005, the poverty head count rate as measured by cost of basic needs (CBN) estimated that the incidence of poverty was 40.0% at national level, 43.8% in rural areas and 28.4% in urban areas (BBS, 2006). Poverty is the main underlying cause of malnutrition (Muller & Krawinkel, 2005). For social and biological reasons, women of the reproductive age are amongst the most vulnerable to malnutrition.

The degree and distribution of protein-energy malnutrition and micronutrient deficiencies among a population depend on many factors, including the political and

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* Correspondence author: SM Mostafa Kamal; Email: *kamaliubd@yahoo.com*

economic situation, the level of education and sanitation, the seasonal and climate conditions, food production, cultural and religious food customs, breastfeeding habits, prevalence of infectious diseases, the existence and effectiveness of nutrition programmes and the availability and quality of health services (Young *et al.*, 2004; de Waal & Whiteside, 2003).

Malnutrition, defined as being underweight, is a serious public health problem linked to a substantial increase in the risk of mortality and morbidity (Blossner & Onis, 2005). Women and young children are the most affected subjects. Diets that place people at risk for malnutrition are those deficient in macronutrients (protein, carbohydrates and fat, leading to protein-energy malnutrition), micronutrients (electrolytes, minerals and vitamins, leading to specific micronutrient deficiencies) or both (Muller & Krawinkel, 2005; Millward & Jackson, 2004).

Underweight and overweight among men and women are normally the result of deficit energy consumption and excess energy intake. These two physical conditions are associated with distinct types of public health problems. For instance, obesity is an important risk factor for diabetes mellitus (Jafar, Chatturvedi & Pappas, 2006; Naser, Gruber & Thomson, 2006; Woodward and Reid, 2003; Mokdad *et al.*, 2003), cardiovascular disease (Jafar *et al.*, 2006; Pucarin-Cvetkovic *et al.*, 2006), cancer, stroke and respiratory problems (Mokdad *et al.*, 2001; Must *et al.*, 1999), high cholesterol, high blood pressure, asthma and arthritis (Naser *et al.*, 2006; Mokdad *et al.*, 2003). Whereas being underweight is associated with pre-term birth and low birth weight (Ehrenberg *et al.*, 2003; Schieve *et al.*, 2000), malnourished children (Rayhan & Khan, 2006) and poor psychological health (Ali & Lindstrom, 2006), including high mortality (Visscher *et al.*, 2000). Besides, underweight is a particular concern as it is the first and fourth leading cause of death and disability, particularly in the developing countries (Woodward & Reid, 2003). Thus, extremes of body mass index such as underweight, overweight and obese categories are associated with a variety of adverse health outcomes such as diabetes mellitus, cardiovascular diseases, low birth weight, poor quality of life and higher mortality.

Women and children are vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care. Particularly for women, the high nutritional costs of pregnancy and lactation also contribute significantly to their poor nutritional status. For social and biological reasons, women of the reproductive age are amongst the most vulnerable to malnutrition (Girma & Genebo, 2002).

In Bangladesh, like other developing countries, poverty, ignorance and social taboos play strong negative effects on food intake of women; they eat last and the least in a family. Most of the poor women suffer from the consequence of a long history of poor nutrition, frequent illness and poor access to health facilities. Women are also mainly responsible for daily household work for the family. Burdened with repeated pregnancies from early adolescence and the household chores, they have to perform as wives as well as mothers. Pregnancy in adolescence and protein energy malnutrition are common in Bangladesh. Malnutrition is especially critical for women because inadequate nutrition not only causes ill-effects on her own health but also to the children.

Studies on the association of women's socio-economic characteristics with their nutritional status are limited in Bangladesh. The present study aimed to investigate the association of socio-demographic and other selected factors with being underweight among the ever-married, non-pregnant women of Bangladesh. Hopefully, this study

will enrich the availability of information and contribute to developing appropriate interventions for reducing malnutrition among the women in Bangladesh.

METHODOLOGY

The study used data from the nationally representative 2007 Bangladesh Demographic and Health Survey (BDHS). The survey maintained all the protocols prescribed by the World Health Organization (WHO,2000) and a written consent was obtained individually from all respondents before the start of the interview. The survey was designed to provide data to monitor the population and health situation in Bangladesh as a follow up to the previous four BDHSs conducted during 1993-2004. The survey utilised a multistage cluster sample based on the 2001 Bangladesh Census and was designed to produce separate estimates for key indicators for each of the six divisions of the country- Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet. Data collection took place over a five-month period from 24 March to 11 August 2007. The survey obtained detailed information on fertility levels, marriage, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutritional status of women and young children, childhood mortality, maternal and child health, knowledge and attitudes regarding HIV/AIDS and other sexually transmitted infections (STIs). The survey collected information of a weighted sample of 10,996 ever married women. The sample was weighted by the weighting factor provided in the survey data. Of the women, 718 were currently pregnant and 133 had missing information regarding weight, height and Body Mass Index (BMI). Thus a total of 851 women were excluded from the analyses. The details of the survey are described elsewhere (NIPORT *et al.,* 2009).

Measurement of variables

Outcome variable

The unit of analysis of this study i.e., the outcome variable is the 'underweight'. The 'underweight' status was measured from BMI with the BMI being calculated as follows:

$$BMI = \frac{Weight\ in\ kg}{\left(Height\ in\ meters\right)^2}$$

Thus, the BMI was classified according to WHO (2000):

Underweight = BMI < 18.5 kg/m²
Normal weight = BMI 18.5 to 24.9 kg/m²
Over weight = BMI 25.0 to 29.9 kg/m²
Obese = BMI $\geq$ 30.0 kg/m²

Explanatory variables

Previous studies reveal that a number of socio-demographic, cultural, political and environmental factors affect women's nutritional status. Current age is an important factor in analysing nutritional status. The current age of the study women was classified into seven categories : 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49 years by a five-year age cohort. Women's employment status was classified as 'currently working' and 'not working'. Since Bangladesh is predominantly a Muslim country and the proportion of women belonging to other religions such as Hindu, Buddhist, Christian etc. was very small, these categories were merged as non-Muslim. Thus, the variable 'religion' was dichotomised as 'Muslim' and 'non-Muslim'. Since women's education is an important factor for nutritional status, it was broken down into five categories namely: no formal education, incomplete primary, complete primary, incomplete secondary, complete secondary and higher.

One of the background characteristics used in this study was the household economic status namely 'wealth index'. The

wealth index used in this study was developed and tested in a large number of countries to measure inequalities in household income, use of health services, and health outcomes. It is an indicator of the level of wealth that is consistent with expenditure and income measures (Rutstein, 1999). The wealth index was constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction materials). To create the wealth index, each asset was assigned a weight (factor score) generated through principal component analysis, and the resulting asset scores were standardised in relation to a normal distribution with a mean of zero and standard deviation of one. Each household was then assigned a score for each asset, and the scores were summed for each household; individuals were ranked according to the total score of the household in which they resided. The sample was then divided into quintiles from one (lowest) to five (highest). A single asset index was developed for the entire BDHS sample; there were no separate indices for urban and rural populations (NIPORT *et al.,* 2009).

The six administrative regions of the country: Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet divisions were selected as another background variable in this study to assess regional variation in nutritional status of women. Current place of residence, 'rural' and 'urban' areas, is a dichotomous variable. Due to paucity of information, never married (i.e., single) women were not included in the analyses. Current marital status of the women was grouped as a dichotomous variable namely 'currently married' and 'widowed, divorced or separated'.

Statistical analyses

To examine the relationship between nutritional status and background

characteristics of the women, we applied both quantitative and qualitative statistics in this study. For statistical analyses BMI was made a binary response. If a woman was underweight, she was coded as '1' and '0' for otherwise. In doing so, the women with normal weight, overweight and obese were coded '0'. Fixed effect binary logistic regression analyses were used in this study. Bivariate logistic regression analyses were applied to examine the association between background characteristics and under-weight, while multivariate binary logistic regression analysis was applied to assess the net effects of the selected factors on 'underweight' among women. The results of the regression analyses are presented by odds ratios (OR) with 95% confidence interval (CI) for easy understanding of the effect of the corresponding factor, net of other confounders. Statistical analyses were performed using SPSS v17.

RESULTS

Background profile of the respondents

Table 1 shows the background characteristics of the study women. The mean age of the respondents was 31.1 (SD±9.3) years. The mean weight, height and BMI were 47.4 (SD±9.7) kg, 150.4 (SD±6.4) cm and 21.0 (SD±5.0) kg/m² respectively. When women's nutritional status was categorised by BMI groups, 28.5% were found to be underweight, 57.6% were normal, 11.4% were overweight and only 2.4% were obese (not shown in Table 1). As shown in Table 1, 30.2% women were employed and 9.8% were non-Muslim. With regard to education, one-third had no formal education, less than one-third had some primary education, 23.2% had not completed secondary education and 14.2% had completed at least a secondary level of education. In terms of wealth index, almost one-third were poor, 47.0% were rich and about one-fourth were from middle class families. More women were from Dhaka and

Rajshahi divisions. Over two-thirds were from rural areas and 8.1% were not currently married (widowed, divorced or separated) while 91.9% were currently married.

Prevalence and factors associated with underweight

All the independent variables selected for this study were significantly ($p<0.05$) associated with underweight among the study women (Table 1). When the women were broken down by 5-year age groups, the prevalence of underweight was found to be highest among the teenagers 15-19 (35.4%) and the lowest among women aged 30-34 years (23.5%). The unadjusted odds of underweight was 13.0% (OR=1.13, 95% CI=0.95-1.35), higher among the married adolescents and 37.0% (OR=0.63, 95% CI=0.53-0.75), lower among those of aged 30-34 years as compared to the women aged 45-49.

More than one-fourth (27.9%) of the non-working women were underweight, while this prevalence among the working women was 30.1%. Compared to the non-working women, the unadjusted odds of being underweight was 11.0% (OR=1.11, 95% CI=1.01-1.22) among the working women. Among the Muslim women, the rate of underweight was 28.2%. The corresponding figure among the non-Muslims was 31.5%. The likelihood of being underweight among the non-Muslim women as compared to those who were Muslims was 17.0% higher (OR=1.17, 95% CI=1.02-1.35).

Women's education showed an inverse association with underweight. Among women with no formal education, more than two-fifths were reported to be underweight, while only 8.1% were underweight among those with higher education. The risk of being underweight was almost seven times higher (OR=6.76, 95% CI=5.20-8.80) among women with no formal education as compared to women with higher education. Like women's education, the wealth index was inversely associated with underweight. The likelihood

of underweight was significantly ($p<0.001$) 5.2 times (OR=5.23, 95% CI=4.51-6.07) in the poorest as compared to their richest counterparts.

Place of region showed significant wide variation in nutritional status of women. The prevalence of underweight was highest in women of Sylhet division (37.3%), followed by women of Barisal (30.8%), Rajshahi (29.3%), Chittagong (26.4%), Dhaka (26.1%) and Khulna (24.0%) divisions respectively. The unadjusted odds ratios reveal that the risk of being underweight was 34.0% higher (OR=1.34, 95% CI=1.14-1.57) among women of Sylhet division, while the risk of underweight was 29.0% lower (OR=0.71, 95% CI=0.60-0.84) among women of Khulna division as compared to those of Barisal division.

One-fourth of the urban women reported to be underweight, while this proportion among women in rural areas was one-third (33.6%). The risk of underweight was two times (OR=1.98, 95% CI=1.80-2.17) among rural women than their urban sisters. The prevalence of underweight was 27.8% in the currently married women as opposed to 36.2% among those who were widowed, divorced or separated. The risk of being underweight was 47% higher (OR=1.47, 95% CI=1.27-1.71) among widowed, divorced or separated women than their currently married counterparts.

Determinants of underweight

All the variables discussed above for bivariate analyses were included in the multivariate analysis. The fixed effect binary logistic regression analysis revealed that except for working status of women, the explanatory variables of age, religion, women's education, wealth index, place of region, residence and current marital status had a significant ($p<0.05$) net effect on underweight of women. After adjusting, the odds ratios of being underweight became sharper for younger aged women. The effect of women's education and wealth index was

Table 1. Frequency distribution of women by background characteristics and their association with body mass index (BMI)

Characteristics	Frequency		Body Mass Index (BMI)		
	N	*%*	*<18.50 (%)*	*Unadjusted OR*	*95% CI*
Current age					
<20	1098	10.8	35.4	1.13	0.95-1.35
20-24	1902	18.7	30.9	0.92	0.78-1.09
25-29	1777	17.5	26.3	0.74***	0.62-0.87
30-34	1575	15.5	23.5	0.63***	0.53-0.75
35-39	1558	15.4	25.4	0.70***	0.59-0.83
40-44	1194	11.8	28.8	0.83*	0.70-1.00
45-49	1041	10.3	32.7	Ref	—
Currently working					
No	7083	69.8	27.9	Ref	—-
Yes	3058	30.2	30.1	1.11*	1.01-1.22
Religion					
Muslim	9150	90.2	28.2	Ref	
Non-Muslim	994	9.8	31.5	1.17*	1.02-1.35
Education level					
No education	3332	32.9	37.4	6.76***	5.20-8.80
Incomplete primary	2115	20.9	31.5	5.22***	3.98-6.83
Complete primary	889	8.8	27.2	4.24***	3.16-5.68
Incomplete secondary	2349	23.2	22.6	3.31***	2.52-4.34
Complete secondary	638	6.3	21.5	3.10***	2.26-4.25
Higher	801	7.9	8.1	Ref	—-
Wealth index					
Poorest	1640	16.2	43.7	5.23***	4.51-6.07
Poorer	1823	18.0	36.1	3.81***	3.29-4.42
Middle	1913	18.9	32.9	3.31***	2.86-3.83
Richer	2048	20.2	26.4	2.42***	2.08-2.81
Richest	2721	26.8	12.9	Ref	—-
Division					
Barisal	1332	13.1	30.8	Ref	—-
Chittagong	1778	17.5	26.4	0.81**	0.69-0.95
Dhaka	2181	21.5	26.1	0.80***	0.68-0.93
Khulna	1592	15.7	24.0	0.71***	0.60-0.84
Rajshahi	1935	19.1	29.3	0.93	0.80-1.09
Sylhet	1327	13.1	37.3	1.34***	1.14-1.57
Residence					
Urban	3867	38.1	20.4	Ref	—-
Rural	6278	61.9	33.6	1.98***	1.80-2.17
Current marital status					
Currently married	9322	91.9	27.8	Ref	
Wid./Div./Sep.	823	8.1	36.2	1.47***	1.27-1.71
Total	10145	100.0	28.5		

Note: Level of significance *** *p*<0.001; ** *p*<0.01; * *p*<0.05; Ref = Reference category

substantially attenuated after being adjusted for other confounding factors. The higher the wealth, the lower was the risk of being underweight. The effect of other variables was also attenuated by other confounders (Table 2).

DISCUSSION AND CONCLUSION

Nutritional status is the result of complex interactions between food consumption, overall health status and health care practices. Poor nutritional status is one of the most important health and welfare problems that is faced by Bangladesh. Young children and women of reproductive age are especially vulnerable to nutritional deficits and micronutrient deficiencies. At the individual level, inadequate or inappropriate feeding patterns lead to malnutrition.

The findings of this study showed that over one-fourth of the women were underweight at national level. In rural and urban areas, this proportion was one-third and one-fourth respectively. Almost 58.0% of the women had normal weight and nearly 14.0% were overweight. These findings suggest that both underweight and overweight or obesity co-exist and accounted for over two-fifths in the Bangladeshi women. In a study, 34.0% of the reproductive aged rural women of Bangladesh were reported to suffer from malnutrition (Milton *et al.*, 2010). Another recent study reports that the prevalence of underweight in urban areas is 25.2% (Khan & Kraemer, 2009). The prevalence of malnutrition in Bangladesh remains the highest in the world (HKI, 2006).

Numerous socio-economic and cultural factors influence the nutritional status of women. Both the bivariate and multivariate analyses reveal that several factors significantly influence underweight among women in Bangladesh; these include age, religion, women's education, wealth index, place of region, current place of residence and marital status. Studies showed that maternal malnutrition in Bangladesh is clearly associated with household socio-economic status. The regional disparity in nutritional status, in particular, the lower and higher risk of underweight among the women of Khulna and Sylhet divisions as compared to those of Barisal division is partly attributed to the inequality of social development process, social discrimination of women's status and inequity in access to health care facilities. Among the selected variables, women's education and wealth index was the most important determinants of underweight. The severity of underweight among women was by and far the largest in the poorest wealth quintile.

Higher prevalence and higher risk for underweight among the younger women is a matter of concern. This is because, the higher incidence of underweight among women aged 15-29 may cause low birth weight of their child as well as other adverse maternal complications due to malnutrition, as the rate of pregnancy and childbirth is higher among these groups of women in Bangladesh. Detailed investigations into the dietary habits and physical activity in this population are necassary.

The results of the multivariate logistic regression analysis revealed that non-Muslims were more likely to be underweight than their Muslim counterparts. A recent study conducted on Indian women indicated that Muslim and Christian women were more likely to be overweight or obese than the Hindu women (Ramesh & Jareena, 2009). Thus our finding is consistent with that of India. Women's education and wealth index showed an inverse relationship with malnutrition among women. A similar finding exists between education, wealth index and nutritional status of women in urban Bangladesh (Khan & Kraemer, 2009). The higher the education and wealth, the lower the risk of underweight.

Compared to women of urban areas, women from rural areas were at higher risk of underweight. The widow, divorced and separated women were significantly more likely to be underweight than women who

Table 2. Results of multivariate logistic regression analysis showing the effect of background factors on malnutrition among women in Bangladesh

Characteristics	Adjusted OR	95% CI
Current age		
<20	1.52***	1.24-1.85
20-24	1.23**	1.02-1.47
25-29	0.90	0.75-1.08
30-34	0.70***	0.59-0.85
35-39	0.78**	0.65-0.94
40-44	0.87	0.72-1.05
45-49	Ref	—-
Currently working		
No	Ref	—-
Yes	1.02	0.92-1.13
Religion		
Muslim	Ref	—-
Non-Muslim	1.16*	1.00-1.35
Education level		
No education	3.34***	2.51-4.44
Incomplete primary	2.68***	2.02-3.57
Complete primary	2.19***	1.61-2.97
Incomplete secondary	1.91***	1.44-2.53
Complete secondary	2.10***	1.52-2.91
Higher	Ref	—-
Wealth index		
Poorest	3.31***	2.76-3.97
Poorer	2.53***	2.13-3.01
Middle	2.32***	1.97-2.76
Richer	1.91***	1.63-2.24
Richest	Ref	—-
Division		
Barisal	Ref	—-
Chittagong	0.90	0.76-1.06
Dhaka	0.91	0.78-1.07
Khulna	0.77***	0.65-0.91
Rajshahi	0.94	0.80-1.11
Sylhet	1.37***	1.15-1.63
Residence		
Urban	Ref	—-
Rural	1.18**	1.05-1.31
Current marital status		
Currently married	Ref	—-
Wid./Div./Sep.	1.33***	1.13-1.56

Note: Level of significance *** $p<0.001$; ** $p<0.01$; * $p<0.05$; Ref = Reference category

were currently married. Surprisingly, currently working women had greater tendency to be undernourished than non-working women. This finding may be attributed to the fact that, of the working women, only 9.3% were engaged in a prestigious profession, while 60.5% were engaged in low paid jobs as factory workers, labourers, farmhands, home-based manufacturing, domestic servants etc. who generally enjoy lower autonomy in households as well as in society. These women are less likely to have a balanced and healthy diet for nutrition, resulting in higher risk of underweight as compared to the non-working women. The women with higher education serve as housewives if they do not get prestigious jobs suitable for them. However, most of the findings of this study are fairly consistent with those conducted in many other developing countries (Ramesh & Jareena, 2009; Monteiro, Conde & Popkin, 2004; Shukla *et al.*, 2002; Griffiths & Bentley, 2001; Singh, Beegom & Mehta,1999).

The strength of this study is that it analysed a nationally representative large data set and studied the extremes of BMI simultaneously among ever-married non-pregnant women in Bangladesh using sophisticated statistical techniques. However, the study has some limitations. For example, BMI is a crude index because it does not consider the distribution of fat, which can vary in different individuals and populations (Naser *et al.*, 2006). The BMI's cut-off point of 18.5 may overestimate undernutrition in some Asian populations, because the mean BMI is comparatively lower and the amount of fat in the body is relatively higher among them (Mendez, Monteiro & Popkin, 2005).

This study used cross-sectional data which could not confirm the cause and effect relationships (Khan & Kraemer, 2009). The results may be biased as the influence of other factors such as physical activity, body composition, visceral adiposity, physical fitness and dietary intake have not been included in the analyses. Mis-classification of pregnant women especially in the first trimester may also influence the results as there is a possibility that most women do not perform pregnancy kit tests in Bangladesh.

In conclusion, this study has shown that over one-fourth of Bangladeshi women suffer from chronic underweight, with important public health implications for the burden of diseases. The substantial proportion of underweight persons produces a burden of nutritional disorders for the country. Under-nutrition makes people prone to communicable diseases and reduces productivity. Therefore, the existence of such a burden poses a big challenge. Shifts in lifestyles and eating patterns have led to an increasing prevalence of chronic non-communicable diseases in the adult population in developing countries (Otgontuya *et al.,* 2009). Although the factors associated with underweight, obesity and overweight are also prevalent, it requires solutions to tackle the extremes of underweight in the lower socio-economic groups. Moreover, as undernutrition prevails in different subgroups of socio-economic segments, different intervention strategies should be undertaken to reduce the malnutrition.

Systematic monitoring and surveillance of the nutritional status are also important to address the widespread problem of underweight. Effective policies, information and health education programmes for women are required to ensure adequate access to health services and to understand the components of a healthy diet.

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