



NUTRITIONAL STATUS OF EVER-MARRIED WOMEN IN BANGLADESH

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ABSTRACT

Bangladesh is a developing country and nutritional problem is one of the most common and intractable problems in the world. The aim of the study was to identify the socio-demographic & economic predictors to nutritional status among Bangladeshi women. More recently Bangladesh Demography and Health Survey (BDHS 2011) estimated that about 24% of ever-married women of age 15-49 are under nutrient or malnutrition ($BMI < 18.5$) and 17% are over nutrient ($BMI > 25.0$). For this study, the secondary data has been used extracted from BDHS 2011. Information on 17842 women has been considered for the analysis. In this study, outcome variable was Body Mass Index (BMI) and socio-demographic & economic factors were considered as exposure for the analysis. Firstly, socio-demographic & economic factors and nutritional status are studied to know the characteristics of the study subjects. Multinomial logistic regression was also performed to nutritional status for advanced analysis. Statistical analyses were carried out using SPSS. Bivariate analysis reveals that several socio-demographic & economic variables have a significant association with nutritional status. Age, residence, educational qualification, division and wealth index are found to be highly and significantly associated with Nutritional status. Multinomial logistic regression model shows that, Odds Ratio of having under nutrient (reference group is women with normal nutritional status) we have observed that age, education, residence, wealth index and division have significant effect on Nutritional status. Analyzing Odds Ratio of having over nutrient (reference group is women with normal nutritional status) we have observed that age, education, residence, wealth index have significant effect on nutritional status.

Key words: BMI, nutritional status, socio-demographic

INTRODUCTION

Bangladesh has very high under nutrient rates among women than many others developing countries in the world. Under nutrient has serious implication for the productivity as well as overall development of the country because micronutrients are essential for growth, protection from infections, cognitive function and for performing physical work. "Under nutrition contributes to dysfunctional societies with individuals too weak, too vulnerable to disease and too lacking in physical energy to carry out the extraordinarily laborious tasks of escaping the poverty trap. Bangladesh is still struggling to emerge from poverty. Bangladesh ranks 139rd among 188 developing countries on the Human Poverty Index (HPI) (UNDP 2015). The literacy in Bangladesh is approximately 53.4% (BBS) and the level of general education also poor. Very little nutrition education is imparted in school where large majority of population never go. Nutrition is the notion of 'diet' as different from single food intake. It is an integrated concept of ecological, economic, social, cultural and nutritional requirements. Nutritional status is one of the most accurate measures of the quality of health in a society. Body mass index (BMI) is defined and calculated as the ratio of weight in kilograms to height

in meter squared and it is accepted by the World Health Organization(WHO) as an indirect indicator of nutritional status in a particular population. It is also used to classify individuals as undernourished,normal, over nutrient .In many developing nations, women are supposed to provide for all members of the extended family. Health status of these women would reflect the general health and social environment of the population. Due to unique role of women in the population, it is important to investigate the relationship between the BMI and socio-demographic & available economic factors of ever-married women. The aim of this study is to look at the relationship between the BMI and various socio-demographic and available economic factors of ever-married Bangladeshi women based on the dataset collected by BDHS 2011.

MATERIALS AND METHODS

The cross-sectional data were extracted from BDHS 2011.17,842ever-married Bangladeshi women with the mean age of 31.78± 8.27 years (ranged from 12 to 49 years) were interviewed by BDHS 2011. The survey was conducted under the authority of the National Institute for Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare. The present study uses the data collected from BDHS 2011.Women with Nutritional status (under nutrient, normal, over nutrient) are considered as dependent variable in this study.For multinomial logistic regression, the nutritional status is divided into three categories:undernourished (BMI<18.5), normal (BMI: 18.5-24.9) and over nutrient (BMI>25.0).The study includes a set of independent variables to understand the extent and differentials of Nutritional status among women and its effect on the outcomes.From the main dataset, gathered information on age, place of residence, educational qualification, division and wealth index for this study. The data set was checked for outliers by using statistical techniques (Dunn and Clark 1974). For the descriptive analysis mean (Normal deviation), frequency (percentage) etc are used. The independent sample t-testand ANOVA were utilized for comparison of mean values in BMI between two or more than two groups, respectively. Then comparison ofvariables are performed to nutritional status using chi-square test (Pearson) for categorical variable. Multinomial logistic regression was also performed to nutritional status for advanced analysis.

Let's try to write the model as

$$Y = \beta_0 + \sum_{j=1}^k \beta_j X_j + \varepsilon \dots\dots\dots (1)$$

Let Y is a categorical dependent variable, which take value 1, 2 and 3.

Thus

$$Y_i = \begin{cases} 1, & \text{Under nutrient} \\ 2, & \text{Normal} \\ 3, & \text{Over nutrient} \end{cases} \dots\dots\dots .$$

where, i = 1,2,.....n

Also consider a collection of k independent variables which will be denoted by the vector

$$X' = (X_1, X_2, \dots, X_k)$$

And β be a $(K + 1) \times 1$ vector of unknown parameters.

The logit for each non-reference category j=2,.....C-1

against the reference category 1 depends on the values of the explanatory variable through:

$$\text{Log} \left(\frac{\pi_i^{(j)}}{\pi_i^{(1)}} \right) = \beta_0^{(j)} + \beta_1^{(j)} X_{1i} + \beta_2^{(j)} X_{2i} + \dots + \beta_k^{(j)} X_{ki}, i = 1, 2, \dots n \dots \dots \dots (2)$$

For each j=2... C-1 where $\beta_0^{(j)}$ and $\beta_1^{(j)} \dots \beta_k^{(j)}$ are unknown population parameters.

Multinomial logistic regression analysis was utilized to examine the association between nutritional status and anthropometric measures, socio-economic and socio-demographic factors. Nutritional status was used as dependent variable. The underlying multinomial logistic regression model corresponding to each variable for SBP is:

$$\text{Log} \left(\frac{\pi^{(j)}}{\pi^{(1)}} \right) = \beta_0^{(j)} + \beta_1^{(j)} X_1 + \beta_2^{(j)} X_2 + \beta_3^{(j)} X_3 + \beta_4^{(j)} X_4 + \beta_5^{(j)} X_5 +$$

$$\beta_8^{(j)} X_8 + \beta_9^{(j)} X_9 + \beta_{10}^{(j)} X_{10} + \beta_{11}^{(j)} X_{11} + \beta_{12}^{(j)} X_{12} + \beta_{13}^{(j)} X_{13} \dots \dots \dots (3)$$

Where, $\pi^{(1)}$ = Normal and j = 2 and 3 (2= under nutrient and 3= over nutrient), X_1 = Age, X_2 = place of residence, X_3 = Division, X_4 = Education, X_5 = wealth index, $\beta_0^{(j)}$ = Intercept term, and, $\beta_i^{(j)}$ = unknown logistic regression coefficients (i= 1, 2, 3,13). The parameter β_i refers to the effect of X_i on the log odds Y= 2, 3, controlling the other X_i .

And for DBP, the multinomial logistic regression model is:

$$\text{log} \left(\frac{\pi^{(j)}}{\pi^{(1)}} \right) = \beta_0^{(j)} + \beta_1^{(j)} X_1 + \beta_2^{(j)} X_2 + \beta_3^{(j)} X_3 + \beta_4^{(j)} X_4 + \beta_5^{(j)} X_5 \dots \dots \dots (4)$$

Where, $\pi^{(1)}$ = Normal and j = 2 and 3 (2= under nutrient and 3= over nutrient), X_1 = Age, X_2 = place of residence, X_3 = Division, X_4 = Education, X_5 = wealth index, $\beta_0^{(j)}$ = Intercept term, and $\beta_i^{(j)}$ = unknown logistic regression coefficients (i= 1, 2, 3,11). The parameter β_i refers to the effect of X_i on the log odds Y= 2, 3, controlling the other X_i .

For testing the significance of the parameters of logistic regression model following test procedures are usually used Likelihood ratio test. . Statistical analyses were carried out using SPSS (the statistical packages for social science).

RESULTS AND DISCUSSION

A total sample of 17842 Of ever-married Bangladeshi women was analyzed. The age of subjects varied from 13 to 49 years with mean age 31.78 ± 8.27 years (95% CI: 31.55-31.84).The average BMI of the women was 21.60 ± 3.86 kg/m² (95% CI: 21.53-21.66).

More than half of the women were normal weight (59.11%) and 17.68% were over nutrient. A remarkable number of participants were under nutrient (23.21%)(Table 1).

Table 1. Frequency distribution of BMI categories among Bangladeshi ever-married women

Nutritional status	N	%	Cumulative %
Under nutrient (BMI<18.5 kg/m ²)	4023	23.21	23.21
Normal (BMI:18.5<BMI<24.9 kg/m ²)	10243	59.11	82.22
Over nutrient (BMI>25.0 kg/m ²)	3064	17.68	100.0

In the table frequency and percentage, we have observed that women age is highest (38.35%) in the age interval 20-29 and lowest (11.23%) in the age interval 13-19. For residence we have

observed that most of the respondents(65.27%)women living in rural areas.Education is the most important factor for showing the pattern of nutritional status of women in Bangladesh. We have observed that educational level is highest (35.90%) among respondent with secondary education and lowest (8.21%) among those with a higher education. Also we have observed that people of Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet division are approximately same. But highest (17.29%) respondents are in Dhaka division and lowest (11.58%) respondents are in Barisal division. Wealth status is also the most important factor for showing the pattern of nutritional status of women in Bangladesh. Most of the respondent's wealth statuses are poorest. Poorer, middle, richer and richest are approximately same. But most of the respondent's wealth status is richest(23.52%) (Table 2)

Table 2. Characteristics of the study subjects

Socio-demographic and economic variable	Description in categories	Frequency	Percentage
Age	13-19	2004	11.23
	20-29	6843	38.35
	30-39	4990	27.97
	40-49	4005	22.45
Residence	Urban	6196	34.73
	Rural	11646	65.27
Education	Illiterate	4639	26.00
	Primary	5332	29.88
	Secondary	6406	35.90
	Higher	1465	8.21
Division	Barisal	2066	11.58
	Chittagong	2871	16.09
	Dhaka	3084	17.29
	Khulna	2656	14.89
	Rajshahi	2608	14.62
	Rangpur	2469	13.84
Wealth index	Sylhet	2088	11.70
	Poorest	21.60	17.35
	Poorer	3345	18.75
	Middle	3428	19.21
	Richer	3777	21.17
	Richest	4196	23.52

The analysis showed that the differences in BMI of women were significant ($p < 0.001$) when we compared the age, educational levels, residence, division and that of their wealth index.

Pervin./Nutritional status of ever-married women

The comparison of the characteristics subjects to nutritional status will be done. Through this comparison we can find the association of various socio-demographic and economic factors with BMI. To compare the percentages chi-square test has been used and also compare the means, t-test has been used. These tests have been performed at 5% level of significance (Table 3, 4 and 5).

Appropriate logistic model fitted to outcome variable to find the significant covariates. Since our outcome variable is categorical (three categories). We have used multinomial logistic regression. OR (Odds Ratio) and 95% CI (Confidence interval) has been analyzed significance association of covariates to outcome. These statistical analyses have been carried out by using SPSS statistical software. Result showed that, women of age-group 13-19 years are on 1.45 times more risk to have under nutrient than women of age group 40-49 years (OR=1.45, with 95% C.I 1.26 and 1.66) which is significant. Also we have found that women of age-group 30-39 years are on .83 times less risk to have under nutrient than women of age group 40-49 years (OR=.83, with 95% C.I .74 and .92) which is significant too.

Table 3. Descriptive statistics of BMI categories among Bangladeshi ever-married women by Socio-demographic and economic factors (age and education)

Socio-demographic and economic factor	Description in categories	BMI			Chi-square p-value
		Under nutrient (n=4023) % (95% CI)	Normal (n=10243) % (95% CI)	Over nutrient (n=3064) % (95% CI)	
Age	13-19	16.11 (14.97-17.24)	11.95 (11.32-12.58)	2.87 (2.28-3.46)	461.634 (<0.001)
	20-29	38.53 (37.02-40.03)	39.81 (38.86-40.76)	33.13 (31.46-34.79)	
	30-39	23.51 (22.20-24.82)	27.47 (26.61-28.34)	35.15 (33.46-36.84)	
	40-49	21.85 (20.57-23.13)	20.77 (19.98-21.55)	28.85 (27.25-30.46)	
Education	Illiterate	33.56 (32.10-33.02)	25.82 (24.97-26.67)	17.27 (15.93-18.60)	702.461 (<0.001)
	Primary	33.33 (31.88-34.79)	30.47 (29.58-31.36)	23.86 (22.35-25.37)	
	Secondary	30.18 (28.76-31.17)	36.24 (35.31-37.17)	42.62 (40.87-44.37)	
	Higher	2.93 (2.41-3.45)	7.47 (6.96-7.98)	16.25 (14.95-17.56)	

Table 4. Descriptive statistics of BMI categories among Bangladeshi ever-married women by Socio-demographic and economic factors (division and residence)

Socio-demographic and economic factor	Description in categories	BMI			Chi-square p-value
		Under nutrient (n=4023) % (95% CI)	Normal (n=10243) % (95% CI)	Over nutrient (n=3064) % (95% CI)	
Division	Barisal	11.71	11.45	9.95	185.594 (<0.001)
		(10.71-12.70)	(10.83-12.07)	(8.89-11.01)	
		14.52	16.31	17.36	
	Chittagong	(13.43-15.60)	(15.60-17.03)	(16.02-18.70)	
		16.75	17.08	18.37	
		(15.60-17.91)	(16.36-17.81)	(17.00-19.75)	
	Khulna	11.93	15.28	18.24	
		(10.93-12.93)	(14.58-15.98)	(16.87-19.61)	
		14.04	14.66	15.24	
Rajshahi	(12.97-15.11)	(13.98-15.35)	(13.97-16.51)		
	15.19	14.80	10.08		
	(14.08-16.30)	(14.11-15.49)	(09.02-11.15)		
Sylhet	15.86	10.40	10.74		
	(14.73-16.99)	(09.82-10.99)	(9.64-11.83)		
	Residence	23.07	33.01	55.35	830.480 (<0.001)
(21.77-24.37)		(32.10-33.92)	(53.59-57.11)		
76.93		66.99	44.89		
Rural	(75.63-78.23)	(66.08-67.90)	(42.89-46.41)		

Table 5. Descriptive statistics of BMI categories among Bangladeshi ever-married women by wealth index

Socio-demographic and economic factor	Description in categories	BMI			Chi-square p-value
		Under nutrient (n=4023) % (95% CI)	Normal (n=10243) % (95% CI)	Over nutrient (n=3064) % (95% CI)	
Wealth index	Poorest	29.36 (27.95-30.76)	16.46 (15.74-17.18)	5.09 (4.31-5.87)	2352.659 (<0.001)
	Poorer	23.86 (22.55-25.18)	20.22 (19.44-20.99)	7.38 (6.45-8.30)	
	Middle	20.51 (19.26-21.75)	20.68 (19.89-21.46)	12.96 (11.77-14.14)	
	Richer	17.44 (16.28-18.62)	21.74 (20.94-22.54)	24.12 (22.60-25.63)	
	Richest	8.82 (7.95-9.70)	20.90 (20.11-21.69)	50.46 (48.69-52.23)	

Result showed that, higher education (OR=1.57, with 95% C.I are 1.27 and 1.96) which is significant too (Table 6). Illiterate are on 1.75 times more risk to have under nutrient than higher education (OR=1.75, with 95% C.I are 1.40 and 2.19) which is significant. Also we have found that primary are on 1.57 times more risk to have under nutrient than

Table 6. Risk factors of Socio-demographic and economic factor to nutritional status of women in Bangladesh (For under nutrient)

Socio-demographic and economic factor	Categories	β -coefficient	SE	P-value	OR (95% CI)
Age	13-19	.369	.070	.000	1.45 (1.260-1.661)
	20-29	-.007	.056	.901	.993 (.891-1.108)
	30-39	-.193	.057	.001	.83 (.738-.922)
	40-49	1	1	1	1
Education	Illiterate	.558	.115	.000	1.747 (1.395-2.188)
	Primary	.453	.111	.000	1.574 (1.267-1.955)
	Secondary	.350	.108	.001	1.419 (1.148-1.753)
	Higher	1	1	1	1

Note: Reference group is women with BMI 18.5-24.9

We have seen that, urban residence are on .87 times less risk to have under nutrient than rural residence (OR=.87, with 95% C.I are .81 and .97) and is significant. Also we have seen that, Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur are less risk to have under nutrient

than Sylhet which are significant. Result showed that, women of poorest, poorer, middle and richer condition are more risk to have under nutrient than richest condition which are significant too (Table 7).

Table 7. Risk factors of Socio-demographic and economic factor to nutritional status of women in Bangladesh (For under nutrient)

Socio-demographic and economic factor	Categories	β -coefficient	SE	P-value	OR (95% CI)
Residence	urban	-.122	.048	.012	.886 (.806-.973)
	rural	1	1	1	1
Division	Barisal	-.459	.077	.000	.632 (.543-.735)
	Chittagong	-.503	.072	.000	.605 (.525-.696)
	Dhaka	-.415	.070	.000	.660 (.576-.757)
	Khulna	-.681	.075	.000	.506 (.437-.586)
	Rajshahi	-.523	.073	.000	.592 (.514-.683)
	Rangpur	-.563	.072	.000	.569 (.495-.656)
	Sylhet	1	1	1	1
Wealth index	Poorest	1.245	.082	.000	3.472 (2.959-4.074)
	Poorer	.867	.080	.000	2.380 (2.033-2.785)
	Middle	.730	.078	.000	2.074 (1.779-2.419)
	Richer	.562	.076	.000	1.754 (1.513-2.034)
	Richest	1	1	1	1

Note: Reference group is women with BMI 18.5-24.9

Analyzing Odds Ratio of having over nutrient (reference group is women with normal nutritional status) we have observed that, women of age-group 13-19 years are on .16 times less risk to have over nutrient than women of age group 40-49 years (OR=.16, with 95% C.I are .12 and .20) which is significant. The result showed that, women of age-group 20-29, 30-39 years are less risk to have over nutrient than women of age group 40-49 years which are significant too. Also we have found that, illiterate and primary education are less risk to have over nutrient than higher education but secondary education is .92 times less risk to have over nutrient than higher education and which is not significant (Table 8).

Table 8. Risk factors of Socio-demographic and economic factor to nutritional status of women in Bangladesh (For over nutrient)

Socio-demographic and economic factor	Categories	β -coefficient	SE	P-value	OR (95% CI)
Age	13-19	-1.854	.123	.000	.157 (.123-.199)
	20-29	-.649	.060	.000	.522 (.464-.588)
	30-39	-.146	.058	.012	.864 (.771-.968)
	40-49	1	1	1	1
Education	Illiterate	-.494	.089	.000	.610 (.513-.726)
	Primary	-.341	.080	.000	.711 (.608-.832)
	Secondary	-.082	.071	.249	.921 (.801-1.059)
	Higher	1	1	1	1

Note: Reference group is women with BMI 18.5-24.9

Result showed that, urban residence are on 1.35 times more risk to have over nutrient than rural residence (OR=1.35, with 95% C.I are 1.22 and 1.45) and is significant. Also we have seen that, Khulna, Rajshahi are more risk to have over nutrient than Sylhet division which are significant but Barisal, Chittagong, Dhaka, and Rangpur which are not significant. We have found that women of poorest, poorer, middle and richer condition are less risk to have over nutrient than richest condition which all are significant (Table 9)

CONCLUSIONS

Based on the discussion of this study some policy implications and recommendations have been suggested that would help the government and other policy makers to take proper initiative to promote nutritional status in Bangladesh. We have seen that the women living in rural area are suffering from under nutrient. Medical facility, educational attainment and other facilities should be increased in rural area for decreasing under nutrient. Women's education is found to have a significant effect on nutritional status. Educational opportunities for women should be expanded to help reduce lack of under nutrient. Poor family experiences higher under nutrient. So, Government and also the NGOs should take some necessary steps to eradicate poverty.

Table 9. Risk factors of Socio-demographic and economic factor to nutritional status of women in Bangladesh (For over nutrient)

Socio-demographic and economic factor	Categories	β -coefficient	SE	P-value	OR (95% CI)
Residence	urban	.300	.050	.000	1.350 (1.224-1.489)
	rural	1	1	1	1
Division	Barisal	.054	.097	.575	1.056 (.873-1.277)
	Chittagong	.132	.085	.120	1.141 (.966-1.349)
	Dhaka	-.003	.085	.970	.997 (.845-1.176)
	Khulna	.278	.085	.001	1.321 (1.117-1.561)
	Rajshahi	.208	.088	.018	1.231 (1.036-1.463)
	Rangpur	-.019	.095	.838	.981 (.814-1.181)
	Sylhet	1	1	1	1
Wealth index	Poorest	-1.627	.102	.000	.196 (.161-.240)
	Poorer	-1.505	.089	.000	.222 (.186-.265)
	Middle	-1.046	.074	.000	.351 (.304-.406)
	Richer	-.577	.060	.000	.561 (.499-.631)
	Richest	1	1	1	1

Note: Reference group is women with BMI 18.5-24.9

REFERENCES

- Bangladesh Bureau of Statistics (BBS) 2011. Population census, Available at <http://www.bbs.gov.bd/userfiles/Image/Rptpopcen.pdf>
- Bangladesh demographic and health survey (BDHS) 2011 data. <http://www.measuredhs.com/data/available-datasets.cfm>. 2013. [Accessed 10 February 2013]
- Dunn OJ and Clark VM. 1974. Applied Statistics: Analysis of Variance and Regression. Toronto: John Wiley & Sons.
- Islam MZ, Akhtaruzzaman M and Lamberg-Allardt C. 2004. Nutritional status of women in Bangladesh: comparison of energy intake and nutritional status of a low income rural group with a high income urban group. Asia Pacific Journal of Clinical Nutrition 13: 61-68.

- Kavitha K, Sumayaa S, Ravikumar S and Tajunisha Z. 2011. A Study on Nutritional Status of Pregnant Women of Rural Area in Ramanathapuram District, Tamil Nadu. *International Journal of Current Research* 3: 122-125.
- Khan MM and Kraemer A. 2009. Factors associated with being underweight, overweight and obesity among ever-married non-pregnant urban women in Bangladesh. *Singapore Medical Journal* 50: 804-13
- NIPORT 2013. National Institute of Population Research and Training, Mitra and Associates, ICF International. NIPORT, Mitra and Associates, ICF International, Dhaka, Bangladesh, and Calverton, Maryland, USA.
- Pryer JA, Rogers S and Rahman A. 2003. Factors affecting nutritional status in female adults in Dhaka slums, Bangladesh. *Social Biology* 50: 1037-1045.
- Shankar H, Dabral SB and Walia DK. 2010. Nutritional status of newly married women (married last 2 years from date of survey) in rural area of Allahabad, India. *Indian Journal of Preventive and Social Medicine* 41: 192-197.
- Tavani A, Negri E and La Vecchia C. 1994. Determinants of body mass index: a study from northern Italy. *International Journal of Obesity and Related Metabolic Disorders* 18(7): 497-502.
- World Health Organization (WHO). 2006. The WHO child growth normal: length/height-for-age, weight-for-age, weight-for-height and body mass index for-age: methods and development. Geneva, Switzerland: World Health Organization. Available at <http://www.who.int/childgrowth/normal>.