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Gender Differentiate in Nutritional Status among Bangladeshi Adults: A Cross Sectional Study

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Abstract

Background: Malnutrition is the important key risk factors for the various diseases. In this study, Body Mass Index (BMI) was used to measure nutritional status for adults. The aim of the study was to differentiate nutritional status between male and female in Bangladesh.

Methods: Data was extracted from Bangladesh Demographic and Health Survey (BDHS-2011) dataset. Independent sample t-test, Z-proportional test, chi-square (χ^2) test and multinomial logistic regression were used in this study.

Results: This study revealed that the prevalence of under and over nutrition among Bangladeshi adults aged 16-34 years were 23.6% and 14.3% respectively. It was found that the prevalence of under nutrition among men (26.3%) was significantly ($p<0.01$) higher than that of women (23.3%), while the prevalence of over nutrition among women (15.2%) was higher than that of men (7.2%). Height and weight of adult male was significantly ($p<0.01$) higher than female, but the mean value of BMI of female (21.32 ± 3.59 kg/m^2) was significantly higher ($p<0.01$) than male (20.54 ± 2.83 kg/m^2). Urban male and female were higher BMI than rural male and female ($p<0.01$). Multinomial logistic regressions exhibited that living location (division), education level, toilet facilities, marital status and wealth index were risk factors for malnutrition for both sexes.

Conclusion: This study demonstrated that a remarkable number of both male and female were malnourished in Bangladesh. This study suggested that controlling some modifiable factors such as household wealth quintile, education, working status and residence might reduce the prevalence of malnutrition among adults in Bangladesh.

Keywords: Gender differentiates; Nutritional Status; Adults; Bangladesh; Logistic regression

Introduction

The Body Mass Index (BMI) is a simple numeric measure to assess fatness or thinness of an individual which is widely used to determine nutritional status in a population group [1].

BMI is calculated from a person's weight and height for adults. In this study, BMI categories (cut off points) were considered to measure nutritional status of Bangladeshi adults. Underweight (BMI ≤ 18.5 kg/m^2), normal weight (18.5<BMI<25 kg/m^2), and overweight (25 ≤ BMI<30 kg/m^2) and obese (BMI ≥ 30 kg/m^2) were used to measure under nutrition, healthy weight and over nutrition respectively [1]. Nutritional status based on BMI is also related to demographic, economic, social and environmental conditions of the population [2,3]. Bangladesh, a low income country, have experienced in malnutrition [4-6]. The household wealth quintile and women education level have been increasing during the last two decades. It is assumed that the number of over nourished individual in Bangladesh has been increasing, and the male-female differentiate in nutritional status become somewhat minimized. Over weight has been shown to be a risk factor for hypertension, heart disease, diabetes mellitus, cardiovascular disease, gall bladder disease and various types of cancer. On the other hand, underweight has been associated with a higher risk of hip fracture in women [7,8].

Many researchers have studied women nutritional status around the world [8-11]. Globally few studies [12,13] have focused on the gender differences in BMI and underweight and overweight prevalence at the population level. One study reported that in low and middle income countries women have higher BMI than men [13]. In addition, another study mentioned that more women in developed countries are overweight and obese compared with their male counterparts [12]. However, no such evidence for a gender difference in BMI in Bangladesh has been found in the literature, except [14,15] which found

that women in rural areas had a greater prevalence of overweight than men. In addition, the Global Burden of Disease study [12] reported that overweight and obesity are more prevalent among Bangladeshi women than men. Many researchers have found that two non modifiable factors wealth quintile and education level are most important predictors for good nutritional status. These two factors are increasing for both male and female but the education level has been dramatically increasing among women for last two decades in Bangladesh [16]. Efforts will be made to improve the health conditions of a population, both male and female are considered. It is needed to investigate the gender differentiate in nutritional status among Bangladeshi adults.

The objectives of this study are to investigate the prevalence of under-nutrition and over-nutrition among Bangladeshi adults and look differentiate in nutritional status between male and female. In addition, is to find the effect of socio-economic and demographic factors on malnutrition among male and females in Bangladesh.

Methods

Data source and sample size

This cross-sectional study extracted data from Bangladesh Demographic and Health Survey (BDHS-2011). The survey is based

on a two-stage stratified sample of households [17] which is nationally representative and covers the entire population of the country. The survey collected socio-demographic, health and lifestyle information from each subject. In addition, body height and weight were measured. The sampling technique, survey design, survey instruments, measuring system and quality control have been described elsewhere [17].

BDHS-2011 collected data mainly from married women in reproductive age (15 to 49 years) in Bangladesh and the male data collected by two categories of age group one is ever-married aged 15-34 years and other was 35 to older. Our study aim was to gender differentiate in nutritional status among married adults for conducting the analysis, we merge the both male and female data in one data set over the age range 16 to 34 years. The final data set was checked for outliers by the present authors using statistical techniques [18], because these abnormal points can affect the interpretation of results [19]. Some missing values were also detected and these cases were excluded. Pregnant women were also excluded in the present study. After removing outliers, cases with incomplete data, and the total data set was reduced to 12,610 for the analysis in the present study among them male data was 1436 and female 11,174. A total number of 4387 and 8223 participants were living in urban and rural environment respectively.

Measurement of variables

Outcome variable

The outcome variable of the study was nutritional status of Bangladeshi married adults aged 16-34 years. Nutritional status was measured by BMI. The BMI was subdivided into four classes according to most widely used categories of BMI for adults:

(i) Underweight (under nutrition) (BMI ≤ 18.5 kg/m^2),

(ii) Normal weight (healthy weight (18.5<BMI<25 kg/m^2),

(iii) Overweight (25 ≤ BMI<30 kg/m^2) and

(iv) Obese (BMI ≥ 30 kg/m^2) (overweight and obese are considered as over nutrition) [20-21].

Independent variables

Various socio-economic and demographic factors were used in this study as independent variables such as: place of residence (1=Urban, 2=Rural), region (1=Barisal, 2=Chittagong, 3=Dhaka, 4=Khulna, 5=Rajshahi, 6=Rangpur, 7=Sylhet), type of toilet facility (1=Hygienic, 2=Unhygienic), has electricity (0=No,1=Yes), educational level (0=No education, 1=Primary, 2=Secondary, 3=Higher), wealth index (1=Poor, 2= Middle, 3=Rich), Current marital status (1=Currently married, 2=Other), Current working status (0=No, 1=Yes). All independent variable had been selected on the basis of previous research [22-23].

statistical analysis

The prevalence of under nutrition, normal nutrition and over nutrition among Bangladeshi married adults in 16 to 34 age range was calculated by frequency distribution of BMI categories (dependent variable). Independent sample t-test was used to find differences in BMI between male and female. Chi-square (χ^2) test was used in the present study to find the association between BMI categories of married adults and their socio-economic, demographic factor. In the present study, the significantly associated factors with BMI categories were considered as the independent variables in the logistic regression models. Since our outcome variable BMI has three categories:

(i) Underweight

(ii) Normal weight and

(iii) Overweight or obese. Multinomial logistic regression was used in the study to find the effect of socio-economic, demographic and anthropometric factors on nutritional status (BMI categories) of Bangladeshi married adults. This statistical analysis was performed by using SPSS statistical software (IBM SPSS Statistics version 20).

Results

A total number of Bangladeshi adults 12,610 was considered in this study, among them male data was 1436 and female 11,174. The age range of the adults was 16-34 years with mean age 28.05 ± 3.65 years for male and 25.13 ± 4.97 years for female.

Gender differentiate in height, weight and BMI in Bangladesh

Table 1 showed the descriptive statistics for age, weight, height and Body Mass Index (BMI) among Bangladeshi adults. In this study, 11.39% men and 88.61% women were considered. It was observed that the mean age, weight and height of men was significantly (p<0.01) higher than that of women, while the mean BMI of women was significantly (p<0.01) higher than that of men.

Table 2 shows that the descriptive statistics for BMI by type of place of residence and here 35% urban and 65% rural population are considered. The mean BMI is higher in urban population than the rural population (p<0.01). We also observed that in both urban and rural female BMI is significantly (p<0.01) larger than the male BMI.

Gender differentiate in nutritional status among adults in Bangladesh

Z proportion test was used to calculate the significant difference between two proportions of gender for different BMI category. The proportions of underweight and normal weight for male was significantly (p<0.05) higher than that of female whereas the proportions overweight and obese for female was significantly (p<0.05) than male (Table 3).

Variables	Gender	N	Mean	SD	SE	95% CI for mean		t- value	p- value
						Lower	Upper		
Age (year)	Male	1436	28.05	3.65	0.10	2.66	3.19	21.53	p<0.01
	Female	11174	25.13	4.97	0.05	2.71	3.13	27.24	
Weight (kg)	Male	1436	54.39	8.43	0.22	5.68	6.17	22.42	p<0.01
	Female	11174	48.72	9.11	0.09	5.68	6.14	23.80	
Height (cm)	Male	1436	162.68	6.28	0.17	11.34	11.95	74.63	p<0.01
	Female	11174	151.03	5.47	0.05	11.30	11.98	67.08	
BMI (kg/m^2)	Male	1436	20.54	2.83	0.07	-0.97	-0.59	-7.93	p<0.01
	Female	11174	21.32	3.59	0.03	-0.94	-0.62	-9.53	

Table 1: Descriptive statistics for age, weight, height and Body Mass Index (BMI) by gender.

Variables	Gender	N	Mean	SD	SE	95% CI for Mean		p-value
						Lower	Upper	
Urban	Both	4387 (35%)	22.20	3.83	0.06	22.09	22.31	p<0.01
Rural	Both	8223 (65%)	20.71	3.23	0.04	20.64	20.78	
Urban	Male	533	21.13	3.08	0.13	20.86	21.39	p<0.01
	Female	3854	22.35	3.90	0.06	22.23	22.47	
Rural	Male	903	20.19	2.60	0.09	20.02	20.36	p<0.01
	Female	7320	20.78	3.29	0.04	20.70	20.85	

Table 2: Descriptive statistics for BMI by type of place of residence.

BMI category	Gender	Percentage	Proportion	Z-value	p-value
Underweight (BMI<18.5)	Male (377)	26.3%	0.263	2.52	p>0.05
	Female (2598)	23.3%	0.233		
Normal weight(18.5 ≤ BMI<25)	Male (956)	66.6%	0.666	3.05	p<0.01
	Female (6876)	61.5%	0.615		
Over weight and Obese (25 ≤ BMI)	Male (103)	7.2%	0.072	-2.22	p<0.05
	Female (1700)	15.2%	0.152		

Table 3: The prevalence of under nutrition, healthy weight and over nutrition of Bangladeshi married adults by gender.

Division (N, %)	Dependent variable (BMI)			X^2-value	p-value
	Underweight n (%)	Normal weight n (%)	Overweight & Obese n (%)		
Chittagon (2109, 16.7%)	460 (21.8%)	1316 (62.4%)	333 (15.8%)	99.53	P<0.01
Dhaka (2193, 17.4%)	498 (22.7%)	1365 (62.2%)	330 (15.0%)		
Khulna (1836, 14.6%)	365 (19.9%)	1168 (63.6%)	303 (16.5%)		
Rajshahi (1813, 14.4%)	427 (23.6%)	1103 (60.8%)	283 (15.6%)		
Rangpur (1838, 14.6%)	459 (25.0%)	1198 (65.2%)	181 (9.8%)		
Sylhet (1445, 11.5%)	444 (30.7%)	813 (56.3%)	188 (13.0%)		
Wealth index (N, %)					
Poor (4628, 36.7%)	1520 (32.8%)	2879 (62.2%)	229 (4.9%)	1026.8	P<0.01
Middle (2430, 19.3%)	611 (25.1%)	1580 (65.0%)	239 (9.8%)		
Richer (5552, 44.0%)	844 (15.2%)	3373 (60.8%)	1335 (24.0%)		
Type of place of residence (N,%)					
Urban (4387, 34.8%)	759 (17.3%)	2672 (60.9%)	956 (21.8%)	378.63	P<0.01
Rural (8223, 65.2%)	2216 (26.9%)	5160 (62.8%)	847 (10.3%)		
Type of toilet facilities					
Hygienic (3897, 30.9%)	581(14.9%)	2324 (59.6%)	992 (25.5%)	676.6	P<0.01
Unhygienic (8713, 69.1)	2394 (27.5%)	5508 (63.2%)	811 (9.3%)		
Has electricity (N, %)					
No (4551, 36.1%)	1440 (31.6)	2841 (62.4)	270 (5.9)	544.19	P<0.01
Yes (8059, 63.9%)	1535 (19.0)	4991 (61.9)	1533 (19.0)		
Husband's education level, (N,%)					
Uneducated, 2075 (16.5)	640 (30.8%)	1278 (61.6%)	157 (7.6%)	513.49	P<0.01
Primary, 3857 (30.6%)	1087 (28.2%)	2387 (61.9%)	383 (9.9%)		
Secondary, 5458 (43.3%)	1126 (20.6%)	3419 (62.6%)	913 (16.7%)		
Higher, 1220 (9.7%)	122 (10.0%)	748 (61.3%)	350 (28.7%)		

Table 4: Nutritional status is stratified by Socio-demographic characteristics participants.

Chi-square test for association between two factors

The Chi-square test was used in the present study for selecting the independent variables for multinomial logistic regression models. The frequency distribution of the category of Body Mass Index (BMI) among Bangladeshi married adults by division is presented in Table 4. The prevalence of underweight among Bangladeshi married adults was 19.9%. The prevalence of overweight among Bangladeshi married adults was 9.8%. Chi-square test demonstrated that the association between category of BMI among married adults and their residence in division was statistically significant also place of residence, currently living together, educational level, wealth index, toilet facilities are statistically significant.

Determinants of under nutrition

The multinomial logistic regressions were used to find the effect of socio-economic and demographic factors on Bangladeshi adult's nutritional status. In this study, normal weight was considered as reference case, and under weight, over weight and obese were compared with normal weight separately. There was no evidence of multicollinearity problems among predictors, since the magnitude of standard error value of all considered independent variables was in the range 0.001 to 0.50. Multinomial logistic regression models demonstrated that male individual who were living in Sylhet division were likely to be underweight than male who were living in Rangpur [AOR=0.56; CI: 0.35-0.91; p<0.05] whereas women who were living in

Sylhet division had more chance to get underweight than women who were living in Barisal [AOR=0.62; CI: 0.52-0.75; p<0.01], Chittagong [AOR=0.69; CI: 0.58-0.82; p<0.01], Dhaka [AOR=0.71; CI: 0.60-0.84; p<0.01], Khulna [AOR=0.59; CI: 0.49-0.70; p<0.01], Rajshahi [AOR=0.70; CI: 0.59-0.83; p<0.01], Rangpur [AOR=0.66; CI: 0.56-0.79; p<0.01] divisions. This model also demonstrated that women who were living in rural environment were more likely to get underweight than urban women [AOR=0.87; CI: 0.77-0.97; p<0.05], while there was no effect of type of residence on male nutritional status. Currently non-married women had more chance to become underweight than currently married women [AOR=0.64; CI: 0.51-0.81; p<0.001] but marital status did not play any role for male individuals. For highest education level among male, it was detected that the underweight especially distinct had a less chance among higher educated male than uneducated [AOR=2.92; CI: 1.61-5.30; p<0.01] and primary [AOR=2.67; CI: 1.53-4.67; p<0.01] educated. Same results were found for female highest education level, it was also detected that higher educated women had less chance to get underweight than uneducated [AOR=1.72; CI: 1.34-2.20; p<0.01], primary [AOR=1.75; CI: 1.39-2.22; p<0.01] and secondary [AOR=1.58; CI: 1.26-1.97; p<0.01] educated women. Women from poor and middle income family was more likely to get underweight than rich women [AOR=1.59; CI: 1.35-1.89; p<0.01] and [AOR=1.29; CI: 1.11-1.50; p<0.01] respectively, but wealth index did not play any role on male nutritional status. Those women who have non hygienic toilet facilities have more chance to become underweight than women having hygienic toilet facilities in her house [AOR=0.86; CI: 75-0.99; p<0.05], but for male individuals, having toilet facilities did not have any effect on their nutritional status (Table 5).

Determinants of over nutrition

Table 6 demonstrated that female individual who were living in Sylhet division were less likely to be overweight and obesity than female who were living in Rajshahi [AOR=1.25; CI: 1.00-1.56; p<0.05]. Model also showed that there was no effect of division on male nutritional status. It was also found that women who were living in rural environment were less likely to get overweight and obesity than urban women [AOR=1.27; CI: 1.13-1.44; p<0.01], while there was no effect of type of residence on male nutritional status. For education level among male, it was found that the overweight and obesity especially distinct had a more chance among higher educated male than uneducated [AOR=0.28; CI: 0.10-0.78; p<0.05] and primary [AOR=0.50; CI: 0.27-0.95; p<0.05] educated. Same results were found for female highest education level, it was also detected that higher educated women had more chance to get overweight and obesity than uneducated [AOR=0.66; CI: 0.52-0.84; p<0.01], primary [AOR=0.71; CI: 0.58-0.85; p<0.01] and secondary [AOR=0.81; CI: 0.69-0.95; p<0.05] educated women. We observed that the overweight and obesity were more

BMI category	Group	Male						Female					
		Coefficients	p-value	AOR	Wald	95% CI for AOR		Coefficients	p-value	AOR	Wald	95% CI for AOR	
						Lower	Upper					Lower	Upper
Under nutrition	**Division**												
	Barisal	-0.17	0.54	0.85	0.4	0.50	1.45	-0.47	p<0.01	0.62	24.1	0.52	0.75
	Chittagong	-0.47	0.06	0.63	3.5	0.38	1.03	-0.37	p<0.01	0.69	18.3	0.58	0.82
	Dhaka	-0.31	0.20	0.74	1.6	0.46	1.18	-0.34	p<0.01	0.71	15.8	0.60	0.84
	Khulna	-0.50	0.05	0.61	4.0	0.37	0.99	-0.53	p<0.01	0.59	33.1	0.49	0.70
	Rajshahi	-0.26	0.29	0.77	1.1	0.47	1.25	-0.36	p<0.01	0.70	16.4	0.59	0.83
	Rangpur	-0.58	0.02	0.56	5.6	0.35	0.91	-0.42	p<0.01	0.66	22.1	0.56	0.79
	Sylhet R		.	.		.	.		.	.		.	.
	Place of residence												
	Urban	0.10	0.52	1.10	.4	0.82	1.49	-0.14	0.02	0.87	5.7	0.77	0.97
	Rural R		.	.		.	.		.	.		.	.
	Marital status												
	Currently married	-0.67	0.23	0.51	1.4	0.17	1.54	-0.44	p<0.01	0.64	14.3	0.51	0.81
	Not married		.	.		.	.		.	.		.	.
	Working Status												
	No	-0.02	0.96	0.98	0.00	0.40	2.41	0.07	0.36	1.07	0.9	0.93	1.23
	Yes R		.	.		.	.		.	.		.	.
	Education level												
	Uneducated	1.07	0.00	2.92	12.5	1.61	5.30	0.54	p<0.01	1.72	18.3	1.34	2.20
	Primary	0.98	0.00	2.67	11.9	1.53	4.67	0.56	p<0.01	1.75	22.2	1.39	2.22
	Secondary	0.51	0.07	1.67	3.2	0.95	2.92	0.45	p<0.01	1.58	15.7	1.26	1.97
	Higher R		.	.		.	.		.	.		.	.
	Wealth index												
	Poor	0.38	0.09	1.46	2.9	0.95	2.26	0.47	p<0.01	1.59	29.3	1.35	1.89
	Middle	0.25	0.22	1.28	1.5	0.86	1.90	0.25	p<0.01	1.29	11.0	1.11	1.50
	Rich R		.	.		.	.		.	.		.	.
	Toilet facilities												
	Hygienic	-0.09	0.61	0.91	0.3	0.63	1.31	-0.15	0.04	0.86	4.2	0.75	0.99
	Nonhygienic R		.	.		.	.		.	.		.	.

Table 5: Effect of socio-demographic factors on under nutrition among adults by gender.

BMI category	Group	Male						Female					
		Coefficients	p-value	AOR	Wald	95% CI for AOR		Coefficients	p-value	AOR	Wald	95% CI for AOR	
						Lower	Upper					Lower	Upper
Over nutrition	**Division**												
	Barisal	-0.21	0.71	0.81	0.1	0.26	2.53	0.11	0.35	1.12	.9	0.88	1.43
	Chittagong	0.40	0.35	1.49	0.9	0.64	3.45	0.02	0.84	1.02	0.0	0.83	1.26
	Dhaka	-0.46	0.31	0.63	1.0	0.26	1.55	-0.03	0.78	0.97	0.1	0.78	1.20
	Khulna	-0.15	0.74	0.86	0.1	0.35	2.12	0.18	0.10	1.20	2.7	0.97	1.49
	Rajshahi	0.26	0.56	1.30	0.3	0.53	3.16	0.22	0.046	1.25	3.9	1.00	1.56
	Rangpur	-0.15	0.75	0.86	0.1	0.34	2.17	-0.11	0.37	0.90	0.8	0.70	1.14
	Sylhet [R]		.	.		.	.		.	.		.	.
	Place of residence												
	Urban	0.25	0.31	1.29	1.0	0.79	2.09	0.24	p<0.01	1.27	14.7	1.13	1.44
	Rural [R]		.	.		.	.		.	.		.	.
	Working Status												
	No	0.86	0.06	2.37	3.5	0.96	5.89	0.08	0.33	1.08	0.9	.92	1.28
	Yes [R]		.	.		.	.		.	.		.	.
	Education level												
	Uneducated	-1.28	0.02	0.28	5.9	0.10	0.78	-0.41	p<0.01	0.66	11.8	0.52	0.84
	Primary	-0.69	0.03	0.50	4.5	0.27	0.95	-0.35	p<0.01	0.71	12.9	0.58	0.85
	Secondary	-0.44	0.10	0.64	2.7	0.38	1.09	-0.21	0.01	0.81	6.6	0.69	0.95
	Higher [R]		.	.		.	.		.	.		.	.
	Wealth index												
	Poor	-1.30	0.01	0.27	6.4	0.10	0.75	-1.05	p<0.01	0.35	76.4	0.28	0.44
	Middle	-1.05	0.01	0.35	6.9	0.16	0.77	-0.58	p<0.01	0.56	41.5	0.47	0.67
	Rich [R]		.	.		.	.		.	.		.	.
	Toilet facilities												
	Hygienic	0.31	0.24	1.36	1.0	0.81	2.27	0.38	p<0.01	1.46	29.3	1.27	1.67
	Nonhygienic [R]		.	.		.	.		.	.		.	.

(R:- References case)

Table 6: Effect of socio-demographic factors on over nutrition among adults by gender.

likely to get among male who were living in rich family than poor [AOR=0.27; CI: 0.10-0.75; p<0.05] and middle [AOR=0.35; CI: 0.16-0.77; p<0.05] family. Again for female, the same result was observed that the overweight and obesity were more likely to get who were living in rich family than poor [AOR=0.35; CI: 0.28-0.44; p<0.01] and middle [AOR=0.56; CI: 0.47-0.67; p<0.01] family. Those women who have hygienic toilet facilities in her house have less likely chance to get overweight and obesity than women having hygienic toilet facilities in her house [AOR=1.46; CI: 1.27-1.67; p<0.01], but we did not find the contribution of toilet facilities on male nutritional status.

Discussion

The data used in this study, gathered by the 2011 BDHS, are nationally representative, covering both urban and rural areas. In this study, we examined several important modifiable and non-modifiable factors associated with malnutrition. Previous studies in Bangladesh have examined the relationship between BMI and age, mortality, level of education, wealth index and other social variables among only reproductive age women [24,25], they used much smaller data sets that were not representative of the nation. More, recently Hossain et al., studied BMI among non-pregnant married women in reproductive age in Bangladesh; they used BDHS-2007 data [26].

The present study may be the first to examine the gender differentiate in nutritional status among Bangladeshi adults aged 16-34 years. This study showed that the mean BMI of Bangladeshi adults was 20.54 ± 2.83 kg/m^2 for male and 21.32 ± 3.59 kg/m^2 for female. In this study, we found that the prevalence of underweight men and women were 26.3% and 23.3% respectively and overweight and obesity adults were 7.2% (men) and 15.2% (women). Comparing with total population more than half of the men (66.6%) were of normal weight in the same time half of the women (61.5%) were also of normal weight.

This information is consistent with other studies on Bangladeshi men and women [15]. Higher prevalence of overweight among women were also reported from the Global Burden of Disease studies [12]. In this study, mean BMI of women had significantly higher than men, similar results was also found in other parts of Asia [27-29]. Few studies reported that men had higher BMI than women in high-income regions of the world [27].

Looking at the whole sample population, it was noted that BMI is higher with increasing education level of women and men, wealth index. These results are partially supported by the findings of a Bangladeshi study using the 2004 BDHS samples [25]. They found that age, education level, region of residence, marital status and type of occupation affected the BMI of men and women in Bangladesh. However, their study was based on only urban women. The results of the current study are also in partial agreement with the findings of another Bangladeshi study [24]. The percentage of underweight women was higher in rural (26.9%) compared with urban (17.3%) regions,

while the reverse was observed for the percentage of overweight and obese women.

The present study suggests that poor economic conditions, illiteracy and other socioeconomic facilities in rural areas are the main causes of the observed decrease in BMI of women in Bangladesh. Decreased protein in the diet, increased psychological and physiological stress and decreased socioeconomic conditions of Bangladeshi women are some of the other possible reasons for the decrease in BMI rather than male.

Nowadays some wealthy adult women in Bangladesh are very conscious of their body weight and try to keep themselves slim without performing any exercise and only controlling their diet. Consequently, they are not aware of the long-term medical problems related to being underweight. It may be necessary for the authorities to make the general population aware of the importance of a balanced diet and the need to make good conscious decisions on one's health.

Conclusions

In the present study, we used secondary data that was collected by BDHS-2011 from Bangladeshi adults (men and women) aged 16-34 years. In this study we use the men and women for determining the prevalence of malnutrition and investigating the risk factors which would be associated with malnutrition of adults in Bangladesh. Independent sample t-test, Z-proportional test, chi-square (χ^2) test and multinomial logistic regression were used in this study. These models provided the important results that might be helped to reduce the gender differentiate in nutritional status among adults in Bangladesh. This study demonstrated that a remarkable number of both male and female were malnourished in Bangladesh. This study suggested that controlling some modifiable factors such as household wealth quintile, education, working status and residence might reduce the prevalence of malnutrition among adults in Bangladesh.

Limitation of the Study

This study was an analysis of secondary data and it was bounded by the limitation of those data. Despite the careful design and stratification of sample population, selection bias and reporting error might still be possible. We only investigate the association between the nutritional status among their selected socio-economic, demographic and anthropometric. We were not able to cover physiological factors that may also be influenced by nutritional status of the women, like age at menarche [30], level of physical activities, level of energy intake [31] and behavior patterns like dietary habits, smoking habits, weight goals, methods of weight-loss and body-shape perceptions [32]. Subsequent researchers may consider including these variables.

Future Study

We consider many factors for investigating their effect on the malnutrition of adults in Bangladesh, but other possible influences on BMI include smoking habits, weight-loss methods, body-shape perceptions, eating attitudes and behaviors, self concept and physical activity [32], level of energy intake [33-34]. Also, BDHS-2011 collected data using cluster sampling, sometimes there is cluster effect of selected variables and without removing cluster effect we cannot get accurate results, so it is essential to check whether there is cluster effect or not in BDHS-2011 dataset. If there is cluster effect, single model cannot remove this effect; we need multilevel to removing this effect. There is a great scope to do further research in connection of Bangladeshi adult's nutritional status.

Policy implication and recommendation

The findings of this dissertation may have some policy implications and recommendations that would be helped the health authorities and policy makers to achieve substantial improvement in the area of malnutrition. 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 the awareness among non-pregnant ever married of BMI in Bangladesh. The prevalence of malnutrition among underweight and overweight/obesity women of Bangladesh was higher than men. So it is necessary to take an action for making awareness among married women in Bangladesh about the health problems in their future life. BMI status was a significant factor for malnutrition. Different electronic and printed medias such as television, newspaper, community radio etc. can help to make awareness about the bad side of malnutrition regarding health among married women of Bangladesh. Government and non-government organization should make awareness and counseling of underweight and overweight or obesity among married women of Bangladesh.

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