The Independent Effects of Educational Attainment and Mass Media Exposure on Overweight and Obesity Among Bangladeshi Women: A Rural-Urban Comparison

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Abstract

Problems regarding obesity and being overweight are growing, not only in industrialized countries but also in developing countries. This study aimed to examine the effects of education and mass media on urban and rural women suffering from weight issues and obesity in Bangladesh, a developing country. The data were from the 2017 Demographic and Health Survey conducted in Bangladesh among women aged 15–49. The data were analyzed using the chi-square test and multinomial logistic regression (MLR). The prevalence of obesity and being overweight was higher among urban women (23.4% and 36.7%, respectively) than among rural women (12.5% and 32.7%, respectively). Model 1 provides unadjusted odds ratios (ORs), while Models 2, 3, and 4 provide adjusted ORs obtained by MLR for overweight and obesity. According to Model 4, the ORs for obesity and being overweight among women with higher education were higher in urban areas (OR = 3.65 and 1.93, respectively) than in rural areas (OR = 2.14 and 1.58, respectively). The corresponding ORs for women exposed to mass media were 1.78 and 1.17 in urban areas and 1.65 and 1.30 in rural areas. Women with higher education levels and exposure to mass media have a higher risk of being overweight and obese. Appropriate health promotion interventions based on education and mass media should work to reduce this problem.

Keywords

Education; mass media; multinomial logistic regression; overweight and obesity

Introduction

Various chronic diseases such as diabetes, hypertension, cardiovascular diseases, some cancers, and musculoskeletal disorders are increasing worldwide due to obesity or being overweight (Banik & Rahman, 2018; World Health Organization, 2021). Globally, a dramatic increase in the prevalence of obesity has been observed in recent decades, nearly tripling between 1975 and 2016. In 2016, more than 1.9 billion adults (39% of the total global population) were overweight; of these, more than 650 million (13%) were obese (World Health Organization, 2021). If this trend continues, a large portion (over 3 billion) of adults worldwide will be overweight or obese by 2030 (Kelly et al., 2008).

An increasing prevalence of obesity and being overweight has been observed among women of reproductive age in developing countries. For instance, in 2014, 14.4% of Bangladeshi women were overweight, and 3.5% were obese; in 2016, the figures rose to 25.2% and 11.2%, respectively (Biswas et al., 2017). Obesity and being overweight have increased rapidly in developing countries due to various causal factors, including continued economic progress, rapid urbanization, globalization of food production, changes in dietary patterns (e.g., high fatty foods, sedentary work environment, and transportation modes), and increased physical inactivity (Caballero, 2007; Mendez et al., 2005; World Health Organization, 2021). Other risk factors influencing obesity and being overweight are age, education, occupation, region, and residence (Biswas et al., 2017; Khan & Kraemer, 2009).

A meta-analysis by Kim et al. (2017) found that the risk of being overweight or obese is higher among individuals with lower education than those with higher education. The authors also concluded that the association between education and obesity or being overweight varied by age, region, and observation period. In the United States, this situation is partially explained by the fact that obese girls are less likely to continue their studies after secondary education due to negative social attitudes, with obese girls being considered ugly, unattractive, dumb, and lazy (Crosnoe, 2007; Dejong, 1980). Moreover, a study of South Korean women found that highly educated women were less likely to be obese than less educated women. Further, rural women were more likely to be obese than their urban counterparts (Chung et al., 2017).

A systematic review by Cohen et al. (2013) that included information on 91 countries concluded that gender and economic development of a country play an essential role in establishing the relationship between individuals' educational attainment and obesity. The study also found a positive association between educational attainment and obesity among individuals in low-income countries. However, an inverse relationship was found in high-income countries. For example, Assari (2019) in the United States and Wardle et al. (2002) in England observed that higher educational attainment of natives or immigrants was shown to be protective against obesity.

In general, highly educated people are more exposed to mass media and work in an environment where they usually engage in sedentary activities (Atienza et al., 2006; Piirtola et al., 2020). A prolonged sedentary lifestyle and exposure to mass media (e.g., watching television, listening to the radio, and reading newspapers) lead to unhealthy eating habits and reduced physical activity, which increases the risk of obesity (Ghose & Yaya, 2018; Rosiek et al., 2015). Grøntved and Hu (2011) observed that watching television poses a significant risk of being overweight or obese, as it is the most widespread and pervasive mode of sedentary behavior. People with higher education and spending much time reading newspapers were identified as having a predominantly sedentary lifestyle (Atienza et al., 2006).

More specifically, individuals who spend more time on screen devices such as televisions, computers, smartphones, tablets, the internet, podcasting, blogging, social media, and video games are more likely to be associated with a sedentary lifestyle. Individuals accustomed to eating more fried foods, sweets, snacks, and sodas and consuming few fruits and vegetables are linked to unhealthy diets (Delfino et al., 2018; Gomes Maia et al., 2016; Mazur et al., 2018). Advertising of unhealthy foods through the media encourages the consumption of more obesogenic foods, and the tendency to consume fast food or snacks increases when using media (Boyce, 2007). Thus, higher levels of education increase exposure to mass media, sedentary activity, and consumption of fast foods or obesogenic foods, which in turn leads to being overweight or obese (Atienza et al., 2006; Delfino et al., 2018; Gomes Maia et al., 2016; Mazur et al., 2018; Piirtola et al., 2020).

In addition, sedentary lifestyles or physical activity levels vary according to human characteristics, living environments, and circumstances. Moniruzzaman et al. (2017) observed that the prevalence of low or inadequate physical activity was substantially higher in urban (59.5%) than in rural (41.9%) areas of Bangladesh. They also observed that insufficient physical activity was much higher among women than men, particularly among older women and women with higher education and socioeconomic status. They noted that the level of physical activity during leisure time was negligible (< 3%) in Bangladesh and that a small percentage of physically active individuals contributed to physical activity mainly through work (40% in urban areas and 77% in rural areas) and commuting (57% and 21%, respectively) (Moniruzzaman et al., 2017).

There are several studies on being overweight and obesity among women in Bangladesh (e.g., Biswas et al., 2017; Hoque et al., 2017; Kelly et al., 2008; Khan & Kraemer, 2009; Tanwi et al., 2019). Some of these, relevant to the present study, are briefly reviewed here. Khan and Kraemer (2009) used data from the 2004 Bangladesh Demographic and Health Survey (BDHS) to assess the impact of factors associated with obesity among urban women, emphasizing factors other than education and mass media. Hoque et al. (2017) focused on the double burden of underweight and overweight with data from the 2011 BDHS and examined how those burdens differ by gender and socioeconomic characteristics. They did not examine the risk factors for obesity separately. Although Ghose (2017) differentiated the risks of being overweight and obese by analyzing 2014 BDHS data, they only examined the effects of television viewing on overweight and obesity.

Tanwi et al. (2019) used pooled data from BDHS 2004–2014; consequently, the impact of education on people who were overweight in 2014 was unclear. They did not expose the risks of being overweight and obese separately and did not adjust for potential confounding factors to confirm the association between education and being overweight. None of the above studies used Asian cut-offs for BMI to identify overweight and obese women. It should be noted that Asian populations with lower BMI are at higher risk of cardio-metabolic diseases than western populations. Hence, to study malnutrition in Asian populations, it would be more appropriate to consider Asian cut-off points for BMI.

Moreover, none of the above studies compared being overweight and obese in urban women with rural women, i.e., in these studies, the type of residence was included as a covariate like any other covariate. The current situation calls for such a study, as being overweight and obese are rising in urban and rural areas. Nevertheless, when studying overweight and obesity among women in developing countries like Bangladesh, some key factors, such as education and mass media, cannot be ignored. Therefore, to minimize the research gap, this study aimed to examine the effects of education and mass media on overweight and obesity among women

of childbearing age in urban and rural Bangladesh, considering Asian cut-offs for BMI. In this regard, it was hypothesized that women with secondary or higher education and women exposed to mass media are more likely to be overweight or obese than their reference groups. It was also hypothesized that the prevalence of being overweight or obese is higher in urban areas than in rural areas.

Material and methods

Source of data

This study used the 2017 Bangladesh Demographic and Health Survey (BDHS) data. Mitra and Associates conducted this survey from October 2017 to March 2018 under the authority of the National Institute of Population Research and Training (NIPORT), Ministry of Health and Family Welfare, Bangladesh. The United States Agency for International Development (USAID) Bangladesh provided the funds, and ICF International provided the technical support along with the Demographic and Health Survey (DHS) Program (NIPORT & ICF, 2020).

The BDHS is a nationally representative and retrospective survey. Data were collected in urban and rural areas of all the eight administrative regions (divisions) of Bangladesh through a two-stage stratified cluster sampling. A geographical area consisting of 120 households was termed an enumeration area. The first stage comprised 675 enumeration areas, 250 from urban and 425 from rural areas. The enumeration areas were chosen with probability proportional to their size. The second stage selected, on average, 30 households per enumeration area. Of a total of 20,160 households selected, 19,457 were successfully surveyed. Finally, 20,127 ever-married women of reproductive age 15 to 49 years were interviewed from 20,376 women. A detailed description of the BDHS 2017 is available in the report book (NIPORT & ICF, 2020).

Data extraction

To avoid exaggerated body mass index (BMI) values due to weight gain during pregnancy, pregnant women and those who gave birth within two months of the interview were excluded from this study. Moreover, in extreme cases, that is, women with BMI < 12 or BMI > 60 were excluded from the study. According to Heeringa et al. (2010), an analysis based on complete case data is acceptable because the data used in this study included less than 1% of missing cases. Therefore, missing values were excluded from the dataset. Finally, from 20,127 eligible women, 5,168, 13,159, and 18,327 weighted numbers of women of reproductive age with complete information were extracted for the urban, rural, and total samples, respectively. It should be noted that this study used sampling weights to adjust for differences in the probability of selection in the sampling design for different regions and their urban and rural parts. Thus, in this study, the actual representativeness of the data was established at the national and regional levels.

Variables

In this study, the outcome variable "body mass index (BMI)" measures nutritional status in adults. BMI was calculated using women's weight and height data according to the following formula:

$$\text{BMI} = weight\ (kg)/(height\ (m))^2.$$

The WHO BMI criterion for Asians is as follows: BMI < 18.5 for underweight, 18.5–22.9 for normal weight, 23–27.5 for overweight, and > 27.5 for obese women (WHO Expert Consultation, 2004). This study focuses only on the last two BMI categories, namely overweight and obese women aged 15–49 years.

Access to mass media is a combination of three variables: frequency of reading newspapers or magazines, frequency of listening to the radio, and frequency of watching television. The exposure variables are women's education and access to mass media. For analytical convenience, women's education (in single years) was recoded as 'below primary,' 'primary' corresponding to 1 to 5 years of schooling, 'secondary' corresponding to 6 to 10 years of education, and 'above secondary' corresponding to 11+ years of education. Moreover, mass media was recoded as 'no' and 'yes.' Further, the risk factors considered as confounders (data not shown) were represented in Table 1 with their respective categories.

Methods

This study included a stratified analysis of the type of place of residence. The analysis included descriptive parts such as the number and percentage of women in each category of the variables studied. Moreover, a bivariate analysis, the chi-square test for independence of attributes, was performed. Since the outcome variable has more than two categories, multinomial logistic regression was employed to observe the association between exposures (women's education and exposure to mass media) and the outcome variable, e.g., BMI (Campbell & Campbell, 2007). The effect of confounding factors on the association between exposure and outcome helps to identify strong confounders. Hence, the following four models were used to examine the effects of the confounding factors on the targeted association. An unadjusted model is called Model 1.

Moreover, the unadjusted model was adjusted for age, a confounder (Model 2). Further, Model 2 was adjusted for a confounder, e.g., economic status (Model 3). Finally, Model 3 was adjusted for the following confounders: parity, women`s occupation, and division (Model 4). The group of women with the lowest risk of becoming overweight and obese, varied by bivariate analysis, was considered the reference group for each variable and compared with the other group of women (Bruemmer et al., 2009). Regarding the outcome variable, respondents in the normal weight group were considered the reference category, and respondents in the overweight and obese groups were compared with this reference group. Results with p < .05 were considered statistically significant.

Data were analyzed with SPSS software version 27. Multicollinearity was checked to meet the assumption of logistic regression. No evidence of multicollinearity was observed among the explanatory variables, as the variance inflation factor (VIF) was < 5 (Chatterjee & Hadi, 2006).

Results

The descriptive statistics (mean and standard deviation) and 95% confidence interval (CI) of the mean values of height, weight, and BMI among urban, rural, and total women in Bangladesh are shown in Table 1. The results show that the height of urban women was the same as that of rural women, while urban women were heavier than their rural counterparts. Hence, urban women had a higher BMI on average than rural women.

Table 1: Mean ± Standard Deviation (95% Confidence Interval of Means) of Height, Weight, and BMI Among Women in Urban and Rural Bangladesh, BDHS 2017

Anthropometric variables	Urban (4,105)	Rural (9,279)	Total (13,384)
Height (m)	1.51 ± 0.05	1.51 ± 0.06	1.51 ± 0.05
	95% CI [1.50, 1.51]	95% CI [1.50, 1.51]	95% CI [1.50, 1.51]
Weight (kg)	55.78 ± 11.12	52.05 ± 9-97	53.10 ± 10.44
	95% CI [55.29, 56.27]	95% CI [51.74, 52.36]	95% CI [52.84, 53.37]
BMI (kg/m^2)	24.45 ± 4.48	22.87 ± 4.02	23.31 ± 4.21
	95% CI [24.27, 24.64]	95% CI [22.74, 22.99]	95% CI [23.21, 23.42]

The prevalence of being overweight and obese among Bangladeshi women based on BMI is shown in Table 2. The overall prevalence of being overweight ($23 \leq BMI < 27.5$) and obesity ($BMI \geq 27.5$) was reported to be 33.8% and 15.5%, respectively. The prevalence of being overweight was higher among women in urban areas than in rural areas (36.7% vs. 32.7%). However, the prevalence of obesity among urban women was twice that of rural women (23.4% vs. 12.5%). Statistically significant differences were observed between rural and urban areas in the prevalence of being overweight ($p = .0001$), obesity ($p = .0001$), and being overweight and obese ($p = .0001$).

Table 2: Prevalence of Overweight and Obesity Among Urban and Rural Women Using BMI, BDHS 2017.

Background characteristics	Urban n (%)	Rural n (%)	Total n (%)	Urban-Rural difference using χ^2 analysis		
				χ^2 value	df	p value
Normal weight $18.5 \leq BMI < 23$	1,616 (31.3)	5,477 (41.6)	7,093 (38.7)	167.6	1	< .0001[a]
Overweight $23 \leq BMI < 27.5$	1,897 (36.7)	4,304 (32.7)	6,201 (33.8)	21.5	1	< .0001[a]
Obesity $BMI \geq 27.5$	1,210 (23.4)	1,639 (12.5)	2,849 (15.5)	339.4	1	< .0001[a]
Overweight-obesity $BMI \geq 23$	3,107 (61.1)	5,943 (45.2)	9,050 (49.4)	332.0	1	< .0001[a]

Note: n represents the number of respondents, and values in the parenthesis indicate percentages.

Table 3 represents the list of background characteristics with their respective categories and the number of respondents in urban and rural areas. About six out of ten urban women had post-primary education (secondary 38.9% and higher secondary 18.1%), while it was 48.2%

among rural women. About eight out of ten women (82.7%) in urban areas came into contact with the mass media; the corresponding figure for women in rural areas was only 59.5%.

The percentage of being overweight and obese for each category of explanatory variables is shown in Table 4. The highest percentages of women with secondary education were overweight and obese, and the levels of overweight and obesity in urban areas were almost equal to those in rural areas. Only 10.5% and 11.8% of rural women were overweight and obese, respectively; the corresponding figures for urban women were almost double. Around nine out of ten urban women exposed to mass media were overweight or obese, while less than three-quarters of rural women belonged to these groups.

Being overweight and obese were more common among middle-aged women (25–29, 30–34, and 35–39 years old) and those with two or more children in rural and urban areas. More than four-fifths of urban women with higher economic status were overweight and obese, while about 40% of rural women belonged to these groups. About two-thirds of rural or urban women who were not working at the time of the survey were overweight or obese. Among urban women in all eight divisions, the prevalence of being overweight or obese was highest in Dhaka Division (about 48%), while among rural women, it was highest in Chittagong Division (about 24%).

Chi-square values and corresponding p values showed that women's BMI status was significantly associated with all background characteristics.

Table 5 represents the odds ratios (ORs) with a 95% confidence interval (CI) of being overweight and obese for various exposure variables compared with the reference category. Model 1 provides unadjusted ORs, and Models 2, 3, and 4 provide adjusted ORs for overweight and obese women. In Model 1, urban women with higher secondary education were 2.74 times more likely to be obese (unadjusted OR = 2.74, 95% CI [1.97, 3.81]) than those with less than primary education. The corresponding unadjusted OR for rural women with higher secondary education was 2.24, 95% CI [1.74, 2.86]. A similar trend was observed among overweight women with higher secondary education.

Table 3: Name of Background Characteristics and Number of Respondents in Urban and Rural Areas, BDHS 2017

Background characteristics	Category	No. of respondents in	
		Urban	Rural
Exposure variables			
Women's education	Below primary	770 (14.9)	2,450 (18.6)
	Primary	1,453 (28.1)	4,360 (33.1)
	Secondary	2,009 (38.9)	5,107 (38.8)
	Above secondary	936 (18.1)	1,242 (9.4)
Mass media contact	No	892 (17.3)	5,334 (40.5)
	Yes	4,276 (82.7)	7,825 (59.5)
Demographic characteristics			
Age	15–19	399 (7.7)	1,221 (9.3)
	20–24	881 (17.1)	2,123 (16.1)
	25–29	993 (19.2)	2,189 (16.6)
	30–34	924 (17.9)	2,293 (17.4)

Background characteristics	Category	No. of respondents in	
		Urban	Rural
	34–39	765 (14.8)	2,040 (15.5)
	40–44	609 (11.8)	1,639 (12.5)
	45–49	596 (11.5)	1,655 (12.6)
Parity	0	493 (9.5)	1,040 (7.9)
	1	1,225 (23.7)	2,472 (18.8)
	2	1,607 (31.1)	3,704 (28.1)
	3+	1,843 (35.7)	5,943 (45.2)
Socioeconomic characteristics			
Wealth index	Low	675 (13.1)	6,358 (48.3)
	Middle	615 (11.9)	3,089 (23.5)
	High	3,878 (75.0)	3,712 (28.2)
Women`s occupation	Not working	3,064 (59.3)	6,228 (47.3)
	Working	2,105 (40.7)	6,931 (52.7)
Cultural characteristics			
Division	Barisal	183 (3.5)	841 (6.4)
	Chittagong	874 (16.9)	2,374 (18.0)
	Dhaka	2,361 (45.7)	2,249 (17.1)
	Khulna	494 (9.6)	1,669 (12.7)
	Mymensingh	237 (4.6)	1,164 (8.8)
	Rajshahi	525 (10.2)	2,081 (15.8)
	Rangpur	303 (5.9)	1,908 (14.5)
	Sylhet	191 (3.7)	872 (6.6)
Total number of cases (%)		5,168 (28.2)	13,159 (71.8)

Table 4: Percentage of Being Overweight, Obese, and Normal Weight Status Among Urban and Rural Women Across the Categories of Background Characteristics Based on Rao Scott Chi-Square Test, BDHS 2017.

Background characteristics	Urban			Rural		
	Obese	Overweight	Normal weight	Obese	Overweight	Normal weight
Women's education						
Below primary	11.2	13.9	17.9	12.8	16.1	20.9
Primary	24.9	27.2	30.3	32.1	32.6	33.2
Secondary	39.2	40.4	37.4	43.2	40.8	37.3
Higher secondary	24.7	18.6	14.4	11.8	10.5	8.7
χ2 (*p* value)	91.8 (< .0001[a])			136.9 (< .0001[a])		
Mass media contact						
No	9.3	16.2	21.6	26.6	34.7	45.6
Yes	90.7	83.8	78.4	73.4	65.3	54.4
χ2 (*p* value)	109.3 (< .0001[a])			349 (< .0001[a])		
Current age						
15–19	2.1	4.7	11.4	2.2	5.1	12.3
20–24	9.1	16.3	21.5	10.8	13.4	18.9
25–29	16.7	20.9	20.4	16.0	18.3	16.2
30–34	22.0	18.2	16.7	20.9	19.5	15.7
35–39	19.9	15.0	12.1	21.0	17.2	13.9

Background characteristics	Urban			Rural		
	Obese	Overweight	Normal weight	Obese	Overweight	Normal weight
40–44	15.6	12.9	8.9	14.5	13.9	11.0
45–49	14.7	11.9	9.2	14.6	12.6	12.1
χ2 (*p* value)	447.3 (< .0001[a])			574 (< .0001[a])		
Parity						
0	5.2	8.3	12.6	4.5	6.0	9.2
1	17.8	23.5	25.7	14.5	16.9	20.2
2	35.7	32.7	28.7	31.1	30.2	27.1
3+	41.3	35.5	30.0	49.9	46.9	43.5
χ2 (*p* value)	143 (< .0001[a])			177.6 (< .0001[a])		
Economic status						
Low	4.8	11.0	18.9	28.9	39.1	55.1
Middle	7.4	11.6	14.1	23.8	26.3	22.9
High	87.8	77.4	67.0	47.3	34.6	22.0
χ2 (*p* value)	243.4 (< .0001[a])			908.1 (< .0001[a])		
Women's working status						
Not working	68.8	59.8	52.7	54.1	49.0	45.2
Working	31.2	40.2	43.3	45.9	51.0	54.8
χ2 (*p* value)	77.5 (< .0001[a])			53.9 (< .0001[a])		
Division						
Barisal	3.2	3.7	3.7	6.0	6.9	6.2
Chittagong	17.5	17.8	16.0	24.9	20.6	16.5
Dhaka	48.0	45.5	44.7	18.8	18.6	16.2
Khulna	9.0	10.1	9.2	14.8	13.8	11.7
Mymensingh	3.9	4.3	5.2	5.6	7.2	9.7
Rajshahi	10.2	9.8	10.8	14.6	15.4	16.2
Rangpur	5.6	5.7	6.1	10.8	12.4	16.5
Sylhet	2.6	2.9	4.4	4.6	5.1	6.9
χ2 (*p* value)	38.5 (.011)			383.7 (< .0001[a])		

However, rural women with secondary education had significantly higher odds (89%) of being obese (unadjusted OR = 1.89, 95% CI [1.57, 2.28]) than women with below primary school education. The corresponding unadjusted OR for urban women with secondary education was 1.66, 95% CI [1.28, 2.16]. A similar trend was observed among overweight women with secondary education. A significantly higher prevalence of being overweight and obese was observed among women with primary education in rural areas but not in urban areas.

The unadjusted model (Model 1) was adjusted for the respondent's age in Model 2, resulting in higher odds of being overweight and obese. Except for women with higher secondary education and their odds of being obese, the ORs for being overweight and obesity among educated women were higher in rural areas than urban areas. For example, urban women with higher secondary education were 5.35 (adjusted OR = 5.35, 95% CI [3.85, 7.44]) times more likely to be obese and rural women with the same level of education were 5.23 (adjusted OR = 5.23, 95% CI [4.01, 6.82]) times more likely to be obese than women with lower primary education. ORs for women in other education categories were higher in rural than urban areas. These relationships remained significant when Model 2 was further adjusted for economic status, but the OR values decreased (see Model 3). ORs for overweight and obese were higher among urban women than rural women in all education groups. Since the ORs corresponding to different levels of education increased significantly with current age and decreased with economic status, they have a significant contribution in Model 2 and Model 3, respectively.

Further, in Model 4, the fully adjusted model, women with all levels of education in urban areas were more likely to be overweight or obese than those in rural areas. For example, urban women with higher secondary education had a higher OR of being obese (fully adjusted) than rural women with the same level of education (OR = 3.65, 95% CI [2.55, 5.22] in urban areas and OR = 2.14, 95% CI [1.60, 2.88] in rural areas). Similarly, women with secondary or higher education were more likely to be overweight than those with lower primary education. For example, higher secondary educated women had substantially higher odds in urban areas (OR = 1.93, 95% CI [1.44, 2.59]) than in rural areas (OR = 1.58, 95% CI [1.26, 2.00]).

Regarding exposure to mass media, in Model 1, urban women exposed to mass media were more likely (unadjusted OR = 2.67, 95% CI [2.07, 3.45]) to be obese than those not exposed. The corresponding odds for rural women were also close to their urban counterparts (unadjusted OR = 2.31, 95% CI [1.99, 2.70]). However, rural women had higher ORs for being overweight than their urban counterparts. These associations remained significant in subsequent models adjusted for potential confounders (see Model 2, Model 3, and Model 4), with the odds of being obese relatively higher among urban than rural women and the odds of being overweight higher among rural than urban women. Current age and economic status contributed significantly, as they did to education in Model 2 and Model 3, respectively. The ORs were further reduced in Model 4 when Model 3 was adjusted for all selected confounders.

However, in Model 4, ORs for obesity was significantly higher among women exposed to mass media in urban and rural areas than those not exposed. Urban women had higher odds (fully adjusted OR = 1.78, 95% CI [1.35, 2.35]) than their rural counterparts (adjusted OR = 1.65, 95% CI [1.38, 1.98]). Women in rural areas who had contact with mass media were significantly more likely to be overweight (fully adjusted OR = 1.30, 95% CI [1.17, 1.45]).

Discussion

Main findings

Using the Bangladesh Demographic and Health Survey (BDHS) 2017 data, this study explored the association between educational attainment and exposure to mass media and being overweight and obesity among women of reproductive age in urban and rural Bangladesh. In the unadjusted model, rural women with primary education had significantly higher odds of being overweight and obese. This association was significant in the subsequent adjusted models. Moreover, educated women in urban areas had significantly higher odds of being overweight and obese than those in rural areas, except in Model 1 and Model 2. Nevertheless, rural women with primary or secondary education had higher odds of being overweight than their urban counterparts. The reason could be that these women, especially those living in urban areas, usually have sedentary jobs, although some do physical activity. On the other hand, educated women in rural areas have adopted a sedentary lifestyle but have not yet adopted exercise habits and are, therefore, overweight. For example, they work long hours sitting and do not do the recommended amount of physical activity (Chan et al., 2017; Tanwi et al., 2019) and have much more exposure to mass media, such as watching television, listening to the radio, and reading the newspaper (Ghose, 2017).

Moreover, women exposed to mass media were more likely to be overweight and obese. Among them, urban women were more likely to be obese than their rural counterparts.

However, rural women were more likely to be overweight than urban women. One explanation could be that some rural women work more regularly than urban women (see Table 3). There is no doubt that mass media resources are not as readily available in rural areas as in urban areas.

For this reason, some rural women have less time and opportunity to engage in mass media. They are primarily engaged in agriculture and physically demanding tasks that make them physically active. However, the lifestyles of rural women are becoming more sedentary, and their eating habits are leading to obesity. Moniruzzaman et al. (2016) observed a similar scenario in urban and rural areas, where one-third of women were not physically active enough, 25% did not exercise, and the rest were somewhat physically active. They also noted that rural dwellers dominate proportionally among physically active individuals compared to urban dwellers. Of rural women who are physically active, the majority (61%) came from work-related activities; one-third came from commuting; a smaller proportion (9%) came from leisure-time physical activity. The corresponding proportions in urban areas were 47%, 38%, and 15%, respectively. Those involved in work activities were mostly young and of reproductive age (Moniruzzaman et al., 2016). Similar to this discussion, Tu et al. (2019) observed higher sedentary behavior and physical inactivity level in rural China.

Table 5. Odds Ratios (95% Confidence Intervals) of Overweight and Obesity Among Urban and Rural Women by Exposure Variables, BDHS 2014

Exposure variables	Urban		Rural	
	Obesity	Overweight	Obesity	Overweight
Model 1				
Women's education				
Below primary (ref.)				
Primary	1.30 (0.99, 1.70)	1.16 (0.91, 1.47)	1.58 (1.29, 1.93)***	1.27 (1.11, 1.47)*
Secondary	1.66 (1.28, 2.16)***	1.40 (1.14, 1.70)***	1.89 (1.57, 2.28)***	1.42 (1.24, 1.62)***
Higher secondary	2.74 (1.97, 3.81)***	1.68 (1.29, 2.18)***	2.24 (1.74, 2.86)***	1.58 (1.30, 1.91)***
Mass media contact				
No (ref.)				
Yes	2.67 (2.07, 3.45)***	1.43 (1.20, 1.70)***	2.31 (1.99, 2.70)***	1.58 (1.42, 1.75)***
Model 2				
Women's education				
Below primary (ref.)				
Primary	1.87 (1.43, 2.44)***	1.44 (1.13, 1.82)***	2.09 (1.70, 2.58)***	1.52 (1.31, 1.76)***
Secondary	3.28 (2.51, 4.28)***	2.05 (1.66, 2.53)***	3.80 (3.07, 4.69)***	2.19 (1.88, 2.54)***
Higher secondary	5.35 (3.85, 7.44)***	2.42 (1.87, 3.13)***	5.23 (4.01, 6.82)***	2.69 (2.19, 3.31)***
Mass media contact				
No (ref.)				
Yes	3.03 (2.34, 3.92)***	1.52 (1.28, 1.80)***	2.63 (2.25, 3.08)***	1.71 (1.54, 1.90)***
Model 3				
Women's education				
Below primary (ref.)				
Primary	1.83 (1.40, 2.41)**	1.42 (1.12, 1.80)**	1.74 (1.41, 2.14)**	1.37 (1.19, 1.59)***
Secondary	2.67 (2.02, 3.52)***	1.88 (1.50, 2.35)***	2.31 (1.87, 2.85)***	1.66 (1.42, 1.94)***

Exposure variables	Urban		Rural	
	Obesity	Overweight	Obesity	Overweight
Higher secondary	3.76 (2.67, 5.31)***	2.05 (1.55, 2.72)***	2.29 (1.73, 3.03)***	1.69 (1.35, 2.13)**
Mass media contact				
No (ref.)				
Yes	1.83 (1.38, 2.41)***	1.19 (1.00, 1.42)	1.71 (1.44, 2.03)***	1.33 (1.20, 1.48)***
Model 4				
Women's education				
Below primary (ref.)				
Primary	1.81 (1.38, 2.37)*	1.40 (1.10, 1.78)**	1.71 (1.38, 2.12)**	1.35 (1.16, 1.57)**
Secondary	2.41 (1.81, 3.21)***	1.75 (1.39, 2.21)***	2.16 (1.74, 2.69)***	1.58 (1.35, 1.85)***
Higher secondary	3.65 (2.55, 5.22)***	1.93 (1.44, 2.59)***	2.14 (1.60, 2.88)**	1.58 (1.26, 2.00)**
Mass media contact				
No (ref.)				
Yes	1.78 (1.35, 2.35)***	1.17 (0.98, 1.40)	1.65 (1.38, 1.98)***	1.30 (1.17, 1.45)***

Note: ref. = reference group; Model 1: unadjusted; Model 2: adjusted for age; Model 3: adjusted for age and economic status; Model 4: adjusted age, economic status, parity, women`s occupation, and division.***p < .001, **p < .01, *p < .05.

Comparison of the current results with previous studies

In general, educated women in urban areas were more likely to be overweight and obese than those in rural areas. Among women exposed to mass media, obesity was more common in urban areas, while being overweight was more common in rural areas. Similar findings on education and mass media exposure concerning obesity were observed in Bangladesh (Ghose, 2017), India (Al Kibria et al., 2019), Pakistan (Janjua et al., 2015), Malaysia (Chan et al., 2017), Ethiopia (Tebekaw et al., 2014) and Nigeria (Ghose & Yaya, 2018).

Women's educational attainment was found to be positively associated with being overweight and obese. The results of this study are consistent with those of previous studies in Bangladesh (Hoque et al., 2017; Khan & Kraemer, 2009; Tanwi et al., 2019). Moreover, higher-educated Ethiopian women were more likely to be overweight (Tebekaw et al., 2014). The current study also found that socioeconomic status confounds the association between education and being overweight or obese. Ozodiegwu et al. (2020) observed that women from Sub-Saharan African countries with higher household wealth but lower educational attainment were more likely to be overweight or obese than women with higher education.

The present study also found that women exposed to mass media were more likely to be overweight and obese. This result is partially consistent with an earlier study on women's television viewing in Bangladesh (Ghose, 2017). Similar to the current research, Nigerian women exposed to mass media showed a significant positive association with being overweight and obese compared to those not exposed (Ghose & Yaya, 2018). Ethiopian women who watched television were more likely to be overweight (Tebekaw et al., 2014).

General discussion and implication of research

Educated people usually work in sedentary environments, which leads to a sedentary lifestyle with increased exposure to mass media (Chan et al., 2017; Ghose, 2017). Several factors are responsible for this sedentary lifestyle; for example, people with higher education in Bangladesh work in environments that provide little or no opportunity for exercise during office breaks. In addition, they spend a lot of time in transportation due to traffic jams, which is also a sedentary behavior (Alam et al., 2006; Saquib et al., 2013). Individuals with higher levels of education have limited scopes to exercise because household chores are less physically demanding. Economic, environmental, and behavioral changes, such as increased consumption of fast-food and fatty foods, are associated with urbanized lifestyles. These changes increase BMI in developed and developing countries (Chowdhury et al., 2015; Rahim et al., 2007).

Educated individuals with high socioeconomic status usually live in urban areas; however, they do not have adequate opportunities to exercise and maintain a healthy lifestyle, which forces them to become overweight or obese (Chowdhury et al., 2015; Popkin et al., 2012). Campbell and Campbell (2007) stated that healthy environmental elements such as playgrounds, gyms, and open places for exercise are limited or almost non-existent in urban areas. They also stated that urban dwellers dare not go out for physical exercise because of a lack of safety or the risk of sexual harassment. It is worth mentioning that there are no footpaths in the unplanned urbanization system of Bangladesh (Alam et al., 2006; Saquib et al., 2013). The authors also pointed out that outdoor exercise is risky and uncomfortable because of seasonal obstacles, such as rainy seasons and dusty winters. This unfavorable situation forces women, especially in the cities, not to go out for exercise, although some of them have free time and spend it with mass media.

Conversely, some rural women who avoid or have limited contact with the mass media burn calories by becoming more physically active through greater participation in work-related physical activity, daily household chores, and other labor-intensive activities. These activities helped them maintain a normal BMI (Chowdhury et al., 2015; Day, 2018). However, parallel to urban areas, physical inactivity and sedentary lifestyles are also increasing in rural areas, such as China (Tu et al., 2019).

Women who are not in paid work spend much of their daily time with mass media, leading to a sedentary lifestyle that increases the risk of being overweight and obese (Park et al., 2020; Rosiek et al., 2015). Another reason for the sedentary lifestyle could be the availability of different television channels with different attractive programs, different newspapers with a variety of news from various fields like the national, international, recreational, economic, stock market, etc., and several radio channels with attractive programs available for 24 hours (Park et al., 2020; Rahman & Alam, 2014). However, the availability of separate bicycle and pedestrian paths for each street and ample space for sports and exercise facilities would improve physical activity (Moniruzzaman et al., 2016; Zhang & Ma, 2018).

Limiting the sale and advertising in the mass media of unhealthy foods, such as high-calorie foods, sugary drinks, and sugary and saturated foods, helps control weight gain (Zhang & Ma, 2018). In addition, eating more fruits and vegetables, doing necessary physical activities, engaging in less sedentary activity, and avoiding unhealthy dietary habits help lose weight (Khan et al., 2019). Moreover, the risk of being overweight and obese in Bangladesh can be

reduced by ensuring a healthier work environment for highly educated people and reducing
the amount of time they spend with the mass media (Foley et al., 2016; Ghose, 2017).

Significance for public health

This study examined the effect of education and mass media exposure on overweight and
obesity. It also examined the differences between urban and rural areas in this context. The
findings of this study suggest that women with secondary or higher education and women
exposed to mass media are more likely to be overweight and obese than those with less than
primary education and no mass media exposure, respectively. This trend is more pronounced
in urban than in rural areas. It can be seen that rural women tend to be gradually overweight
and obese, and the difference between urban and rural seems to be narrowing. Women 30
years or older and economically well-off should receive special attention to reduce the
prevalence of overweight and obesity. Prerequisites to control the rapid increase in this
prevalence are healthy dietary habits, physical activity, healthy work environments, and
reduced exposure to mass media. These findings will be helpful to health policymakers.

Strengths and limitations

This study has some strengths. First, to our knowledge, this is the first study on the association
between educational attainment and mass media exposure and being overweight and obese;
therefore, the application of nationally representative data with a large sample size may allow
the generalization of results to Bangladeshi women of reproductive age. Second, the data were
analyzed according to the complex sampling design that applies the sampling weights,
stratum, and cluster; thus, the results appear free of bias. However, this study is not free from
limitations. First, this study used information about whether or not the women studied had
contact with mass media instead of considering the duration of contact with mass media.

As Ghose (2017) stated, the duration of television watching can provide better information for
intervention studies. Second, the data were self-reported, so there may be erroneous
information. The sampling strategy and participant selection may not be 100% free of bias.
Therefore, reporting, recall, or selection errors may occur in this study. Third, the BDHS did
not collect information on women's diet and exercise; however, these two variables are more
important for examining the risk factors of overweight and obesity. Further research could
therefore address other variables related to diet and physical activity for in-depth
investigation. Finally, due to the cross-sectional nature of data, the interpretation of causal
association is limited; further research could explore causal associations through a
longitudinal study.

Conclusion

The findings of this study indicate that women with secondary or higher education and
women exposed to mass media are more likely to be overweight and obese than women with
less than primary education and no exposure to mass media. This trend is more pronounced
in urban areas than in rural areas. It can be seen that rural women tend to be gradually
overweight and obese, and the difference between urban and rural seems to be narrowing.
Regardless of the differences between rural and urban areas, the prevalence of overweight and

obesity among women in Bangladesh is increasing. Prerequisites for controlling the rapid increase in this prevalence include healthy dietary habits, physical activity, healthy work environments, and reduced exposure to mass media. In particular, appropriate health-promoting interventions based on education and mass media should be envisaged to reduce the prevalence of overweight and obesity. In this regard, special attention should be paid to women aged 30 years or older; and women from economically affluent families.

Acknowledgments

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