Factors associated with being underweight, overweight and obese among ever-married non-pregnant urban women in Bangladesh

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ABSTRACT

Introduction: Extremes of body mass index (BMI), viz. underweight, overweight and obese categories, are associated with a variety of adverse health outcomes such as diabetes mellitus, cardiovascular diseases, low birth weight, poor quality of life and higher mortality. In Bangladesh, the prevalence of underweightness is very high with an increasing trend of overweightness and obesity. This is a serious public health concern as it indicates a dual burden of disease. The present study assessed the associations of being underweight, overweight and obese with socioeconomic, demographical and migration variables among ever-married non-pregnant urban Bangladeshi women aged 13–49 years.

Methods: The data was extracted from the Bangladesh Demographic and Health Survey 2004. Bivariable, factor and multinomial logistic regression analyses were performed in this study.

Results: The prevalence of being underweight, overweight and obese among ever-married non-pregnant urban women in Bangladesh was 25.2 percent, 15.7 percent and 3.9 percent, respectively. Age, education, region of residence, marital status, current use of contraception and type of occupation were significantly associated with BMI categories. Adjusted multinomial logistic regression analysis indicated that women with a high socioeconomic status were significantly negatively associated with being underweight (odds ratio [OR] 0.55, 95 percent confidence interval [CI] 0.48–0.63) but positively associated with being overweight (OR 1.70, 95 percent CI 1.48–1.96) and obese (OR 2.48, 95 percent CI 1.89–3.26), as compared to the women with normal BMI. In contrast, women who migrated from rural to urban areas showed a significantly positive association with being underweight (OR 1.15, 95 percent CI 1.04–1.27) but negative associations with being overweight (OR 0.80, 95 percent CI 0.71–0.89) and obese (OR 0.75, 95 percent CI 0.62–0.92), when compared with women who did not migrate.

Conclusion: Suitable interventions based on further studies are needed to reduce the prevalence of being underweight and overweight among ever-married non-pregnant urban women in Bangladesh. Factors, viz. socioeconomic status, rural-urban migration and education, should be considered while developing interventional strategies to reduce the prevalence of extreme BMIs among women living in urban areas of Bangladesh.

Keywords: obesity, overweight, rural-urban migration, socioeconomic status, underweight

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INTRODUCTION

Body mass index (BMI, kg/m^2) is an indicator of nutritional status.[1] The extreme categories of BMI, viz. underweight, overweight and obese, as compared to the normal BMI, are associated with a variety of adverse health outcomes.[2-5] In particular, being overweight or obese is associated with high mortality, disability, and a poor quality of life.[3,6-8] Evidence indicates that conditions being underweight or overweight can exist in close proximity, such as in the same community and same household.[1,9] Such conditions could be linked to different environmental, behavioural and individual risk factors.[9] An increasing trend of overweightness and obesity in combination with a high prevalence of underweightness is found to be common in many developing countries,[9,10] including Bangladesh.[11] Globally, about 1.6 billion adults are overweight, of which at least 400 million adults are obese.[12] Continued economic development, rapid urbanisation mainly in developing countries, globalisation of food production

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and changes in dietary patterns are some of the important causal factors.[10,13]

Being underweight is normally the result of deficit energy consumption, while being overweight is related to excess energy intake. These two conditions are associated with distinct types of public health problems.[9] For instance, overweightness is an important risk factor for diabetes mellitus,[2,4,6,8,9,14-16] cardiovascular disease,[2,4,14,15,17] cancer, stroke, respiratory problems,[8,15,16] high cholesterol, high blood pressure, asthma, and arthritis,[6,8] whereas being underweight is associated with preterm birth and low birth weight,[18,19] malnourished children,[20] and poor psychological health,[21] including high mortality.[5] Comparatively, underweightness is a particular concern for developing countries, as it is the first and fourth leading cause of death and disability in the high-mortality and low-mortality developing countries, respectively.[4]

The BMI is dependent on many factors like age, education, occupation, household economic status, food habits and sedentary lifestyles.[11,22-24] The higher level of malnutrition among women and female children compared to men and male children in Bangladesh[11,22] may be associated with a higher level of gender discrimination that exists in all sectors of Bangladesh. Gender discrimination also exists in other south Asian countries.[25] A lower level of education, income, nutrition and healthcare are some of the indicators of gender discrimination in Bangladesh.[26] Such discrimination usually starts from early childhood and continues throughout their lives. The patriarchal society in Bangladesh allows men to control women in all spheres of life.[26,27] The independent impact of women malnutrition (e.g. due to food and healthcare discrimination) on their babies and children is also remarkable. For instance, underweight babies are strongly associated with the underweight mothers.[28,29] Generally, gender discrimination, gender roles and social norms can characterise a malnourished mother by a cycle of early marriage and childbearing, close birth spacing and undernutrition. This intergenerational influence (i.e. from mother to baby) of childhood nutrition suggests the necessity of having a better nutritional status in early childhood to improve the child health in the next generation.[24,28] Some other factors, such as the mother's illiteracy, low household income, higher number of children, less access to the mass media, less supplementation of diets, unhygienic water supply and sanitation, are also associated with the chronic and severe malnutrition of children in Bangladesh.[29,30]

Urbanisation is a worldwide phenomenon that mostly occurs in developing countries. Recent data shows that the worldwide urban population will be 4.58 billion by 2025 from 3.29 billion in 2007; in contrast, the rural population will be 3.43 billion by 2025 from 3.38 billion in 2007.[31] Bangladesh is also experiencing rapid urbanisation like the other developing countries in Asia. For instance, the percentage of the urban population rose from 6.2% in 1965 to 9.9% in 1975 and reached 25% in 2000.[32] In the city of Dhaka, the total population increased from 0.42 million in 1950 to 3.3 million in 1980, to 10.2 million in 2000, and is expected to increase to 16.8 million in 2015.[32-34]

The rural-urban migration is the main contributor to the urban growth in Bangladesh. More than two-thirds of urban growth, which occurred after the independence of the country in 1971, is attributed to this internal migration. Specifically, about 300,000–400,000 new migrants are added per year in the city of Dhaka.[35] Greater opportunities for jobs, higher income, better access to public services such as electricity, health clinics and schools in the cities and metropolitan areas also attract many people to migrate to the urban areas. Most of the migrants are from low income families and the majority of such migrants normally settle in slum and squatter settlements. Consequently, these migrants encounter various problems such as security, poor housing and social discrimination. All these factors put migrants at increased health risks as compared to other subpopulations in the urban areas.[32,36,37] Thus, rapid urbanisation in Bangladesh poses a great public health challenge for local health authorities.[38,39] The migrant population in urban areas is often under-served by the authorities concerned, and hence it experiences a wide range of distinct health problems.[40]

To our knowledge, the associations of women's rural to urban migration and other socioeconomic characteristics with the extremes of BMI are rarely studied in Bangladesh. Considering the factors like rapid urbanisation, rural-urban migration as well as the increasing trend of overweightness and obesity in urban areas in Bangladesh, the present study aimed to investigate the association of rural-urban migration and other selected factors with being underweight, overweight and obese among the ever-married currently non-pregnant women living in urban areas of Bangladesh. Hopefully, this study will enrich available information and contribute to developing appropriate interventions for reducing the extreme BMI among urban women populations in Bangladesh.

METHODS

We used a representative set of cross-sectional data of women, collected via the Bangladesh Demographic and Health Survey (BDHS) 2004. The details of the sampling, survey design, survey instruments and quality control are reported elsewhere.[41] Briefly, the data was extracted from the women data set of the BDHS 2004. This was a

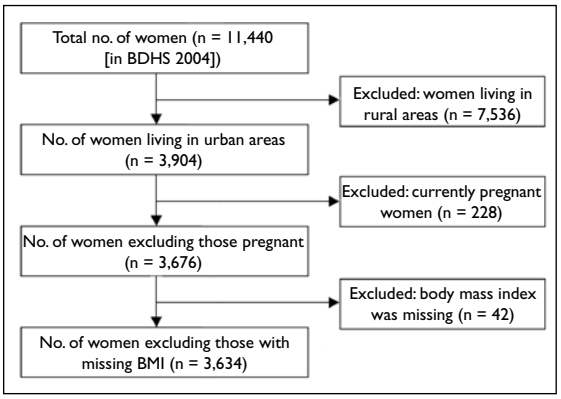

Fig. 1 Flow chart shows the selection of target women for the study.

nationally representative survey of 11,440 ever-married women aged 10–49 years from 10,500 households located in 361 clusters (122 in urban areas and 239 in rural areas) throughout the country. This survey utilised a multistage cluster sample based on the 2001 Bangladesh Census and the data was collected by trained interviewers from January 1 to May 25, 2004. The survey collected various information including background characteristics (such as age, region of residence, place of residence, education, childhood place of residence and household characteristics), current status of pregnancy, and the height and weight of the women.

For analytical purposes, the data was restricted only to the urban ever-married women, who were not pregnant at the time of the survey. The schematic diagram (Fig. 1) shows the necessary steps taken for extracting the data for this study. Pregnant women were excluded because anthropometric measurements, like body weight, increase rapidly during the pregnancy and indicate both nutritional status of the women and growth of the foetuses, and reduce the specificity of the indicator.[42] The BMI of a woman, which was calculated by using the height and weight measurements, was the dependent variable in this study. We considered the most widely-used categories of BMI for adults, viz. underweight (BMI ≤ 18.5 kg/m^2), normal weight (18.5 < BMI < 25 kg/m^2), overweight (25 ≤ BMI < 30 kg/m^2), and obese (BMI ≥ 30 kg/m^2).[3,28]

We used 17 independent variables (with categories shown in parenthesis), viz. age (10–19: 1, 20–29: 2, 30–39: 3, 40–49: 4); education (no education: 0, primary: 1, secondary: 2, higher secondary and above: 3); region of residence (Barisal: 1, Chittagong: 2, Dhaka: 3, Khulna: 4, Rajshahi: 5, Sylhet: 6); marital status (married: 1, widowed/divorced: 2, separated: 3); current use of contraceptive method (none: 1, modern method: 2, folkloric and traditional methods: 3); type of occupation (not working: 1, professional/managerial: 2, sales/business: 3, agriculture [self-employed and employee]: 4, household and domestic labour: 5, skilled [e.g. tailor, policeman, birth attendant/dai]: 6, unskilled [e.g. construction worker, brick breaking]: 7, others: 8); drinking water source was piped inside dwelling (yes: 1, no: 0); toilet facility was modern/septic (yes: 1, no: 0); floor material of the house was concrete and cement (yes: 1, no: 0); wall material of the house was concrete and cement (yes: 1, no: 0); roof material of the house was concrete and cement (yes: 1, no: 0); household had electricity (yes: 1, no: 0); household had telephone (yes: 1, no: 0); women read newspaper/magazine everyday (yes: 1, no: 0); women watched television everyday (yes: 1, no: 0); the childhood place of residence for women was in the countryside/rural area (yes: 1, no: 0); and the previous place of residence for women was in the countryside before moving to the urban area (yes: 1, no: 0).

Bangladesh has six administrative regions (also called divisions) and they differ greatly in terms of socioeconomic factors (e.g. education, exposure to media, unemployment), demographical factors (e.g. total fertility rate, contraceptive use, percentage of teenage pregnancy, birth spacing), utilisation of health services (e.g. proportion of birth attended by skilled personnel, use of satellite clinic in the past three months, micronutrient intake) and health outcomes (e.g. neonatal mortality, stillbirth).[41,43] For instance, the percentage of women with no education was highest in the Sylhet division (40.8%) and lowest in the Barisal division (24.8%). The total fertility rate varied from 2.6 in the Rajshahi division to 4.2 in the Sylhet division.[41]

The rural-urban migration was considered as one of the main independent variables in this study. There were two variables in the BDHS 2004 female questionnaire used for measuring the rural-urban migration in this study. These are: (1) For most of the time until you were 12 years old (i.e. during childhood), did you live in a city, in a town, or in the countryside? (2) Just before you moved here (current place), did you live in a city, a town, or in the countryside? Hereafter, the first and second variables are respectively referred to as childhood place of residence and previous place of residence. If any woman reported that she lived in the countryside during her childhood or her previous place of residence was in the countryside before moving to the urban area (current place), then the woman was considered as a rural-urban migrant.

The Statistical Package for Social Sciences version 17.0 (SPSS Inc, Chicago, IL, USA) was used for statistical analysis. This study first compared being underweight, overweight and obese among ever-married non-pregnant women aged 10–49 years by some selected socioeconomic and demographical variables, including the childhood as well as the previous place of residence, and then attempted to determine the association of these variables with the

Table I. Body mass index and demographics of women living in the urban regions of Bangladesh.

Characteristics	Total no.*	Prevalence of body mass index categories (%)				p-value
		Underweight	Normal weight	Overweight	Obese	
Total prevalence	3,634	25.2	55.2	15.7	3.9	
Age (years)						
10–19	425	36.9	60.0	2.1	0.9	< 0.001
20–29	1,341	25.4	59.4	12.6	2.5	
30–39	1,112	20.0	53.8	21.0	5.3	
40–49	756	25.9	47.2	20.9	6.0	
Educational level						
No education	1,144	34.3	56.2	8.6	1.0	< 0.001
Primary	977	29.4	56.1	11.8	2.8	
Secondary	1,100	18.2	54.9	20.3	6.6	
Higher secondary and above	413	9.0	51.3	32.2	7.5	
Region of residence						
Barisal	332	25.0	55.4	15.1	4.5	< 0.001
Chittagong	704	24.6	57.8	14.2	3.4	
Dhaka	1,048	22.2	54.9	18.3	4.6	
Khulna	548	23.9	52.9	17.7	5.5	
Rajshahi	718	28.8	58.1	11.3	1.8	
Sylhet	284	31.3	47.2	17.3	4.2	
Marital status						
Married	3,318	24.4	55.7	15.9	4.0	0.003
Widowed/divorced	221	32.6	48.9	15.4	3.2	
Not living together	95	37.9	52.6	6.3	3.2	
Current method of contraception						
None	1,343	30.1	51.5	14.3	4.1	< 0.001
Modern	1,884	21.7	60.1	14.7	3.5	
Folkloric and traditional	407	25.3	45.0	24.6	5.2	
Type of occupation						
Not working	2,712	24.1	54.2	17.0	4.7	< 0.001
Professional/managerial	54	16.7	44.4	35.2	3.7	
Sales/business	73	34.2	47.9	11.0	6.8	
Agriculture	141	31.2	64.5	2.8	1.4	
Household and domestic	273	32.2	60.4	7.0	0.4	
Skilled labour	220	18.6	60.9	19.1	1.4	
Unskilled labour	106	44.3	51.9	3.8	0.0	
Others	52	15.4	59.6	23.1	1.9	
Childhood residence in the countryside						
Yes (rural-urban migrants)	2,383	27.9	55.5	13.5	3.1	< 0.001
No (non-migrants)	1,249	20.0	54.8	19.8	5.4	
Place of previous residence was the countryside						
Yes (rural-urban migrants)	1,799	29.1	56.7	11.7	2.6	< 0.001
No (non-migrants)	1,008	17.2	51.6	24.7	6.5	

*numbers may not tally due to missing information.

BMI categories of underweight, overweight and obese by statistical techniques. Bivariate analysis was used to show the associations of socioeconomic and demographical variables with BMI. As most of the variables were similar in nature, we performed a factor analysis (applying the principal component method) using 11 variables (except age, education, region of residence, marital status, current use of contraception and type of occupation) to reduce the number of variables into two factors. Factor scores were also obtained for these factors. Since BMI was categorised into four mutually-exclusive groups which carry different implications in public health, we performed a multinomial logistic regression to estimate the odds ratio (OR) and 95% confidence interval (CI) taking "normal BMI" as the reference category. Two factors revealed by the factor analysis including age, education, region of residence, marital status, current use of contraception and type of occupation, were inserted into the multinomial logistic regression. The estimated coefficients and their exponential transformations that yielded the ORs are always relative to the reference category. Thus, the odds of a person with underweight vs. normal BMI is the probability of being an

Table II. Body mass index and household characteristics of women living in the urban regions of Bangladesh.

Characteristics	Total no.*	Prevalence of body mass index categories (%)				p-value
		Underweight	Normal weight	Overweight	Obese	
Piped water available indoors						
Yes	662	11.0	52.6	26.6	9.8	< 0.001
No	2,968	28.4	55.8	13.2	2.6	
Toilet facility was modern/septic						
Yes	1,076	10.5	51.7	28.7	9.1	< 0.001
No	2,554	31.4	56.7	10.1	1.7	
Main floor material was concrete/cement						
Yes	1,662	12.9	54.5	25.3	7.2	< 0.001
No	1,963	35.6	55.8	7.4	1.1	
Main wall material was concrete/cement						
Yes	1,654	14.6	53.9	24.4	7.1	< 0.001
No	1,976	34.2	56.3	8.3	1.2	
Main roof material was concrete/cement/tiled						
Yes	834	10.3	48.6	30.6	10.6	< 0.001
No	2,793	29.7	57.2	11.2	1.9	
Household had electricity						
Yes	2,709	19.9	55.6	19.5	5.1	< 0.001
No	920	41.1	54.0	4.5	0.4	
Household had telephone						
Yes	599	6.2	50.6	33.1	10.2	< 0.001
No	3,029	29.0	56.1	12.2	2.7	
Read newspapers/magazine daily						
Yes	212	3.8	42.9	37.7	15.6	< 0.001
No	3,421	26.5	56.0	14.3	3.2	
Watched television daily						
Yes	1,801	16.7	54.4	22.7	6.3	< 0.001
No	1,832	33.6	56.1	8.7	1.6	

*numbers may not tally due to missing information.

underweight divided by the probability of a person with a normal weight.

RESULTS

The age of the respondents varied from 13 to 49 years, with an average age of 30.7 years. 11.7% of women were below 20 years of age and 20.8% were above 39 years. 31.5% were illiterate and only 11.4% had higher than a secondary education. Most of the women (28.8%) were from the Dhaka region, followed by the Rajshahi (19.8%) and Chittagong (19.4%) regions. Education levels were significantly different in the six administrative regions of the country, with the highest illiteracy rate in the Sylhet region (39.4%) and the lowest in the Barisal (18.1%) region. The average family size and average number of children were highest in the Sylhet region, compared to the other regions of the country. Religion also varied significantly ($p < 0.001$) by region, with the highest percentage of Hindus in Sylhet (17.6%) and the lowest in Dhaka (4.8%). The percentage of women in the poorest categories of the wealth index varied from 6.6% in Dhaka to 12.0% in Rajshahi. 65.6% of the women were born in the countryside and were now living in urban areas (considered as migrants). The previous place of residence before moving to the current place was the countryside for about 50% of the women.

Table I shows the prevalence of being underweight, normal, overweight and obese by selected demographical background characteristics. The overall prevalence of underweightness was 25.2% among non-pregnant urban women. The variables of age, education, region of residence, marital status, current use of contraception, type of occupation and rural-urban migration, were significantly associated with BMI. For instance, a woman's age (until 39 years) was significantly negatively associated with being underweight. The same variable was positively associated with being overweight and obese. Education was also significantly negatively associated with being underweight, but positively associated with being overweight and obese. The group of highest education (higher secondary and above) was associated with the

Table III. Factor analysis to identify two factors and their factor loadings.

Variables	Socioeconomic status	Rural-urban migration
Drinking water (piped inside home: 1, else: 0)	0.57	−0.10
Toilet (modern: 1, else: 0)	0.77	−0.07
Floor material (brick: 1, else: 0)	0.84	−0.09
Wall material (brick: 1, else: 0)	0.83	−0.07
Roof material (brick: 1, else: 0)	0.75	−0.02
Has electricity (yes: 1, no: 0)	0.57	−0.16
Has telephone (yes: 1, no: 0)	0.64	−0.08
Read newspapers daily (yes: 1, no: 0)	0.44	−0.13
Watched television daily (yes: 1, no: 0)	0.56	−0.26
Childhood place of residence was the countryside (yes: 1, else: 0)	−0.13	0.89
Previous place of residence was the countryside (yes: 1, else: 0)	−0.11	0.89
Rotated eigenvalue of the factors	4.14	1.73
% of rotated variance explained	37.61	15.76
Cumulative % of rotated variance explained	37.61	53.37

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalisation. Rotation converged in three iterations.

lowest level of being underweight (9.0%) but the highest level of being overweight (7.5%). The highest prevalence of being underweight was found in the Sylhet (31.3%) and Rajshahi (28.8%) regions. Overweightness along with obesity was relatively common in the Dhaka and Khulna regions. Based on occupation, the highest prevalence of being underweight (44.3%) and obese (6.8%) was found among women who were unskilled labourers and who were engaged in sales, respectively. Women who belonged to higher rank occupations showed the lowest prevalence (16.7%) of being underweight, but the highest prevalence of being overweight (35.2%). The women, whose childhood place of residence and/or previous place of residence was the countryside, showed a positive association with being underweight but a negative association with being overweight and obese. For instance, the prevalence of being underweight and overweight was 27.9% and 13.5% among rural-urban migrant women and 20.0% and 19.8% among non-migrant women, respectively.

Table II presents the bivariable associations of BMI with selected household characteristics. Characteristics such as piped water indoors, modern toilet facilities, concrete/cement flooring of the house, concrete/cement walls of the house, concrete/cement roof of the house, availability of electricity per household, possession of telephone per household, daily reading of newspapers/magazine and watching television daily, were significantly negatively associated with being underweight, whereas all these variables were positively associated with being either overweight or obese. The results of the factor analysis based on the principal component method are presented in Table III. We restricted the model to extract only two factors from 11 variables. On the basis of high factor loadings, we named the two factors as: "socioeconomic status", and "rural-urban migration".

The term, socioeconomic status, was given because all the nine variables with a "yes" answer and with a high-factor loading represented the higher socioeconomic condition of the women. Among these variables, concrete/cement flooring (factor loading 0.84), concrete/cement walls (0.83), modern toilet (0.77) and concrete/cement roof (0.75), were strongly associated with this socioeconomic status. The rural-urban migration factor was mainly based on two variables, viz. the childhood place of residence was the countryside (0.89) and the previous place of residence was the countryside/rural area (0.89). In the second factor, both variables indicated the movement of women from the rural to the urban areas. In total, 53.4% of the rotated variance was explained by these factors, of which 37.6% was explained by the socioeconomic status factor and 15.8% was explained by the rural-urban migration factor.

Table IV presents the results of multinomial logistic regressions for the different extreme categories of BMI taking normal BMI as the reference category. Model I considered the scores of two factors (based on the regression technique in the factor analysis) as independent variables. Model I showed that higher socioeconomic status was significantly negatively associated with underweightness, but positively associated with overweightness and obesity. In contrast, rural-urban migration showed a significantly positive association with underweightness, but significantly negative association with overweightness and obesity. Model II again estimated the ORs and 95% CIs for the same factors after adjusting the effects of age, education, region of residence, marital status, current use of contraception, and type of occupation. All the associations of high

socioeconomic status and rural-urban migration with underweightness, overweightness, and obesity were almost similar even after adjusting several significant variables in model II.

DISCUSSION

The present study clearly demonstrates that the prevalence of being overweight and obese is gradually increasing among ever-married women living in the urbanised areas of Bangladesh. Fig. 2 shows that the percentage of the overweight women doubled during the period 1996–2004, from 8% in 1996–1997 to 16% in 2004. The prevalence of obesity also showed an increasing trend among ever-married urban women in Bangladesh, while the prevalence of being underweight is still very high although it is decreasing gradually (e.g. from 36% in 1996–1997 to 25% in 2004). Our results are consistent with the results of another study conducted in Bangladesh.[11] Similar patterns were also reported in India[28] and Indonesia.[44] The latter report showed that the prevalence of chronic energy deficiency among women decreased from 16.2% in 1996 to 14.4% in 1997, whereas the prevalence of obesity increased from 11.6% to 14.3% during the same period.[44]

In this study, the overall prevalence of being underweight was 25.2% among urban non-pregnant women of Bangladesh. A higher prevalence of being underweight among urban women was also reported by other studies conducted in Bangladesh (29.3%–44.0%),[11,22] and in India (38.5% in 2005).[28] Some studies documented a higher prevalence of underweightness in urban Bangladeshi women compared to their male counterparts.[22] Like adult women, the prevalence of malnutrition is remarkably higher among female children than male children.[11,22] In Bangladesh, the malnutrition among female children usually starts from early childhood and continues throughout their lives. Gender discriminations may influence the nutritional status of women in Bangladesh, which can be indicated by factors such as education, income, nutrition, and access to healthcare.[26,27]

Based on the present study, the prevalence of being underweight was significantly higher among migrant women as compared to non-migrant women. In contrast, the prevalence of being overweight and obese was significantly lower among migrant women as compared to non-migrant women. These results remained unchanged even after adjusting for the significant impact of socioeconomic status and other the variables of age, education, region of residence, marital status, current use of contraception and type of occupation (Table IV). The rural-urban migration factor is found to be associated with stress and anxiety because the migrant women receive less traditional social

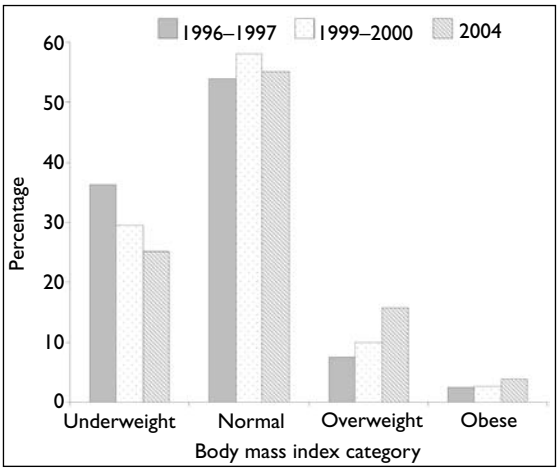

Fig. 2 Bar chart shows the trend of body mass index categories among Bangladeshi married women in 1996–2004.

support in their new environment. Social integrations for migrants in a new setting are also hampered by the lack of education and occupational experience.[45] The coexistence of higher prevalences of underweightness and overweightness may be an indication of the nutritional paradox in a wider context of urban areas, as mentioned by other studies.[1,46] This is a situation of a dual burden of malnutrition[11] in urban Bangladesh which underscores the need for immediate attention from a public health point-of-view.

The prevalence of being overweight was about double among the urban women compared to the rural women in developing countries.[13] One may question why the prevalence of being overweight is higher in the urban areas than the rural areas. The rising urbanisation and continued economic development in the developing countries are found to be positively associated with the prevalence of being overweight.[13] Other urban characteristics, such as the excessive use of cars and other fuel-based vehicles, limited space for walking and physical activity, the availability, preference and consumption of fast and fatty foods and less preference for vegetables, improved technologies that require less energy, and sedentary and changing lifestyles, all contribute to the rising trend of being overweight or obese in the urban areas.[9,10,14] Additionally, obesity is considered to be a condition of high socioeconomic status in many developing countries.[10,47,48] For instance, possession of a television is an indicator of a high socioeconomic class. Watching television regularly was positively associated with obesity.[6,49] The present study also confirms a significantly higher prevalence of overweightness and obesity among the women with a higher socioeconomic status. Social expectations regarding body size, beliefs, and cultural practices about food, nutrition and physical activity may explain the association between higher BMI and higher

Table IV. Multinomial logistic regression for estimating the odds ratio and 95% confidence interval for being underweight, overweight and obese (with normal BMI as the reference category) by the scores of two factors derived by the factor analysis.

Factors	B-coefficient	OR	95% CI	p-value
Model I				
Underweight (BMI ≤ 18.5 kg/m^2)				
Socioeconomic status	−0.64	0.53	0.48–0.59	< 0.001
Rural-urban migration	0.13	1.14	1.05–1.24	0.002
Overweight (25 ≤ BMI < 30 kg/m^2)				
Socioeconomic status	0.71	2.02	1.84–2.23	< 0.001
Rural-urban migration	−0.18	0.83	0.76–0.92	< 0.001
Obese (BMI ≥ 30 kg/m^2):				
Socioeconomic status	1.11	3.03	2.51–3.67	< 0.001
Rural-urban migration	−0.25	0.78	0.65–0.93	0.005
Model II				
Underweight (BMI ≤ 18.5 kg/m^2)				
Socioeconomic status	−0.57	0.56	0.50–0.64	< 0.001
Rural-urban migration	0.13	1.14	1.04–1.24	0.003
Overweight (25 ≤ BMI < 30 kg/m^2)				
Socioeconomic status	0.53	1.70	1.50–1.93	< 0.001
Rural-urban migration	−0.18	0.84	0.75–0.93	0.001
Obese (BMI ≥ 30 kg/m^2)				
Socioeconomic status	1.03	2.80	2.18–3.59	< 0.001
Rural-urban migration	−0.31	0.73	0.61–0.88	0.001

Model II: adjusted for age, education, region of residence, marital status, current use of contraception and type of occupation.
OR: odds ratio; CI: confidence interval; BMI: body mass index

socioeconomic status.[28] In contrast, a poor socioeconomic condition is associated with chronic malnutrition in Bangladesh because socioeconomically poor people cannot afford expensive items such as milk, meat, poultry, fruits and other nutritious foods.[50]

Public health interventions are clearly needed to reduce the prevalence of underweightness among urban women in Bangladesh as well as to control the prevalence of overweightness and obesity among them. Unfortunately, the coexistence of two extreme BMIs among urban women poses a great challenge for the public health, as interventions to address both underweightness and overweightness simultaneously are not simple. If the intervention targets to prevent one problem, it might exacerbate the other.[1] For instance, a recommendation of using a reduced fat diet at the household level can reduce the BMI for overweightness and obesity, but this intervention could accelerate the risk for the underweight members in the same household. In such a situation, the prevention programmes should provide a health education that contributes to the optimal weight for all the persons in the household. An intervention of reduced energy consumption should be implemented only for overweight and obese people.[1] Focus should also be given on healthy diets (e.g. consumption of fruits and vegetables) and lifestyles (e.g. engaging in more physical activity) that lead to the optimal BMI and other health outcomes.[1,45] The target population need to be motivated to consume food with less calories and to increase physical activity and walking. However, further investigations are necessary to find suitable diets and physical activities that are simultaneously protective for both extremes of BMI.

Awareness programmes about the consequences of obesity, including prevention activities, should be available in the schools, the workplace and the community. Incentives are also necessary for food institutions to change their product compositions to contain less fat. Policy makers should consider obesity as a threat and disorder of the socioeconomic environment rather than an individual behaviour.[10] Information like preventing the entire population from gaining just one unit of BMI may reduce the incidence of diabetes mellitus by 12.4%–13.0%,[6,51] should be communicated to the women. It is necessary to study the tracking of nutritional status from childhood to adulthood,[13] particularly for women. Systematic monitoring and surveillance of the nutritional status are also important to address the widespread problem of underweightness and the emerging problem of overweightness.[28] Although it is reported that the difference in BMIs between migrants and natives diminish through time and BMIs of long-term migrants nearly equal their native counterparts of similar socioeconomic background,[52] in this study, a weak association between the duration of living in the current place of residence (which also indicates the duration of migration) and BMI (r 0.038, p = 0.044, n = 2,808) was found.

The strength of this study is that it analysed a large set of

data and studied the extremes of BMI simultaneously among ever-married non-pregnant urban women in Bangladesh using sophisticated statistical techniques. However, some of the limitations are as follows: BMI is a crude index because it does not consider the distribution of fat, which can vary in different individuals and populations.[6] The BMI's cut-off point of 18.5 may overestimate the undernutrition in some Asian populations because the mean BMI is comparatively lower and the amount of fat in the body is relatively higher among them.[13] This study used the cross-sectional data which could not confirm the cause and effect relationships. The results may be biased as the influences of other factors such as smoking, physical activity, body composition, visceral adiposity, physical fitness and dietary intake, are not adjusted in the multinomial logistic regression. Misclassification of pregnant women especially in the first trimester may also influence the results as there is a possibility that some women do not perform pregnancy kit tests in Bangladesh. The association of sales/business occupations with a higher level of obesity needs further investigations based on the type of businesses.

In conclusion, the prevalence of being underweight and overweight among ever-married urban non-pregnant women is high in Bangladesh. The incidence of being overweight and obese is gradually increasing among them although the prevalence of being underweight is gradually decreasing. The extremes of BMI underscore the need for health promotion interventions among this population. Socioeconomic status, rural-urban migration and education are identified as important determinants of extreme BMI, and hence they should be considered for developing interventions. However, the interventions based on these important determinants are not easy to implement as they can influence the extreme categories of BMI in both directions. For instance, education appears as a protective factor for the underweight women but as a risk factor for the overweight and obese women. Moreover, the revealed positive association between obesity and education is not consistent with the results of another study in Iran.[53] Therefore, any intervention based on these factors needs careful attention and evaluation before implementation. Further studies are also needed to find suitable prevention strategies to reduce the prevalence of being underweight, overweight and obese among ever-married women living in urban areas of Bangladesh.

In conclusion, the following key points are emphasised: firstly, the extremes of BMI are adversely associated with various health outcomes. The present study reveals that the prevalence of overweightness and obesity among ever-married non-pregnant urban women are gradually increasing along with a high prevalence of underweightness. Secondly, the higher socioeconomic status of an individual is positively and significantly associated with both being overweight and obese, while it is negatively associated with being underweight, after adjusting for the impact of several important variables. In contrast, rural-urban migration shows a significant positive association with being underweight but a negative association with being overweight and obese. Lastly, important determinants, viz. socioeconomic status, rural-urban migration and education, should be considered while developing interventions to reduce the extreme BMIs among urban women in Bangladesh.

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