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Generalized Traditional Risk Factors of Being Overweight and Obesity among Ever Married Non-Pregnant Women in Bangladesh: An Application of Decision Tree Analysis

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Abstract

Background: As the prevalence of obesity increases, the co-existing underweight and increasing overweight has also become a public health problem in many developing countries like as Bangladesh. Therefore, this study seeks to identify the major determinants factors of being overweight or obese.
Methods: This study used a cross-sectional analysis from the 2011 Bangladesh Demographic and Health Survey that include 2,740 maternal women. To assess the determinants factors of overweight and obese, a multivariate technique name as decision tree analysis was used in this study.
Results: Around 68% of the maternal women were underweight and 32% were either overweight or obese. Women higher socio-economic status, women age ≥25 years, higher educational level and urban place of residence were found to be most dominant factors of being overweight and obese.
Conclusion: The findings suggest that, the major policy implications of this study are the importance of socio-economic status women, age ≥25 years with higher educational level and urban women to minimize its adverse effect on overweight and obese.

Keywords

Overweight, socio-demographic factors, decision tree approach, Bangladesh.

1. BACKGROUND

Globally the prevalence of overweight and obesity are increasing rapidly while the underweight continues to be common in low- and lower-middle income countries. Currently around 39% of the world adult populations are overweight; around 13% of them were obese. This variation of the prevalence of overweight and obesity were also reported by geographically. In America, populations were found to be more prevalent of overweight (61.3%) and obese (26.8%) while lower prevalence of overweight (22.2%) and obesity (5%) reported among Asian population. Similarly, higher prevalence of underweight (52.7%) reported in this region.

In the last two decades, nutritional transition characterized by the trend of underweight to overweight or obese is the subject of increasing talk in Asian countries [1]. The commonly held perspective that before nutritional transition, overweight and underweight tend to be concentrate in high and low socio economic groups respectively [2]. However, developing countries experiencing the rapid mass of urbanization and globalization of food production which contribute to the overweight burden posited to shifts low socio economic groups, even though the underweight burden remains [3]. The potential coexist of this trend is an overlap between over and under nutrition not only in household [4] but also the individual [3]. Therefore, it is imperative that the pattering of under nutrition and overweight to inform the health policies for the management of nutrition related burden of diseases [5]. There are many report describing the epidemiological feature of the traditional risk factors of being undernourished and overweight in different circumstances. Khan et al [6] conducted a comparative study on the basis of Bangladesh Demographic and Health Survey (BDHS, 2007 & 2011) data and found age, education, marital status, children ever born, wealth index, husband occupation and education as a most important determinants of nutritional status in both survey years. Khan and Kramer [7] conducted another study on 3634 ever married non pregnant women and found similar risk factors of being overweight and obese mentioned khan et al [6]. Corsi et al [8] also found BMI influenced by neighborhood variation in his study on 57 low and lower middle countries. They also found between the country, around 13.4% and 18.9% variation observed for underweight and overweight respectively. Beside these, some others study identified sex difference [9, 10], physical activity [11, 12], television watching habit [13, 14], dietary pattern [15], health knowledge [16] and acculturation [17] as a risk factors of overweight or obesity.

Furthermore, previous studies demonstrate that in order to determine the risk factors of overweight, logistic regression method was used. However, logistic regression has limitation in managing complicated data because many factors are involved that could affect each other's [18, 19]. Such disadvantage could easily be overcome by decision tree analysis [20, 21], screen for the most important risk factors and identify the cut points for risk factors. Therefore, we performed the decision tree analysis to identify the most important risk factors of being overweight.

2. METHODS

2.1 Data

Data were obtained from cross-sectional Bangladesh Demographic and Health Survey (BDHS, 2011). Using the multistage cluster sampling, BDHS collect all information including socio-economic, demographic and anthropometric, birth and health information from 17, 842 ever married women aged 15-49. We excluded women having no children in the last five years, having normal weight and currently pregnant in the second and third trimester. The final analyzed sample survey was 2,704.

2.2 Dependent variable

Maternal BMI status was considered as the dependent variable. Maternal BMI classified into four categories; underweight, normal weight, overweight and obese. Due to our study suitability, we omitted the women having the normal weight and include only underweight and overweight women.

2.3 Independent variable

We used different individual, household and community level characteristics as independent variable. Review of the previous study, we identify these selected variables. The considered independent variables are age (15-19, 20-24,25-29,30-34, 35-39, ≥40 years), respondents education (no education, primary, secondary and higher education), respondents husband education (no education, primary, secondary and higher education), respondents socio economic status (poorest, poorer, average, richer, richest), region (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet), place of residence (urban, rural), present working status (yes, no), household food security (never, sometimes, few often) and the number of antenatal visit (no visit, less than or equal four visit, above four visit).

2.4 Statistical analysis

To identify the optimal splits, this study used the Chi-squared Automatic Interaction Detection (CHAID) method. Decision tree analysis was used to assess the most important predicting variable of being overweight and obese. CHAID algorithm with growing criteria of the likelihood ratio Chi-square statistics was used for building the tree and evaluating the splits. To identify the nodes with a relatively high probability, a gain chart was constructed showing the nodes sorted by the number of cases in the target category for each node. All statistical analysis was performed by using SPSS 20.0 (SPSS Inc. Chicago, II, USA).

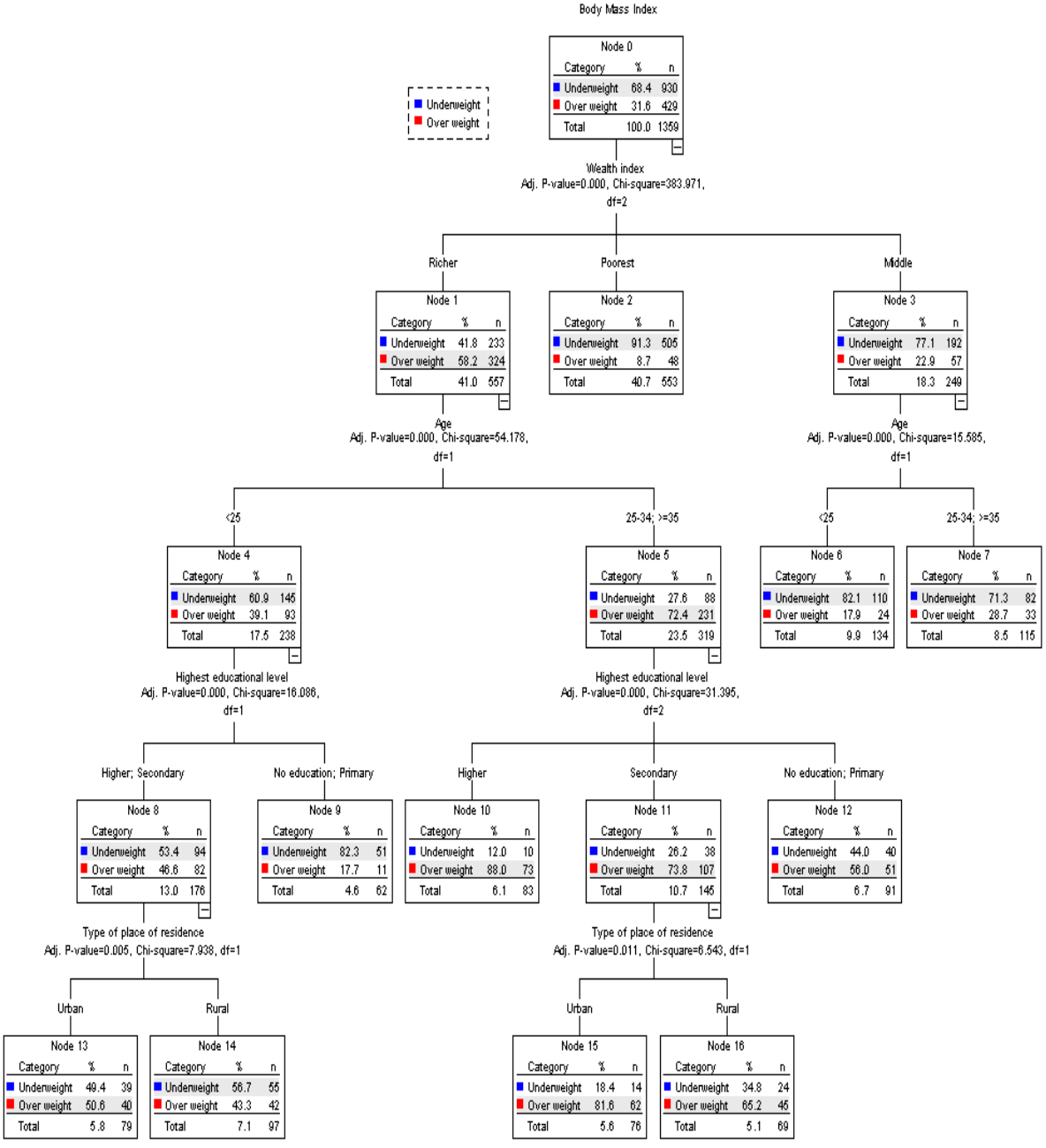

Chart: Body Mass Index

Traditional Risk factors	Body Mass Index Underweight	Overweight/obese	P-value
Age (years)			
<25	1024 (79.1)	270 (20.9)	<0.001
25-34	668 (57.2)	500 (42.8)	
≥35	170 (61.2)	108 (38.8)	
Education			
Illiterate	450 (85.7)	75 (14.3)	<0.001
Primary	662 (79.6)	170 (20.4)	
Secondary	693 (60.9)	445 (39.1)	
Higher	57 (23.3)	188(76.7)	
Marital status			
Married	1823 (67.7)	870 (32.3)	<0.05
Others	39 (83.0)	8 (17.0)	
Present working status			
No	1678 (68.4)	777 (31.6)	0.110
Yes	184 (64.6)	101 (35.4)	
Wealth Index			
Poorer	1028 (91.5)	96 (8.5)	<0.001
Middle	368 (77.1)	109 (22.9)	
Richer	466 (40.9)	673 (59.1)	
Area of living			
Rural	1424 (77.4)	416 (22.6)	<0.001
Urban	438 (48.7)	462 (51.3)	
Region			
Barisal	220 (70.5)	92 (29.5)	<0.001
Chittagong	323 (64.6)	177 (35.4)	
Dhaka	291 (65.4)	154 (34.6)	
Khulna	188 (59.3)	129 (40.7)	
Rajshahi	223 (63.9)	126 (36.1)	
Rangpur	282 (77.5)	82 (22.5)	
Sylhet	335 (74.0)	118 (26.0)	
CEB			
≤2	1129 (67.2)	550 (32.8)	<0.001
3-4	501 (64.2)	279 (35.8)	
>4	232 (82.6)	49 (17.4)	
Age at first birth			
≤18	1292 (75.6)	416 (24.4)	<0.001
19-22	467 (60.9)	300 (39.1)	
>22	103 (38.9)	162 (61.1)	
Total	**1862 (68.0)**	**878 (32.0)**	

Table 1: The comparison of traditional risk factors between BMI and anemia category

3. RESULTS

We analyzed the data of 2,740 women, between ages 15 to 49. Most of the subject was underweight (68%) and the resulting were overweight or obese (32%). The respondents age were divided into three categories i.e., <25, 25-34 and ≥35. Within these groups, majority of the respondents were <25-year age groups. Majority of the illiterate (85.7%) and primary (79.6%) educated women were underweight while overweight found to be more prevalent among higher educated (76.7%) women. Poorer women were more likely to underweight (91.55%). Most of the rural women were underweight (77.4%) and overweight (51.3%) found to be more prevalent in urban area. Higher prevalence of underweight (75.6%) found among the women whose were given birth before age ≤18 years.

We used the decision tree analysis to screen for the most important traditional risk factors of being overweight or obese. Of the nine variables that were entered in CHAID analysis, four variables were selected by the program for the classification tree. The four variables were: wealth index, age, highest educational level and type of place of residence.

The CHAID identified the variables that play the important role of being overweight (Fig. 1). This indicates that the wealth index was the most important determining factors. This first level split produces three initial branches of the classification tree: richer (unadjusted overweight percentage= 58.2%), poorest (unadjusted overweight percentage=8.7%) and middle (unadjusted overweight percentage=22.9%). We could see differences in three sub-trees. We could not find any predicting variable under the poorest split. However, for both the richer and middle, age proved to be the best predicting variable. For the richer age <25 years, higher and secondary education found to be most important predicting variable of being overweight and obese. Under this split, type of place of residence (both urban and rural) also found to be important predicting variable of being overweight and obese. Also, for the age 25-34 and ≥35 years, educational level (higher, secondary, no education, primary) found to be most important predicting variable. Among these three sub splits, only place of residence (rural, urban) found to be important predicting variable under secondary education level. We did not find any important predicting variable in others two splits. Finally, we also did not find any predicting variable under the wealth index named "middle" splits.

4. DISCUSSION

In this, the first nationally representative study in Bangladesh that used the decision tree approach to find out the most important risk factors of being overweight. We select nine variable that may be the possible determinant of overweight and obesity. However, only four variable i.e wealth index, age, educational level and place of residence found to be most important determinant factor of being overweight and obese by decision tree approach.

We found wealth index as the most important predictors of being overweight and obese. The demographic and health survey developed wealth index to measure the inequalities; in household characteristics, in the use of the health and others services, and health outcomes [22]. It was constructed using household asset data via principal components analysis [23] and serves as an important indicator of the household level wealth that is consistent with expenditure and income measure [24]. Change in diet and activity pattern are fueling the obesity epidemic in the developing countries like Bangladesh [3]. In the recent decades most countries in the Asia and have experienced a shift in the overall structure of its dietary pattern [25]. People now more interested to increase consumption of fat, added sugar in the diet and Western diet [25]. These factors may lead to the increase prevalence of overweight and obesity in Bangladesh, especially among the higher socio-economic status groups. Many others study conducted in Bangladesh found the similar result [6, 26, 27]. However, in developed countries higher prevalence of overweight and obesity reported among poor socio-economic groups [28]. This negative association may be attributable to lower energy expenditure and the ability to afford food and energy-dense food [28].

Highest educational level found to be another important determinant of being overweight and obese. A recent comparative study in Bangladesh also noticed the higher prevalence of overweight and obesity among the higher educated women [6]. Cohen et al [29] recently conducted a systematic review includes 289 articles that report on 410 populations in 91 countries. They found inverse association between educational level and obesity in higher-income countries and positive association in lower income countries. Different studies reported higher education associated with socio-economic positions, occupation and income [30-32]. Higher educated people are more likely to be involved higher job position that yielding better income. Also they are mainly live in urban area with sufficient transportation facilities which decrease the chance of physical activity. These factors contribute to the increase prevalence of overweight and obese population among the higher educated group especially in urban area. This study also reported urban women were more likely to be overweight. The direction of our result supported by the literature described above. However, previous study conducted in Bangladesh and others Asian countries also found similar result [2, 6, 26].

This study identified women age as a important determinant of being overweight and obese. Higher prevalence of overweight and obesity reported among the women aged more than 25 years. Study conducted in Bangladesh and India found the similar direction of result [2, 6]. Completion of education and changing life style may work as a common risk factors of increasing prevalence of obesity in this age.

In Bangladesh, majority of the women completed their education during this age range and involved different form of jobs; which may introduce women with modern settings of life. Lower age at marriage also found to be associated with increasing prevalence of overweight and obesity which is common in Bangladesh [33].

The primary strength of this study is to use the decision tree approach to identify the determinants factors of being overweight and obesity. Previous studies in Bangladesh identify the determinants of overweight and obesity by conventional logistic regression analysis. The result of the conventional logistic regression model limited to additive effects of each variable which may overlook the risk factors [34]. In this perspective, decision tree approach yielding a better result. However, in this study, we are not able to justify our findings without comparison of conventional logistic regression analysis due to the lack of appropriate literature.

5. CONCLUSIONS

This study found four key determinants of being overweight and obese by Decision tree approach. The selected determinants were wealth index, age, highest educational level and place of residence. Policies to address these determinants are needed to reduce the prevalence of overweight and obesity.

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List of abbreviations

BMI: Body mass Index, CHAID: Chi-squared Automatic Interaction Detection, BDHS: Bangladesh Demographic and Health Survey.

Declaration

Ethics: This paper is based on analysis of secondary data.

Consent to publish: BDHS had taken written consent from each of the individual.

Competing interests: The author declares that there is no conflict of interest.

Availability of data and materials: Data and materials are available in Demographic and Health Survey website (http://www.dhsprogram.com).

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