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Discriminating Bangladeshi Adults by Simultaneous Prevalence of Obesity and Diabetes

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Abstract

The present analysis was to identify the socioeconomic factors responsible for prevalence of obesity and diabetes simultaneously among adults of 18 years and above residing in both urban and rural localities of Bangladesh. Accordingly, information was collected from 960 adults by some doctors and nurses from and nearby their working places. Among the investigated adults, 66.9% were diabetic patients and 20.2% of them were obese. In the sample, total obese adults were 29.3%. Obesity and diabetes were significantly associated. Prevalence of obesity and diabetes were significantly associated with age, marital status and utilization of time. Income was the most responsible factor for this simultaneous health hazard followed by expenditure, physical activity, marital status, religion and occupation. This conclusion was drawn from the results of odds ratio and discriminant analysis.

Keywords: obesity, diabetes, socioeconomic variables, odds ratio, standard error of odds ratio, discriminant analysis

Abbreviations: WHO: World Health Organization; OR: odds ratio; BMI: body mass index

Introduction

Obesity is the risk factor for more than 30 chronic non-communicable diseases, specially, diabetes, hypertension, high cholesterol, and many other poor health conditions [1, 2]. The prevalence of obesity was increasing in many countries due to upward social mobility and the problem was shifting towards lower socioeconomic group of people [3–6]. The problem of obesity was also in increasing trend in developed countries [3–5, 7– 9]. In 2016, World Health Organization (WHO) reported that the overweight adults were 1.9 billion and obese adults were 650 million throughout the world [9]. Thus, WHO considers this health hazard as an epidemic worldwide and it needs public health intervention to control those factors which are associated with obesity and hence with diabetes [10].

It had been observed in some studies, both in home and abroad, that behavioural factors, like dietary habit, physical inactivity, sedentary activity were the responsible factors for obesity and diabetes [11–14]. Besides, some other socioeconomic variables were also associated with obesity and diabetes [14–17].

From the above discussion it is clear that the epidemic of obesity and obesity related non-communicable diseases are alarmingly increasing among different groups of people, specially, among adults. Keeping this in mind, it was decided to identify some responsible factors for simultaneous prevalence of obesity diabetes among Bangladeshi adults.

Methodology

For the study, the adults were investigated by quota sampling plan to cover 70% diabetic patients so that sufficient number of obese and diabetic patients would be included in the sample [17]. Due to some constraints data were recorded from 960 adults. Among them 66.9% were diabetic patients instead of 70% and 33.1% were normal subjects. The sample respondents were of ages 18 years and above and were the residents of both urban and rural localities. Data were recorded by some doctors and nurses from and nearby their working places during the academic session 2017–2018 by direct interview. For data collection a pre-designed and pre-tested questionnaire had been utilized. Maximum questions in the questionnaire were related to different socioeconomic variables of the respondents and of the families. Except two information, *viz.* monthly family income and monthly family expenditure, all other questions were related to different socioeconomic variables of the respondents and of their personal habit, *viz.* food habit, working habit, physical activity, utilization of time, etc. For diabetic patients there were questions related to duration of disease, disease related health hazard, *i.e.*, eye problem, kidney problem, heart problem, blood pressure, blood sugar, treatment stage of disease, admission into hospital, etc. The value of each of the variable was noted in nominal scale. The data of weight (kg) divided by height (m^2) was used to measure the value of body mass index (BMI) to identify obese adults (if BMI ≥27.5: underweight, if BMI < 18.5: normal, if 18.5≤ BMI < 23.0: overweight, if 23.0 < BMI < 27.5: obese) [18, 19].

According to the objective of the study, association of each of the socioeconomic characteristics with prevalence of obesity diabetes was examined. Significant association was decided if probability of any chi-square test statistic used for observing association ≤0.05. Irrespective of significant or insignificant association, the odds ratio (OR) in favour of a higher group (%) of obese and diabetic adults along with standard error of OR was calculated. Finally, discriminant analysis was done to discriminate obese and diabetic adults from other adults. During discriminant analysis, some variables were identified responsible for discrimination [20–22]. The responsible variable is one for which the correlation coefficient of it with discriminant function score is highest [21]. All the statistical calculation was done using SPSS Version 25.

Results

It was already mentioned that out of total 960 adults 66.9% were diabetic patients, 20.2% of them obese against 29.3% obese in the sample. Majority (43.9%) of the respondents were overweight (23≤ BMI < 27.5) [18, 19]and 68.4% of them were diabetic. More obese (53.7%) were noted among non-diabetic adults. Diabetes and level of obesity were found significantly associated (χ^2 = 101.258, p value = 0.000) (Table 1). Decreasing trend in level of obesity was observed among diabetic adults. This might had been occurred as diabetic adults usually tried to control their body weight.

It was observed that there were 130 obese and diabetic adults (Table1). The main objective of this analysis was to discriminate these 130 adults from the rest 830 adults and to identify some socioeconomic variables for this discrimination. Both the groups were classified into different levels of socioeconomic characteristics and odds ratios were calculated to identify those obese and diabetic adults who were more exposed to this health hazard.

Level of obesity	Prevalence of diabetes				Total	
	Yes		No			
	n	%	n	%	n	%
Under-weight	27	93.1	2	6.9	29	3.0
Normal	297	90.3	32	14.0	229	23.9
Overweight	288	68.4	133	31.6	421	43.9
Obese	130	46.3	151	53.7	281	29.3
Total	642	66.9	318	33.1	960	100.0

Table 1: Distribution of adults according to their level of obesity and prevalence of diabetes.

It was seen that 43.5% respondents were rural people and 14.6% of them were suffering from obesity and diabetes as against the overall 13.5% adults of this category. However, there was no significant difference in the proportions of urban and rural adults of this category ($\chi^2 = 0.699$, p value = 0.403) (Table 2). Still, rural adults were 17% more exposed to this health hazard compared to their urban counter parts. [OR = 1.17, SE ln(OR) = 0.19]. Among the investigated adults 55.2% were males and 12.3% of them were patients of diabetes and obesity. The corresponding percentage for females was 15.1. But this differential in proportion was not significant ($\chi^2 = 1.649$, p value = 0.199). But the odds ratio [OR = 1.27, SE ln(OR) = 0.19] indicated that simultaneously diabetes and obesity was almost 1.27 times likely to develop in females compared to males. The sample consisted of 82.6% Muslims and 12.6% of them were suffering from this health hazard. The corresponding percentage of non-Muslim adults were 18.0. Compared to Muslim adults the non-Muslim adults were more sufferers. But there was no significant association between religion and prevalence of obesity diabetes ($\chi^2 = 3.377$, p value = 0.066). However, prevalence of obesity diabetes was 1.52 times more likely among non-Muslims as in Muslims. Most of the adults (54.2%) were of ages 40 years and above and 9.4% of them were suffering from obesity and diabetes simultaneously. Again 19.8% were of ages less than 30 years. But, higher proportion (23.2%) of them were the sufferers. This differentials in proportions of affected persons by their age levels were highly significant as was observed by ($\chi^2 = 48.793$, p value = 0.000) chi-square test. The younger adults (age < 30 years) were 72% more exposed to this health hazard [OR =1.72, SE ln(OR) = 0.20]. There were 69.8% married adults and 11.2% of them were obese and diabetic simultaneously. The corresponding percentage among single (30.2%) adults was 19.0. These proportions of affected subjects were statistically significant ($\chi^2 = 1.441$, p value = 0.001). Single adults were 86.0% more exposed to this health hazard [OR =1.86, SE ln(OR) = 0.19]. In the sample, the percentage of higher educated adults were 58.5 and 13.3 of them were obese and diabetic. The percentage of illiterate subjects (5.6%) of such group was 16.7. The differentials in proportions of affected groups in different levels of education was not statistically significant ($\chi^2 = 0.493$, p value = 0.920). But illiterate adults were 30% more exposed to this problem compared to subjects of other levels of education [OR =1.30, SE ln(OR) = 0.02]. Housewives, students and unemployed persons were not rendering physical labour directly. The percentage of this group was 34.5 and 14.8 of them were obese and diabetic at the same time. The farmers and unskilled labours were 26.6% and 13.3% of them were suffering from this health hazard. The lowest sufferers (11.7%) was noted among service persons (22.2%). However, there was no significant association between profession and prevalence of obesity diabetes ($\chi^2 = 1.054$, p value = 0.788). Obesity diabetes was almost 1.18 times likely to develop in subjects not directly involved in physical labour as in other subjects [OR = 1.18, SE ln(OR) = 0.20]. Reading paper, viewing television and gossiping over mobile phone after office work were the activities of major group of adults (34.7%) and 7.2% of them were obese and diabetic. These group were physically inactive. Another physically inactive group (14.5%) consisted of some students who passed their time by reading and using mobile phone. The percentage of obese and diabetic adults among them was 24.5. This health hazard was 2.45 times likely to develop in this latter group of subjects as in other group [OR = 2.45, SE ln(OR) = 0.22]. Significant association between prevalence of obesity diabetes and utilization of time was observed ($\chi^2 = 27.583$, p value = 0.000). In a separate question on involvement in physical work 36.6% opined affirmative. Still,17.4% of them were suffering from this health problem and they were more exposed to this problem by 62% compared to others who did not do any physical work [OR = 1.62, SE (lnOR) = 0.19]. It was observed that obesity diabetes was associated with physical labour ($\chi^2 = 6.959$, p value = 0.008).

Percentage of adults from highest income group of families was 11.7 and 17.9 of them were affected by both obesity and diabetes. This health problem was lower in adults belonging to lowest income group of families. Adults of highest income group of families were 46% more exposed to this health problem [OR = 1.46, SE ln(OR) = 0.27]. However, obesity diabetes was not statistically dependent on family income (χ^2 = 4.781, p value = 0.311). Similar was the case for family expenditure (χ^2 = 8.600, p value = 0.072). But adults from families spending higher amount of money (seventy-thousand and above) were 45% more exposed to this health problem [OR = 1.45, SE ln(OR) = 0.19].

Percentage of adults accustomed with restaurant food was 51.4 and 13.0 of them were obese and diabetic. The corresponding percentage of adults not eating restaurant food was 14.1. Both these groups were almost similarly exposed to this health problem [OR = 1.10, SE (lnOR) = 0.19]. Habit of eating restaurant food was not associated with obesity diabetes (χ^2 = 0.271, p value = 0.602). Insignificant association of habit of taking can food and obesity diabetes was also observed (χ^2 = 3.081, p value = 0.079). But non-users of can food was 39% more exposed to this health hazard [OR = 1.39, SE ln(OR) = 0.19]. The percentage of can food users was 60.8 and only 12 of them were affected by the disease. The smokers were 38.9% and 16.1% of them were suffering from obesity diabetes. Obesity diabetes was almost 1.42 times likely to develop in smokers as non-smokers [OR = 1.42, SE ln(OR) = 0.19]. But prevalence of obesity diabetes was independent of smoking habit (χ^2 = 3.575, p value = 0.059).

Prevalence of hypertension (diastolic blood pressure ≥85 and systolic blood pressure ≥140) was observed among 15.1% adults and 13.8% of them were obese and diabetic. However, both hypertensive and non-hypertensive groups were almost similarly exposed to this health hazard [OR = 1.03, SE ln(OR) = 0.26]. But level of hypertension was not associated with prevalence of obesity diabetes (χ^2 = 0.009, p value = 0.923).

Socioeconomic variables	**Prevalence of obesity diabetes**				**Total**	
	Yes		**No**			
	n	%	n	%	n	%
Residence						
Rural	61	14.6	357	85.4	418	43.5
Urban	69	12.7	473	87.3	542	56.5
Total	130	13.5	830	86.5	960	100.0
Gender						
Male	65	12.3	465	87.7	530	55.2
Female	65	15.1	365	84.9	430	44.8
Religion						
Muslim	100	12.6	693	87.4	793	82.6
Non-Muslim	30	18.0	137	82.0	167	17.4
Marital status						
Currently married	75	11.2	595	88.8	670	69.8
Currently single	55	19.0	235	81.0	290	30.2
Age (years)						
< 20	12	42.9	16	57.1	28	2.9
20–30	32	19.8	130	80.2	162	16.9
30–40	37	14.8	213	85.2	250	26.0
40–50	40	15.2	224	84.8	264	27.5
> 50	9	3.5	247	96.5	256	26.7
Education						
Illiterate	9	16.7	45	83.3	54	5.6
Primary	15	13.0	100	87.0	115	12.0
Secondary	31	13.5	198	86.5	229	23.9
Higher	75	13.3	487	86.7	562	58.5
Occupation						
Agriculture and unskilled labor	34	13.3	221	86.7	255	26.6
Business and skilled labor	22	13.7	139	86.3	161	16.8
Service	25	11.7	188	88.3	213	22.2

Housewives, students and unemployed	49	14.8	282	85.2	331	34.5
Income (000 taka)						
< 40	34	10.9	277	89.2	311	32.4
40–60	23	12.2	166	87.8	189	19.7
60–80	28	14.9	160	85.2	188	19.6
80–100	25	15.6	135	84.4	160	16.7
> 100	20	17.9	92	82.1	112	11.7
Smoking habit						
Yes	60	16.1	313	83.9	373	38.9
No	70	11.9	519	88.1	587	61.1
Family expenditure (000 taka)						
< 30	7	6.0	109	94.0	116	12.1
30–50	41	13.9	254	86.1	295	30.7
50–70	26	12.5	182	87.5	208	21.7
70–90	31	17.5	146	82.5	177	18.4
> 90	25	15.2	139	84.8	164	17.1
Taking restaurant food						
Yes	64	13.0	429	87.0	493	51.4
No	66	14.1	401	85.9	467	48.6
Use of can food						
Yes	70	12.0	514	88.0	584	60.8
No	60	16.0	316	84.0	376	39.2
Physical work						
Yes	61	17.4	290	82.6	351	36.6
No	69	11.3	540	88.7	609	63.4
Utilization of time						
Read and use mobile phone	34	24.5	105	75.5	139	14.5
Play and use mobile phone	39	16.2	202	83.8	241	25.1
Do household work and watch T.V.	33	13.4	214	86.6	247	25.7
Read paper and use mobile phone after office work	20	8.0	229	92.0	249	25.9
Watch T.V. and use mobile phone after office work	4	4.8	80	95.2	84	8.8
Prevalence of hypertension						
Yes	20	13.8	124	86.2	145	15.1
No	110	13.5	705	8.5	815	84.9
Total	130	13.5	830	86.5	960	100.0

Table 2: Distribution of adults according to prevalence of obesity diabetes and different socioeconomic variables.

Discriminant analysis

The variables included for discriminant analysis were residence, religion, gender, marital status, age, education, occupation, income, expenditure, utilization of time, physical work, smoking habit, habit of eating restaurant and can food and hypertension. However, none of these variables were significantly different for the two groups of adults as was observed by F-test (Table 3). The covariance matrices of these variables were homogeneous as was observed by Box's M test, where the test statistic was, F = 1.158, p value = 0.134. As there were two groups of adults, one discriminant function was derived. For this function the value of Wilk's Λ = 0.880, χ^2 = 18.206, p value = 0.252. The discriminant function coefficients were shown (Table 3). The important results of this analysis were the correlation coefficient (r) of discriminating variable with discriminant function score. The highest value of r in magnitude indicated the most responsible variable for this discrimination [21]. It was observed that the variable income was the most responsible one for this discrimination followed by expenditure, physical work, marital status, religion, occupation, and hypertension.

Variables	Wilk's Λ	F-statistic	p-value	Coefficient	Correlation coefficient (r)
Residence	1.000	0.071	0.790	0.102	0.059
Religion	0.999	1.740	0.189	0.318	0.292
Gender	1.000	0.014	0.905	0.587	0.026
Marital status	0.988	1.822	0.179	0.521	0.299
Age	0.999	0.178	0.674	0.526	0.093
Education	0.997	0.490	0.485	0.189	0.155
Occupation	0.99	1.483	0.225	-0.500	-0.269
Income	0.978	3.330	0.071	-0.057	0.402
Utilization of time	1.000	0.064	0.800	0.150	-0.056
Habit of taking restaurant food	1.000	0.006	0.938	0.184	0.017
Habit of taking can food	0.998	0.250	0.618	-0.034	-0.111
Physical work	0.983	2.535	0.113	0.377	0.352
Smoking habit	1.000	0.007	0.931	0.037	-0.019
Hypertension	0.992	1.162	0.283	-0.333	-0.238
Expenditure	0.979	3.222	0.075	0.831	0.397

Table 3: Results of discriminant analysis.

Discussion

The results presented above were observed in analysing data collected from 960 adults of both urban and rural areas. They were classified into two groups, one group consisted of 130 obese and diabetic patients and in another group, there were 830 other subjects including some diabetic and normal subjects. The respondents were selected by quota sampling plan. The rural subjects were 43.5%. These rural adults were 17% more exposed to prevalence of obesity and diabetes. There were 44.8% female adults and obesity diabetes was 1.27 times likely in them as in males. In other studies, females were found more exposed to diabetes and to obesity [15, 22]. There were only 17.4% non-Muslim adults, but they were 52% more exposed to this health hazard of obesity diabetes. Marital status of the adults was independent of obesity diabetes, but single adults were 86% more exposed to the problem. Age was the risk factor for many non-communicable diseases [1–8, 15, 16, 23, 24]. This study also indicated that age was significantly associated with obesity diabetes. But, unusually the adults of lower ages (< 30 years) were found 72% more exposed to this health problem. Education was not found associated with non-communicable diseases [23, 24]. In this case also, education was found independent of obesity diabetes. But illiterate adults were 30% more exposed to this problem. Though occupation was independent of obesity diabetes, the adults not involved in physical labour were 18% more exposed to this problem. Like other studies, physical inactivity was identified as risk factor for obesity diabetes [15, 16, 23, 24]. Sedentary activity was the risk factor for this health hazard. Adults coming from highest income and highest expenditure group of families were 46% and 45%, respectively more exposed to this health hazard.

Smoking habit, habit of eating restaurant food and can food were independent of obesity diabetes. But this health hazard was 1.42 times likely in smokers as in non-smokers. Similar was the case for adults who were habituated in eating restaurant food. Hypertensive and non-hypertensive adults were similarly exposed to this health problem.

Conclusion and Suggestion

The prevalence of obesity is increasing globally and it is associated with different non-communicable diseases including diabetes [10, 11, 13, 14, 23, 24]. Thus, it was decided to identify some socioeconomic variables responsible for the simultaneous prevalence of obesity and diabetes among Bangladeshi adults. For this purpose, 960 adults of both urban and rural localities were interviewed. Among these adults 130 were suffering from both obesity and diabetes. The rural adults, females, non-Muslim adults, single adults, younger persons (age < 30 years), illiterate adults, rich people, smokers, physically inactive adults, users of can food and adults involved in sedentary activity

were more exposed to the health hazard of obesity and diabetes simultaneously. Except age, physical activity and utilization of time all other socioeconomic variables were independent of simultaneous prevalence of obesity and diabetes.

The discriminant analysis indicated that income was the most responsible variable for the simultaneous prevalence of obesity and diabetes followed by expenditure, physical activity, marital status, religion and occupation. The problem of obesity and diabetes cannot be avoided as there is increasing trend in social upward mobility. But, the intensity of the problem can be reduced, if proper action-plan is formulated by the Government and by the health planners. For this, people should be motivated to follow some guidelines related to healthy lifestyle throughout the life span. The following steps may be fruitful in leading healthy life:

- People should be encouraged to take healthy and homemade food as much as possible so that they can avoid sugar-based, salty and fatty food.
- People should be encouraged to avoid unhealthy drugs, smoking and soft or hard drinks.
- People should be encouraged to do some physical labour, physical exercise or at least try to walk after office hour or whenever it is possible. It will help them in reducing body weight.
- People should consult the doctor in case of a health problem and should join blood screening program, if possible.

Rural and urban health service providers, medical practitioners and government employed health workers can encourage the people to follow the above steps. Moreover, there should be free medical camp so that people can check their blood sugar, blood pressure and body weight at least quarterly.

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