Research Article

Factors Responsible for Prevalence of Elevated Blood Pressure Among Obese Adults in Bangladesh

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Abstract

This paper deals with the analysis of data collected from 995 adults of 18 years and above residing in both urban and rural areas of Bangladesh. In the sample there were 300 obese respondents and 452 patients of elevated blood pressure. The number of patients of elevated blood pressure in obese adults was 116 (11.7%). This percentage was slightly more (12.1%) among urban adults. More females and more married persons were suffering simultaneously from these two non-communicable diseases. The risk of prevalence of the diseases in females was 70% more compared to the risk of males. The risk of married persons was 2.81 times than the risk of single adults. Higher prevalence rate (16.6%) was noted among younger (age < 25 years) adults and for them the risk was 62% more. Higher risk (R.R.= 1.41) was also recorded for higher educated respondents. Adults belonged to families of upper medium economic status had 77% more risk of prevalence compared to the risk of adults of other economic status. The risk of prevalence was 79% more in diabetic adults suffering for 5 -10 years.

Keywords: Obesity; Elevated Blood Pressure; Association of Prevalence of Elevated Blood Pressure with Socioeconomic Variable; Risk Ratio; Discriminant Analysis

Introduction

Obesity is a complex body condition when excessive fat accumulates in body. This accumulation of fat in body can change the way of life over time, and it can lead to life-threating condition through prevalence of many non-communicable diseases, especially diabetes, elevated blood pressure, heart disease, kidney diseases, asthma, and other respiratory problems [1-5]. A body mass index (BMI = weight in kg divided by height in metre²) greater than equal to 27.5 of a person is identified as obesity [6,7]. The prevalence of overweight and obesity have increased rapidly over the last decades especially in developing countries [5,8-10]. The percentage of obese adults of 18 years and above were in increasing trend from 1990 to 2022 and the rate became 16% in 2022 from 7% in 1990 [5,11].

Obesity is one of the most risk factors for the prevalence of hypertension [12-14]. Hypertension is also called elevated blood pressure (BP mmHg) (diastolic BP < 80, and systolic BP 120 - < 129) [15]. It is the primary cause of some non-communicable diseases and risk factor for cardiovascular disease, including heart attack and stroke [16]. The causes of elevated blood pressure are diabetes, kidney disease, sleep apnoea, and pregnancy. The problem is more prevalent in elderly people throughout the world and the rate of the disease is in increasing trend in developing countries as majority of the elderly people will be in developing countries [17-22].

It was reported that obesity is a lifestyle disease the sources of which are socioeconomic factors [9,10,16,22-26]. This was true for Bangladeshi adults also and it was reported that age, marital status, physical inactivity were responsible factors for the prevalence of hypertension among obese adults [9,16]. In this paper an attempt was made to identify the responsible factors for the prevalence of elevated blood pressure among obese adults.

Materials and Methods

The results presented here was based on analysis of data collected from 995 adults of ages 18 years and above residing in both urban and rural areas of Bangladesh. These adults were visiting an urban diagnostic center and in a semi-urban diagnostic center for their blood and urine screening test. During their visit the adults were interviewed by some nurses and medical assistants working in the centers. On request, the visiting adults provided the requesting information which were recorded in predesigned and pre-tested questionnaire. The information was recorded during the session 2018-19.

It was decided prior to the survey work to collect data from 50.1% males and 49.9% females to maintain the sex ratio of the country which was 50.1:49.9 during the study period [27]. Out of 995 respondents, the number of male adults and the number of female adults were 498 and 497, respectively. The recorded information was on socio-demography and health conditions of the respondents. The prevalence of diseases among the respondents and the duration of the suffering from the diseases were noted. Also, data regarding the stage of treatment by the registered medical practitioner/rural medical assistants, and the lifestyle of the respondents were recorded. Except age, income, expenditure, duration of suffering from the disease, all the data were qualitative in nature. The qualitative variables were transformed to nominal scale. For ease of analysis, the variable age and the variable duration of diabetes were expressed in groups. The economic condition of any of the fami2ly was decided as lower (if monthly income of a family was < Tk.50 thousand and expenditure was < Tk. 40 thousand), medium (if income was Tk. 50 - 100 thousand and expenditure was between Tk.40 - < 80 thousand), upper medium (if income was 50 -100 thousand taka and expenditure was between Tk. 80 - < 100 thousand taka) and higher (if income was Tk. 150 and above and expenditure was Tk.120 thousand and above). To identify the obese adults, the body mass index, (BMI, weight in kg divided by height in meter square) was measured and any respondent was identified as underweight (if BMI < 18.5), normal (if 18.5 < BMI < 23.0), overweight (if 23.0 < BMI < 27.5) and obese (if BMI ≥ 27.5) [6,7]. According to blood pressure (BP mmHg) measurement the respondents were classified into two groups. In one group there were 452 respondents who had BP (120 - < 129)/ < 80 and they were identified as patients of elevated blood pressure [15]. There were 300 (30.2%) obese adults; among them 116 (11.7%) had elevated blood pressure. Diabetes was prevalent among 81 (8.1%) adults having elevated blood pressure.

The study variable was prevalence of elevated blood pressure in obese adults. We had two groups of adults; in one group there were 116 patients of obesity and elevated blood pressure. In another group, there were 879 respondents free of the simultaneous prevalence of the two diseases under consideration. These two groups were discriminated to identify the responsible variables for discrimination. A variable was identified as most responsible one for which the absolute correlation coefficient of the variable with discriminant function score was significantly higher [28-31].

According to the objective of the study, association of the study variable with other socio-demographic variables were investigated. Irrespective of significance of the association, the responsible level of a variable for the prevalence of the study variable in higher rate was identified by calculating risk ratio [32,33].

Results and Discussion

The percentage of sample obese adults suffering from elevated blood pressure was 11.7 (Table 1). Out of 995 respondents 46.6% were urban residents and 12.1% of them were patients of obesity and elevated blood pressure. The corresponding percentage among rural people was 11.3. These two percentages of affected adults were statistically similar and for both the groups the risks of prevalence of the diseases were also similar [χ^2 =0.142, p-value=0.706; R.R.=1.07, C.I. (0.76, 1.51)]. The percentage of Muslim adults was 85.2; the prevalence rate in them was 11.7% and this percentage was not significantly more than the percentage prevailed in non-Muslim adults (11.6%) [χ^2 = 0.001, p-value=0.969]. The risks of prevalence for both Muslim and non-Muslim adults were similar [R.R.=1.01, C.I. (0.62, 1.64)]. There were 49.9% female respondents and prevalence rate in them was 14.7%. This rate was significantly higher than the rate prevailed in males (8.6%) [χ^2 = 8.851, p-value= 0.003]. The risk of prevalence for females was 70% more than the risk for males [R.R.=1.70, C.I. (1.18, 2.45]. The percentage of married adults was 93.1 and prevalence rate in them was 12.2%. This rate was significantly higher than the rate prevailed in single adults (4.3%) and married adults had 2.81 times risk of prevalence compared to the risk of single adults [χ^2 = 3.847, p-value = 0.050; R.R.=2.81, C.I. (0.92, 8.61)].

The prevalence rate was significantly decreasing with the increase in age of respondents and highest rate was noted among youngest adults (16.6%) [χ^2 = 36.059, p-value = 0.000] and lowest rate (0.5%) was recorded among elderly people of age 50 years and above. The Percentage of youngest adults was 19.7 and for them the risk of prevalence was 62% more compared to the risk of adults of other ages [R.R. = 1.62, C.I. (1.12, 2.35)]. The rate of prevalence was in significantly increasing trend with the increase in level of education. The lowest rate was found in illiterate adults (1.5%) and the highest rate was observed in higher educated adults (13.3%). [χ^2 =11.397, p-value= 0.010]. The higher educated adults were 57.5% in the sample. For this group the risk of prevalence was 41% more compared to the risk of adults of other levels of education [R.R.=1.41, C.I. (0.98,2.03)]. There were 23.1% housewives in the sample; the prevalence rate in them was 14.8%. For them the

Socioeconomic characteristics	Prevalence of elevated blood pressure among obese adults				Total	
	Yes		No			
	Number	%	Number	%	Number	%
Residence						
Rural	60	11.3	471	88.7	531	53.4
Urban	56	12.1	408	87.9	464	46.6
Total	116	11.7	879	88.3	995	100.0
Religion						
Muslim	99	11.7	749	88.3	848	85.2
Non-Muslim	17	11.6	130	88.4	147	14.8
Gender						
Male	43	8.6	455	91.4	498	50.1
Female	73	14.7	424	85.3	497	49.9
Marital status						
Married	113	12.2	813	87.8	926	93.1
Single	3	4.3	66	95.7	69	6.9
Age (in years)						
< 25	33	16.6	163	83.4	196	19.7
25 -40	63	15.7	338	84.3	401	40.3
40 -50	19	9.4	184	90.6	203	20.4
50+	1	0.5	194	99.5	195	19.6
Education						
Illiterate	1	1.5	64	98.5	65	6.5
Primary	8	6.6	113	93.4	121	12.2
Secondary	31	13.1	206	86.9	237	23.8
Higher	76	13.3	496	86.7	572	57.5
Occupation						
Farming	8	7.7	96	92.3	104	10.5
Business	29	12.4	205	87.6	234	23.5
Service	33	10.8	272	89.2	305	30.7
Retired	12	9.8	110	90.2	122	12.3
Housewife	34	14.8	196	85.2	230	23.1
Economic condition						
Low	32	8.3	353	91.7	385	38.7
Medium	53	12.5	371	87.5	424	42.6
Upper medium	12	19.7	49	80.3	61	6.1
High	19	15.2	106	84.8	125	12.6
Smoking habit						
Yes	32	9.7	297	90.3	329	33.1
No	84	12.6	582	87.4	666	66.9
Involvement in sedentary activity						
Yes	58	13.1	384	86.9	442	44.4
No	58	10.5	495	89.5	553	55.6
Involvement in physical activity						
Yes	47	9.8	434	90.2	481	48.3
No	69	13.4	445	86.6	514	51.7
Habit of taking process food						
Yes	50	13.8	313	86.2	363	36.5
No	66	10.4	566	89.6	632	63.5

Duration of diabetes (in years)						
Did not arise	35	10.7	293	89.3	328	33.0
< 5	29	10.0	262	90.0	291	29.2
5 -10	37	18.0	169	82.0	206	20.7
10 -15	9	9.1	90	90.9	99	9.9
15+	6	8.5	65	91.5	71	7.1
Total	116	11.7	879	88.3	995	100.0

Table 1: Distribution of respondents according to prevalence of elevated blood pressure among obese adults.

risk of prevalence was 38% more compared to the risk of adults of other professions [R.R.=1.38, C.I. (0.96,2.00)]. The next higher rate was 12.4% and it was observed among businesspersons (23.5%). However, the differentials in rates of prevalence were not statistically significant [χ^2 = 4.493, p-value= 0.343]. The businesspersons had only 8% more risk of prevalence [R.R.=1.08].

The lowest prevalence rate (8.3%) was observed in adults belonged to families of low economic condition. The rates were significantly more among adults of other economic conditions [χ^2 =9.804, p-value= 0.020]. Highest rate (19.7%) was noted among adults belonged to upper medium economic condition. For them the risk of prevalence was 77% more compared to the risk of adults of other economic conditions [R.R.= 1.77, C.I. (1.03, 4.53)]. Majority (42.6%) of the respondents were from families of medium economic condition. The rate of prevalence in them was 12.5% which was second lowest rate prevailed in adults and this rate was higher than the rate of prevalence observed in all adults (11.7%). Smoking was not a risk factor for prevalence of the diseases under consideration. The risk of prevalence for smoker adults was only 0.77 times compared to the risk of non-smoker adults [R.R.=0.77, C.I. (0.52, 1.13)]. There was no significant difference in the prevalence rates observed in smokers (9.7%) and in non-smoker adults (12.6%) [χ^2 =1.711, p-value= 0.182]. Similar insignificant difference in prevalence rates in adults involved in sedentary activities (13.1%) and not involved in sedentary activities (10.5%) [= 1.655, p-value = 0.199]. However, involvement in sedentary activities was a risk factor for prevalence of the diseases under consideration as risk of prevalence for adults involved in sedentary activities was 1.25 times compared to the risk of other group of adults [R.R.= 1.25, C.I. (0.95, 1.59)]. Process food consumption was a risk factor for prevalence of the diseases as process food consumers had 32% more risk of prevalence [R.R.=1.32, C.I. (0.93, 1.86)]. But prevalence rates observed among process food consumers (13.8%) and among non-consumers (10.4%) were not significantly different [χ^2 = 2.484, p-value= 0.115]. The percentage of physically inactive adults was 51.7%; the prevalence rate in them was 13.4%, though this rate was not significantly different from the rate prevailed in physically active adults (9.8%) [χ^2 = 3.219, p-value= 0.073]. However, physically inactive adults had 37% more risk of prevalence [R.R.=1.37, C.I. (0.48, 3.87)].

There were 67% diabetic patients in the sample who were suffering for different periods of time. The percentage of adults suffering from diabetes for 5 to less than years was 20.7. Among them 18.0% were suffering for 5 to less than years. For this group the risk of prevalence was 79% more than the risk prevailed in other adults [R.R.=1.79, C.I. (1.25, 2.56)]. Obesity and elevated blood pressure was also noted among 10.7% non-diabetic adults. Obesity and elevated blood pressure was more prevalent among newly and middle staged diabetic patients. The rates of prevalence among diabetic patients suffering for different time periods were significantly different [χ^2 = 10.408, p-value= 0.034].

Results of Discriminant Analysis

It was already mentioned that there were 116 obese adults who had elevated blood pressure. The objective of the analysis was to identify some socioeconomic variables which could be used to discriminate above mentioned 116 adults from the remaining 879 adults who were not suffering simultaneously from obesity and elevated blood pressure. The discriminant analysis was performed using simultaneous prevalence of obesity and elevated blood pressure as grouping variable and other socioeconomic characteristics as independent variables.

The preliminary analytical results Box's M= 160.905, p-value = 0.000 indicated that the two groups of adults were significantly different in respect of some socioeconomic variables. Those variables would be identified from the results of discriminant analysis. The analysis was satisfactory as χ^2 = 81.436, p-value= 0.000. The detail results were presented in Table 2. It was already mentioned that the highest absolute value of a correlation coefficient of any variable with discriminant function score was the most responsible variable in discriminating two groups of adults. Accordingly, age was identified as the most responsible variable in discriminating two groups of adults, followed by education, gender, economic condition and marital status. The impacts of these variables were significantly different for two groups of adults.

Discussion

Elevated blood pressure or hypertension prevails, in general, among obese adults and it leads to other health problems, like dia-

Variable	Correlation coefficient	Discriminant function coefficient	Wilk's Lambda	F-statistic	p-value
Age	-0.625	-1.010	0.968	33.335	0.000
Education	0.332	0.430	0.991	9.404	0.002
Gender	0.323	0.387	0.991	8.912	0.003
Economic condition	0.293	0.267	0.993	7.359	0.007
Marital status	-0.212	-0.139	0.996	3.854	0.050
Habit of doing physical work	-0.194	0.172	0.997	3.223	0.073
Habit of taking process food	0.171	0.116	0.998	2.485	0.115
Occupation	0.154	-0.118	0.998	2.026	0.156
Smoking habit	0.144	-0.028	0.998	1.781	0.182
Involvement in sedentary activity	0.139	0.063	0.998	1.654	0.199
Residence	0.041	-0.122	1.000	0.142	0.706
Duration of diabetes	0.038	0.685	1.000	0.121	0.728
Religion	-0.004	0.010	1.000	0.001	0.969

Table 2: Results of discriminant analysis.

betes, cardiovascular diseases, kidney diseases, and many other non-communicable diseases. This fact was observed in different studies in both home and abroad [9 13,16,22,34-36-40], In some studies, responsible variables were also identified for the prevalence of hypertension among obese adults [41,42]. The factors responsible for the prevalence of this health problem among Bangladeshi adults were age, duration of diabetes, involvement in sedentary activity, and physical inactivity. In this study also attempt was made to identify the risk factors for the prevalence of elevated blood pressure among obese adults.

Among the 995 investigated adults, 112 were suffering simultaneously from obesity and elevated blood pressure. The proportions of affected people by these two non-communicable diseases were almost similar in males and females, in Muslims and non-Muslims. None of the lifestyle factors, viz, smoking habit, involvement in sedentary activity, habit of consumption of process food and physical activity had no impacts on prevalence of elevated blood pressure in obese adults. However, physical inactivity and process food consumption had 37% and 32%, respectively, more risk of prevalence.

Married persons, females, younger adults, had higher risk of prevalence. Higher education, upper medium economic condition are the risk levels for the prevalence. Diabetic patients suffering for 5 to less than 10 years had higher risk of prevalence. Age, education, gender, economic condition, and marital status were the responsible variables in discriminating patients' group from the other adults.

Conclusion

The analytical results presented here were based on 995 adults of 18 years and above. Among these adults, 116 (11.7%) were pa-

tients of obesity and elevated blood pressure. Higher prevalence rates prevailed in urban and Muslim adults. They were 46.6% and 85.2%, respectively in the sample. Significantly higher prevalence rates were noted among females, married respondents and youngest adults. Females were 49.9%, married persons were 93.1%, and there were 19.7% youngest adults. The prevalence rates in these respondents were more than the rate prevailed in all sample adults. With the increase in level of education the prevalence rate was also increasing, and highest rate (13.3) variables%) was observed among higher educated adults. The risk of prevalence was 41% more for higher educated adults. Among the housewives the prevalence rate was 14.8 and it was highest prevalence rate among different professional groups; but this rate was not significantly different from the rates prevailed in other professionals.

There were only 6.1% adults belonged to families of upper medium economic condition, but for them the risk of prevalence was 77% more compared to the risk of other adults. None of the lifestyle factors had any significant influence in enhancing the prevalence rate, sedentary activists, process food consumers, and physically inactive adults had higher risk of prevalence. This study also indicated that obesity, diabetes, and elevated blood pressure were inter-related health problem. Finally, it could be concluded that the patients' group of elevated blood pressure in presence of obesity were significantly different from other adults due the variables age, education, gender, economic condition, and marital status.

The influences of the responsible variables on prevalence of elevated blood pressure among obese adults cannot be avoided as standard of lifestyle of the people are in increasing trend. But people can avoid the adverse effect of some of the socioeconomic variables under consideration if they were concisus about their lifestyle and used to try to follow some basic criteria in maintaining

healthy life. Peoples' effort can be encouraged by the Government and by the health workers so that rules and regulations can be introduced so that protection system and public health care system become positive towards the control of obesity induced elevated blood pressure.

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Conflict of Interest

Authors declare no conflict of interest.

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