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Research Article

Discriminating Patients of Elevated Blood Pressure in Addition to Obesity- Heart Disease from Other Adults

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Abstract

The study was conducted to identify socioeconomic characteristics responsible for simultaneous prevalence of elevated blood pressure-obesity- heart disease. For the study, 995 Bangladeshi adults of 18 years and above were interviewed by some nurses and medical assistants working in diagnostic centres located in urban and semi-urban areas. These adults were visiting the centres for their blood screening test. Among these adults 3.2% were patients of elevated blood pressure in addition to prevalence of obesity and heart disease. Compared to this rate higher prevalence rates were observed among urban people, non-Muslim people, females, single adults, adults of ages 25 years and above but less than 40 years, secondary level educated adults, housewives, adults of families of upper medium economic status, smokers, physically inactive adults, and diabetic patients of initial stages. But more than 100% risk of prevalence of the diseases was observed among younger adults of age group 25 to less than 40 years, housewives, adults of families of upper medium economic status, and diabetic patients of early stages. However, the patients' group were discriminated well from other adults due to the variables age, occupation, and economic status.

Keywords: Diabetes; Discriminant Analysis; Elevated Blood Pressure; Heart disease; Obesity; Risk Ratio

Introduction

Obesity is a chronic health hazard which occurs due to excessive fat deposits in the body, and it is the risk factor for development of many non-communicable diseases, viz. diabetes, heart disease, hypertension/elevated blood pressure, cardiovascular diseases, kidney diseases, retinopathy, disability, etc. [1-6]. The development of other non-communicable diseases due to prevalence of obesity is in increasing trend, and it is happening as society is moving towards upward direction in economic activities. The level of education of people in society is increasing, and most of the economic activities are mechanized. As a result, physical inactivity is becoming more among people creating the higher extent of health and more people are becoming obese hypertensive, obese-diabetic, obese- heart patient, obese-kidney patient, obese-disable patient, etc. The rates of prevalence of this health hazard are in increasing trend due to the increase in levels of socioeconomic factors [7-20].

According to an estimate noted in 2022 there were 2.5 billion overweight adults of 18 years and above, out of these 890 million were living with obesity [1]. The Worldwide prevalence of obesity became double between 1990 to 2022. It was already mentioned that obesity induced hypertension is a risk factor for cardiovascular diseases. It was also reported that 1.28 billion adults of ages 30 - 79 years worldwide were hypertensive [10,16]. Almost 75% hypertensive people reside in low-and-middle income countries including Bangladesh [13,14]. The prevalence rate of hypertension in adults of Bangladesh was reported as around 25% [15]. It was also reported that the estimated death from cardiovascular disease were 17.9 million worldwide. Among these deaths 85% were due to heart attack and stroke [16]. It was also reported that simultaneous prevalence of obesity and hypertension in the same person had 100% more risk of cardiovascular diseases [17,18]. Thus, these two non-communicable diseases create major threat throughout the world, and the problem is in increasing trend [1,19-22].

Hypertension/elevated blood pressure (BP mmHg) (diastolic BP < 80, and systolic BP 120 - < 129)} along with obesity is a risk factor for diabetes, kidney diseases, sleep apnoea, heart disease [4,5,23]. It is the primary cause of some non-communicable diseases and risk factors for cardiovascular disease, including heart attack and stroke [24-28]. The problem is more prevalent among elderly people worldwide and the rate of incidence of the disease is in increasing trend in developing countries as majority of elderly people will be in developing countries [3,5,29-32]. Moreover, due to increasing trend in economic activities throughout the world, the level of overweight and obesity are also in increasing trend resulting increasing trend in prevalence rate of lifestyle diseases [6-9,11-15,18-22]. The factors responsible for lifestyle diseases in presence of obesity, heart disease were age, occupation, economic status, marital status, physical inactivity, and initial stage of diabetes, etc. were responsible [6-8,11-15,25-28]. The present analysis was conducted to study the prevalence rate of elevated blood pressure in patients of obesity- heart disease. It was also planned to identify the responsible socioeconomic variables in discriminating the patients of elevated blood pressure-obesity-heart disease from other adults.

Materials and Methods

The analytical results presented here was based on data collected from 995 adults of ages 18 years and above. These adults were interviewed by some nurses and medical assistants working in two diagnostic centers, one located in urban area and other located in semi-urban area of Bangladesh. The respondents were visiting the centers for their blood screening test and routine urine test during the session 2018–19. Among the adults the rural and urban residents were 531 and 464, respectively. The data were collected from the respondents through a pre- designed and pre-tested questionnaire.

The survey work was planned to cover the male and female respondents in the ratio 50.1: 49.9 as this was the sex ratio in the country in the session 2018 -19 [33]. According to this sex ratio, the number of male adults and the number of female adults covered were 498 and 497, respectively. The data on socio-demographic characteristics, health conditions covering the simultaneous prevalence of obesity - elevated blood pressure - heart diseases, and duration of diseases suffered by the respondents were noted. Also, information on the stage of treatment of respondents by the registered medical practitioner, rural medical/health workers was noted. Besides these data, the information on lifestyle of the respondents were also recorded. Most of the data were qualitative in nature except age, family income, family expenditure, duration of suffering from the disease. For ease of analysis, the qualitative characteristics were transformed to nominal scale. During analysis the variables age and duration of diabetes were expressed in classes, and each variable was classified into 4 classes. The economic status of any adult of a family was evaluated based on monthly income and monthly expenditure (in 000 Taka). The families were considered as lower (if monthly income of a family was < 50 and expenditure was < 40), medium (if income was 50 - 100 and expenditure was between 40 - < 80), upper medium (if income was100-150 and expenditure was between 80 - < 120) and higher (if income was 150 and above and expenditure was 120 and above). To identify the obesity of any adult, the body mass index, (BMI, weight in kg divided by height in meter^2) was measured. Based on BMI, a respondent was considered 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) [34,35]. Further, the respondents were classified into two classes depending on their blood pressure (BP mmHg) measurement. In one group there were 452 respondents who had BP (120 - < 129)/ < 80 and they were identified as patients of elevated blood pressure [36].

There were 300 (30.2%) obese adults; among them 65 (21.7%) were patients of heart diseases (Table 1). Thirty-two of these obese-heart disease patients had elevated blood pressure (Table 2).

The remaining 963 adults were free of obesity-elevated blood pressure-heart disease. According to the objective of the study, it was planned to discriminate these two groups of adults. For discriminant analysis, the study variable was simultaneous prevalence of elevated blood pressure, obesity, and heart diseases. The discriminant analysis helped to identify the responsible variables for discrimination of two groups of respondents. A variable was identified as most responsible one for which the absolute correlation coefficient of the variable with discriminant function score was significantly higher [37-40].

Body mass index	Prevalence of diseases					Total
	Heart	Eye	Kidney	Disability	None except diabetes	
Under weight	3	1	1	0	33	38
Normal	16	22	10	4	181	233
Overweight	42	25	19	14	324	424
Obese	65	75	62	30	68	300
Total	126	123	92	48	606	995

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

Further, association of the study variable with other socio-demographic variables were investigated and the risk of prevalence of study variable for any level of socioeconomic characteristics for which the rate of prevalence was higher was calculated irrespective of significance of the association [41,42].

Results

It was already mentioned that the number of respondents investigated was 995; the rural-urban ratio of them was 53.4: 46.6. The ratio of prevalence rate in these adults was 2.6: 3.9 against the rate 3.2% in all respondents. The urban adults had 47% more risk of prevalence compared to the risk of rural adults [R.R.=1.47; C.I. (0.74, 2.92); (Table 2)], though the rates prevailed in both rural and urban adults were statistically similar [χ^2=1.229, p-value = 0.268]. Similarity in prevalence rates in males (50.1%) and in females (49.9%) were also observed, where these rates were 3.0% and 3.4%, respectively [χ^2=0.133, p-value = 0.713]. Females had 14% more risk of prevalence [R.R.= 1.13, C.I. (0.58, 2.26)]. There were only 14.8% non-Muslim adults in the sample; the prevalence rate in them was 4.1% against the overall prevalence rate 3.2%. Non-Muslim adults had 33% more risk of prevalence, but rates in Muslim and in non-Muslim adults were not statistically different [R.R.= 1.33. C.I. (0.56, 3.18; χ^2=0.415, p-value=0.590]. The percentage of single adults was only 6.9; the prevalence rate in them was 4.3%. These group of respondents had 39% more risk of prevalence [R.R.= 1.39, C.I. (0.43, 4.45)] compared to the risk of married persons, prevalence rate in married persons was 3.1%.

There were 40.3% younger adults of age group 25 to less than 40 years; the prevalence rate in them was 5.2%.

This rate was significantly higher than the rates prevailed in adults of other age groups [χ^2=10.467, p-value= 0.015]. For this group the risk of prevalence was 183% more compared to the risk of adults of other age groups [R.R.= 2.83, C.I. (1.38, 5.81)]. The prevalence rate was decreasing with the increase in ages after 40 years. Level of education and prevalence of th isease under consideration were not significantly associated [χ^2=1.091, p-value = 0.779]. But lowest rate (2.5%) was observed among primary level educated people and highest rate (4.2%). prevailed among secondary level educated adults. Due to this higher rate, secondary level educated persons had 45% higher risk of prevalence compared to

Socioeconomic characteristics	Prevalence of elevated blood pressure among obese-heart- disease patients				Total	
	Yes		No			
	Number	%	Number	%	Number	%
Residence						
Rural	14	2.6	517	97.4	531	53.4
Urban	18	3.9	446	96.1	464	46.6
Total	32	3.2	963	96.8	995	100.0
Gender						
Male	15	3.0	483	97.0	498	50.1
Female	17	3.4	480	96.6	497	49.9
Religion						
Muslim	26	3.1	822	96.9	848	85.2
Non-Muslim	6	4.1	141	95.9	147	14.8
Marital status						
Married	29	3.1	897	96.9	926	93.1
Single	3	4.3	66	95.7	69	6.9
Age (in years)						
< 25	5	2.6	191	97.4	196	19.7
25 - 40	21	5.2	380	94.8	401	40.3
40-50	5	2.5	198	97.5	203	20.4
50+	1	0.5	194	99.5	195	19.6
Education						
Illiterate	2	3.1	63	96.9	65	6.5
Primary	3	2.5	118	97.5	121	12.2
Secondary	10	4.2	227	95.8	237	23.8
Higher	17	3.0	555	97.0	572	57.5
Occupation						
Farming	3	2.9	101	97.1	104	10.5
Business	4	1.7	230	98.3	234	23.5
Service	9	3.0	296	97.0	305	30.7
Retired	4	3.3	118	96.7	122	12.3
Housewife	12	5.2	218	94.8	230	23.1
Economic status						
Lower	8	2.1	377	97.9	385	38.7
Medium	13	3.1	411	96.9	424	42.6
Upper medium	5	8.2	56	91.8	61	6.1
Higher	6	4.8	119	95.2	125	12.6
Smoking habit						
Yes	12	3.6	317	96.4	329	33.1

No	20	3.0	646	97.0	666	66.9
Habit of taking process food						
Yes	12	3.3	351	96.7	363	36.5
No	20	3.2	612	06.8	632	63.5
Habit of doing physical work						
Yes	12	2.5	469	97.5	481	48.3
No	20	3.9	494	96.1	514	51.7
Involvement in sedentary activity						
Yes	16	2.9	426	97.1	442	44.4
No	16	3.6	537	96.4	553	55.6
Duration of diabetes (in years)						
Did not arise	3	0.9	325	99.1	328	33.0
< 5	18	6.2	273	93.8	291	29.2
5-10	9	4.4	197	95.6	206	20.7
10-15	1	1.0	98	99.0	99	9.9
15+	1	1.4	70	98.6	71	7.1
Total	32	3.2	963	96.8	995	100.0

Table 2: Distribution of adults according to prevalence of elevated blood pressure in obese- heart disease patients of different socioeconomic characteristics.

the risk of other adults [R.R. = 1.45, C.I. (0.70, 3.02)]. Prevalence of obesity-heart disease-elevated blood pressure was independent of occupation of respondents [χ^2=4.773, p-value = 0.311]. But out of 23.1% sample housewives 5.2% were affected by these 3 diseases. This percentage was highest among the percentages of prevalence in other occupational groups. Housewives had 100% more risk of prevalence [R.R. = 2.00, C.I. (0.99, 4.03)]. The next higher prevalence rate (3.3%) prevailed in retired people. There were 6.1% adults from families of upper medium economic status; the prevalence rate in them was 8.2% and for them the risk of prevalence was 187% more [R.R. = 2.87, C.I. (1.86, 4.42)]. The rates prevailed in adults belonging to families of different economic status were almost significantly different and lowest rate was observed in adults of lower economic status [χ^2= 7.502., p-value = 0.0587].

The lifestyle factors considered in this study were smoking habit, habit of taking process food, habit of doing physical work and involvement in sedentary activity. None of these factors was significantly associated with simultaneous prevalence of the diseases under consideration [χ^2= 0.294, p-value = 0.588; χ^2 = 0.015, p-value= 0.903, χ^2= 1.556, p-value = 0.212, and χ^2 = 0.147, p-value= 0.519, respectively]. But smokers and physically inactive adults had higher risk of prevalence. Smokers had 21% more risk of prevalence compared to the risk of non-smokers [R.R. =1.21, C.I. (0.29, 5.58)]. The risk of prevalence of physically inactive adults was 1.56 times than it was in physically active adults [R.R.= 1.56, C.I. (0.77, 3.16)]. The risk of prevalence was almost same for both process food consumers and non-consumers [R.R. = 1.04, C.I. (0.25, 4.34)].

Duration of diabetes was a significantly influencing factor for prevalence of diseases [χ^2 = 16.998, p-value= 0.002]. Highest prevalence rate (6.2%) was noted among diabetic patients suffering for shortest duration. They were 29.2% in the sample and for them the risk of prevalence was 211% more compared to the risk of other diabetic patients [R.R. = 3.11, C.I. (1.45, 6.68)]. However, the prevalence rate was in decreasing trend with the increase in duration of diabetes.

Results of discriminant analysis

There were 32 patients with elevated blood pressure who had obesity and heart disease. The remaining 963 respondents had no

experience of simultaneous suffering of these three diseases. One of the objectives of this study was to discriminate these two groups of adults and to identify the responsible socioeconomic variables for this discrimination. The variables included in this discriminant analysis were residence, religion, gender, age, marital status, education, occupation, economic status, smoking habit, habit of taking process food, habit of doing physical work, involvement in sedentary activity, and duration of diabetes. The initial result indicated that the analysis is suitable [Box's M= 235. 939, p-value =0.000] as the two groups of respondents were significantly different in respect of variation of the variables included in the analysis. Further, the analysis was also suitable as Wilk's Lambda = 0.986, χ^2 =43.451, p-value= 0.042. The other results were presented in Tabe 3. The variables were shown in the table according to ascending order of magnitude of absolute value of r of the variable with discriminant function coefficient score. The highest value of r indicated that the corresponding variable was most important in discriminating the groups. Thus, economic status of the family of the adults was most responsible variable followed by occupation and age in discriminating the patients' group from other adults.

Variable	Correlation coefficient	Discriminant function coefficient	Wilk's Lambda	F-statistic	p-value
Economic status	0.498	0.633	0.996	4.435	0.035
Occupation	0.443	0.395	0.996	3.856	0.042
Age	-0.415	- 0.676	0.997	3.782	0.048
Habit of doing physical work	-0.295	- 0.092	0.997	2.805	0.065
Residence	0.262	0.375	0.998	2.005	0.080
Involvement in sedentary activity	0.153	0.067	1.000	1.228	0.213
Religion	0.152	0.146	1.000	0.416	0.519
Marital status	0.131	0.196	1.000	0.305	0.581
Smoking habit	-0.128	-0.296	1.000	0.293	0.588
Gender	0.086	-0.105	1.000	0.133	0.705
Duration of diabetes	0.059	0.400	1.000	0.063	0.802
Habit of taking process food	0.029	-0.376	1000	0.015	0.903
Education	-0.015	-0.299	1.000	0.004	0.950

Table 3: Results of discriminant analysis.

Discussion

Obesity is a multifactorial disease influenced by biological, psychological, socioeconomical and environmental factors and it has impact on quality of life [43,44]. It can raise the level of blood pressure and can raise the risk of CVD [45,46]. Due to prevalence of obesity renal damage occurs which creates high blood pressure and hypertension, and the problem increases if it is not controlled properly resulting in severe heart attack [47,48]. Some of the socioeconomic factors responsible for simultaneous prevalence of obesity heart disease, obesity hypertension, and other noncommunicable diseases along with obesity among Bangladeshi adults were identified [6-8,11-15]. In this study an attempt was made to identify the responsible socioeconomic factors for simultaneous prevalence of elevated blood pressure among obese- heart disease patients.

The three diseases were noted among 3.2% adults. Out of them, 56.3%, 81.3%, 53.1%, 65.6%, 53.1%, 37.5%, and 40.6% were from urban area, Muslim community, females, younger adults of ages 25 to less than 40 years, higher educated group, housewives, and from

families of medium economic status, respectively. These percentages were higher compared to the corresponding percentages of other levels of demographic variables. Among the affected adults 62.5% were physically inactive and for them the risk of prevalence was 1.56 times compared to the risk of physically active adults. Fifty percent affected adults were involved in sedentary activity, but they had no risk of prevalence. Majority (56.3%) of the affected adults were suffering from diabetes for shorter duration of less than 5 years. From the results of risk ratio, it was observed that urban people, non-Muslim adults, single adults, secondary level educated adults, and smokers had higher risk of prevalence, though the related variables were not significantly associated with the simultaneous prevalence of elevated blood pressure, obesity and heart disease. These variables were also not important in discriminating the patients' group from others. The variables age, occupation, and habit of doing physical work were important in discriminating the patients' group from others. Housewives, younger adults and physically inactive adults played significant role in discriminating the patient's group from other adults. None of the lifestyle factors was significantly associated with prevalence of elevated blood pressure-obesity-heart disease. But physically inactive adults had 56% more risk of prevalence.

Simultaneous prevalence of obesity, elevated blood pressure, and heart disease dependent on each of the variable's age, economic status, and duration of diabetes. However, the variables economic status, occupation, and age discriminated well the patients' group from others, and economic status was the most responsible variable for this discrimination.

Conclusion

The study was planned to identify the most responsible socioeconomic factors which discriminated the patients with elevated blood pressure -obesity - heart disease from other adults. For this purpose, an analysis was done using the data collected from 995 adults of 18 years and above residing in both rural and urban areas of Bangladesh. Out of these 995 adults, 32 were suffering simultaneously from elevated blood pressure, obesity, and heart disease. The urban adults were 46.6%. They had 47% more risk of prevalence of the diseases under consideration. There were 14.8% non-Muslim adults; they had 33% more risk of prevalence. The single adults were 6.9% in the sample. They had 39% more risk of prevalence. Secondary level educated people were 23.8%; the risk of prevalence in them was 45% more. Percentage of sample housewives was 23.1. For them the risk of prevalence was 100% more compared to the risk of other professionals. The sample physically inactive adults were 51.7%; for them the risk of prevalence was 56% more. Other lifestyle factors had no influence in enhancing the prevalence rate of diseases.

Each of the variable's age, economic status, and duration of diabetes was significantly associated with simultaneous prevalence of obesity, elevated blood pressure, and heart disease. But discriminant analysis indicated that the variables economic status, occupation, and age were the three main factors in discriminating the patients' group from other adults. Again, the most responsible variable for discrimination was economic status followed by occupation and age.

Obesity is a body condition enhancing the prevalence rate of many other non-communicable diseases. The problem of obesity cannot be avoided as lifestyle of human beings is changing with the change in upward movement of economic activities in almost all countries in the world. But the problem can be reduced if people can be advised to try to maintain healthy life with their available resources. As a first step of maintaining healthy life people must be cautious about their food and working conditions. Physical work of any type along with intake of healthy food may help in reducing level of obesity and hence can avoid the prevalence of other non-communicable diseases. Government, non-government organizations. health planners, social workers, and rural administrative setup can do a lot in suggesting the ways and means so that people can maintain healthy life.

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Conflict of Interest

Authors declare no conflict of interest.

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