

Identification of Socioeconomic Variables Responsible for Prevalence of Hypertension among Bangladeshi Adults

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Abstract

The paper dealt with analytical results of data collected from 995 adults of 18 years and above living in rural and urban areas of Bangladesh. The analysis was done to identify some socioeconomic variables which were responsible for the prevalence of hypertension in adults of 18 years and above. The prevalence rate was observed among 5.9% adults. The rate was significantly higher than the overall prevalence rate among non-Muslims, elderly people, retired persons, smokers, and process food consumers, adults involved in sedentary activities, obese adults, and diabetic adults suffering for longer duration. The risk of prevalence was more among urban people, males, single adults, lower educated adults, and adults of economically affluent families. However, the most responsible variable for prevalence of hypertension was age followed by duration of diabetes, process food consumption, sedentary activity, body mass index, smoking habit. These variables were identified in discriminating hypertensive and non-hypertensive adults.

Keywords: Hypertension, Socioeconomic variable, Association, Risk ratio, Discriminant analysis, Correlation coefficient.

Introduction

One of the components of non-communicable diseases is hypertension which is the leading cause of global mortality and morbidity [1]. It is the major risk factor for cardiovascular disease (CVD), including stroke, heart failure, heart attack and aneurysm. But it remains the major and relatively easy preventable disease as it is associated with other non-communicable diseases, such as diabetes, kidney diseases, nerve damage, overactive thyroid gland, sleep apnoea, pregnancy, obesity, etc. [2-6]. Many studies, both in home and abroad, documented that the association between obesity and hypertension were in increasing trend in both children and adults [4-8]. Obesity and diabetes are also associated [9-16]. Patients with diabetes and hypertension have a higher incidence of coronary heart disease than do patients with diabetes or hypertension alone [17].

The problem of hypertension is more prevalent among elderly people and will be rapidly increasing in developing countries as majority of the elderly people will reside in those countries by 2025 [18-21]. Number of adults with hypertension increased from 594 million in 1975 to 1.13 billion in 2015. The increase was noted largely in low-and middle-income countries. Around 7.5 million deaths or 12.8% of the total of all deaths worldwide occur due to high blood pressure [22]. It is predicted to be increased to 1.56 billion adults with hypertension in 2025 [23]. The risk factors for hypertension are increasing age, family history, obesity, high sodium diets, physical

inactivity, excessive alcohol consumption, sedentary activity, and smoking, etc. [24-31]. In this paper an attempt was made to identify the most responsible socioeconomic variable for the prevalence of hypertension among Bangladeshi adults of 18 years and above. Attempt was also made to identify the level of a variable which created the higher risk for prevalence.

Methodology

The analytical results presented here were based on data collected from 995 adults of 18 years and above. These adults were investigated by some nurses and medical assistants working in some objectively selected diagnostic centres located in both urban and semi-urban areas of Bangladesh. The respondents of this study were 498 males and 497 females. These figures maintained the national sex ratio 50.1: 49.9 of male and female population of Bangladesh [32]. The sample also covered urban and rural people of the country and it contained 67% diabetic patients which ensured sufficient number of obese and hypertensive adults. The data were recorded during the session 2018-19.

The data on different socioeconomic variables of each selected respondent were recorded through a pre-designed and pre-tested questionnaire containing different questions related to residence, religion, gender, marital status, age, education, occupation, family income, and family expenditure. Beside these demographic data, other information were on life-style, viz. physical work, smoking habit,

consumption of restaurant food, and involvement in sedentary activity. The information of prevalence of any of the non-communicable diseases, duration of diabetes, and the stages of treatment of the disease including cost of treatment were also recorded. Some of the socioeconomic variables were qualitative and some were quantitative in nature, but all the variables were noted in nominal scale for ease of analysis. The data of weight (in kg) divided by height (in metre²) 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 $18.5 \leq \text{BMI} < 23.0$; overweight, if $23.0 < \text{BMI} < 27.5$ [33-34]. They were also divided into 2 groups according to their blood pressure (B.P) level (mmHg). One is hypertensive (if BP $\geq 140/90$) adults and another non-hypertensive adults if B.P $< 140/90$ [35-36].

To fulfil the objective of the study, the association of each of the socioeconomic variable with prevalence of hypertension was investigated, where significant association was decided if p-value of any Chi-square statistic ≤ 0.05 [$P(\chi^2) \leq 0.05$]. Irrespective of significant or insignificant association, the risk ratio and its confidence interval was calculated for adults for whom prevalence of hypertension was noted in higher rate for a particular level of a socioeconomic variable. Finally, discriminant analysis was done to select the most responsible variable for the prevalence of this health problem. The most responsible variable was identified depending on the highest

absolute value of correlation coefficient of socioeconomic variable with discriminant function score [37-42]. All the calculations were done using SPSS Version 25.

Results

Out of 995 adults 5.9% were hypertensive. Urban respondents were 46.6% and 6.7% of them were hypertensive [Table 1]. For them the risk of prevalence of the problem was 27% more compared to the risk of rural adults [R.R. =1.27, C.I. (0.77, 2.09)]. But prevalence of hypertension was independent of residence of the respondents [$\chi^2 = 0.880$, p -value= 0.348]. Gender variation was also independent of prevalence [$\chi^2 = 0.440$, p - value = 0.507]. In the sample 51.1% were males and 6.4% of them were facing the problem of hypertension. The chance of prevalence among them was 1.18 times as it was among females [R.R. =1.18, C.I. (0.72, 1.94)]. Non-Muslims respondents were only 14.8%. But the rate of prevalence of hypertension in them was 10.2% and for them the risk of prevalence was 97% more as it was for Muslim adults [R.R. = 1.97, C.I. (1.13, 3.44)]. The prevalence rates were significantly different for two religious groups [$\chi^2 = 5.650$, p -value $\chi^2 = 0.017$]. Marital status of the respondents was independent of the prevalence of hypertension [$\chi^2 = 1.017$, p -value=0.313]. But prevalence rate (8.7%) was higher in single adults (6.9%). This group was 52% more exposed to this health problem [R.R. =1.52, C.I. (0.68, 3.410)].

Table 1: Distribution of adults according to prevalence of hypertension and socioeconomic variables

Socioeconomic Characteristics	Prevalence of hypertension				Total	
	Yes		No		Number	(%)
	Number	%	Number	%		
Residence						
Rural	28	5.3	503	94.7	531	53.4
Urban	31	6.7	433	93.3	464	46.6
Total	59	5.9	936	94.1	995	100.0
Gender						
Male	32	6.4	466	93.6	498	50.1
Female	27	5.4	470	94.6	497	49.9
Religion						
Muslim	44	5.2	804	95.8	848	85.2
Non-Muslim	15	10.2	132	89.8	147	14.8
Marital status						
Currently married	53	5.7	873	94.3	926	93.1
Currently single	6	8.7	63	91.3	69	6.9
Age (in years)						
< 25	1	0.5	195	99.5	196	19.7
25 - 40	5	1.2	396	98.8	401	40.3
40 - 50	7	3.4	196	96.6	203	20.4
50 - 60	12	10.4	103	89.6	115	11.6
60+	34	42.5	46	57.5	80	8.0
Education						
Illiterate	7	10.8	58	89.2	65	6.5
Primary	9	7.4	112	92.6	121	12.2
Secondary	11	4.6	226	95.4	237	23.8
Higher	32	5.6	540	94.4	572	57.5
Occupation						

Agriculture and unskilled labor	6	5.8	98	94.2	104	10.5
Business	13	5.6	221	94.4	234	23.5
Service and skilled labor	12	3.9	293	96.1	305	30.7
Retire	17	13.9	105	86.1	122	12.3
Housewife	11	4.8	219	96.2	230	23.1
Income (000 taka)						
< 50	25	6.4	364	93.6	389	39.1
50 - 100	21	5.0	399	95.0	420	42.2
100 - 150	4	5.6	57	94.4	61	6.1
150+	9	7.2	116	92.8	125	12.6
Family expenditure (in 000 taka)						
< 40	29	7.0	387	93.0	416	41.4
40 - 60	11	3.6	391	96.4	302	30.4
60 - 80	9	6.3	134	93.7	143	14.4
80+	10	7.5	124	92.5	134	13.5
Smoking habit						
Yes	29	8.8	300	91.2	329	33.1
No	30	4.5	636	95.5	666	66.9
Habit of taking process food						
Yes	37	10.2	326	89.8	363	36.5
No	22	3.5	610	96.5	632	63.5
Physical work						
Yes	31	6.4	450	93.6	481	48.3
No	28	5.4	486	94.6	514	51.7
Utilization of time						
Sedentary activity	42	9.5	400	90.5	442	44.4
No	17	3.1	536	96.9	553	55.6
Obesity						
Underweight	3	7.9	35	92.1	38	3.8
Normal	10	4.3	223	95.7	233	23.4
Overweight	14	3.3	410	96.7	424	42.6
Obesity	32	10.7	268	89.3	300	30.2
Prevalence of diabetes						
Yes	49	7.3	618	92.7	667	67.0
No	10	3.0	318	97.0	328	33.0
Duration of diabetes (in years)						
Does not arise	10	3.0	318	97.0	328	33.0
< 5	4	1.4	287	98.6	291	29.2
5 - 10	7	3.4	199	96.6	206	20.7
10 - 15	12	12.1	87	87.9	99	9.9
15 - 20	18	40.9	26	59.1	44	4.4
20+	8	29.6	19	70.4	27	2.7
Total	59	5.9	936	94.1	995	100.0

The sample adults of age 60 years and above were 8.0%. The prevalence rate of hypertension among them was 42.5%. For them the risk of prevalence was 15.52 times as it was in others [R.R. =15.52, C.I. (9.80, 24, 71)]. The percentage of respondents of age 50 years and above was 19.6 and prevalence rate among them was 23.6%. The risk of prevalence for them was 14.52 times as it was in adults of age less than 50 years [R.R. =14.52, C.I. (8.00, 26.35)]. It was noted that significantly increasing trend of prevalence prevailed among the respondents with the increasing in their age [$\chi^2=224.317$,

p -value=0.000]. The sample illiterate adults were 6.5% and primary educated adults were 12.2%. The prevalence rates for these two groups were 10.8% and 7.4%, respectively. These two percentages were higher than the percentages of prevalence among secondary and higher educated adults. The prevalence rate was decreasing with the increase in level of education of adults, though the downward trend was not significant [$\chi^2=4.043$, p-value=0.257]. The risk of prevalence for illiterate adults was 93% more as it was for educated adults [R.R. =1.93, C.I. (0.91, 4.08)]. Higher risk of prevalence was also noted

among adults educated up to primary level [R.R. =1.62, C.I. (0.93, 2.81)]. In the sample, there were 12.3% retired persons and 13.9% of them were hypertensive. This percentage of hypertensive adults was too high compared to the percentage of similar adults of any other profession. The percentages were significantly different [$\chi^2 = 16.797$, p -value=0.002]. For retired persons the chance of prevalence was 2.90 times as it was for others [R.R. =2.90, C.I. (1.70, 4.93)]. The percentage of adults doing physical work was 48.3. Among them the rate of prevalence was 6.4%. But physical activity was not reducing the risk of prevalence of hypertension [$\chi^2 = 0.443$, p -value=0.506; R.R. =1.18, C.I. (0.72, 1.94)]. The sample adults involved in sedentary activity was 44.4% and 9.5% of them were hypertensive. For them the chance of prevalence was 3.09 times compared to that of others [R.R. =3.09, C.I. (1.78, 5.35)]. Sedentary activity was significantly enhancing the prevalence of hypertension [$\chi^2 = 18.197$, p -value=0.000].

Adults from highest income group of families were 12.6%. For them the prevalence rate was 7.2%. This group of adults had 25% more risk of the problem [R.R. =1.25, C.I. (0.63, 2.48)]. But prevalence rate was not significantly associated with level of family income [$\chi^2 = 1.228$, p -value=0.746]. The percentage of adults belonged to families spending highest amount of money as family expenditure was 13.5. The prevalence rate among this group was 7.5%. For them the chance of prevalence was 31% more as it was for others [R.R. =1.31, C.I. (0.68, 2.52)]. However, prevalence of hypertension did not depend on level of family expenditure [$\chi^2 = 4.74$, p -value=0.237].

Habit of consumption of process food was noted among 36.5% adults and 10.2% of them were hypertensive. The chance of hypertension for them was 2.93 times as it was for others [R.R. =2.93, C.I. (1.76, 4.89)]. Habit of consumption of process food was significantly associated with prevalence of hypertension [$\chi^2 = 18.621$, p -value=0.000]. Smoker adults were 33.1% in the sample and hypertensive smoker adults were 8.8%. They were 96% more exposed to this health problem compared to the problem of non-smokers [R.R.1.96, C.I. (1.20, 3.21)]. Smoking habit was significantly enhancing the prevalence of hypertension [$\chi^2 = 7.334$, p -value=0.007].

Level of obesity was significantly associated with prevalence of hypertension and obese adults were 1.75 times more exposed to this problem [$\chi^2 = 18.701$, p -value=0.000; R.R. =2.75, C.I. (1.68, 4.51)]. The sample obese adults were 30.2% and 10.7% of them were hypertensive. The overall percentage of sample obese-hypertensive adults was 3.2. Diabetic adults were 67.0% in the sample and 7.3% of them were hypertensive. Again, the sample hypertensive-diabetic adults were 4.9%. Prevalence of diabetes was significantly associated with prevalence of hypertension [$\chi^2 = 7.280$, p -value= 0.007]. For diabetic patients the chance of prevalence was 2.41 times as it was for non-diabetic adults [R.R. =2.41, C.I. (1.24, 4.69)]. Diabetic patients were suffering, on average, for 7.33 years with standard deviation of 5.50 years; 10.6% of them were suffering for 15 years and above and 36.6% of them were hypertensive. The chance of prevalence among them was 10.25 times as it was for others [R.R. =10.25, C.I. (6.50, 16.15)]. The prevalence rate was significantly increasing with the increase in duration of diabetes [$\chi^2 = 148.579$, p -value=0.000]. Those who were suffering for 15 to less than 20 years their risk for hypertension was 9.48 times compared to the risk of others [R.R.=9.48].

Discriminant Analysis

The analysis presented above signified that prevalence of hypertension was dependent on religion, occupation, smoking habit, consumption of process food, sedentary activity, obesity, prevalence of diabetes and duration of diabetes. These variables were not equally responsible for this health problem. The most responsible one can be identified by performing discriminant analysis to discriminate hypertensive and non-hypertensive adults. The most responsible variable is the one which has highest absolute value of correlation coefficient with discriminant function score. To perform the discriminant analysis the variables included were residence, religion, gender, marital status, age, education, occupation, family income, family expenditure, smoking habit, physical work, consumption of process food, and utilization of time, obesity, prevalence of diabetes and duration of diabetes. Some of these variables were significantly different for two groups of adults. This was observed by F-test and these variables significantly discriminated the two groups. The results of the discriminant analysis were presented in Table 2. The most responsible variable to discriminate hypertensive adults from non-hypertensive adults was age followed by duration of diabetes, consumption of process food, sedentary activity, body mass index, smoking habit, etc.

Table 2: Results related to discriminant analysis

Socioeconomic Variable	Wilk's	F - value	P - value	Discriminant function coefficient	Correlation coefficient of variable and discriminant function score
Residence	0.999	0.879	0.349	0.063	0.058
Religion	0.994	5.670	0.017	0.172	0.148
Gender	1.000	0.439	0.508	0.145	-0.041
Marital status	0.999	1.016	0.314	-0.013	0.063
Age	0.840	188.795	0.000	0.708	0.852
Education	0.998	2.125	0.145	-0.115	-0.090
Occupation	1.000	0.348	0.556	-0.035	0.037
Family Income	0.999	0.573	0.449	0.289	0.047
Family expenditure	1.000	0.209	0.648	-0.348	-0.028

Body mass index	0.991	9.290	0.002	0.059	0.189
Smoking habit	0.993	7.374	0.007	-0.121	-0.168
Utilization of time	0.982	18.449	0.000	0.168	0.267
Habit of taking process food	0.981	18.938	0.000	0.278	0.270
Physical work	1.000	0.442	0.506	0.007	0.041
Prevalence of diabetes	0.993	7.319	0.007	0.312	-0.168
Duration of diabetes	0.915	91.861	0.000	0.409	0.594

Discussion

Obesity, diabetes and hypertension are inter-related health problems and prevalence of these health hazard creates other health problems, like cardiovascular diseases, kidney disease, retinopathy, and many other non-communicable diseases and all these problems are influenced by some socio-demographic and lifestyle factors [43-50]. It was noted that age, gender, sedentary lifestyle, habit of taking restaurant food, process food, salt and fat enriched food were the risk factors for obesity, diabetes and hypertension among Bangladeshi adults [51-52]. This paper dealt with the identification of some socioeconomic variables responsible for hypertension. For this, 995 adults of 18 years and above residing in both urban and rural areas of Bangladesh were investigated. Among the investigated respondents 5.9% were hypertensive. Hypertensive and non-hypertensive adults were discriminated by discriminant analysis to identify the most responsible variable for discrimination. Before performing discriminant analysis association between socioeconomic variable and prevalence of hypertension was investigated.

Evidence was noted that urban adults (46.6%), males (51.1%) married persons (93.1%), illiterate persons (6.5%), adults from families of highest income (12.6%) and highest family expenditure (13.5%) were at higher risk of prevalence of hypertension compared to the risk of their counterparts. However, the corresponding variables were not statistically associated with prevalence of hypertension. Significantly associated variables were age, occupation, smoking habit, consumption of process food, sedentary activity, obesity, and prevalence of diabetes and duration of diabetes. The prevalence rate of hypertension was in increasing trend with the increase in age. Higher prevalence rate was noted among retired persons (12.3%), smokers (33.1%), and process food consumers (36.5%), persons involved in sedentary activity (44.4%), obese adults (30.2%), diabetic adults (67%), and adults suffering from diabetes for 15 years and above (7.1%). For the above group of adults the prevalence rates were 13.9%, 8.8%, 10.2%, 9.5%, 10.7%, 7.3% and 36.6%, respectively against 5.9% prevalence rate prevailed in the sample adults. This overall prevalence rate was significantly different than each of the rates mentioned above. It indicated that the hypertensive adults were significantly different from non-hypertensive adults in respect of the above variables. The most responsible variable for the difference between two groups of adults was age followed by duration of diabetes, consumption of restaurant food, sedentary activity, body mass index, smoking habit, etc.

Conclusion

The paper provided some information on responsible variables for prevalence of hypertension among Bangladeshi adults. For the purpose of identification of responsible variables, 995 adults of age 18 years and above residing in both urban and rural localities were investigated and data related to socio-demography and lifestyle of those adults was recorded. The analysis showed that the rate of prevalence of hypertension was 5.9% and the rates for rural and urban respondents, for males and females, for illiterate and literate people, for higher and lower economic group of people were statistically similar. However, the risks of prevalence among urban people, males, single adults, illiterate adults and adults from rich families were more by 27%, 18%, 52%, 93%, and 25%, respectively. Prevalence rates were significantly different for Muslims and non-Muslims, for people of different ages and different professions, for people of different levels of obesity, for people suffering from diabetes for different periods. The risk of prevalence in non-Muslim adults was 97% more. The same was 190% more among retired persons, 175% more among obese adults, 141% more among diabetic patients, and 925% more among diabetic patients suffering for 15 years and above. There was increasing trend in the rate of prevalence of hypertension with the increase in duration of suffering from diabetes. Similar increasing trend was noted among adults when their age was increasing. The risk of prevalence among eldest group of adults was 15.56 times compared to the risk of adults of ages less than 60 years. The risk of prevalence for adults of ages 50 years and above was 14.52 times as it was for others. The prevalence rate among smokers was 8.8% and for them the risk of prevalence was 96% more. Involvement in sedentary activity and habituated in restaurant food were two other risk factors for prevalence of hypertension. The risks of prevalence for these two groups were 3.09 times and 2.93 times, respectively.

It was noted that some socioeconomic variables were significantly associated with prevalence of hypertension and some were not. But particular level of some of the variables was enhancing the risk of prevalence. However, the most responsible variable for the prevalence of hypertension was age followed by duration of diabetes, consumption of restaurant food, involvement in sedentary activity, body mass index, smoking habit, etc. These variables discriminated well between hypertensive and non-hypertensive adults. Finally, the results of risk ratio and discriminant analysis indicated that elderly

people, people suffering from diabetes for longer duration, habit of taking process food, adults involved in sedentary activity, obese adults and smokers were at higher risk of prevalence of hypertension.

Due to social and economic upward movement habit of taking restaurant food, involvement in sedentary activity and obesity cannot be avoided. But attempts should be made to divert the attention of people towards leading healthy life. For this, people should follow the different steps which are essential for healthy life. These are

- Avoiding first food, excessive salt and high fatty food and sugar-based food.
- Doing any type of physical work and physical exercise.
- Walk whenever it is possible.
- Avoiding time passing only by watching television or reading newspaper,
- Doing medical check-up at least quarterly and follow strictly the suggestion of the medical practitioner whenever high blood pressure is detected.
- Trying to maintain the blood sugar level below danger level.
- Avoiding smoking and drinking alcohol.

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