

Identification of Socioeconomic Variables Responsible for Diabetic Heart Disease among Bangladeshi Adults

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Abstract: The findings in this paper were analytical results of data collected from 808 adults who were interviewed by some doctors and nurses from and nearby their working places according to their convenience. Among the investigated adults 6.9 percent were suffering from diabetic heart disease simultaneously. Both the health hazards are components of non-communicable diseases and these diseases are prevailed among both urban and rural people of all walk of life.. In this study, 84.2 percent adults were urban residents and 6.9percent of them were suffering DHD. Difference in residential accommodation was not associated with diabetic heart disease and both urban and rural adults were at similar risk of prevalence of DHD. The most responsible variable for DHD was income followed by expenditure, occupation and marital status. These variables were detected by factor analysis as factor loadings of these variables were higher.

Keywords: Diabetic heart disease, Socioeconomic variables, Risk ratio, Standard error of risk ratio, Factor analysis, factor loading.

1. INTRODUCTION

Diabetes and cardiovascular diseases (CVD) are the two of the four groups of non-communicable (NCDs) [1]. But diabetes is a prime risk factor for CVD. It also affects the heart muscle, causing both systolic and diastolic heart failure. Due to longer duration of diabetes, high blood glucose from diabetes can damage the blood vessels and the nerves that control heart and blood vessels. Overtime, a diabetic patient has the more risk of developing heart problem.

It is evident that although hyperglycaemia contributes to myocardial damage after ischemic events, it is clearly not only one factor, because both pre-diabetes and the presence of the metabolic syndrome, even in normal glycaemia patients increase the risk of most of types of CVD [2, 3, and 4]. Diabetic blood is more likely to be high in triglycerides. Hypertriglyceridemia in diabetes occurs, in part, because insulin action regulates lipid flux [5]. Thus, healthcare providers now emphasis on decreasing CVD risk in patients with diabetes by treating dyslipidaemia and hypertension and by improving glycaemia control [6].

Though biological risk factors of diabetes are addressed in detail, still upward trend in deaths

due to diabetes is noted [5]. This is true for both home and abroad. It was reported that approximately 463 million adults of ages 20 – 79 years worldwide were diabetic [7]. This figure will be increased up to 700 million in 2045. Proportion of type 2 diabetes is increasing in most countries and 79 percent of adults with diabetes were living in low and middle-income countries [7]. Most of the diabetic people were in the age group 40 – 59 years and 374 million people are at risk of developing type 2 diabetes [7]. In another report it was mentioned that 1 in 5 diabetic patients were at the age above 65 years and 2 in 3 were urban residents [8, 9]. Every year 4.2 million deaths due to diabetes were also reported [7]. The annual death due to CVD was reported 17.9 million [10]. The risk of diabetes among adults was also reported in different studies of home and abroad [11, 12, 13, 14,15,16,17, and 18].

In one study, it was observed that most of the Bangladeshi urban adults (36.3%) were suffering from diabetes [7]. The prevalence of diabetes in adults of ages 20 – 79 years was 7.4 percent in Bangladesh [13, 14]. According to IDF the prevalence will be 13 percent by 2030[9]. Diabetes was the targeted disease by

WHO as it has some economic consequences also [18, 19].

But there is no separate estimate of death due to diabetic heart problem. Even, nothing is known about the socioeconomic factors responsible for this health hazard among adults. In this paper, an attempt was made to identify the socioeconomic factors responsible for the diabetic heart disease of the adults. The specific objectives of the study were

- To measure the risk of socioeconomic variables in enhancing the diabetic heart disease (DHD) among adults.
- To identify the responsible socioeconomic variables for DHD.

2. METHODOLOGY

The analytical results presented here were based on data collected from both urban and rural 808 adults of Bangladesh. The adults were investigated by a group of doctors and nurses from and nearby their working places according to their convenience during academic session 2016 –17. According to the objective of the study, the data related to different socioeconomic variables of the adults of ages 18 years and above were recorded through pre-designed, pre-tested printed questionnaire. Information related to the prevalence of diabetes-cum heart disease was noted along with different socioeconomic variables. The socioeconomic variables under study were residence, gender, religion, age, marital status, education, occupation, income, expenditure, body mass index, smoking habit, habit of taking restaurant and can-food, utilization of time, physical labor intensive work, etc. Some of the variables were qualitative in character. But for analytical purpose all the variables were measured in nominal scores. In some studies, both in home and abroad, it was noted that diabetes was associated with level of obesity [14, 20, 21, 22, 23]. Again, level of obesity was

measured by body mass index (BMI).The BMI was measured by weight in kg / (height in meter)²[19,24,25]. The adults were classified as underweight [BMI< 20], normal [BMI= 20 - < 25], overweight [BMI= 25 - < 30], and obese [BMI≥ 30] [21].

The adults were divided into two groups. In one group there were 56 diabetic –cum-heart patients. Rest of the adults (752) were either free of any disease or were suffering from multiple diseases. The association of socioeconomic variables with prevalence of diabetic heart disease were observed by Chi – square test, where significant association was decided if p- value of any test statistic was < 0.05. The risk ratio was calculated for all dichotomous data [26]. Factor analysis was done to select some factors which can explain maximum variation in the data set [25]. A factor is the linear combination of the variables included in the analysis. The coefficients of the variables used in the analysis are known as factor loadings. Higher factor loading of any variable indicates the more responsible variable for the disease [18, 24,25,26].

3. RESULT

The total investigated adults were 808. Among them 84.2 percent [Table 1] were from urban area and 6.9percent of them were suffering from diabetic heart disease. The percentage of adults in the sample suffering from DHD was also 6.9. However, there was no significant differences in the percentages of DHD patients of urban and rural areas [$\chi^2 = 0.002$, p-value= 0.961]. The risk ratio 1.02 with standard error 0.74 indicated that both rural and urban adults were at similar risk of diabetic heart disease.

The percentage of male adults was 69.7 and 5.7percent of them were diabetic heart patients. The female DHD patients were 9.8 percent and they had 72percent more risk of diabetic and

Table1: *Distribution of diabetic heart patients according to different socioeconomic variables*

Socioeconomic variables	Prevalence of diabetes and heart diseases				Total	
	Yes		No		n	%
	n	%	n	%		
Residence						
Rural	9	7.0	119	93.0	128	15.8
Urban	47	6.9	633	93.1	680	84.2
Total	56	6.9	752	93.1	808	100.0
Gender						
Male	32	5.7	531	94.3	563	69.7
Female	24	9.8	221	90.2	245	30.3

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Religion						
Muslim	51	7.0	675	93.0	726	89.9
Non-Muslim	5	6.1	77	93.9	82	10.1
Marital status						
Currently married	33	8.0	378	92.0	411	50.9
Currently single	23	5.8	374	94.2	397	49.1
Age (in years)						
< 20	3	8.3	33	91.7	36	4.5
20 – 30	16	5.1	296	94.9	312	38.6
30 – 40	2	3.0	64	97.0	66	8.2
40 – 50	6	4.3	132	95.7	138	17.1
50 ⁺	29	11.3	227	88.7	256	31.7
Education						
Illiterate	1	4.5	21	95.5	22	2.7
Primary	2	3.6	54	96.4	56	6.9
Secondary	15	11.6	114	88.4	129	16.0
Higher	38	6.3	563	93.7	601	74.4
Occupation						
Agriculture and unskilled labor	0	0.0	35	100.0	35	4.3
Business and skilled labor	4	5.3	72	94.7	76	9.4
Service	13	7.1	170	92.9	183	22.6
Housewives and others	39	7.6	475	92.4	514	63.6
Income (in 000 taka)						
< 30	9	5.7	150	94.3	159	19.7
30 – 60	8	6.9	108	93.1	116	14.3
60 – 90	2	3.2	60	96.8	62	7.7
90 ⁺	37	7.9	434	92.1	471	58.3
Smoking habit						
Yes	8	5.6	134	94.4	142	17.6
No	48	7.2	618	92.8	666	82.4

Table1: *Continued*

Socioeconomic variables	Prevalence of diabetes and heart diseases				Total	
	Yes		No		n	%
	n	%	n	%		
Family expenditure (in 000 taka)						
< 40	12	6.4	176	93.6	188	23.3
40 – 50	7	4.8	140	95.2	147	18.2
50 – 60	10	5.4	175	94.6	185	22.9
60 ⁺	27	9.4	261	90.6	288	35.6
Taking restaurant food						
Yes	29	6.1	446	93.9	475	58.8
No	27	8.1	306	91.9	333	41.2
Use of can food						
Yes	35	6.7	487	93.3	522	64.6
No	21	7.3	265	92.7	286	35.4
Obesity						
Underweight	2	1.9	105	98.1	107	13.2
Normal	27	6.7	378	93.3	405	50.1
Overweight	23	8.8	238	91.2	261	32.3
Obese	4	11.4	31	88.6	35	4.3
Utilization of time						
Academic activities	9	4.4	195	95.6	204	25.2
Reading and watching T.V.	12	7.0	160	93.0	172	21.3
Games and sports	2	3.6	54	96.4	56	6.9
Paper reading and use of mobile	26	11.7	197	88.3	223	27.6
Use of T.V. and mobile	7	4.6	146	95.4	153	18.9
Physical exercise						
Yes	26	6.3	388	93.7	414	51.2

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No	30	7.6	364	92.4	394	48.8
Total	56	6.9	752	93.1	808	100.0

Heart disease [R.R. =1.72, s.e (R.R.) = 0.46] compared to the risk of male adults. There was significant association between gender variation and variation in the prevalence of diabetic heart diseases [$\chi^2=4.475, p\text{-value}=0.034$]. The percentage of Muslim respondents was 89.9 and 7.0percent of them were diabetic heart patients. The percentage of non -Muslim DHD patients was 6.1. But this differential percentages of DHD patients between two religious groups were not statistically significant [$\chi^2 = 0.098, p\text{-value}=0.754$]. The risk of DHD for adults of both the religious groups were almost similar [R.R. = 1.15, s.e.(R.R.)= 1.29] though for Muslim adults the risk is 15% more. The percentage of married adults was 50.9 and 8.0percent of them were suffering from diabetic heart disease. The DHD patients among married adults were more in percentage. But this difference in proportions of DHD patients for married and currently single adults was not significantly different [$\chi^2 = 1.565, p\text{-value} = 0.434$]. However, the risk of DHD for married adults was 39 percent more compared to the risk of single adults [R.R. =1.39, s.e.(R.R.) = 0.26.].

The diabetic heart patients of different age groups were significantly different in proportions [$\chi^2=12.340, p\text{-value}=0.015$] and the adults of ages 40 years and above were at 75percent more risk of the disease compared to the risk of adults of ages less than 40 years [R.R. =1.75, s.e. (R.R.)= 0.264]. The DHD patients of ages 40 years and above were 8.9 percent against the overall percentage 6.9 of DHD patients. The percentage of higher educated adults was 74.4 and 6.3percent of them were suffering from diabetic heart disease. This percentage among secondary educated adults was 11.6, which was almost double than the percentage (6.9) of overall DHD patients.

This group of adults were at 92 percent more risk of the disease compared to the risk of adults of other The adults were classified by agriculturists and unskilled labours, businessmen and skilled labours, service persons and others including housewives [27]. The percentages of these 4 occupational groups were 4.3, 9.4, 22.6 and 63.6, respectively and highest percentage of DHD patients (7.6) was noted in the last occupational group of adults. The risk for this group of adults was 31 percent

more than the risk of adults of other occupational groups

[R.R= 1.31, s.e(R.R)=0.330]. However, the proportions of DHD patients among all occupational groups of adults were homogeneous [$\chi^2=3.286, p\text{-value}= 0.350$].

Levels of education [R.R=1.92, s.e(R.R)=0.58]. However, there was no significant differences in the proportions of DHD patients of different levels of education [$\chi^2=5.931, p\text{-value}=0.115$]. Maximum adults (58.3%) belonged to the families having income taka 60 thousand and above but less than taka 90 thousands and a big group of adults (7.9%) of these families were DHD patients, though the proportions of patients of different income levels were similar [$\chi^2=2.342, p\text{-value}=0.505$]. Even then the risk of the disease among the richest adults compared to the risk of adults of other income levels was higher [R.R = 1.39, s.e.(R.R.) = 0.293]. Highest (taka 60 thousands and above) family expenditure was noted among 35.6 per families and this was the biggest group of families. In these families, 9.4percent adults were the patients of diabetic heart disease. Significant differences in the proportions of diabetic heart disease patients in families spending different amounts of money were not observed [$\chi^2 = 4.494, p\text{-value}= 0.213$]. But adults of families spending highest amount of money as family expenditure were at 68percent more risk of DHD compared to the risk of adults spending other amounts of money [R.R.= 1.68, s.e(R.R.) = 0.284].

The percentage of obese adults was only 4.3 but highest proportion (0.114) of them was the patients of diabetic heart disease. Though insignificant association between level of obesity and prevalence of diabetic heart disease was noted [$\chi^2 = 6.824, p\text{-value} = 0.078$], still overweight and obese adults were at higher risk of the disease by an amount 61percent compared to the risk of adults of other two levels of obesity [R.R. =1.61, s.e. (R.R.) =0.280]. Longer duration of use of mobile phone and watching T.V. for long time are sedentary activities. Majority (27.6%) of the adults were passing their times by reading newspaper and by using mobile phone and 11.7 percent of them were suffering from the DHD .The next higher

proportion (0.07) of DHD patients were passing their time watching T.V. and reading. Significant differences in proportions of diabetic heart patients were noted among adults utilizing time differently [$\chi^2=12.033$, p-value = 0.017]. Those who were mainly engaged in sedentary activity, like paper reading and watching T.V. their risk of the disease was more than double compared to the risk of other adults [R.R.= 2.27 , s.e.(R.R.) = 0.335]. Most of the adults (51.2%) were doing physical exercise and they were less affected by diabetic heart disease (6.3%) against 7.6 percent DHD patients who were not doing any physical exercise. But this study did not signify any evidence that physical exercise had any positive impact in reducing the percentage of patients of diabetic heart [$\chi^2 =0.557$, p-value=0.455]. However, the risk of DHD among adults not doing any physical exercise was 21 percent more compared to to the risk of adults doing physical exercise [R.R.=1.21, s.e.(R.R.) = 0.687]. The percentage of smoker adults was 17.6 and 5.6 percent of them were suffering from diabetic heart disease .A big group (82.4%) of adults were non-smoker but higher proportion of them (7.2%) were suffering from diabetic heart disease. Though non- significant association between smoking habit and prevalence of DHD was noted, still non-smokers had 28 percent more risk of affecting by the disease compared to the risk of smokers adults [$\chi^2 = 0.449$, p-value=0.503; R.R.=1.28, s.e (R.R.)= 0.4]. The study indicated that 58.8 percent adults were used to take restaurant food and 6.1 percent of them were the patients of diabetic heart disease. Those who were not taking restaurant food 8.1 percent of them were patients of DHD and for this group the risk of affecting by the disease was 36 percent more than the risk of adults taking restaurant food [R.R.= 1.36, s.e.(R.R) = 0.268] . But irrespective of taking or not taking restaurant food the proportions of diabetic heart patients of both group of adults were not significantly different as was observed by chi-square test [$\chi^2 =1.217$, p- value =0.270]. Insignificant association between habit of taking can food and prevalence of diabetic heart

Table 2: Results of factor analysis

Variable	Communality	Coefficients of factor
Age	0.260	-0.510
Marital status	0.352	0.593
Occupation	0.539	0.734

disease was noted [$\chi^2 = 0.116$, p-value= 0.733]. Most of the adults (64.6%) were habituated in taking can food and 6.7percent of them were affected by the disease. Higher proportion (0.073) of non-can food user adults were at slightly higher risk of prevalence of the disease compared to the adults who were habituated in taking can food [R.R = 1.10, s.e(R.R.) = 0.309].

4. FACTOR ANALYSIS

The results presented above indicated that the variables gender, age, and utilization of time were significantly associated with diabetic heart disease. But this association did not indicate that only these three variables were responsible for DHD. The most responsible variable can be detected by factor analysis, where higher value of a factor loading indicates the more responsible variable for the variation in the data set [24, 25, and 26]. Thus attempt was made to identify the most responsible variable through factor analysis. For the purpose, all the variables were included in the analysis and factors were detected for the prevalence of diabetic heart disease. The inclusion of the variables was satisfactory as KMO= 0.564which provided $\chi^2 = 367.04$, p -value= 0.000. During factor analysis it was noted that the communalities of the variables residence, gender, religion, education, body mass index, utilization of time, restaurant food , can food , physical exercise and smoking habit were less than 0.40 [28]. So these variables were dropped from the analysis. With the remaining variables again factor analysis was done. During this analysis also the inclusion of the variables was perfect as the KMO= 0.563, $\chi^2 =177.18$, p-value = 0.000. The final included variables had the capacity to explain 50.878percent variation in the data set through the detection of one component under the restriction of characteristic root 2. The results of the factor analysis were presented in Table 2. It was observed that income was the most responsible variable for the variation in the prevalence of diabetic heart disease among adults followed by expenditure, occupation and marital status. The other responsible variable was age.

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Income	0.698	0.836
Expenditure	0.695	0.834

5. DISCUSSION

The risk in terms biological aspects of diabetic heart disease was reported in abroad [2 - 6]

No well known similar work was reported in Bangladesh. But, there were reports that diabetes was the major health hazard among Bangladeshi adults [11, 14, 18, and 29]. Current research was an attempt to relate DHD with some socioeconomic factors. The factors were residence, gender, religion, age, education, occupation, income, expenditure, and restaurant and can food, physical exercise, utilization of time, BMI, smoking habit. The association of these variables with DHD was investigated here. But the analysis showed that that only the variables age of adults, their gender, utilization of time by them were significantly associated with the prevalence of diabetic heart disease. Though most of the socioeconomic variables were not associated with DHD, still the risk of the disease was more for females, married adults, secondary educated adults, house wives and others, rich adults, smokers, aged adults, overweight and obese adults, adults of families spending more money as family expenditure. Non- involvement in physical exercise was also a risk factor for the disease.

6. CONCLUSION

The information presented here were the outcome of the analysis of the data collected from 808 adults of age 18 years and above residing in both urban and rural areas of Bangladesh. The data were collected by some doctors and nurses from and nearby their working places. The target of the analysis was to identify some socioeconomic variables responsible for the diabetic heart disease. The analysis indicated that gender variation, variation in age and variation in utilization of time by the adults were significantly associated with diabetic heart disease. The risk of prevalence of DHD among females (30.3%) was higher compared to the risk of male adults. The risk of the disease for adults of age 50 years (31.7%) and above was more than double [R.R. =2.02] than the risk of adults of other ages. Even the risk was 75 percent more for adults of ages 40 years (48.8%) and above. It indicated that the risk of DHD was in upward trend with the increase in age. It was also higher for adults involved in sedentary activities [27.6%, R.R. =2.27]. In terms of risk of the disease the rural

(15.8%) and urban (84.2%) adults was similar. The risk of the disease was also similar for both religious groups of adults understudy [R.R. = 1.15]. Insignificant association between prevalence of DHD and marital status was noted. But married adults (50.9%) were at higher risk of affecting by the disease [R.R. =1.39].

The prevalence of DHD (11.6%) was higher among secondary educated adults (16.0%). The risk of the disease of this group of adults was 92% more than the risk of other educated adults. But the variation in the prevalence rates according to the variation in the levels of education was not significantly different. Insignificant differences in the prevalence rates were noted among adults of different levels of occupation. But the risk [R.R.=1.31] of diabetic heart disease among house wives and others was higher compared to the risk of different other professionals. The prevalence rates of DHD among adults of different levels of income were not significantly different. But the risk of DHD among adults of highest income group (58.3%) was more [R.R.=1.31]. Insignificant differences in the prevalence rates were noted for adults of families spending different amounts of money as family expenditure. But for the adults of families spending 60 thousand and above taka (35.6%) as family expenditure were at higher risk of DHD [R.R. =1.68]. Significant differences in the prevalence of DHD were noted among the adults involved in different activities. Higher percentage (11.7%) of adults passing time by reading paper and using mobile phone were affected by the disease. Their percentage (27.6%) was also higher in the sample. Their risk of affecting by the disease was more than double [R.R. = 2.27] compared to to the risk of other adults. Habit of taking restaurant food and can food did not enhance the risk of DHD. Body mass index was not significantly associated with prevalence of diabetic heart disease. But overweight and obese group (36.6%) were at higher risk [R.R. =1.61] Due to upward social mobility, increased mechanical movement and more involvement in sedentary activities the prevalence of diabetic and heart disease cannot be avoided. But the prevalence rate can be controlled, if people can take some initiative

- To control diet by taking healthy and homemade food avoiding unsaturated fat.

- To avoid more sugar based and salty food.
- To be careful about the self-care behaviour and avoid smoking.
- To do some physical labor and /or physical exercise or at least walk a while whenever possible.
- To join the blood screening program and to be careful about the lipid profile.
- To adhere the lifelong medical therapy by the patients.
- To avoid the increase in body weight.
- To avoid can and restaurant food.
- Health planners and social activists can do a lot to encourage the people to follow the above steps.

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