Identification of Risk Factors for Diabetes Disability among Bangladeshi Adults

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Abstract

The paper was to throw some light on the risk factors for diabetes disability among Bangladeshi adults of 18 years and above residing in both urban and rural areas. In investigating the adults, it was decided to cover 50.1% males and 49.9% females to maintain the national level of sex ratio in the sample. The respondents were interviewed when they were visiting some diagnostic centres in urban and semi-urban areas. The percentage of diabetic respondents included in the sample was 67% and 25.5% of them were suffering for 10 years and above, 6.4% were disable against 4.8% total disable respondents in the sample, and obese adults were 30.2%. Diabetic disable adults in the sample were 4.3%. The most responsible variable for diabetes disability was obesity followed by longer duration of diabetes, sedentary activity, smoking habit, being housewife, being married, etc. These variables were identified on the basis of risk ratio and correlation coefficients of variables and discriminant function scores. Beside these variables, rural people, Muslims, adults of ages 40 – 50 years, illiterate people had more risk of facing the problem of diabetes disability.

Keywords: diabetes; disability, risk ratio; discriminant analysis, socioeconomic variable; discriminant function score; correlation coefficient of variable with discriminant function score

Introduction

Physical disability for males and females indicates increased risk of not being able to do usual daily task; like normal walking, normal working, and maintaining physical balance without any support. Obesity and diabetes may increase the risk of disability because of complications arises in mobility conditions, in hearing capacity and in visual impairment , including cardiovascular disease (CVD) and peripheral vascular disease and peripheral neuropathy [1, 2, 3, 4]. In another study it was reported that the risk of disability might be increased 67% due to diabetes [5]. It was well documented fact that neuropathy is a common physical disorder, especially among elderly diabetic patients [1, 6]. The diabetic disable patients is expected to be increased by 2025 in developed countries as older people will comprise two-thirds of the diabetic patients in those countries [7, 8]. The prevalence of diabetes in adults is predicted to rise to 642 million in 2040 [9]. Currently the figure is 422 million worldwide and they are mostly from low-and middle income countries [10]. It was reported that disability prevailed among 90% of the diabetic patients in Bangladesh [11]. The rate of prevalence of the problem was 4.3% in 2006 in India compared to 1 to 2 per cent in western world [12]. Due to the prevalence of disability the chance of sleep apnea, lower limb amputation, morbidity is increased and it creates a great economic burden [12 – 19]. The problem is predominant among females, older people and diabetic patients suffering for longer duration [20, 21]. As disability

increases with the increase in prevalence of diabetes, some influencing factors of diabetes viz. old age, female, illiteracy, physical inactivity, lifestyle, sedentary activity, food habit, family history etc. May be the causes of disability [5, 22 – 26] Keeping this health problem of adults in mind the objective of this paper was determined to identify the socioeconomic variables responsible for simultaneous prevalence of diabetes disability among Bangladeshi adults.

Methodology

The data for this paper were recorded on investigation by some nurses and medical assistants working in some purposively pre-selected diagnostic centres located in urban and semi-urban areas of Bangladesh. The investigating units were 995 adults of age 18 years and above by quota sampling plan to cover males and females in the ratio 50.1: 49.9 as this ratio is prevailed in the national level of population of Bangladesh [27]. Out of 995 respondents 498 were males and 497 were females and they were the residents of both urban and rural localities. As the adults were investigated from diagnostic centre, most (67%) of them were found diabetic patients. The data were recorded during the session 2018-19.

The information of different socioeconomic variables of each selected respondent were recorded through a pre-designed and pre-tested questionnaire which contains different questions related to residence,

religion, gender, marital status, age, education, occupation, family income, family expenditure. Beside these personal data, other information were on life-style, and prevalence of any of the non-communicable diseases, duration of diabetes, and the stages of treatment of the disease including its cost. Some of the 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 metre^2) was used to measure the value of body mass index (BMI) to identify obese adults(if BMI $\geq$ 27.5; underweight ,if BMI< 18.5; normal, if 18.5 $\leq$BMI< 23.0; overweight, if 23.0 <BMI< 27.5) [28, 29]. They were also divided into 4 groups According to their blood pressure (B.P) level (mmHg). The 4 groups were identified as optimal (if BP < 120/80), normal (if BP <130/85), high normal (if BP < 140/90) and hypertensive (if BP $\geq$ 140/90) [30, 31]. To fulfil the objective of the study, the association of each of the socioeconomic variable with simultaneous prevalence of diabetes disability was investigated, where significant association was decided on the basis Of p-value of any $\chi^2 \leq 0.05$.

Irrespective of significant or insignificant association, the risk ratio and its confidence interval was calculated for adults for whom prevalence of diabetes disability was noted in higher rate for a particular level of a socioeconomic variable. Finally, discriminant analysis was done to discriminate the adults suffering from diabetes disability and others who were free of these health problem. In performing discriminant analysis some of the socioeconomic variables were identified as responsible for discrimination of two groups of adults. It was done by the higher absolute values of correlation coefficients with discriminant function score and variable values [32, 33, 34]. All the calculations were done using SPSS Version 25.

Result

In the sample there were 43 (4.3%) diabetic-disable adults and the remaining 952 adults were free of these two simultaneous health problems. Total respondents were classified by the prevalence of health problems and prevalence of diabetes and the classified results

Prevalence of health problem		Prevalence of diabetes		Total
		Yes	No	
None	Number	360	246	606 60.9
	%	54.0	75.0	
Heart	Number	101	25	126 12.7
	%	15.0	7.6	
Eye	Number	86	37	123 12.4
	%	12.9	11.3	
Kidney	Number	77	15	92
	%	11.5	4.6	9.2
Disability	Number	43	5	48
	%	6.4	1.5	4.8
Total	Number	667	328	995
	%	67.0	33.0	100.0

Table 1: *Distribution of adults according to Prevalence of diabetes and health Problem*

Were presented in Table 1. Total diabetic adults were 667 (67%) and 6.4% of them were disable also. Prevalence of diabetes and prevalence of health problem were significantly associated [χ^2 =48.844, p –value=0.000].The rural respondents were 53.4% and 4.9% of them were diabetic disable [Table 2]. For them the risk of this health hazard was 34% more compared to the risk of urban residents [R.R. =1.34, C.I {0.737, 2.436}]. But prevalence rate did not vary significantly with the variation of residents [χ^2 =0.910, p –value= 0.340; Table 2].There were 85.2% Muslim adults and prevalence of diabetic disability was noted among 4.6% of them. The chance of this health problem for them was 69% more as it was for non-Muslim adults [R.R. =1.69, C.I. {0.613, 4.656}]. The prevalence rates for both religious groups were statistically similar [χ^2 =1.069, p-value=0.301]. There were 49.9% females in the sample and 5.0% of them were suffering from diabetes and disability simultaneously. The risk of prevalence of the problem was 39% more as it was for males [R.R. = 1.39, C.I. {0.768, 2.517}]. However, there was no significant variation in the prevalence rates for males and females [χ^2 =1.206, p –value=0.272]. It was observed that all 43 diabetic disable adults were currently married though marital status was not significantly associated with prevalence of this health hazard [χ^2 = 3.349, p-value=0.067]. It was noted that younger adults (age < 25 years) were about one-fifth (19.7%) of the respondents and prevalence of the disease was least among them.

The next lowest prevalence rate (3.8%) was observed among 8% sample elderly adults (Age 60 years and above). Adults of ages 40 – 50 years were 20.4%. Among them the prevalence rate was highest (5.9%). For them the risk of prevalence was 51% more as it was among adults of other ages [R.R. = 1.51, C.I. {0.789, 2.889}]. But, statistically the prevalence rates for adults of all age groups were similar [χ^2 = 2.817, p-value= 0.583]. There were only 6.5% illiterate adults and 7.7% of them were suffering from diabetes disability. For them the chance of prevalence of the problem was 1.88 times as it was for other educated persons [R.R. = 1.88, C.I. {0.766, 4.613}], though prevalence rates of this health hazard were statistically similar for respondents of all levels of education [χ^2 =1.928, p-value= 0.588] Higher percentage (7.0%) of diabetes disability was observed among housewives (23.1%). For them the risk of prevalence of the problem was 97% more as it was for other professionals [R.R. =1.97, C.I. {0.836, 4.639}]. The next higher prevalence rate (4.9%) was observed among retired persons (12.3%). But, prevalence rates of diabetes disability among respondents of different occupations were statistically similar [χ^2 =0.5865, p –value=0.209]. Physical inactivity was observed among 51.7% adults, but rate of diabetic disability among them was lower. Higher prevalence rate (5.0%) was observed among physically active adults. For them the risk of prevalence was 35% more as it was in others [R.R. =1.35, C.I. {0.750, 1.432}]. However, physical labour was not significantly associated with prevalence of diabetes

disability [χ^2 =1.005, p –value=0.316]. The percentage of adults involved in sedentary activity was 44.2 and 6.3% of them were facing the problem of diabetes disability. The chance of prevalence of the problem for them was 2.34 times as it was for their counterpart [R.R. =2.34, C.I. {1.265, 4.330}]. The utilization of time by the respondents and prevalence of the problem among them were significantly associated [χ^2 = 7.796, p –value=0.000]. The percentage of adults of families having family income

Taka 100 thousand and above was 18.7 and prevalence of diabetes disability was observed among 4.8% of them. The risk of the problem was almost similar for adults of families of other income levels [R.R. =1.15, C.I. {0.565, 2.343}]. The prevalence rates were also statistically similar for all groups of adults of different levels of income [χ^2 = 0.476, p – value=0.924]. Similar was the case for adults of families of different levels of family expenditure

Socioeconomic characteristics	Prevalence of diabetes disability				Total	
	Yes		No			
	Number	%	Number	%	Number	%
Residence						
Rural	26	4.9	5o5	95.1	531	53.4
Urban	17	3.7	447	96.3	464	46.6
Total	43	4.3	952	95.7	995	100.0
Gender						
Male	18	3.6	480	96.4	498	50.1
Female	25	5.0	472	95.0	497	49.9
Religion						
Muslim	39	4.6	809	95.4	848	85.2
Non-Muslim	4	2.7	143	97.3	147	14.8
Marital status						
Currently married	43	4.6	883	95.4	926	93.1
Currently single	0	0.0	69	100.0	69	6.9
Age (in years)						
< 25	5	2.6	191	97.4	196	19.7
25 – 40	18	4.5	483	95.5	401	40.3
40 – 50	12	5.9	191	94.1	203	20.4
50 – 60	5	4.3	110	95.7	115	11.6
60+	3	3.8	77	96.2	80	8.0
Education						
Illiterate	5	7.7	60	92.3	65	6.5
Primary	5	4.1	116	95.9	121	12.2
Secondary	10	4.2	227	95.8	237	23.8
Higher	23	4.0	549	96.0	572	57.5
Occupation						
Agriculture and unemployed	3	2.9	101	97.1	104	10.5
Business	7	3.0	227	97.0	234	23.5
Service and skilled labor	11	3.6	294	96.4	305	30.7
Retire	6	4.9	116	95.1	122	12.3
Housewife	16	7.0	93.0	93.0	230	23.1
Income (000 taka)						
< 50	18	4.6	371	95.4	389	39.1
50 – 100	16	3.8	404	96.2	420	42.2
100 – 150	3	4.9	58	95.1	61	6.1
150+	6	4.8	119	95.2	125	12.6
Family expenditure (in 000 taka)						
< 40	21	5.0	395	95.0	416	41.4
40 – 60	10	3.3	292	96.7	302	30.4
60 – 80	6	4.2	137	95.8	143	14.4
80+	6	4.5	128	94.5	134	13.5
Obesity	Number	%	Number	%	Number	%
Underweight	0	0.0	38	100.0	38	3.8
Normal	4	1.7	229	98.3	233	23.4
Overweight	12	2.6	412	97.4	424	42.6
Obese	27	9.0	273	91.0	300	30.2
Smoking habit						
Yes	7	2.1	322	99.9	329	33.1
No	36	5.4	630	95.6	666	66.9
Habit of taking process food						

Yes	15	4.1	348	95.9	363	36.5
No	28	4.4	604	95.6	632	63.5
Physical work						
Yes	24	5.0	457	95.0	481	48.3
No	19	3.7	495	96.3	514	51.7
Involved in sedentary activity						
Yes	28	6.3	414	93.7	442	44.4
No	15	2.7	538	97.3	553	55.6
Level of blood pressure						
Optimum	19	3.5	521	96.5	540	54.3
Normal	16	5.7	264	94.3	280	28.1
High normal	6	5.2	110	94.8	116	11.7
Hypertensive	2	3.4	57	96.6	59	5.9
Duration of diabetes (in years)						
Does not arise	0	0.0	328	100.0	328	33.0
< 5	14	4.8	277	95.2	291	29.2
5 – 10	16	7.8	190	92.2	206	20.7
10 – 15	11	11.1	88	88.9	99	9.9
15^+	2	2.8	69	97.2	71	7.1
Total	43	4.3	952	95.7	995	100.0

Table 2: *Distribution of adults according to socioeconomic characteristics and prevalence of Diabetes disability*

[χ^2 = 1.290, p –value= 0.732]. However, adults belonged to families spending lowest amount of money were in 33% more risk than the risk of other adults [R.R. = 1.33, C.I. {0.792, 2.385}]. The percentage of respondents habituated in process food was 36.5, but lower proportion (0.041) of them were patients of diabetes disability. The problem was predominant among them who were not habituated in process food. However, the risk of the problem was almost similar for process food consumers and non-consumers [R.R. =1.07, C.I. {0.574, 1.976}]. The prevalence of this health hazard was independent of food habit of the adults [χ^2 =0.050, p –value=0.824]. But smoking habit of the respondents was not independent of prevalence of the disease [χ^2 = 5.772, p –value=0.017]. Non-smokers (66.9%) were at the risk of prevalence of the disease by 2.54 times [R.R. =2.54, C.I. {1.142, 5,651}]. The proportion of non-smokers facing the problem was 0.054.

The percentage of adults of normal blood pressure was 28.1 and 5.7% of them were patients of diabetes disability. For them the risk of prevalence of the disease was 51% more as it was for adults of other blood pressure [R.R. =1.51, C.I. {0.826, 2.762}]. However, prevalence rates of diabetes disability among adults of different blood pressure were statistically similar [χ^2 =2.483, p –value=0.478]. There were 30.2% obese adults in the sample and 9.0% of them were suffering from diabetes disability. The risk of prevalence of the disease for obese adults was 3.91 times as it was for others [R.R. =3.91, C.I. {2.138, 7.151}]. The Prevalence of diabetes disability was significantly different for adults of different levels of

obesity [χ^2 =23.701, p –value=0.000]. There were 9.9% adults who were suffering from diabetes for 10 to less than 15 years and 11.1% of them were also suffering from disability. For this group of adults the risk of prevalence of both the diseases was 3.11 times as it was for others [R.R. =3.11, C.I. {1.619, 5.978}]. The prevalence of diabetes disability was significantly associated with duration of diabetes [χ^2 =32.406, p –value=0.000].

Discriminant Analysis

It was observed that some of the socioeconomic variables were significantly associated with the prevalence of diabetes disability. But none was identified as most responsible one for this prevalence. The responsible variable was identified in performing discriminant analysis. The variables included in the analysis were residence, religion, gender, age, marital status, education, occupation, family income, family expenditure, Body mass index, smoking habit, consumption of process food, physical labour, utilization of time, blood pressure level and duration of diabetes. Some of these variables were significantly different for two groups of adults. These variables were significantly sufficient in discriminating the diabetic disable adults from others [= 0.943, =58.226, p –value=0.000]]. The results of the discriminant analysis were presented in Table 3. The analysis showed that the variable body mass index was most responsible one for discrimination followed by duration of diabetes, utilization of time, smoking habit, occupation, marital status, level of blood pressure, etc.

Table 3: *Results of discriminant analysis*

habit [46].

Variables	Λ	F-Statistic	p-value	Discriminant coefficient	Correlation coefficient of variable and discriminant function score, r
Residence	0.999	0.909	0.341	-0.094	-0.123
Religion	0.999	1.068	0.302	-0.154	-0.133
Gender	0.999	1.205	0.273	-0.165	0.141
Marital status	0.997	3.353	0.067	-0.202	-0.235
Age	0.998	1.551	0.213	-0.047	0.160
Education	0.999	0.981	0.322	-0.091	-0.127
Occupation	0.995	5.210	0.023	0.142	0.294
Family income	1.000	0.004	0.947	0.033	-0.009
Family expenditure	1.000	0.044	0.834	0.085	-0.027
Body mass index	0.970	30.367	0.000	0.673	0.709
Smoking habit	0.994	5.743	0.017	0.470	0.308
Consumption of process food	1.000	0.048	0.824	-0.032	-0.029
Physical labour	0.999	1.004	0.317	0.270	0.129
Utilization of time	0.992	7.841	0.005	0.151	0.360
Blood pressure	0.998	2.113	0.146	-0.038	0.187
Duration of diabetes	0.986	14.514	0.000	0.3.99	0.490

Discussion

Long-term complications of diabetes were reported in some earlier studies [4]. One of the complications is physical disability, especially among elderly adults in both developed and developing countries [5, 9, 10, and 35]. Strong association between diabetes and physical disability was reported in earlier studies [1, 6, 36, and 37]. Beside diabetes, some other clinical and socioeconomic variables were found associated with disability [35, 38, 39, and 40]. The presentation of this paper was to focus some responsible socioeconomic variables for the prevalence of diabetes disability among some Bangladeshi urban and rural adults of ages 18 years and above. For the purpose of the study the data were recorded from adults visiting some selected diagnostic centres of urban and semi-urban areas. The centres were selected purposively. The total investigated adults were 995; among them 498 were males and 497 were females. The percentages of diabetic patients and disable persons were 67.0 and 4.8, respectively in the sample. The diabetic disable patients were 43 (4.3%) and 952 adults were free of these two simultaneous health hazard. These two groups of respondents were discriminated and during discrimination some variables were identified as responsible for prevalence of diabetes disability.

In the sample there were 53.4% rural adults, 85.2% Muslim adults, 49.9% females. For all of them the risk of prevalence was higher compared to the risk of their counter parts. All 43 diabetic disable adults were married. But these four demographic characteristics were independent of prevalence of diabetes disability. The other independent demographic characteristics were age, education and occupation. But adults of ages 40 – 50 years were at 51% more risk compared to that of adults of other ages. The risk of prevalence of housewife was 97% more as it was in others. The prevalence was also higher among retired persons. The females and retired persons are not directly involved in physical labour and most of them are involved in sedentary activity [41, 42]. This study did not show any significant association between physical labour and prevalence of diabetes disability. But those who were involved in sedentary activity for them the chance of prevalence was 2.34 times as it was in others. Utilization of time was significantly associated with prevalence of this health hazard. Again, physical labour was not found associated with prevalence of the disease.

Obesity and diabetes are interrelated health hazard and these are lifestyle diseases [38, 39, 42, and 43]. Again, diabetes increases the risk of disability [5]. Hence diabetes disability are expected to be related to lifestyle. Lifestyle is related to family income and family expenditure [44, 45]. Another two components of lifestyle are smoking habit and food

These study did not show any significant association between prevalence of diabetes disability and family income or family expenditure. But adults belonged to families having minimum income of Taka 100 thousand per month were at higher risk compared to others. The chance of prevalence of the disease in adults belonged to families of lowest family expenditure was 33% more as it was for others. Though smoking habit was significantly associated with prevalence of the disease, the prevalence was not higher for smokers. The risk was 2.54 times for non- smokers. Consumption of process food was independent of prevalence of diabetes disability. The risk factor for human being is level of obesity and this factor was significantly associated with prevalence of diabetes disability. The risk of the disease for obese adults was 3.91 times as it was in others. Duration of diabetes was significantly associated with prevalence of diabetes disability. The risk of the disease was 3.11 times for adults suffering from diabetes for 10 -15 years.

Finally, it was observed that the most responsible variable for diabetes disability was body mass index followed by duration of diabetes, sedentary activity, smoking habit, being female and married, etc. These were identified from the results of discriminant analysis and risk ratios.

Conclusion

The objective of the paper was to identify some responsible socioeconomic variables for the prevalence of diabetes disability among Bangladeshi adults. The adults of ages 18 years and above visiting some pre-selected diagnostic centres located in urban and semi-urban areas were interviewed by some nurses and medical assistants of the centres. During investigation males and females were covered in the ratio 50.1: 49.9 to maintain the national level of sex ratio.

The sample covered 53.4% rural and 46.6% urban respondents. Diabetes was noted among 67% of the adults and disability was observed in 6.4% of them. Total disable adults were 4.8%.

Diabetes disability was predominant among females, Muslims and rural adults. All noted diabetic disable adults were found married. Adults of ages 40 – 50 years were at higher risk of prevalence of this health hazard compared to the risk of others. Housewives, adults of higher income group and lowest expenditure group of families were at higher risk of prevalence of the problem. But all the above socioeconomic variables were independent of diabetes disability. Adults involved in sedentary activity were at higher risk of facing the problem of this health hazard. Obese adults had around 4 times chance of affecting by the disease. Diabetic adults suffering for 10 – 15 years were at around 3 times risk of

prevalence of the problem. Level of body mass index, smoking habit, utilization of time, and duration of diabetes were significantly associated with prevalence of diabetes disability.

The two groups of respondents were significantly different in respect of variables occupation, smoking habit, utilization of time, body mass index, and duration of diabetes. Out of these above mentioned variables, the most responsible one for discrimination of two groups of adults was body mass index followed by duration of diabetes, sedentary activity, smoking habit, occupation, etc.

Due to upward social mobility and change of lifestyle the prevalence of diabetes and its complications cannot be avoided. But impacts of diabetes and other non-communicable diseases originated from diabetes can be controlled if proper action plan is formulated and implemented the plan at national level. The health planners and rural and urban health workers can do a lot to maintain a healthy life in the society. For this, the following actions can be suggested for the people in the society.

(i)   To control the body weight by doing some physical work and physical exercise so that body mass index is not increased.

(ii)   To avoid restaurant food , can food, salty and fatty food as per as possible,

(iii)   To join blood screening programme whenever it is possible.

(iv)   To adhere the regular treatment of diabetes and hypertension.

(v)   Avoid smoking and taking drugs and drinks,

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