Factors Responsible for Diabetes Neuropathy among Bangladeshi Adults

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Abstract: *The information presented here were the analytical results observed from 960 adults residing in both urban and rural areas of Bangladesh. The adults were investigated by some doctors and nurses according to convenience and quota sampling plan. In the sample, 16.1% adults were suffering simultaneously form diabetes and neuropathy. Among the investigated adults 43.5% were from rural areas and prevalence of diabetic neuropathy was noted among 16.3% of them. The prevalence rates were17.1, 16.9, 17.8, 20.5, 19.3, 22.7, 28.4 and 17.6, respectively among males, married persons, Muslim adults, adults of ages 30 - 50 years, secondary educated adults, farmers and unskilled labours, respondents from lowest family expenditure group of families and adults habituated in taking restaurant food. All categories of these respondents were more exposed to the prevalence of diabetes and neuropathy. Level of obesity was significantly associated with the prevalence of the disease under study, but overweight and obese persons were less affected (11.2%) by this health hazard. The most responsible variable for the prevalence of simultaneous diabetes and neuropathy was occupation followed by over age, physical inactivity, smoking habit, hypertension, body mass index and lower economic status. These variables were identified by factor analysis.*

Keywords: *Diabetes, Neuropathy, Association, Odds ratio, Factor analysis, Communality and Factor loadings.*

1. INTRODUCTION

Diabetic neuropathy is a common physical disorder, especially among diabetic patients. It was reported that in Bangladesh it affected 90% of the diabetic patients [1]. It is the most common form of neuropathy in the Western world and one of the most common diabetic complications [2]. The rate of prevalence of the problem was 4.3% in 2006 in India compared to 1 to 2 per cent in western world [3]. The impacts of this prevalence are great morbidity, mortality, sleep apnea, lower limb amputation and great economic burden [2 – 9]. The problem is predominant among females and older people [10]. It is also predominant among diabetic patients suffering for longer duration [11]. Besides these, the other responsible factors of the prevalence of the disease [2] are height, hyperglycemia, hypertension, waist circumference and obesity.

The objective of the present work was to explore some of the demographic variables responsible for the prevalence and non-prevalence of diabetic neuropathy among adults in Bangladesh.

2. METHODOLOGY

For the present analysis the data were recorded from urban and rural adults of ages 18 years and above by quota sampling plan to cover 70% diabetic patients so that sufficient number of adults suffering from different diseases originated from diabetes and obesity would be included in the sample [12]. During investigation data were recorded from 960 adults of ages 18 years and above living in both urban and rural areas of Bangladesh. These adults were interviewed by some doctors and nurses according to their convenience from and nearby their working places. Data were recorded from respondents through a pre-designed and pre-tested questionnaire. Maximum questions in the questionnaire were incorporated to collect demographic and social information of the respondents themselves including their blood pressure, prevalence of any other health hazard, physical activity and their lifestyle. Information of monthly family income and family expenditure (in 000 taka) were also recorded. The value of each of the variable was noted in nominal scale. The data of weight (in kg)

divided by Height (in metre^2) was used to measure the value of body mass index (BMI). The investigated subjects were classified into 4 classes, viz. underweight (if BMI < 20), normal (20 < BMI,< 25), overweight (25< BMI < 30) and obese (BMI $\geq$ 30) [13]. They were also divided into 4 groups according to their blood pressure level (mmHg). The 4 groups were identified as optimal (BP < 120/80), normal (BP <130/85), high normal (BP < 140/85) and hypertensive (BP $\geq$ 140/90) [14].

According to the objective of the study, association of any of the socioeconomic characteristics with level of blood pressure was examined. Significant association was decided if p-value of any Chi-square test statistic was $\leq$ 0.05. The odds ratio [O.R] in favour of a higher group (in percentage) of any demographic characteristic was calculated. Factor analysis was done to identify responsible variables for the prevalence of the disease. The analysis was done using SPSS version 25.

3. RESULTS

Out of 960 adults 66.9% were diabetic and prevalence of neuropathy was noted among 24.1% of them [Table 1].

Table1. *Distribution of adults according to prevalence of diabetes and neuropathy*

Prevalence of diabetes	Prevalence of Neuropathy				Total	
	Yes		No			
	N	%	N	%	N	%
Yes	155	24.1	487	75.9	642	66.9
No	0	0.0	318	100.0	318	33.1
Total	155	16.1	805	83.9	960	100.0

No non-diabetic patient was suffering from neuropathy. Prevalence of diabetes and prevalence of diabetes neuropathy were significantly associated [χ^2 =91.559, p-value = 0.000]. The percentage of rural adults was 43.5 and 16.3% of them were suffering from diabetes neuropathy .This percentage was slightly less (16.1%) among urban adults. But urban and rural adults were similarly exposed to this health problem [Table 2; O.R.= 1.02, S.E{ln O.R)= 0.18}, χ^2 =0.008,p-value=0.928]. In the sample there were 55.2% male respondents and among 17.0% of them the prevalence of diabetes neuropathy was noted. However, the prevalence rate was not associated with sex [χ^2 =0.610,p-value=0.485]. However, the chance of male to be affected by the problem was 1.15 times compared to that of female [O.R.=1.15, S.E{ln(O.R.)} =0.18].

The Muslim respondents (82.6%) had 2.36 times chance to be affected by this health hazard as it was for non-Muslim adults. The prevalence rate (17.8%) among Muslim was more than double compared to their non-Muslim counterpart (8.4%). This differential was highly significant [χ^2 =8.998, p-value=0.003; O.R.=2.36, S.E { ln(O.R.)}=0.29]. The chance of prevalence of the problem among married persons was 1.20 times as it was in single adults [O.R.-1.20, S.E.{ln(O.R.)}=0.20]. But prevalence of diabetes neuropathy was not significantly associated with marital status [χ^2 =0.849, p-value=0.357], though prevalence rate (16.9%) was more among married adults (69.8%) compared to that of single adults (14.5%). Secondary educated adults were 23.9%, 21.0% of them were facing the simultaneous problem of diabetes and neuropathy. They were 1.47% times more exposed to the problem of this health hazard [O.R.= 2.47,S.E.{ ln(O.R.)}=0.0.21]. The prevalence rate was significantly associated with diabetes neuropathy [χ^2 =8.158, p-value=0.043]. The rates were in decreasing trend with the increase in level of education. Significant decreasing trend [χ^2 =11.277,p-value=0.010] in rates of this health hazard was also noted with the increase in white collar job. The rates were lower among servicemen (13.1%) and businessmen (13.7%). Surprisingly enough, this prevalence rate (22.7%) was very high among farmers and unskilled labours. In the sample they were 26.6%. This group was 17% more exposed to this health hazard [O.R.= 1.17;S.E{ln(O.R.)} = 0.23]. This group was doing physical labour, but still they were more exposed to this health problem. Similar was the case with adults doing physical work (36.6%). They were more exposed by 31% [O.R.= 1.31, S.E { ln(O.R.)}= 0.18], though involvement in physical labour was independent of prevalence of diabetes neuropathy [χ^2 = 2.301, p-value=0.129]. The percentage of adults who did some physical work, 18.5% of them had this health problem. The corresponding percentage

among adults who did not do any physical labour was 14.8. The prevalence rate of diabetes neuropathy was not significantly increased [χ^2 =8.665, p-value=0.070] with age.

Table2. *Distribution of adults according to socioeconomic characteristics and prevalence of diabetes neuropathy*

Socioeconomic characteristics	Prevalence of diabetes neuropathy				Total	
	Yes		No			
	N	%	N	%	N	%
Residence						
Rural	68	16.3	350	83.7	418	43.5
Urban	87	16.1	455	83.9	542	56.5
Total	155	16.1	805	83.9	960	100.0
Gender						
Male	90	17.0	440	87.0	530	55.2
Female	65	15.1	365	84.9	430	44.8
Religion						
Muslim	141	17.8	652	82.2	793	82.6
Non-Muslim	14	8.4	153	91.6	167	17.4
Marital status						
Currently married	113	16.9	557	83.1	670	69.8
Currently single	42	14.5	248	85.5	290	30.2
Age (in years)						
< 20	4	14.3	24	85.7	28	2.9
20 – 30	19	11.7	143	88.3	162	16.9
30 – 40	45	18.0	205	82.0	250	26.0
40 – 50	54	20.5	210	79.5	264	27.5
50$^+$	33	12.9	213	87.1	256	26.7
Education						
Illiterate	10	18.5	44	81.5	54	5.6
Primary	22	19.1	93	80.9	115	12.0
Secondary	48	21.0	181	79.0	229	23.9
Higher	75	13.3	487	86.7	562	58.5
Occupation						
Agriculture and unskilled labor	58	22.7	197	77.3	255	26.6
Business and skilled labor	22	13.7	139	86.3	161	16.8
Service	28	13.1	185	86.9	213	22.2
Housewives, students and unemployed	47	14.2	284	85.8	331	34.5
Income (in 000 taka)						
< 40	70	22.5	241	77.5	311	32.4
40 – 60	23	12.2	166	87.8	189	19.7
60 – 80	25	13.3	163	86.7	188	19.6
80 – 100	24	15.0	136	85.0	160	16.7
100$^+$	13	11.6	99	88.4	112	11.7
Smoking habit						
Yes	61	16.4	312	83.6	373	38.9
No	94	16.0	493	84.0	587	61.1
Family expenditure (in 000 taka)						
< 30	33	28.4	83	71.6	116	12.1
30 – 50	52	17.6	243	82.4	295	30.7
50 – 70	26	12.5	182	87.5	208	21.7
70 – 90	26	14.7	51	85.3	177	18.4
90$^+$	18	11.0	146	89.0	164	17.1
Taking restaurant food						
Yes	87	17.6	106	82.4	493	51.4
No	68	14.6	399	85.4	467	48.6
Use of can food						
Yes	92	15.8	492	84.2	584	60.8
No	63	16.8	313	83.2	376	39.2

Physical work						
Yes	65	18.5	286	81.5	318	36.6
No	90	14.8	519	85.2	609	63.4
Utilization of time						
Read and use mobile phone	13	9.4	126	90.6	139	14.5
Play and use mobile phone	46	19.1	195	80.9	241	25.1
Do household work and watch T.V.	54	21.9	193	78.1	247	25.7
Read paper and use mobile phone after office work	41	16.5	208	83.5	249	25.9
Watch T.V. and use mobile phone after office work	1	1.2	83	98.2	84	8.8
Level of Obesity						
Under weight	17	20.0	68	80.0	85	8.9
Normal weight	91	20.0	365	80.0	456	47.5
Overweight	37	11.3	290	88.7	327	34.1
Obese	10	10.3	82	89.7	92	9.6
Level of hypertension						
Optimal	66	15.1	370	84.9	436	45.4
Normal	71	18.7	308	81.3	379	39.5
High Normal	17	18.9	73	81.1	90	9.4
Hypertensive	1	1.8	54	98.2	55	5.7
Duration of Disease (in years)						
0	150	18.6	658	81.4	808	84.2
< 1	1	3.6	27	96.4	28	2.9
1 − 3	3	4.8	59	95.2	62	6.5
3 − 5	0	0.0	32	100.0	32	3.3
5+	1	3.3	29	96.7	30	3.1
Total	155	16.1	805	83.9	960	100.0

But adults of ages 30 to 50 years were 66% more exposed [R.R = 1.66, S,R. {ln(O.R.)} = 0.18] to this health problem. In the sample, they were 53.5% and 19.0% of them were patients of diabetes neuropathy as against the overall 16.1 % patients of this category.

The percentage of adults of lowest income was 32.4 and 22.5% of them were patients of diabetes neuropathy. Lowest rate (11.6%) of this type of patients was noted in the families of highest income group (11.7%). The differences in proportions of diabetes neuropathy patients in families of different levels of income were significant [χ^2 = 14.491, p- value = 0.006]. Lowest income group of adults was 93% more exposed to this health problem [R.R.=1.93, S.E.{ln(O.R)} = 0.18]. Lowest family expenditure was also the risk factor for adults to be affected by this disease [O.R.= 2.35, S.E.{ln(O.R) } = 023].

It was observed that only 12.1% adults had lowest family expenditure and 28.4% of them were suffering from this disease. There was a decreasing trend of prevalence rate of the disease with the increase in family expenditure [χ^2 = 19.003, p value = 0.001].

Habit of taking restaurant food and can food were not associated with the prevalence of diabetes neuropathy [χ^2 = 1.687, p –value = 0.194; χ^2 = 0.170, p value = 0.880, respectively]. However, habituated in restaurant food created 1.26 times risk to this health problem for 51.4% adults and already [O.R.=1.26,S.E.{ln(O.R.)}=0.18] 17.6% of them were suffering from diabetes neuropathy. The percentage of can food users was 60.8 but 15.8% of them were experienced of this health hazard as against 16.8% of their counterpart. However, habit of taking can food was not the risk factor for the prevalence of diabetes neuropathy [O.R.=1.08, S.E.{ln(O.R.)}=0.18].

Level of obesity was significantly associated with prevalence of diabetes neuropathy but it was amazing that the prevalence rates were higher (20.0% in each case) among both underweight (8.9%) and normal group (47.5%). Significant [χ^2 = 13.551, p-value = 0.004] decreasing trend of prevalence rate was noted among overweight (34.1%) and obese group of adults (9.6%). The affected adults in these two groups were 11.3% and 10.3%, respectively. The chance to be affected by this health problem was 1.97 times for adults having lower level of BMI [O.R.=1.97, S.E.{ln(O.R}= 0.19].

Level of hypertension was significantly associated [χ^2 = 11. 041,p value = 0.012] with

the prevalence of diabetes neuropathy and adults including normal, high normal and hypertensive group was 15% more exposed to this health hazard [O.R.=1.15, S.E.{ln(O.R.)}=0.18}]. A big group of adults (45.4%) were of optimal blood pressure and 15.1% of them were suffering from this health problem as against 16.1% sufferers in the sample.

Duration of diseases was a significant factor for the [χ^2 = 22.415, p-value = 0.000] prevalence of diabetes neuropathy though only 5 adults were suffering for more times. These 5 patients were not really exposed to this health problem

[O.R.=0.15, S.E. { ln(O.R.)}0.46].

It was noted that 34.7% adults were involved in sedentary activities but only 12.6 % of them were affected by this health hazard and they were less exposed to the prevalence of diabetes neuropathy [O.R = 0.66,S.E { ln(O.R.)}= 0.20]. However, there was significant association between utilization of time and prevalence of

diabetes neuropathy [χ^2 =26.135, p-value=0.000].

3.1. Factor Analysis

As per objective of the study, attempt was made to identify some of the socioeconomic characteristics enhancing the prevalence of diabetes neuropathy among adults. The identification was done by factor analysis. The variables included for the analysis were residence, religion, gender, marital status, age, education, occupation, income, expenditure, body mass index, level of hypertension, habit of taking restaurant food and can food, smoking habit, physical activity and utilization of time by the respondents. Though the inclusion of the variables was not significant [KMO= 186.157, F= 1.158, p-value = 0.252], still some variables were identified as responsible for the prevalence of the disease. The identification was done using the higher absolute value of the factor loadings [15, 16]. The results of the analysis were presented in Table 3.

Table3. *Results of factor analysis*

Variable	Communality	Coefficient of		
		Factor - 1	Factor-2	Factor -3
Residence	0.486	0.080	0.578	0.384
Religion	0.985	-0.334	-0.930	0.097
Gender	0.394	0.348	-0.432	0.394
Age	0.944	0.937	0.257	0.018
Marital status	0.985	-0.334	-0.930	0.097
Education	0.953	-0.582	0.511	0.595
Occupation	0.995	0.981	0.065	-0.165
Income	0.959	-0.710	0.671	-0.074
Expenditure	0.978	-0.732	0.654	-0.120
Body mass index	1.000	0.745	0.355	-0.458
Utilization of time	0.935	-0.129	0.911	-0.297
Habit of taking restaurant food	0.698	0.042	-0.777	-0.303
Habit of taking can food	0.944	0.525	0.177	0.89
Physical labour	0.999	-0.936	-0.309	0.168
Duration of disease	0.989	0.301	0.231	0.920
Hypertension	0.968	0.777	-0.546	0.251
Smoking habit	0.999	0.936	0.309	-0.168

It was seen that the most responsible variable was occupation followed by age, physical labour, smoking habit, hypertension, body mass index, and family expenditure.

4. DISCUSSION

Except clinical and subclinical aspects, some of the demographic characteristics are responsible for the prevalence of diabetes neuropathy [1, 8, 9]. Accordingly, an attempt was made to identify the most responsible variable for this health hazard. To fulfil the objective, the analysis was done using the collected data of

960 adults of ages 18 years and above. The adults were interviewed by some doctors and nurses using quota sampling plan to cover 70% diabetic patients so that the sample would contain sufficient number of adults of diabetes and patients of diabetes related diseases simultaneously.

The analysis showed that males, married adults, Muslim respondents, illiterate persons, and physically inactive persons were more exposed to the simultaneous problem of diabetes and neuropathy. In earlier studies, it was observed that diabetes was pre-dominant among these

adults [17 – 20]. This analysis indicated that prevalence of diabetes and prevalence of neuropathy was significantly associated. In many studies it was noted that age was the risk factor for diabetes and its related diseases [21 – 24]. This study showed significant association between age and prevalence of diabetes neuropathy. But majority adults of ages 30-50 years were more exposed to this health hazard. Family higher economic condition was the risk factor for diabetes [17, 20, 23]. But this study showed the evidence that lower level of family economy was the cause of prevalence of diabetes neuropathy. In earlier studies it was reported that obesity was one of the cause of prevalence of this health hazard [2, 25]. It was evident from this study that level of obesity was significantly associated with the prevalence of diabetes neuropathy. But adults of underweight and normal weight were more exposed to this health problem. Adults of optimal blood pressure were less exposed to the prevalence of diabetes neuropathy. Another important factor for this health problem was the duration of diseases.

The factor analysis identified some of the responsible factors for the prevalence of diabetes neuropathy. These factors were occupation, age, physical inactivity, smoking habit, hypertension, body mass index and family expenditure.

5. CONCLUSION

The information incorporated in the paper was the analytical results observed from the data collected from 960 adults of ages 18 years and above. Out of 960 adults, 16.1% were patients of diabetes and neuropathy simultaneously. The percentages of males, married persons, Muslim adults, illiterate adults, farmers were 55.2, 69.8, 82.6, 5.6 and 26.6, respectively. All categories of these respondents were more exposed to the prevalence of diabetes and neuropathy.

Prevalence of the disease was more among old people, adults of lower economic conditions, physically inactive adults, smokers and hypertensive people. Though level of obesity was significantly associated with the prevalence of the disease under study, overweight and obese persons were less affected by this health hazard. Habit of taking restaurant food was a risk factor for this disease. The disease was dominant among patients suffering for longer duration. However, the most responsible variable for the prevalence of diabetes neuropathy was occupation of adults. The other

responsible variables were higher age, physical inactivity, smoking habit, hypertension, lower level of obesity and lower economic condition.

Diabetes and diseases originated from it cannot be avoided. But steps can be taken as a precaution so that the rate of obese and diabetic patients can be reduced. For this, people can be advised to

(i)   To control their body weight by doing some physical work and developing the habit of walking whenever it is possible,

(ii)   To avoid restaurant and can food, salty and fatty food and to develop the habit of taking home made food as per as possible,

(iii)   To avoid smoking and taking drugs and drinks,

Government, rural and urban health service providers can encourage the people to follow the above suggestions.

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