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Factors Influencing Non-Communicable Diseases in Male and Female Adults of Bangladesh.

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Abstract

In this paper an attempt was made to identify some variables responsible for 3 different non-communicable diseases in rural and urban adults. The study was made using data collected from 498 males and 497 females of both urban and rural areas of Bangladesh. Out of 498 males 13.1% were the patients of heart disease. The corresponding percentage in 497 females was 12.3. The percentages of males having eye problem, kidney diseases and disability were 11.4, 10.4, and 4.0, respectively irrespective of prevalence of diabetes. These percentages among females were 13.3, 8.0, and 5.6, respectively. The influencing factors for non-communicable diseases in males were family income, family expenditure and physical inactivity. Family income, physical inactivity and habit of taking restaurant food were the responsible variables for heart disease in females. Family income, family expenditure and habit of taking restaurant food were the influencing factors for eye problem in females. Old age, hypertension and longer duration of diabetes were the influencing factors for kidney disease in females. All these influencing factors were identified by factor analysis.

Key Words: Non-communicable diseases; socioeconomic variables; responsible variables; Association; Factor analysis; Factor loading.

Introduction

Obesity, diabetes, hypertension are the major non-communicable diseases (NCDs) and these three are the sources of many other non-communicable diseases. These are non-infectious or non-transmissible but some of these are chronic diseases which last for long periods of time and progress slowly. Obesity in children, adolescents and adults is a major health hazard and this health problem exists in the developed world. It is now increasing in the low-income and middle-income countries also and it is associated with early mortality. NCDs prevail mostly due to change of lifestyle in food habit and working habit in developing countries [1]. People are habituated in taking unhealthy foods rich in sugar, salt and saturated fat. These foods are risk factor for obesity and ultimately other NCDs which result in rapid deaths due to autoimmune diseases, heart diseases, stroke, cancer, diabetes, chronic kidney disease, osteoporosis, Alzheimers disease, cataracts and others. These diseases are the major health burden in the industrialized countries and in the developing countries. More than 36 million people die annually from NCDs (63% of global deaths), including one-third people younger before the age of 60 years [2, 3,4]. More than 90% of these premature deaths from NCDs occur in low- and middle-income countries. Like many low-income countries around the world, Bangladesh is in the midst of an epidemiologic transition where the burden of disease is shifting from a disease profile dominated by infectious diseases, under-nutrition and conditions of childbirth to one increasingly characterized by NCDs [5]. The NCDs are responsible for half of annual mortality (51%) and almost half of the burden of disease (41%) [6]. Recent estimate observed in 2011 indicate that two-thirds deaths each year are attributable to NCDs of total death as against only 11% of total deaths due to communicable diseases [5, 7]. Four-fifth of total deaths are in lower income and middle-income countries and these deaths are nearly two times higher than in high-income countries. Total NCDs deaths are in increasing trend throughout the world due to population ageing.

One of the causes of increasing trend in death is the increase in number of tobacco consumers. The major causes of death in Bangladesh gradually shifted from acute infectious and parasitic diseases to NCDs.

Diabetes is one of the major components of NCDs [1, 8]. It is associated with prolonged ill health and death due to vascular diseases [9, 10, 11, 12]. Around 415 million people have diabetes in the world and 78 million people are in South-east Asia region; by 2040 this will rise to 140 million. Bangladesh is one of the 6 countries of South-east Asia. There were 7.1 million cases of diabetes in Bangladesh in 2015. The prevalence of diabetes in adults (20-79 years of age) is 7.4% in Bangladesh [13]. The risk factors for cardiovascular disease are glucose and lipid abnormalities and the prevalence of this disease is a major factor due to diabetes in both developed and developing countries [14, 15]. Diabetes is prevalent among 10% people of Bangladesh and according to the International Diabetes Federation, the prevalence will be 13% by 2030 [14]. The other causes of deaths due to NCDs are hypertension, tobacco smoking etc. [16,17, 18, 19].

It was observed that some socioeconomic characteristics are responsible for different types of NCD prevailed in Bangladeshi adults. In this paper, an attempt was made to identify some socioeconomic factors for heart problem, eye problem, and kidney disease among Bangladeshi adult males and females separately. Attempt was also made to study the association of non-communicable diseases with some of socioeconomic variables.'

Methodology

For the study, the data were collected from two group of adults; in one group there were 498 males and in another group there were 497 female adults of 18 years and above. Data were collected by some nurses and medical assistants working in different diagnostic centres located in both urban and semi-urban areas of Bangladesh. The centres were selected purposively. For both groups of adults the sex ratio was approximately similar to the sex ratio 50.1: 49.9 at national level [19]. Most of the investigated respondents of both groups were diabetic patients [71.5% males and 62.6% females]. The data were collected during the academic session 2018-19.

From each of the investigated respondent the information on different socioeconomic variables were recorded through a pre-designed and pre-tested questionnaire containing different questions related to personal demographic characteristics and lifestyle. The data on prevalence of any of the non-communicable diseases, duration of the diseases, and the stages of treatment of the diseases including cost of treatment for medication and hospitalization were also recorded. Value of each variable was recorded in nominal scale. The investigated units of each group were classified into for classes according to their body mass index (BMI) and another 4 classes according to their blood pressure (B.P mmHg). The value of weight (in kg) of each respondent was divided by his/her height (in metre^2) to get the value of BMI and adults were identified as obese (if BMI $\geq$ 27.5); underweight ,if BMI< 18.5; normal, if 18.5 $\leq$BMI< 23.0; and overweight, if 23.0 <BMI< 27.5) [20, 21]. The 4 classes of adults were optimal (if BP < 120/80), normal (if BP <130/85), high normal (if BP < 140/90) and hypertensive (if BP $\geq$ 140/90) [22, 23].

One of the objectives of the study was to investigate the association of each of the socioeconomic variable with prevalence of different non-communicable disease. Significant association was decided by Chi-square test when P (χ^2) $\leq$0.05. Before performing factor analysis, the association of prevalence of NCDs and any of the socioeconomic variables was investigated results were presented for significantly associated variables. Factor analysis was done separately for males and for females to identify the important variable for the prevalence of any of the non-communicable diseases [24, 25, 26, 27, 28]. Due to smaller number of disable patients in both groups, factor analysis was not feasible. The most important variables were identified on the basis of absolute values of factor loadings. All the calculations were done using SPSS Version 25.

Result

In the sample, there were 498 males and 497 females. Among males 61.0% were free of heart disease, retinopathy and kidney disease. Only 4.0% were suffering from disability. The percentages of male adults having heart disease, retinopathy and kidney disease were 13.1, 11.4 and 10.4, respectively. The number of sample females was 497 and 60.8% of them were free of any of the above-mentioned health problem. The percentages of patients of the above 4 diseases were 12.3, 13.3, 8.0 and 5.1, respectively. However, there was no significant difference in the proportions of patients of NCDs in males and females as was observed by Chi-square test [χ^2 =3.690, p –value=0.450].

The diseases mentioned above were non-communicable ones. These non-communicable diseases were significantly associated with some of the socioeconomic variables recorded from both males and females. Significant association of prevalence of NCDs with smoking habit, sedentary activity, body mass index, prevalence of diabetes, duration of diabetes and blood pressure of males was observed. The classified information of these variables were presented in Table 1. It was observed from the results presented in Table 1 that 55% males were smokers and 16.1% of them were suffering from heart problem. This percentage was higher than the overall percentage of male patients of heart disease. Higher percentage (63.8%) of non-smokers were free of any of the mentioned non-communicable diseases. Smoking habit was significantly associated [χ^2 = 9.870, p –value=0.043] with non-communicable diseases. Similar significant result was observed in studying the association between sedentary activity and non-communicable diseases [χ^2 =14.145, p –value=0.007]. More (17.8%) sedentary activists were patients of heart problem. Those who were not involved in sedentary activity 66.6% of them were free of any of NCDs. The percentage of obese males was 29.1 and 25.5% of them were kidney patients. The next higher percentage (22.1%) was for heart patients. The corresponding percentages were lower in overweight, normal and underweight males. Obesity and non-communicable diseases were significantly associated [χ^2 = 143.484, p –value=0.000]. Prevalence of diabetes was noted in 71.5% males. Among the diabetic patients 14.6% had heart problem. However, a big (56.2%) group of diabetic patients head no other health problem. Non-communicable diseases was significantly associated with

prevalence of diabetes and duration of diabetes [χ^2 =16.300, p –value=0.003; χ^2 = 48.473, p –value=0.000]. Diabetic patients suffering for 15 years and above were 8.6%, 25.6% of them had kidney problem. The next higher percentage of males (20.9) had heart disease. The percentage of hypertensive males was 6.4. Among them, 34.4% had heart problem. Hypertensive kidney patients were 18.8%. The level of blood pressure and non-communicable diseases were significantly associated [χ^2 = 60.764, p –value=0.000].

In analysing data recorded from female adults it was observed that each of the variable age, physical labour, smoking habit, sedentary activity, body mass index, prevalence of diabetes, duration of diabetes and blood pressure was associated with non-communicable diseases. The analytical results were presented in Table 2. Among females, 60.8% were free of any of the above mentioned non-communicable diseases. This percentage was higher (73.7%) in younger adults and lowest (29.6%) in oldest people and it was decreasing with the increase in ages. Age and prevalence of non-communicable diseases were significantly associated [χ^2 = 44.227, p –value=0.000]. More kidney patients (29.6%) were of ages 60 years and above and retinopathy patients (18.5%) were also in this group of adults. More patients of heart disease (16.2%) was noted in physically inactive adults (55.9%). The corresponding percentage (7.3%) was lower in physically active females. Physical activity was significantly associated with prevalence of non-communicable diseases [χ^2 = 10.625, p –value=0.031]. The percentage of females involved in sedentary activity was 54.9. Among them patients of heart problem were more (16.1%) and adults free of non-communicable diseases were less (54.6%0) compared to females not involved in sedentary activity. Sedentary activity and non-communicable diseases were significantly associated [χ^2 = 15.772, p –value=0.003]. Significant association between smoking habit and diseases was also observed [χ^2 = 87.052, p –value=0.000]. The percentage of smoker females was 11.1 and higher percentage (50.9%) of them had heart problem. The corresponding percentage in non-smokers was less (7.6%). More non-smoker females (64.0%) were free of the diseases compared to that in (34.5%) in smoker females. Higher proportion (0.893) of underweight females were free of the diseases. The corresponding proportion (0.232) in obese females was lowest. More obese females were patients of kidney disease (24.4%) and heart diseases (21.3%). Obesity was significantly influencing the non-communicable diseases [χ^2 = 148.806, p –value=0.000]. In a similar way, prevalence of diabetes [χ^2 = 34.684, p –value=0.000] and duration of diabetes were significantly influencing [χ^2 = 87.165, p –value=0.000] the non-communicable diseases. It was seen that 37.2% females were non-diabetic adults and 76.3% of them were free of non-communicable diseases. The percentages of females of heart problem (6.5%), eye problem (11.3)and kidney disease (4.3%) were lower compared to the corresponding percentages 15.8%, 14.5% and 10.3% in diabetic females. The proportions of patients of these three diseases were 0.214, 0.250 and 0.321, respectively in diabetic females. Lowest percentage (21.4%) of females having high normal blood pressure were free of non-communicable diseases. Higher proportion (0.405) of this group of females were patients of heart disease. Similar higher proportion (0.259) of patient of heart disease was observed among hypertensive adults. Level of blood pressure was significantly associated with non-communicable diseases [χ^2 =85.531, p –value=0.000].

Variable	Prevalence of non-communicable diseases					Total
	None	Heart	Eye	Kidney	Disability	
	N %	N %	N %	N %	N %	N %
Smoking habit						
Yes	161 58.8	44 16.1	29 10.6	33 12.0	7 2.6	274 55.0
No	143 63.8	21 9.4	28 12.5	19 8.5	13 5.8	224 45.0
Total	304 61.0	65 13.1	57 11.4	52 10.4	20 4.0	498 100.0
Sedentary activity						
Yes	85 50.3	30 17.8	21 12.4	23 13.6	10 5.9	169 33.9
No	219 66.6	35 10.6	36 10.9	29 8.8	10 3.0	329 66.1
Body mass index						
Underweight	8 80.0	1 10.0	1 10.0	0 0.0	0 0.0	10 2.0
Normal	76 69.7	14 12.8	12 11.0	5 4.6	2 1.8	109 21.9
Overweight	188 80.3	18 7.7	13 5.6	10 4.3	5 2.1	234 47.0
Obese	32 22.1	32 22.1	31 21.4	37 25.5	13 9.0	145 29.1
Prevalence of diabetes						
Yes	200 56.2	52 14.6	41 11.5	45 12.6	18 5.1	356 71.5
No	104 73.2	13 9.2	16 11.3	7 4.9	2 1.4	142 28.5
Duration of diabetes(in years)						
Does not arise	104 73.2	13 9.2	16 11.3	7 4.9	2 1.4	142 28.5
< 5	93 66.9	21 15.1	10 7.2	10 7.2	5 3.6	139 27.9
5 – 10	59 59.0	10 10.0	16 16.0	11 11.0	5 5.0	100 20.1
10 – 15	32 43.2	12 16.2	10 13.5	13 17.6	7 9.5	74 14.9
15^+	16 37.2	9 20.9	6 14.0	11 25.6	1 2.2	43 8.6
Blood pressure						
Optimal	174 72.8	17 7.1	28 11.7	12 5.0	8 3.3	239 48.0
Normal	76 69.7	14 12.8	12 11.0	5 4.6	2 1.8	109 21.9
High normal	28 37.8	20 27.0	8 10.8	13 17.6	5 6.8	74 14.9
Hypertensive	11 34.4	11 34.4	3 9.4	6 18.8	1 3.1	32 6.4

Total	304 61.0	65 13.1	57 11.4	52 10.4	20 4.0	498 100.0

Table 1: Distribution of male adults according to prevalence of non-communicable diseases and socioeconomic variables

Variable	Prevalence of non-communicable diseases					Total
	None	Heart	Eye	Kidney	Disability	
	N %	N %	N %	N %	N %	N %
Age (in years)						
< 25	84 73.7	8 7.0	15 13.2	4 3.5	3 2.6	114 22.9
25 – 40	139 60.2	31 13.4	36 15.6	12 5.2	13 5.6	231 46.5
40 – 50	59 58.4	15 14.9	7 6.9	12 11.9	8 7.9	101 20.3
50 – 60	12 50.0	3 12.5	3 12.5	4 16.7	2 8.3	24 4.8
60^{+}	8 29.6	4 14.8	5 18.5	8 29.6	2 7.4	27 5.4
Physical labour						
Yes	135 61.6	16 7.3	34 15.5	19 8.7	15 6.8	219 44.1
No	167 60.1	45 16.2	32 11.5	21 7.6	13 4.7	278 55.9
Smoking habit						
Yes	19 34.5	28 50.9	6 10.9	1 1.8	1 1.8	55 11.1
No	283 64.0	33 7.6	60 13.6	39 8.8	27 6.1	442 88.9
Sedentary activity						
Yes	149 54.6	44 16.1	36 13.2	23 8.4	21 7.7	273 54.9
No	153 68.3	17 7.6	30 13.4	17 7.6	7 3.1	224 45.1
Body mass index						
Underweight	25 89.3	2 7.1	0 0.0	1 3.6	0 0.0	28 5.6
Normal	105 84.7	2 1.6	10 8.1	5 4.0	2 1.6	124 24.9
Overweight	136 71.6	24 12.6	12 6.3	9 4.7	9 4.7	190 38.2
Obese	36 23.2	33 21.3	44 28.4	25 16.1	17 11.0	155 31.2
Prevalence of diabetes						
Yes	160 51.4	49 15.8	45 14.5	32 10.3	25 8.0	311 62.6
No	142 76.3	12 6.5	21 11.3	8 4.3	3 1.6	186 37.4
Duration of diabetes						
Does not arise	142 76.3	12 6.5	21 11.3	8 4.3	3 1.6	186 37.4
< 5	96 63.2	14 9.2	21 13.8	12 7.9	9 5.9	152 27.9
5 – 10	49 46.2	26 24.5	11 10.4	9 8.5	11 10.4	106 21.3
10 – 15	10 40.0	3 12.0	6 24.0	2 8.0	4 16.0	25 5.0
15^{+}	5 17.9	6 21.4	7 25.0	9 32.1	1 3.6	28 5.6
Blood pressure						
Optimal	212 70.4	21 7.0	43 14.3	12 4.0	13 4.3	301 60.6
Normal	69 54.3	16 12.6	15 11.8	14 11.0	13 10.2	127 25.6
High normal	9 21.4	17 40.5	7 16.7	8 19.0	1 2.4	42 8.5
Hypertensive	12 44.4	7 25.0	1 3.7	6 22.2	1 3.7	27 5.4
Total	302 60.8	61 12.3	66 13.3	40 8.0	28 5.6	497 100.0

Table 2: Distribution of female adults according to prevalence of non-communicable diseases and Socioeconomic variables

The analysis presented above indicated that some of the variables were significantly associated with NCDs. From data 4 types of NCD were noted. But association between any of the disease with socioeconomic variable was not studied and responsible variable for any of the disease was not identified. Accordingly, factor analysis was done to identify the responsible variables for each of the disease in males and females separately. The variables included in the analysis were residence, religion, age, marital status, education, occupation, family income, family expenditure, habit of taking restaurant food, smoking habit, body mass index, sedentary activity, physical labour, prevalence of diabetes, duration of diabetes and blood pressure. In analysing data the communalities of some of the variables were found less than 0.50. Those variables were deleted from final analysis [28]. From final analytical results it was found that the most responsible variable was family expenditure followed by family income and physical inactivity for heart disease in males. For prevalence of heart disease in females the most responsible variable was family income followed by physical inactivity and habit of taking restaurant food. The analytical results of factor analysis were presented in Table 3, Table 4, and Table 5. The most responsible variable for eye problem in males was family income followed by family expenditure and physical inactivity. The responsible variables for eye problem in females were famly expenditure family income and physical inactivity. Another important variable for eye problem in females was habit of taking restaurant food. The most responsible variable for kidney disease in males was family income followed by family expenditure, physical inactivity and education. The variable age was the most responsible variable for kidney disease in females followed by blood pressure and duration of diabetes.

	Male			Female		
Variable	Communality			Communality		
	Initial	Final	Factor loading	Initial	Final	Factor loading
Residence	0.249			0.117		
Religion	0.018			0.036		
Marital status	0.022			0.117		
Age	0.492			0.678		
Education	0.270			0.302		
Occupation	0.052			0.105		
Family income	0.577	0.76	0.876	0.624	0.746	0.864

		8				
Family expenditure	0.782	0.872	0.934	0.404		
Habit of taking restaurant food	0.468			0.515	0.642	0.801
Smoking habit	0.311			0.421		
Physical labor	0.673	0.719	-0.848	0.626	0.710	-0.843
Sedentary activity	0.166			0.046		
Body mass index	0.201			0.185		
Prevalence of diabetes	0.207			0.364		
Duration of diabetes	0.597			0.789		
Blood pressure	0.569			0.185		

Table 3: Results of factor analysis for heart disease in males and females.

	Male			Female		
Variable	Communality			Communality		
	Initial	Final	Factor loading	Initial	Final	Factor loading
Residence	0.147			0.291		
Religion	0.014			0.197		
Marital status	0.114			0.305		
Age	0.802			0.591		
Education	0.380			0.142		
Occupation	0.220			0.359		
Family income	0.856	0.892	0.945	0.828	0.875	0.936
Family expenditure	0.801	0.880	0.938	0.821	0.897	0.947
Habit of taking restaurant food	0.320			0.562	0.539	0.734
Smoking habit	0.023			0.191		
Physical labor	0.610	0.686	-0.828	0.620	0.739	0.805
Sedentary activity	0.095			0.214		
Body mass index	0.477			0.046		
Prevalence of diabetes	0.222			0.351		
Duration of diabetes	0.429			0.269		
Blood pressure	0.796			0.413		

Table 4: Results of factor analysis for retinopathy in males and females.

	Male			Female		
Variable	Communality			Communality		
	Initial	Final	Factor loading	Initial	Final	Factor loading
Residence	0.295			0.176		
Religion	0.161			0.182		
Marital status	0.093			0.089		
Age	0.535			0.731	896	0.947
Education	0.520	0.500	0.676	0.374		
Occupation	0.143			0.237		
Family income	0.790	0.878	0.937	0.722		
Family expenditure	0.840	0.889	0.943	0.712		
Habit of taking restaurant food	0.500			0.455		
Smoking habit	0.315			0.047		
Physical labor	0.513	0.629	-0.793	0.685		
Sedentary activity	0.046			0.495		
Body mass index	0.301			0.375		
Prevalence of diabetes	0.009			0.201		
Duration of diabetes	0.241			0.783	0.803	0.896
Blood pressure	0.737			0.571	0.705	0.940

Table 5: Results of factor analysis for kidney disease in males and females.

Discussion

Some of the non-communicable diseases are heart disease, cardiovascular disease, stroke, retinopathy, renal disease and many others. Obesity, Diabetes and hypertension are inter associated health hazard and are the sources of many non-communicable diseases [29, 30, 31.]. Some of these health hazards are lifestyle diseases and are associated with socioeconomic variables. This was observed in many studies in both home and abroad [21, 32, 33, 34, 35, 36, 37, 38, 39]. The present paper was mainly to identify some responsible variables for heart disease, retinopathy, and kidney disease in Bangladeshi adult males and females . The responsible variables were identified by factor analysis.

The analysis was based on data collected from 498 males and 497 females. Among males 61.0% were free of heart disease, retinopathy, kidney disease and disability. This figure in females was 60.8. The percentages of male patients of heart, retinopathy, kidney and disability were 13.1, 11.4, 10.4 and 4.0, respectively. The corresponding figures in females were 12.3, 13.3, 8.0 and 5.6.

These figures for both males and females were statistically similar. Age was not an associated factor for non-communicable diseases in males, but higher proportion of eldest females were suffering from kidney disease. Physical labor was associated with non-communicable diseases prevailed in females but not in males. Due to physical inactivity proportion of female heart patients were more compared to the overall proportion of female heart patients. Proportion of female smoker heart patients (50.9%) was very high compared to that of (16.1%) male smoker adults. Higher (66.6%) proportion of males and females (68.3%) not involved in sedentary activity were free of these 4 non-communicable diseases. Due to sedentary activity heart problem was prevailed in higher rate in males (17.8%) and in females (16.1) compared to the rates of other diseases. The percentages of non-diabetic males and non-diabetic females free of non-communicable diseases were 73.2 and 76.3, respectively. A big group (14.6%) of diabetic males were the patients of heart disease. The corresponding percentage in female diabetic patients was 15.8. Most (80.0%) of underweight males and underweight females (89.3%) were free of any of these four non-communicable diseases. But these percentages in obese males and obese females were 22.1 and 23.2, respectively. It indicated that obesity was the major risk factor for non-communicable diseases. More (25.5%) obese males were patients of kidney disease. On the other hand, more (28.4%) obese females were the patients of eye problem. Higher proportion (25.6%) of diabetic male patients suffering for longer duration were the patient of kidney disease. The corresponding percentage in female diabetic patients was 32.1. More hypertensive males (34.4%) and hypertensive females (25.9%) were the patients of heart disease. A big group (72.8%) of males having optimum blood pressure were free of any of these 4 NCDs. The corresponding percentage in females was 70.4.

Different socioeconomic variables had different impacts on NCDs. Some of the variables were more responsible for the diseases. For heart disease in males the most responsible variable was family expenditure. It was also the most responsible variable for kidney disease in males. Family income was the most responsible variable for heart disease in females. It was also the most responsible variable for eye problem in males. Family expenditure was the most responsible variable for kidney disease in males and eye problem in females. Age was the most responsible variable for kidney disease in females. These variables were identified by factor analysis. Other responsible variables were physical labor, blood pressure and duration of diabetes.

Conclusion

The results presented here were observed in analyzing data collected from 498 males and 497 females of ages 18 years and above to study the influences of socioeconomic variables on non-communicable diseases in males and females. Proportions of males and females free of NCDs were 0.610 and 0.608, respectively. The major NCDs observed in both males and females were heart problem, eye problem, kidney disease and disability. The percentages of these diseases in males were 13.1, 11.4, 10.4 and 4.0, respectively. The corresponding percentages in females were 12.3, 13.3, 8.0 and 5.6. Higher proportions of non-diabetic males (73.2%)and females(76.3%); underweight males (80.0%) and females (89.3%); male adults of optimum blood pressure (72.8%) and female adults of optimum blood pressure (70.4%) were free of NCDs. Smoking habit, sedentary activity, prevalence of diabetes, duration of diabetes and blood pressure were the risk factors for NCD in male adults. These were also the risk factors for female adults. Beside these, age and physical labor were two other risk factors for NCDs in females. Higher proportion of elderly females (29.6%) were patients of kidney disease. The percentage of elderly females was 5.4. Percentages of obese males and females were 29.1 and 31.2, respectively. More (25.5%) obese males were patients of kidney disease. Eye problem was prevailed in 28.4% obese females. Higher proportion (50.9%) of female smokers were suffering from heart disease. The corresponding percentage for smoker adults was 16.1 only. Hypertension was the risk factor for male patients (34.4%) and female patients (25.9%) of heart disease. Higher proportion of diabetic male patients (14.6%) and female patients(15.8%) were suffering from heart disease. Proportion of physically inactive females who were patients of heart disease was 16.2%. Patients of kidney disease were higher among both males (25.6%) and females (32.1%) suffering from diabetes for 15 years and above.

Finally, it was observed that family income, family expenditure, and physical inactivity were the responsible variables for heart disease in males. Family income, physical inactivity and habit of taking restaurant food were the responsible variables for heart disease in females. The responsible variables for eye problem and kidney disease in males were family income, family expenditure and physical inactivity. Family income, family expenditure and habit of taking restaurant food were responsible variables for eye problem in females. But age, blood pressure and duration of diabetes were the responsible variables for kidney disease in females.

References

1. Bhuyan, K.C.; Mortuza, Md.A and Faedus, J. (2018): A Study on Identification of Socioeconomic Variables Associated with non-communicable diseases among Bangladeshi adults, American Jour of Biomedical Science and Engineering, 4(3), 24 – 29.
2. WHO, Global action plan for the prevention and control of NCDs 2013-2020, 1-2, 2013, http// www. int/nmh/events/ncd_action_plan/en.
3. Omran, A.R. (2009): The epidemiological transition: a theory of the epidemiology of population change. Milbank Memorial Fund Quaterly. 1971, 49, 509-538.
4. Sharma, A. (2017): Global research priorities for non-communicable diseases prevention, management and control, Inter Jour of Non-communicable Diseases, 2(4), 107- 112.
5. Karar, Z.A.; Alam, N.; Streatfield, P.K. (2009): Epidemiological transition in rural Bangladesh. Global Health Action, DOI, 10, 3402/gha. V2io.1904
6. Bangladesh Bureau of Statistics. Statistical Pocket Book of Bangladesh 2007. http//www.bbs.gov.bd.
7. Robert, B.; Bonita, R.; Hortan, R.; Adams,C.'; Alleyne, G.; Asania, P. et al ; The Lancet NCD Action Group and the NCD Alliance (2011): Priority actions for the non-communicable diseases research, Lancet 317, 1438 – 1447.
8. Bhuyan, K.C. (2020): Socioeconomic variables responsible for exclusively diabetes among Bangladeshi adults, Acta Scientific Nutritional Health , 4(3), 2020, 1 – 6.

9. WHO? Death and Daily estimates for 2002 by Cause for WHO member states, WHO 2004.
10. Lozano, R.; Naghvi, M.; Foreman,K. et al.(2012): Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the global burden of disease study 2010, Lancet , 380, 2095-2128.
11. Murray, C.J.L.; VOST, Lozazo R, et al. (2010): Disability adjusted life years for 291 disease and injuries in 21 regions, 1990-2010, a systematic analysis for the global burden of disease study 2010, Lancet 2012, 380, 2197-2223.
12. Bhuiyan, K.C. Fardus. J. and Rahman, S. (2016): Relationship between socioeconomic factors and diabetes among urban and rural people of Bangladesh. Global Journal of Quantitative Science. December 2016.
13. Silink, M.; Tuomilehto, J. et al. (2011): Prevention and control of diabetes with a focus on low- and middle-income countries, paper 6, A prioritized research agenda for prevention and control of non-communicable diseases, WHO.
14. Prakashchandra, R.D. and Naido, D.P. (2016):Glycaemic control profile in diabetic patients: A sub-analysis of the phoenix lifestyle project. Euromediterranean Biomedical Journal, 11(05), 33-39.
15. International Diabetes Federation (IDF) (2011): Diabetes atlas, 6th edition (internet). Country estimates table 2011, The International Diabetes Federation.
16. Bhuyan, K.C. (2019): Discriminating Bangladeshi adults by non-communicable diseases. Rehabilitation Science, 2019,4(3), 35 – 43. doi: 10.11648/j.rs.20190403.11
17. Bhuyan, K.C.; Fardus, J. and Khanam, M. (2016): Discriminating the students of universities by their smoking habit, AJSE, 15(1).
18. WHO (2007): Impact of tobacco-related illness in Bangladesh? New Delhi, World Health Organization, 2007, http//www.searo.who.int/Link Files.
19. Bangladesh Bureau of Statistics (2018): Statistical Yearbook of Bangladesh,2017, BBS, Dhaka, Bangladesh.
20. Appropriate Body Mass Index for Asian Population and its Implications for Policy and Intervention Strategies, WHO Expert Consultation, Public Health, Lancet 363, 2004.
21. Biswas, T.; Garnett, P. Sarah and Rawal, B.Lal (2017): The prevalence of underweight, overweight, and obesity in Bangladesh: Data from a national survey, PLoS One, 12(5), e0177395.
22. Jan, A.S.; Yan, Li.; Azusa, H.; KEI, A.; Eamon, D. and O'Brien, E. : Blood pressure measurement anno 2016. Amer Jour Hypertens, 2017, 30(5), 453 – 463.https://doi:org/10.1093/ajh/hpw 148.
23. Jessica, Y.I.;Zaman, M.M.; Haq, S.A.; Ahmed, S. and Al-Quadir ,Z. (2018): Epidemiology of hypertension among Bangladeshi adults using the 2017 ACC/AHA Hypertension Clinical Guidelines and Joint National Committee 7 Guideline, Jour Hypertens, 32, 668 – 680.
24. Bhuyan, K.C. (2019): A note on factor analysis applied in medical research, Archives in Biomed Eng. And Biotech. 1(4), 1-3.
25. Yotoka, T. (1983): Some criteria for variable selection in factor analysis, Behaviormetrika, 13, 31 -45.
26. Rusico, J. and Roche, B. (2012): Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure, Psychological Assessment, 24(2), 282 – 292, doi:10.1037/a 0025697.
27. Bhuyan, K.C. (2004): Multivariate Analysis and Its Applications, New Central Book Agency (P)Ltd. India.
28. Bhuyan, K.C. (2020): Identification of responsible variables for obesity hypertension among Bangladeshi adults, Archives of Diab Endo System, 3(1), 27 – 35.
29. Kai, Hu.; Chengxing, S. and Qin, Yu. (2019): Prevalence and challenges of hypertensive heart diseases in the real world, International Jou. Hypertension, Article I.D. 5430358, https:// doi.org/ 10.1155/2019/5430358.
30. Chowdhury, M.Z.I.; Rahman, M.; Akter, T.; Ahmed, A.; Shovon, M.A.; Farhana, Z.; Chowdhury, N. and Tuhin, T.C.(2020): Hypertension prevalence and its trends in Bangladesh: Evidence from a systematic review and meta-analysis, Clinical Hypertension,26(10).
31. Bhuyan, K.C. (2020): Identification of Socioeconomic Variables Responsible for Obesity Kidney Disease among Bangladeshi Adults, Jour Diab and Islet Biology, 3(2), DOI:10.31579/2641-8975/0024.
32. Bhuyan, K.C. (2019): Factors Responsible for Non-communicable Diseases Except Diabetes among Bangladesh Adults, Archives of Diabetes and Endocrine System, 2(12) , 22 – 29, 2019.
33. Mokdad, A.H.; Ford,E.S.; Bowman,B.A.; Dietz, W.H.; Vinicor,F.; Bales,V.S. and Marks,J.S.(2003): Prevalence of obesity , diabetes, and obesity-related health risk factors 2001, JAMA, 289,76 – 79.
34. Barnes, S.A. (2011): The epidemic of obesity and diabetes: Trend and treatment, Tex Heart Inst.,38(2), 142 – 144.
35. Skliros, E.A.; Merkoures, P.; Sotiropoulos, A. et al (2008): The relationship between body mass index and hypertension in elderly Greeks:
36. The Nemea Primary Care Study, Jour Amer Geriatrics Society, 56(5), 954 – 955.
37. Haslam, D.W. and James, W.P. (2005: Obesity, Lancet, 366, 1197 – 1209.
38. John, E.H.; Jussara, M do, Carmo.; Alexander, A da Silva.; Zhen, W. and Michael, E.H. (2015): Obesity- Induced hypertension: Interaction of nuerohumoral and renal mechanisms, Circulation Research, 116, 991 –
39. Theodore, A.K. (2010): Obesity-related hypertension: Epidemiology, Pathophysiology, and clinical management, Amer Jour Hypertension, 23(1), 1170 – 1178. https://doi.org/10.1038/ajh.2010.172.
40. Bhuyan, D. and Bhuyan, K.C. (2019): Discriminating Bangladeshi adults by non-communicable diseases. Rehabilitation Science, 4(3), 35 – 43. doi: 10.11648/j.rs.20190403.11
41. Calamusa G, Amodio E, Costantino C, et al. Body mass index and factors associated with overweight and obesity; A cross-sectional study of adult subjects living in a small city of Western Sicily (Italy). Italian Journal of Public Health, 2012, Volume 9(3), Pages e 7539.
42. Fardus J, Bhuyan KC. Discriminating diabetic patients of some rural and urban areas of Bangladesh, A discriminant analysis approach, Euromediterranean Biomedical Journal, 2016, 11(19), 33-39.
43. Akter S, Rahaman MM, Sarah Krull Abe, Sultana S. Prevalence of diabetes and their risk factors among

Bangladeshi adults: a nationwide survey. WHO, 2014, 92, 204-213 A.

44. Sudeep S. Silent killer, economic opportunity: Rethinking non-communicable disease, Centre on Global Health Security, 2012, World Bank.