

A Study on Identification of Influencing Symptoms of Diabetes and Pre-diabetes among Bangladeshi People

Mohammad Asifur Rahaman ¹, K.C. Bhuiyan ² and Atika Farzana Urmi ^{3*}

¹Department of Information Technology, University of Cumberlands, USA

²Professor of Statistics [Retired], J.U. Dhaka.

³Department of Biostatistics, Virginia Commonwealth University, USA.

*Corresponding Author: Atika Farzana Urmi, Department of Biostatistics, Virginia Commonwealth University, USA.

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Abstract

The present study was based on secondary data recorded from Sylhet diabetic Hospital, Bangladesh. Data were collected from 520 patients, out of which 320 were suffering from diabetes and the remaining 200 were pre-diabetic people. There were 63.1% male respondents and 75.3% were of ages 40 years and above. The corresponding percentage among female was 67.2%. The symptoms of diabetes and pre-diabetes under consideration were polyuria, polydipsia, polyphagia, sudden weight loss, feeling weakness, genital thrush, visual blurring, itching, irritability, delayed healing of sore and cuts, partial paresis, muscle stiffness, alopecia, and obesity. Among these, except itching, delayed healing of sores and cuts and obesity, all other symptoms were significantly associated with diabetes. All symptoms were significantly associated with age and the risks of prevalence of symptoms were higher among the adults of ages 40 years and above. For these adults the most influencing symptom was polydipsia followed by polyuria, and partial paresis. Prevalence of most influencing symptom observed in males was age followed by visual blurring. The most influencing symptoms noted in diabetic patients was polydipsia followed by partial paresis and weakness. The other symptoms of diabetes were polyphagia, polyuria, and sudden weight loss. The influential symptoms of pre-diabetes were age followed by itching and delay in healing of wounds. These influencing symptoms were identified by factor analysis.

Key Words: symptoms of diabetes and pre-diabetes; association of any symptom with gender; age; diabetes; risk ratio; and factor analysis

1. Introduction

Diabetes is a non-communicable disease like other non-communicable diseases. This disease creates metabolic disorder in human being and it is a chronic health hazard if it once diagnosed in a human being creating the increased risk of other non-communicable diseases like cardiovascular diseases, heart attack, stroke, limb amputation, foot ulcers, gangrene, Alzheimer's disease, retinopathy, renal disease, etc. [1-5]. It has some negative economic consequences in the family [6-8]. The risk of diabetes for adults were mentioned in many studies throughout the world including risk for Bangladeshi adults [9-19]. There are many forms of diabetes but Type-2 diabetes is the most common. About 90% to 95% diabetic patients suffer from Type-2 diabetes. About 537 million adults across the world have diabetes and it is predicted that this number will be raised to 643 million in 2030 and 783 million in 2045 [20,21].

As the number of diabetic patients is in increasing trend, the number of deaths due to diabetes is also in increasing trend. The number of deaths due

to diabetes was 1.5 million in 2010 [22] and the estimated number of deaths in 2019 was 2 million [23]. As there are economic consequences of diabetes, WHO has a target to help the countries so that death due to diabetic can be reduced [6-8, 20,]. In Bangladesh also the number both diabetic patients and the number of deaths due to diabetes are in increasing trend. In 2015, these two numbers were 7.1 million and 3.3 million, respectively. Again, number of deaths was about 129,000. This number of deaths was noted among undiagnosed diabetic patients [24].

Prevalence of diabetes cannot be avoided as lifestyle of people is changing rapidly due to change in economic condition. But rate of prevalence can be reduced if people, specifically, the adult people of age 40 years and above can avoid excessive salty food, sugar-based food and food full of unsaturated fat; they should avoid smoking, drinking alcohol, sedentary activity [25-28]. People should develop the habit of walking, habit of doing physical work [26]. Moreover, they should consult doctors regularly after every 3-4 months

and adhere strictly the advice of the doctors when diabetes is diagnosed in them [26].

The diagnosis is done by inspecting some symptoms. The important symptoms for detection of pre-diabetes and diabetes are (i) feeling hunger and fatigue, (ii) peeing more often and feeling more thirsty, (iii) feeling pain and numbness in feet and legs, (iv) dry mouth and itching skin, (v) blurred vision, (vi) slow healing of sores and cuts, (vii) frequent yeast infection, (viii) recent weight gain, (ix) velvety, dark skin changes of the neck and armpit, (x) impotence or erectile dysfunction, (xi) sugar in urine, (xii) blood glucose over 180 (mg/dl), (xiii) sudden weight loss, etc.[20,21,29,30-32]. These symptoms are not similarly prevailed in people of all ages and sex and also not similarly observed in all diabetic and pre-diabetic patients. In this paper an attempt is made to identify the most influencing symptoms in males and females, in people of ages less than 40 years and people of ages 40 years and above, and in diabetic and pre-diabetic people.

2.Methodology

The analytical results included in this paper were based on data recorded from publicly available in web link <https://archive.ics.uci.edu/ml/datasets/Early+stage+diabetes+risk+prediction+dataset> [33]. It was also reported in 2020 [34]. The data were recorded from diabetic patients of Sylhet Diabetic Hospital, Bangladesh using a questionnaire approved by a doctor [35]. The recorded information was on symptoms of prevalence of diabetes(positive) and pre-diabetes or early stage of diabetes(negative)

among patients including information of their age, and gender. The other recorded information was on polyuria, polydipsia, polyphagia, sudden weight loss, partial paresis, irritability, weakness, muscle stiffness, genital thrush, delayed healing, itching, alopecia, obesity, visual blurring, etc. The respondents were divided into two groups, in one group there were 144 respondents of age less than 40 years and in another group there 376 respondents of age 40 years and above.

As a mode of analysis, the association between age and each of symptoms was studied including the risk ratio of prevalence of higher rate for a particular level of symptom. Association of a level of symptom with gender and prevalence of diabetes were also studied. Finally, factor analysis was done to detect the most responsible variable for prevalence of diabetes in male and in female, in respondents of two age group separately [36-38].

3.Results

There were 520 respondents, among them 63.1% were males and 90.5% of them were identified as pre-diabetic (negative) [Table 1]. Among female respondents, only 9.5% were pre-diabetic. Males and females in respect of diabetes and pre-diabetes were significantly different as was observed by Chi-square test [Table 1]. The overall diabetic patients were 61.5%. It was noted that, 72.3% respondents were of ages 40 years and above and 62.5% of them were diabetic patients. However, diabetic and pre-diabetic groups of different age groups were statistically similar as was observed by Chi-square test.

Table 1: Classification of respondents by gender, age, and prevalence of diabetes

Prevalence of diabetes	Gender				Age in years				Total	
	Male		Female		< 40		≥ 40		N	%
	N	%	N	%	N	%	N	%		
Positive	147	45.9	173	54.1	85	26.6	235	73.4	320	61.5
Negative	181	90.5	19	9.5	59	29.5	141	70.5	200	38.5
Total	328	63.1	192	36.9	144	27.7	376	72.3	520	100.0
Test result	$\chi^2=104.942$; p-vale=0.000				$\chi^2=0.530$; p-value=0.466					

The risk of prevalence in males was 5.69 times compared to the risk of females [R.R.=5.69, C.I. (3.34, 9.70); Table 1] and the risk of prevalence of diabetes for elderly people was almost similar as it was for adults of ages less than 40 years [R.R.=1.04, C.I. (0.93, 1.16)].

The symptom polyuria was observed in 49.6% respondents; among them 50.0% were males and another 50.0% were females [Table 2]. However, the differentials in prevalence of polyuria in males and in females was significantly different as was observed by Chi-square test and the risk of prevalence of polyuria in males was 0.68 times [R.R.=0.68, C.I. (0.59, 0.78)]. The symptom polydipsia was noted in 44.8% respondents, among them 53.6% were females; for them the risk of prevalence of polydipsia was 2.30 times compared to the risk of patients with no symptom of polydipsia [R.R.=2.30, C.I. (1.81, 2.93)]. The prevalence rates of this symptom in males and in females were significantly different. The percentage of respondents having symptom polyphagia was 45.6; among them 51.5% were males and the risk for them was 0.71 times compared to the risk among respondents without any symptom of polyphagia [R.R.=0.71, C.I. (0.62, 0.82)]. The proportions of respondents with and without symptom was significantly different. Only 16.9% respondents were obese, among them 62.5% were males. But proportions of obese and non-obese respondents irrespective of gender were not statistically different. The obese males had 0.99 times risk compared to the risk of non-obese males [R.R.= 0.99, C.I. (0.83, 1.18)]. Only 22.3% respondents were experienced of genital thrush; among them 81.9% were males. The rates of this symptom observed in males (81.9%) and in females (18.1%) were significantly different. The risk of this symptoms for males was 42% more than that in males without this health hazard [R.R.=1.42, C.I. (1.26, 1.54)]. The percentage of respondents who

suddenly lost their weight was 41.7; among them 53.0% were females. The risk for this group was 109% more compared to the risk of females who were not experienced of weight loss [R.R.=2.09, C.I. (1.61, 2.71)] and these two groups were significantly different. Feeling weakness is one of the symptoms of diabetes. In this study, the percentage of such weak respondents was 58.7. Among this group 58% were males. The percentage of males who did not feel weakness was 70.2%. These two percentages were significantly different. However, the males who felt weakness had risk 0.83 times [R.R.=0.83, C.I. (0.73, 0.94)]. Muscle stiffness was observed in 37.5% respondents; among this group 57.4% were males. The corresponding percentage in females was 42.6. There were significant differences in proportions of males and females who felt muscle stiffness. The males of such group had 0.86 times risk of the problem [R. R= 0.86, C.I. (0.75,0.99)]. The symptom partial paresis was noted in 43.1% respondents; among them 55.9% were females. These females had 2.22 times of risk of this health problem [R.R.=2.22, C.I. (1.74, 2.83)]. Proportions of males and females in respect of prevalence of partial paresis was significantly different. Itching was independent of males and females irrespective of prevalence of diabetes. The problem was noted in 48.7% respondents; among this group of respondents 60.5% were males and males had 0.92 times risk of facing the problem [R.R.=0.92, C.I. (0.81,1.05)]. Like itching, irritability was also independent of gender irrespective of prevalence of diabetes. The problem of irritability was noted only in 24.2% adults; out of which 61.9% were males and males had 0.98 times risk of this problem [R.R.=0.98, C.I. (0.84, 1.15)]. The percentage of respondents who had visual blurring was 44.8; among them 51.9% were males. These males had 0.72 times risk of visual blurring.

The prevalence of this symptom was significantly different with the variation in gender.

Table 2: Classification of respondents by gender and prevalence of symptoms of diabetes and pre-diabetes

Symptoms of diabetes	Presence	Male		Female		Total	
		Number	%	Number	%	Number	%
Polyuria	Yes	129	50.0	129	50.0	258	49.6
	No	199	76.0	63	24.0	262	50.4
	Total	328	63.1	192	36.9	520	100.0
$\chi^2 = 37.598$, p-value<0.001							
Polydipsia	Yes	108	46.4	125	53.6	233	44.8
	No	220	76.7	67	23.3	287	55.2
	$\chi^2 = 50.704$, p-value=0.000						
Polyphagia	Yes	122	51.5	115	48.5	237	45.6
	No	206	72.8	77	27.2	283	54.4
	$\chi^2 = 25.161$, p-value<0.001						
Obesity	Yes	55	62.5	33	37.5	88	16.9
	No	273	63.2	159	36.8	432	83.1
	$\chi^2 = 0.015$, p-value=0.902						
Genital thrush	Yes	95	81.9	21	18.1	116	22.3
	No	233	57.7	171	42.3	404	77.7
	$\chi^2 = 27.706$, p-value<0.001						
Weight loss	Yes	102	47.0	115	53.0	217	41.7
	No	226	74.6	77	25.4	303	58.3
	$\chi^2 = 41.306$, p-value<0.001						
Weakness	Yes	177	58.0	128	42.0	305	58.7
	No	151	70.2	64	29.8	215	41.3
	$\chi^2 = 8.059$, p-value=0.005						
Muscle stiffness	Yes	112	57.4	83	42.6	195	37.5
	No	216	66.5	109	33.5	325	62.5
	$\chi^2 = 4.263$, p-value=0.039						
Partial paresis	Yes	100	44.6	124	55.4	224	43.1
	No	228	77.0	68	23.0	296	56.9
	$\chi^2 = 57.416$, p-value<0.001						
Itching	Yes	153	60.5	100	39.5	253	48.7
	No	175	65.5	92	34.5	267	51.3
	$\chi^2 = 1.433$, p-value=0.231						
Irritability	Yes	78	61.9	48	38.1	126	24.2
	No	250	63.5	144	36.5	394	75.8
	$\chi^2 = 0.098$, p-value=0.754						
Visual blurring	Yes	121	51.9	112	48.1	233	44.8
	No	207	72.1	80	27.9	287	55.2
	$\chi^2 = 22.571$, p-value<0.001						
Delay healing	Yes	138	57.7	101	42.3	239	46.0
	No	190	67.6	91	32.4	281	54.0
Age (in years)	< 40	81	56.3	63	43.7	144	27.7
	40+	247	65.7	129	34.3	376	72.3
	$\chi^2 = 3.985$, p-value=0.046						
Alopecia	Yes	152	84.9	27	15.1	179	34.4
	No	176	51.6	165	48.4	341	65.6
	$\chi^2 = 55.900$, p-value<0.001						
Total		328	63.1	192	36.9	520	100.0

There were 72.3% respondents of age 40 years and above; among them 65.7% were males. Proportions of males and females for different age groups were significantly different. The symptom alopecia was noted in 34.4% respondents; among them 84.9% were males. Only 15.1% females had this symptom. These two proportions were significantly different as was observed by Chi-square test. Male respondents had 65% more risk of this problem [R.R.=1.65, C.I. (1.46, 1.86)].

The proportion of prevalence of polyuria in respondents of ages 40 years and above (76.4%) was significantly higher than that in other respondents. This group had 12% more risk of prevalence of polyuria [R.R.=1.12; C.I. (1.01, 1.25), Table 3]. Similar was the result in case of prevalence of polydipsia. The symptom was noted in 77.3% elderly respondents. The risk of prevalence of this symptom for respondents of ages 40 years and above was 13% more

[R.R.=1.13; C.I. (1.05, 1.21)]. Polyphagia was noted in 45.6% respondents; among them 82.3% were of ages 40 years and above. This group of respondents had 29% more risk of prevalence [R.R.=1.29; C.I. (1.16,1.43)]. The prevalence rates for respondents of two age groups were significantly different. Among obese respondents 89.8% were of ages 40 years and above. This group of respondents had 31% more chance of becoming obese [R.R.=1.31; C.I. (1.19, 1.44)]. The percentage of non-obese adults of this age group was 68.8. However, level of obesity was significantly different for people of different age groups. The genital thrush prevailed in 22.3% respondents; among them 81.9% were of ages 40 years and above. This group had 18% more risk of having the problem of genital thrush [R.R.=1.18, C.I. (1.08,1.29)]. The rates of presence of genital thrush in groups of respondents of two age groups were significantly different as was observed by Chi-square test.

Table 3: Classification of respondents by age and prevalence of symptoms of diabetes and pre-diabetes

Symptom of diabetes	Presence	< 40 years		40 years and above		Total	
		Number	%	Number	%	Number	%
Polyuria	Yes	61	23.6	197	76.4	258	49.6
	No	83	31.7	179	68.3	262	50.4
	Total	144	27.7	376	72.3	520	100.0
	$\chi^2 = 4.192, p\text{-value} = 0.041$						
Polydipsia	Yes	53	22.7	180	77.3	233	44.8
	No	91	31.7	196	68.3	287	55.2
	$\chi^2 = 5.157, p\text{-value} = 0.023$						
Polyphagia	Yes	42	17.7	195	82.3	237	45.6
	No	102	36.4	181	63.6	283	54.4
	$\chi^2 = 21.621; p\text{-value} < 0.001$						
Obesity	Yes	9	10.2	79	89.8	88	16.9
	No	135	31.3	297	68.7	432	83.1
	$\chi^2 = 16.136, p\text{-value} < 0.001$						
Genital thrush	Yes	21	18.1	95	81.9	116	22.3
	No	123	30.4	281	69.6	404	77.7
	$\chi^2 = 6.856, p\text{-value} = 0.009$						
Weight loss	Yes	45	20.7	172	79.3	217	41.7
	No	99	32.7	204	67.3	303	58.3
	$\chi^2 = 8.996, p\text{-value} = 0.003$						
Weakness	Yes	54	17.7	251	82.3	305	58.7
	No	90	41.9	125	58.1	215	41.3
	$\chi^2 = 36.677, p\text{-value} < 0.001$						
Muscle stiffness	Yes	32	16.4	163	83.6	195	37.5
	No	112	34.5	213	65.5	325	62.5
	$\chi^2 = 19.833, p\text{-value} < 0.001$						
Itching	Yes	41	16.2	212	83.8	253	48.7
	No	103	38.6	164	61.4	267	51.3
	$\chi^2 = 32.469, p\text{-value} < 0.001$						
Irritability	Yes	25	19.8	101	80.2	126	24.2
	No	119	30.2	275	69.8	394	75.8
	$\chi^2 = 5.119, p\text{-value} = 0.024$						
Visual blurring	Yes	32	13.7	201	86.3	233	44.8
	No	112	39.0	175	61.0	287	55.2
	$\chi^2 = 41.078, p\text{-value} < 0.001$						
Delay in healing	Yes	43	18.0	196	82.0	239	46.0
	No	101	35.9	180	64.1	282	54.0

	$\chi^2 = 200.785, p\text{-value} < .001$						
Alopecia	Yes	18	10.1	161	89.9	179	34.4
	No	126	37.0	215	63.0	341	65.6
	$\chi^2 = 42.401, p\text{-value} < .001$						
Diabetes	Positive	85	26.6	235	73.4	320	61.5
	Negative	59	29.5	141	70.5	200	38.5
	$\chi^2 = 0.530, p\text{-value} = 0.466$						
Partial paresis	Yes	43	19.2	181	80.8	224	43.1
	No	101	34.1	195	65.9	296	56.9
	$\chi^2 = 14.185, p\text{-value} < .001$						
Total		144	27.7	376	72.3	520	100.0

Those who lost their weight, 79.3% of them were of ages 40 years and above. This group of adults had 18% more chance of loss of weight compared to the chance of other adults [R.R.=1.18; C.I. (1.06,1.31)]. Among the respondents who were not experienced of weight loss, 67.3% were of ages 40 years and above. However, these two proportions were significantly different. Weakness was felt by 82.3% adults of ages 40 years and above. This group had 42% more chance of becoming weak [R.R.=1.42; C.I. (1.25, 1.61)]. On the other hand, 58.1% adults of similar ages did not feel weakness. These two proportions were significantly different. The percentage of respondents of ages 40 years and above and felt muscle stiffness was 83.6%. The percentage of similar adults without the problem of muscle stiffness was 65.5. These two rates were significantly different. The former group had 28% more risk of feeling this problem [R.R.=1.28; C.I. (1.16,1.41)]. The problem of partial paresis was noted in 43.1% respondents; among them 80.8% were of ages 40 years and above. The corresponding percentage of adults who did not face this problem was 65.9. These two percentages were significantly different. The former group had 23% more risk of this problem [R.R.=1.23; C.I. (1.11,1.36)]. The problem of itching among adults of ages 40 years and above was noted in 83.8% respondents. This group of adults had 36% more risk of facing the problem of itching [R.R.=1.36; C.I. (1.22, 1.52)]. Problem of itching was significantly associated with old age. Irritability was noted in 80.2% elderly people of ages 40 years and above. The percentage of elderly people of similar ages who were free of irritability was 69.8. The former group had 15% more risk of irritability [R.R.=1.15; C.I. (1.03,1.28)]. Irritability and age were significantly associated. Those who were facing the problem of visual blurring, 86.3% of them were of ages 40 years and above. This group of elderly people had 41% more risk of this problem compared to the risk of others. [R.R.=1.41; C.I. (1.27,1.57)]. Visual blurring was

significantly associated with age of elderly people. Some of the respondents (46.0%) had the experience of delayed healing of sores and cuts. Among this group 82.0% were of ages 40 years and above. This group of adults had 28% more chance of facing this problem [R.R.=1.28; C.I. (1.15, 1.42)]. Incidence of delayed healing was significantly more among elderly people. Alopecia was noted in 34.4% respondents; among them 89.9% were of ages 40 years and above. The corresponding percentage in people without the problem of alopecia was 63.0. These two proportions were significantly different. Positive symptom of diabetes was noted in 61.5% respondents; among them 73.4% were of ages 40 years and above. This percentage was slightly more which was noted in the same group of elderly people but with negative symptom of diabetes (70.5%). These two percentages were not significantly different. The study indicated that the chances of prevalence of diabetes and pre-diabetes in elderly people were almost same [R.R.=1.04; C.I. (0.93, 1.16)].

Polyuria was noted in 49.6% respondents; among them 94.2% were diabetic patients. The risk of prevalence of polyuria in diabetic patients was 3.20 times compared to that of others [R.R.=3.20; C.I. (2.65,3.87)]. The prevalence of diabetes and prevalence of polyuria were significantly associated

[Table 4]. Polydipsia was also the significant symptom of diabetes. Among the respondents who were facing the problem of polydipsia 96.6% of them were diabetic. This group had 2.92 times risk of diabetes [R.R.=2.92; C.I. (2.47,3.45)]. Polyphagia was observed in 45.6% respondents; among them 79.7% were patients of diabetes. The prevalence of polyphagia made a higher risk of diabetes by 72% [R.R.=1.72; C.I. (1.49, 1.98)]. Polyphagia significantly enhanced the prevalence of diabetes There were 16.9% obese

Table 4: Classification of respondents according to prevalence of diabetes and prevalence of symptoms of diabetes and pre-diabetes.

Symptoms of diabetes	Presence	Prevalence of diabetes				Total	
		Positive		Negative		Number	%
		Number	%	Number	%		
Polyuria	Yes	243	94.2	15	5.8	258	49.6
	No	77	29.4	185	70.6	262	50.4
	$\chi^2 = 230.595, p\text{-value} < .001$						
	Total	320	61.5	200	38.5	520	100.0
Polydipsia	Yes	225	96.6	8	3.4	233	44.8
	No	95	33.7	192	66.3	287	55.2
	$\chi^2 = 218.845, p\text{-value} < .001$						
Polyphagia	Yes	189	79.7	48	20.3	237	45.6
	No	131	46.3	152	53.7	283	54.4
	$\chi^2 = 61.801, p\text{-value} < .001$						
Obesity	Yes	61	69.3	27	30.7	88	16.9
	No	259	60.0	173	40.0	432	83.1
	$\chi^2 = 2.709, p\text{-value} = 0.100$						

Genital thrush	Yes	83	71.6	33	28.4	116	22.3
	No	237	58.7	167	41.3	404	77.7
	$\chi^2=6.325$, p-value=0.012						
Sudden weight loss	Yes	188	86.6	29	13.4	217	41.7
	No	132	43.6	171	56.4	303	58.3
	$\chi^2=99.108$, p-value<.001						
Weakness	Yes	218	71.5	87	28.5	305	58.7
	No	102	47.4	113	52.6	215	41.3
	$\chi^2=30.775$, p-value<.001						
Muscle stiffness	Yes	135	69.2	60	30.8	195	37.5
	No	185	56.9	140	43.1	325	62.5
	$\chi^2=7.800$, p-value=0.005						
Visual blurring	Yes	175	75.1	58	24.9	233	44.8
	No	145	50.5	142	49.5	287	55.2
	$\chi^2=32.839$, p-value<.001						
Itching	Yes	154	60.9	99	39.1	253	48.7
	No	166	62.2	101	37.8	267	51.3
	$\chi^2=0.093$, p-value=0.760						
Irritability	Yes	110	87.3	16	12.7	126	24.2
	No	210	53.3	184	46.7	394	75.8
	$\chi^2=46.634$, p-value<.001						
Delayed healing	Yes	153	64.0	86	36.0	239	46.0
	No	167	59.4	114	40.6	281	54.0
	$\chi^2=1.148$, p-value=0.248.						
Alopecia	Yes	78	43.6	101	56.4	179	34.4
	No	242	71.0	99	29.0	341	65.6
	$\chi^2=37.212$, p-value<.001						
Partial paresis	Yes	192	85.7	32	14.3	244	43.1
	No	128	43.2	168	56.8	296	56.9
	$\chi^2=97.174$, p-value<.001						
Age (in years)	< 40	95	59.0	59	41.0	144	27.7
	40+	235	62.5	141	37.5	376	72.3
	$\chi^2=0.530$, p-value=0.466						
Total		320	61.5	200	38.5	520	100.0

respondents and 69.3% of them were diabetic patients. Obese people had 16% more chance of prevalence of diabetes [R.R.=1.16; C.I. (0.99,1.36)]. This study did not signify the association of obesity and diabetes. The percentage of diabetic patients among the respondents having the symptom genital thrush was 71.6. This symptom made a higher risk of diabetes by 22% [R.R.=1.22; C.I. (1.06,1.40)]. Prevalence of diabetes was significantly associated with the incidence of genital thrush. The study indicated that sudden weight loss was a significant symptom of diabetes. Those who were experienced of sudden weight loss 86.6% of them were suffering from diabetes. For this group of respondents, the chance of prevalence of diabetes was 99% more than the risk of others [R.R.=1.99; C.I. (1.73, 2.29)]. Diabetes was noted in 71.5% people who were feeling weakness, and this percentage was significantly higher. Among the respondents facing the problem of muscle stiffness 69.2% of them were diabetic patients. The risk of diabetes among patients of muscle stiffness was 22% more compared to the respondents who had no problem of muscle stiffness [R.R.=1.22; C.I. (1.07,1.39)]. The percentage of prevalence of diabetes among respondents without the problem of muscle stiffness was 56.9%. These two prevalence rates were significantly different. The percentage of diabetic patients among respondents having the problem of visual blurring was 75.1. The corresponding percentage of respondents without the problem of visual

blurring was 50.5. These two percentages were significantly different. The former group had 49% more risk compared to the risk of later group [R.R.=1.49; C.I. (1.30,1.71)]. The percentage of diabetic patients facing the problem of itching was 60.9. Those who did not face itching problem 62.2% of them were diabetic. These two percentages indicated that itching problem was not associated with prevalence of diabetes. The study also indicated that itching was not a risky symptom of prevalence of diabetes [R.R.=0.98; C.I. (0.82, 1.18)]. The percentage of diabetic patients among irritable respondents was 87.3, but the percentage of diabetic patients among respondents without feeling of irritability was 53.3. This percentage was significantly lower than the former one. Risk of prevalence of diabetes among irritable respondents was 64% more than the risk of diabetes among others [R.R.=1.64; C.I. (1.46, 1.84)]. The percentages of diabetic patients among irritable and non-irritable respondents were significantly different. Delayed healing of sores or cuts did not significantly indicate the symptom of diabetes as the percentages of diabetic patients among people having the experience of delay in healing or not were 64.0 and 59.4, respectively Both groups had almost similar risk of prevalence of diabetes [R.R.=1.08; C.I. (0.94,1.24)]. Alopecia was not a significant symptom of prevalence of diabetes as the percentage of diabetic patients in respondents facing the problem of alopecia were 43.6%. This percentage was significantly lower than the percentage (71.0%) of diabetic

patients in respondents who had no problem of alopecia. For the former group the risk was 0.61 times compared to the risk of later group [R.R.=0.61; C.I. (0.51,0.73)]. The percentage of diabetic patients among the respondents having the problem of partial paresis was 85.7. This percentage was significantly different than the percentage of diabetic patients (43.2%) in respondents without the problem of partial paresis. The former group had 98% more risk of diabetes [R.R.=1.98; C.I. (1.72,2.28)]. The percentage of diabetic patients among people of ages 40 years and above was 62.5. The corresponding percentage in respondents of ages less than 40 years was 59.0. These two percentages were not significantly different. Age was not a risk factor for the prevalence of diabetes as the risk ratio for the prevalence of diabetes in elderly people was R.R.=1.08 only.

3.1 Factor Analysis

The results presented above indicated that some of the symptoms were more prevalent in diabetic patients and these were different in males and females, in respondents of different age groups, and in diabetic patients and pre-diabetic respondents. To identify the responsible symptoms for different groups factor analysis was done separately for each group. The results were discussed in the following sub-sections. The responsible factors were identified by the factor weights (coefficients). A variable was decided as most influential symptom for the prevalence of diabetes if its weight was highest in magnitude [36-38]. The variables included in each analysis were polyuria, polydipsia, polyphagia, obesity, sudden weight loss, feeling weakness, genital thrush, muscle stiffness, partial paresis, itching, irritability, visual blurring, delayed healing and alopecia.

3.2 Identification of Responsible Symptom for Prevalence of Diabetes in Males and in Females.

Table 5: Results of factor analysis

Variables	Analytical results for males		Analytical results for females	
	Communalities	Coefficient	Communalities	Coefficient
Polydipsia	0.612	0.468	0.698	0.817
Polyphagia	0.509	0.513	0.616	0.531
Obesity	0.803	0.186	0.714	0.134
Sudden weight loss	0.505	0.286	0.552	0.588
Weakness	0.579	0.607	0.483	0.527
Genital thrush	0.642	0.119	0.584	-0.168
Visual blurring	0.665	0.703	0.719	0.238
Itching	0.532	0.488	0.711	0.317
Irritability	0.402	0.417	0.625	0.329
Partial paresis	0.501	0.575	0.673	0.691
Delayed healing	0.607	0.515	0.664	0.388
Muscle stiffness	0.577	0.621	0.807	0.402
Age	0.682	0.792	0.688	0.044
Alopecia	0.596	0.343	0.633	0.477
Polyuria	0.682	0.554	0.712	0.728

The analytical results indicated that the variables included were sufficient to explain the variation in the data set. It was concluded from the results KMO=0.782, $\chi^2 = 1388.130$, p-value=0.000 in identifying responsible factors for males. Satisfactory analysis was also noted in identifying responsible factors using data of female as KMO=0.664, $\chi^2 = 844.746$, p-value=0.000. Final results were presented in Table 5

The most influential symptom for diabetes among males was age followed by visual blurring, muscle stiffness and weakness. The most influencing symptom of diabetes in females was polydipsia followed by polyuria, and partial paresis.

3.3 Identification of Influential Symptom for Prevalence of Diabetes in respondents of age group less than 40 years and age group 40 years and above.

The results were presented in Table 6. The results indicated that the included variables for factor analysis were satisfactory for both groups of respondents as KMO= 0.834, $\chi^2 = 889.426$, p-value =0.000 for the data of respondents of ages less than 40 years. For the data of the respondents of ages 40 years and above KMO= 0.695, $\chi^2 = 1023.652$, p-value=0.000. The most influential symptom for detection of diabetes among people of ages less than 40 years was polyphagia followed by polyuria and polydipsia. Itching was another symptom for prevalence of diabetes in younger people of ages less than 40 years. Polydipsia was the most influential symptom for prevalence of diabetes in elderly people of ages 40 years and. The other two influential symptoms were polyuria and partial paresis. Alopecia and weight loss were another two symptoms to detect prevalence of diabetes in elderly people.

Table 6: Results of factor analysis

Variables	Analytical results for respondents of ages less than 40 years		Analytical results for respondents of ages 40 years and above	
	Communalities	Coefficients	Communalities	Coefficients
Polyuria	0.695	0.813	0.627	0.714
Polydipsia	0.646	0.794	0.681	0.777
Sudden weight loss	0.711	0.643	0.583	0.545
Weakness	0.471	0.614	0.583	0.370
Polyphagia	0.705	0.825	0.640	0.473
Genital thrush	0.793	0.125	0.682	-0.182
Delay in healing	0.600	0.761	0.608	-0.027
Partial paresis	0.692	0.764	0.591	0.665
Muscle stiffness	0.726	0.627	0.617	0.314

Alopecia	0.802	-0.010	0.609	-0.546
Obesity	0.750	0.082	0.755	0.189
Itching	0.672	0.776	0.576	-0.122
Irritability	0.421	0.565	0.587	0.232
Visual blurring	0.857	0.455	0.619	0.500

3.4 Identification of Influential Symptom for Prevalence of Diabetes in Diabetic and Non-diabetic people

The results for this analysis were presented in Table 7. The variables included for the analysis were sufficient as was observed from the results of KMO and its related test results. For the first group KMO=0.672, χ^2 =634.686, p-value=0.000. For the second group KMO=0.738, χ^2

=1600.891, p-value =0.000. According to the highest value of the coefficient it was noted that the most influential symptom of prevalence of diabetes was polydipsia followed by partial paresis and weakness. For non-diabetic people the most influential variable was age followed by itching and delay in healing of sores and cuts. The other two influential variables were visual blurring and muscle stiffness.

Table 7: Factor analysis

Variables	Prevalence of diabetes			
	Positive		Negative	
	Communalities	Coefficients	Communalities	Coefficients
Polyuria	0.620	0.484	0.622	0.452
Polydipsia	0.568	0.633	0.768	0.107
Sudden weight loss	0.561	0.453	0.736	-0.095
Weakness	0.395	0.591	0.711	0.568
Polyphagia	0.587	0.511	0.741	0.585
Genital thrush	0.712	-0.180	0.605	-0.029
Delay in healing	0.604	0.420	0.857	0.808
Partial paresis	0.646	0.610	0.329	0.402
Muscle stiffness	0.712	0.395	0.829	0.769
Alopecia	0.624	-0.293	0.848	0.725
Obesity	0.687	0.105	0.743	0.127
Itching	0.637	0.387	0.822	0.812
Irritability	0.542	0.176	0.745	0.207
Visual blurring	0.745	0.434	0.805	0.779
Age	0.688	0.310	0.788	0.862

4. Discussion

Diabetes is a chronic non-communicable disease, and it is the source of many other non-communicable diseases [1-5,8]. In some studies, it was reported that Bangladeshi adults have also been suffering from diabetes [9-13]. Association of diabetes and socio-demographic variables was reported in many studies in home and abroad [39-41]. In one study in Bangladesh, diabetes was found associated with obesity and old age and diabetic patients were significantly discriminated from non-diabetic adults due to these variables [2, 42, 43]. From the results of the previous studies, it could be concluded that old age and obesity are two factors responsible for diabetes.

In the present study some other symptoms of diabetes including these two were mentioned. The symptoms are polyuria, polydipsia, polyphagia, sudden weight loss, weakness, delay in healing sores and cuts, genital thrush, visual blurring, muscle stiffness, itching, irritability, partial paresis, and alopecia. The prevalence of these symptoms was recorded from 520 respondents investigated from a Diabetic Hospital. Among the respondents, diabetes was noted in 320 people. Pre-diabetic people were noted in another 200 people. In a separate study diabetic people in Bangladesh were found 9.7% and pre-diabetic people were recorded 22.4%. In that study prediabetes and diabetes were defined according to WHO [9]. A prediabetic person was identified if his/her fasting blood glucose level was found 6.1 mmol/L without medication. Diabetic was defined when the fasting blood glucose was noted 7.1 mmol/L or more. For the present study pre-diabetic group was also considered if diabetes was at early stage. There were 328 male and 192 female respondents among the investigated people. They were divided into two groups by their age. In one group there were 144 respondents who were

of ages less than 40 years and in another group, there were 376 people of ages 40 years and above. This later group had risks for many non-communicable diseases including diabetes [2, 11]. But the present study did not signify the evidence of risk of prevalence of diabetes among elderly people.

The percentage of respondents having the problem of polyuria was 49.6. Among them 50.0% were males and another 50.0% were females, 76.4% were of ages 40 years and above, and 94.2% had positive symptom of diabetes. Males and females have similar risk of facing the problem of polyuria. Though lower proportion of respondents had the experience of polyuria, but the risk of diabetes for them was more than three times compared to the risk of others. The problem of polydipsia was reported by 44.8% respondents. Among them 53.6% were females, 77.3% were of ages 40 years and above, and positive symptom of diabetes was noted in 96.6% of them. Females had more possibility of facing the problem of polydipsia. Respondents facing the problem of polydipsia had higher risk of diabetes and it was around three times. The symptom polyphagia prevailed in 45.6% respondents. Among them 51.5% were males, 82.3% were of ages 40 years and above, and 71.7% of them were suffering from diabetes. The risk of diabetes for them was 72% more. Elderly people had 29% more risk of facing the problem of polyphagia. There were only 16.9% obese respondents. Among them 62.5% were males, 89.8% were elderly people and 69.3% were diabetic. But obesity was not significantly associated with gender and prevalence of diabetes. Obesity was prevalent in elderly people as was observed in other studies in Bangladesh [7,10,11,43]. Sudden weight loss was reported by 41.7% respondents; 53.0% of them were females, 79.3% were elderly people and 86.6% were diabetic patients. Females had more

chance of losing weight. Diabetic patients had around two times risk of losing weight. Weakness was felt by 50.7% respondents. Among them 58.0% were males, 42.3% were elderly people and 71.7% had positive symptom of diabetes. Elderly people and diabetic patients had more chance of feeling weakness. There were only 22.3% reported case of genital thrush. Significantly more males, more elderly people and more diabetic patients had the problem of genital thrush. Delay in healing sores and cuts was reported by 46.0% people. Among them 57.7% were males, 82% were elderly people and 64.0% were diabetic patients. This study indicated that diabetes was not a significant factor for delayed healing as risk of diabetes and pre-diabetes was almost similar. More males had the problem of delay in healing, but for them the risk was only 0.85 times. Elderly people had 28% more chance of delayed healing. Problem of muscle stiffness was reported only by 37.5% people. Among this group 57.4% were males, 83.6% were of ages 40 years and above, and 69.2% had positive symptom of diabetes. Like other study, this study indicated that muscle stiffness was associated with diabetes [31]. Elderly people had higher risk of facing this problem. Diabetic patients had also higher risk of this problem. There were 48.7% people who had itching problem. In this group, there were 60.5% males, 83.2% elderly people, and 60.9% were diabetic patients. But the problem was significantly more in elderly people only. Only 24.2% people had the problem of irritability and this problem was independent of gender. Among this group 87.3% were diabetic patients. Irritability problem was significantly more among diabetic patients and they had 64% more risk of facing the problem of irritability. The problem was significantly associated with age level, but the risk of irritability was almost similar for respondents of two age groups. Visual blurring was reported by 44.8% people. But the proportions of males and females having this problem were almost similar. The problem was significantly more among elderly people and among diabetic patients. These two groups of people had higher risk of visual blurring. The problem of partial paresis was reported by 43.1% people. The problem was significantly more in females; for them the risk was 122% more. The risk of the problem in elderly people was 23% more and the same was 98% more in diabetic patients. The problem alopecia was reported by only 34.4% people. Among this group, 84.9% were males, 89.9% were of ages 40 years and above and 56.4% had early stage of diabetes. The risk of facing this problem by males was 1.65 times compared to the risk of females; elderly people had 43% more risk of this problem. But the problem of alopecia was not risky symptom of diabetes.

The above information was related to different symptoms of diabetes prevailed in different categories of respondents in respect of gender, age, and prevalence of diabetes. A particular symptom was not uniformly risk factor for all categories of respondents. Some were more influential for a type of respondents but not influential for others. The objective of the study was to identify the influential symptom prevailed in males, in females, in younger adults, in older adults, in diabetic patients, and in pre-diabetic people. Identification of symptom was done by factor analysis. From factor analysis it was observed that the most influential symptom for males was age followed by visual blurring. For females most influential symptom was polydipsia followed by polyuria. These two symptoms were also influential for elderly people. But polyphagia was the most influential one. The two most influential symptoms for people of other age group were polydipsia followed by polyuria. The most influential symptom for prevalence of diabetes was polydipsia followed by partial paresis. Age was the most influential variable followed by itching for people of pre-diabetic group of respondents.

Conclusion

Diabetes is a chronic non-curable disease but can be controlled if proper action plan is formulated and accordingly people are guided and advised. The guidelines are essential as this chronic disease has been prevailing in increased rate in human being. People are not attacked by this disease suddenly. The problem starts at one stage showing some symptoms gradually. The complications of diabetes will be in increasing trend if proper attention is not given to remove the symptom when it is identified. The symptom may be identified in any person irrespective of age and gender.

Some of the symptoms of diabetes depend on feeling hungrier, sugar in urine and blood glucose over 180 mg/dl, fatigue, numb or tingling feet, sudden weight loss, vaginal infection, skin infection, slow healing of wound, itching, feeling irritability, decreased vision, impotence or erectile dysfunction, increased body mass index, nausea and vomiting, etc. [32]. In this study an attempt was made to find the risk of some symptoms prevailed in males and in females; in people of ages less than 40 years and in people of ages 40 years and above, and in diabetic and pre-diabetic groups of people.

The study was based on secondary data which were recorded from a diabetic hospital in Bangladesh. Variables included for the analysis were polyuria, polydipsia, polyphagia, obesity, sudden weight loss, feeling weakness, genital thrush, partial paresis, muscle stiffness, alopecia, itching, irritability, visual blurring, delay in healing, gender, age, and level of diabetes. There were 63.1% males and 36.9% females; 27.7% were of ages less than 40 years; diabetes was positive among 61.5% people, and pre-diabetes was noted in 38.5% respondents.

Polyuria, polydipsia and polyphagia were the highly risky symptoms among diabetic patients and among elderly respondents. Obesity was a risk factor for elderly people. Feeling of genital thrush was significantly more in males, in elderly people and in diabetic patients. The risk of weight loss was significantly more for females and for diabetic patients. Weakness was a risk factor for diabetic patients and for elderly people. Risk of delayed healing of wounds was more for elderly people. Itching was a risk factor for elderly people, and they had 36% more risk of itching. Diabetic patients had 64% more risk of irritability. Visual blurring was the risk factor for elderly people and for diabetic patients. Risk of muscle stiffness was more for diabetic and elderly people, but. Females had more than two times risk of partial paresis and almost two times risk for diabetic patients. Elderly people had also higher risk of partial paresis. Risk of alopecia was more in males and in elderly people.

From factor analysis it was noted that age, polyuria, polydipsia, genital thrush, and polyphagia were the most influential symptoms for prevalence of diabetes. Diabetes is a non-curable disease which cannot be avoided as lifestyle of human being is changing in upward direction, but it can be controlled if it is detected at its early stage. Some of the symptoms of diabetes, like abnormal blood sugar, higher body mass index, polyuria, sudden weight loss, hunger, nausea and vomiting, etc. But prevalence can be avoided if people are motivated to lead healthy life; even if any one of its warning symptoms is detected the danger of diabetes can be avoided under proper health care scheme. The following steps may help people to avoid the risk of diabetes:

- (i) After age 35/40 years people should go for blood screening test which will help to be cautious against diabetes.
- (ii) If anyone feels that his/her urination is frequent, especially at night, and he/she feels hungry even after taking food, dry mouth and itching skin, decreased vision, he/she consult a doctor as early as possible.
- (iii) People should avoid process food, salty food, sugar-based food and food full of unsaturated fat.
- (iv) Urban people should develop the habit of physical work/exercise regularly and should develop the habit of walking regularly whenever it is possible.
- (v) People should avoid sedentary activity, like viewing television for longer period in a day, gossiping with friends over telephone for longer time, indoor game without physical movement, etc.
Adhere strictly the advice of the doctors and medical practitioners to maintain the body weight, blood pressure and blood sugar.
- (vi) Adults or young everybody must avoid smoking and drinking alcohol.
Health worker in both rural and urban areas can encourage the people to follow the above suggestions.

The study was conducted using the secondary dataset in which different socioeconomic characteristics, except age and sex were not observed. But diabetes or its symptoms may be associated with other socioeconomic variables. Further study is needed to correlate diabetes and pre-diabetes and their symptoms in presence of other social characters.

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