

# Effects of Socio-Demographic Covariates on Blood Glucose Level of the Diabetic Patients: A Multiple Classification Analysis (MCA)

Md. Behzad Noor, Dr. Mir Mohammad Azad, Dr. J.A.M. Shoquillur Rahman

**Abstract**— This study has been undertaken to determine the socio-demographic related covariates affecting blood glucose level of the diabetic patients as well as to identify the extent of influences of the variables by the implied factors on blood glucose level. Data have been collected from two diabetic diagnostic centers in Rajshahi City. The result implies that insulin intake, blood pressure, tablet intake and mental suppression of the diabetic patients have the intense influence on blood glucose level. The proportion of variance explained (adjusted) by the respective variables are  $\beta^2 = 0.422, 0.122$  and  $0.120$  respectively. So, the diabetic patients are supposed to maintain their medication, control their blood pressure, become free from mental suppression, overall, giving up the sedentary life style. They should maintain a regulatory life to keep themselves away from having high blood glucose level.

**Index Terms**— Glucose Level of Diabetic Patients.

## 1 INTRODUCTION

GLUCOSE is a main source of energy for the cells that make up our muscles and other tissues. Blood glucose tests measure how well our body processes sugar (glucose). A normal fasting blood glucose result is lower than 100 milligrams of glucose per deciliter of blood (mg/dl) [1]. Hyperglycemia, or high blood glucose levels, is the hallmark of diabetic and it is linked to the development of long-term diabetic complications. Healthy people without diabetic typically have blood glucose levels of 65-110 mg/dl and 120-140 mg/dl one to two hours after eating [2, 3]. Type-I diabetes is an autoimmune disease. An autoimmune disease results when the body's system for fighting infection (the immune system) turns against a part of the body. In diabetes, the immune system attacks and destroys the insulin-producing beta cells in the pancreas. The pancreas then produces little or no insulin. A person who has type-I diabetes must take insulin daily to live.

In type-II diabetic, the pancreas is usually producing enough insulin, but for unknown reasons the body cannot use the insulin effectively, a condition called insulin resistance. After several years, insulin production decreases. The result is the same as for type-I diabetes - glucose builds up in the blood and the body cannot make efficient use of its main source of fuel [4]. Worldwide, type-II diabetes has soared to epidemic proportions and is at the forefront of current public and community health intervention in both Western and developing countries. Obesity, consanguinity, blood pressure, total cholesterol, HDL-cholesterol and triglycerides are more prevalent in diabetic patients [5]. It is estimated that 135 million people worldwide have diagnosed diabetes in 1995, and this number is expected to rise to at least 300 million by 2025 [6]. The prevalence data on diabetes were available from seven countries in the Region. The sources of information were surveys covering relatively small population groups. For the purpose of projection to the countries with no representative data, the data from the seven countries were used. It was estimated that the Region had about 40.9 million cases of diabetes [7]. For this estimation, the weighted average prevalence of the countries with available data was used. Two other approaches were also used.

- Md. Behzad Noor<sup>1</sup>, Received M.Phil (Fellow), M.Sc. (Thesis) First Class, First Department of Human Resource Development (HRD), Major in HRM and B.Sc. (Hons) from University of Rajshahi, Working as Lecturer, Department of Business Administration, Shanto Mariam University of Creative Technology, , PH:+8801923051674, [bnor\\_ru08@yahoo.com](mailto:bnor_ru08@yahoo.com), Dhaka, Bangladesh
- Dr. Mir Mohammad Azad<sup>2</sup>, Received PhD in Computer Science from Golden State University. Received Masters of Computer Application (MCA) Degree from Bharath Institute of Higher Education and Research Deemed University (Presently Bharath University) and Bachelor of Computer Application (BCA) Degree from Bangalore University, India, Presently Working as an Assistant Professor and Departmental Head of Computer Science and Engineering, Shanto Mariam University of Creative Technology, PH:+8801191695195, [azadrayhan@gmail.com](mailto:azadrayhan@gmail.com), Dhaka, Bangladesh.
- Dr. J.A.M. Shoquillur Rahman, Professor, Department of Population Science and Human Resource Development, University of Rajshahi, Rajshahi, Bangladesh

Table 1: Estimated prevalence of diabetes mellitus in SEAR, 1998

Country	Population ('000)	Estimated cases of diabetes mellitus
Bangladesh	124,000	2,700,000
DPR Korea	23,700	16,497
India	982,200	28,702,100
Indonesia	209,000	4,639,000
Maldives	282	7,000
Sri Lanka	18,700	1,500,000
Thailand	61,000	1,380,000
Total of above countries	1,418,882	38,944,597
Estimated cases from countries with no representative data *	70,250	1,928,178
Estimated total cases in the Region	1,489,132	40,872,775

Source: Based on prevalence estimate derived from the above seven countries.

First, as the data showed that two countries in the Region have either high (Sri Lanka) or very low (DPR Korea) prevalence, a revised estimate was made excluding these two countries, which came to 40.8 million. Secondly, the Indian prevalence estimate for the three countries from where data was not available, was used as it was felt that culturally and socio-demographically, India was the closest to these countries. This gave an estimate of 41.0 million cases [7].

In the Diabetes Atlas 2000, published by the International Diabetes Federation (IDF), it was estimated that in 2000 (report of IDF includes India, Bangladesh, Mauritius and Sri Lanka in the SEA Region of IDF) an estimated 35 million cases of diabetes would be prevalent [7]. The differences are in the year of estimate and the countries included. If we take only India, Bangladesh and Sri Lanka (WHO/SEAR countries included in the IDF report), then the comparison of the two estimates is shown in Table 2 below. Though the total estimate appears to be similar, the country specific estimates show a variation [7].

Table 2: Comparison of estimates of prevalence of diabetes mellitus of derived by IDF and the present report

Country	IDF	WHO SEARO
Bangladesh	1,759,700	2,700,000
India	32,674,400	28,702,100
Sri Lanka	335,400	1,250,000

Source: Diabetes Atlas 2000, International Diabetes Federation

The ten Member Countries of WHO's South-East Asia

Region (Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka and Thailand) are undergoing significant social, economic and demographic changes. Most of the noncommunicable diseases (NCDs) are a part of the degenerative diseases group and have higher prevalence in the older population. In addition, many of the lifestyle risk factors for NCDs like improper nutrition, sedentary life, alcohol and tobacco use are showing an upward trend in these countries. This has led to the emergence of NCDs as important causes of morbidity and mortality in the Region. In 1998 alone, NCDs are estimated to have contributed almost 60% of deaths in the world and accounted for 43% of the global burden of disease. Based on current trends, by 2020, these diseases are expected to account for 73% of deaths and 60% of the disease burden [7].

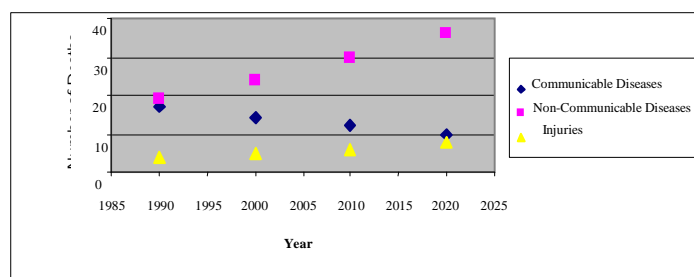


Fig. 1: Projected trends in the number of deaths by broad cause group in developing regions

The development of type-II diabetes is the result of a complex interaction between genetic and environmental factors and has been researched extensively in the scientific and medical literature [8]. The most common form of diabetic is type-II diabetic and this type of diabetic is most often associated with older age, obesity, physical inactivity, and ethnicities [9]. Obesity is a well-known risk factor for cardiovascular disease, including systemic hypertension, heart failure those in turn affect the blood glucose level. Obesity is a well-known risk factor for cardiovascular disease, including systemic hypertension, heart failure those in turn affect the blood glucose level [10].

Investigating the prevalence of type-II Diabetic Mellitus (DM), impaired glucose tolerance and the factors affecting blood glucose level, it has been found that the sex, hyperlipidemia, hypertriglyceridemia and hypertension as independent factors for the abnormalities in glucose tolerance; whereas, BMI and per day insulin and tablet intake affect blood glucose level for the both sexes and for both tablet or insulin users [11]. It has also been revealed that aging, overweight and a sedentary lifestyle are the important determinants in the prevalence of the diabetic during this transition period in Vietnam [12]. For non-insulin-dependent diabetic mellitus (NIDDM), impaired glucose tolerance (IGT) and

hyper tension in rural community of Bangladesh, increased age has been considered as an important risk factor for all disorder related to diabetic whereas BMI associated risk have been significant with NIDDM and hypertension [13,14].

The main aim of this paper is to assess different covariates affecting blood glucose level as well as to intensify their effect on blood glucose level through other implied factors.

## 2 DATA SOURCE

Out of 84 diagnostic and pathologies [15], there are only two well recognized diabetic diagnostic centers named "Rajshahi Diabetic Association and Diagnostic Center" at Laxmipur and "Diabetic Welfare Center, Talaimary, Rajshahi" in Rajshahi city. Theses two diabetic centers have been considered as our study areas. There are 5345 registered diabetic patients at both the diabetic diagnostic centers; out of them 3772 registered patients are in Rajshahi Diabetic Association and Diagnostic Center and 1573 in Diabetic Welfare Center. We serially numbered all those registered diabetic patients from the two centers' respective registered book and thereafter we selected 1069 diabetic patients through the process of linear systematic sampling procedure using the formula  $N=nk$ , where  $N=5348$ ,  $n=1069$  and  $k=5$  [16]. Among 1069 patients there are 504 males and 565 females of whom 454 are tablet users and 615 insulin users.

## 3 ANALYTICAL METHODOLOGY

Multiple Classification Analysis (MCA) requires one dependent variable and two or more independent variables. The dependent variable can be either a continuous or a categorical variable, but all the independent variables must be categorical. MCA can equally handle the nominal and ordinal variables and can also deal with linear and non-linear relationships of predictor variables with dependent variables. Mathematically, the model can be expressed by the following equation:

$$Y_{ijk} = \bar{y} + a_i + b_j + c_k + \dots + e_{ijk}.$$

Where,

$Y_{ijk}$  is the value or score of an individual who falls in the  $i$  th category of the factor A,  $j$  th category of the factor B and  $k$  th category of the factor C.

$\bar{y}$  is the grand mean of Y.

$a_i$  is the effect due to the  $i$  th category of the factor A, which is equal to the difference between  $y$  and the mean of its category of factor A.

$b_j$  is the effect due to  $j$  th category of the factor B, which is

equal to the difference between  $\bar{y}$  and the mean of its category of factor B.

$c_k$  is the effect due to the  $k$  th category of the factor C, which is equal to the difference between  $y$  and the mean of its category of factor C.

$e_{ijk}$  is the error term related with  $Y_{ijk}$  score of the individuals.

The coefficients, which are estimated by solving the normal equation systems, are called the adjusted or net effect of the predictors. These effects measure those of the predictor alone after taking into account the effects of all other predictors. The unadjusted, eta-square ( $\eta^2$ ) coefficient is a correlation ratio, which explains how well the predictor variable explains the variation in the dependent variables. Similarly, the beta-square ( $\beta^2$ ) coefficient indicates the proportion of variation explained by the other predictor variables.

### 3.1 Variables Considered for the Analysis

The multiple classification analysis is undertaken first to evaluate the contribution of socio- demographic and the health related characteristics such as age, respondents' education, occupation, Body Mass Index (BMI), calorie intake, injection intake, obesity, patients' mental suppression, smoking habit and walking habit on the blood glucose level.

In this case blood glucose level is taken to be the dependent variable and socio- demographic and health related variables as explanatory variables. All the socio- demographic variables are the categorical variables. The categories of the selected variables have been disclosed in the following table:

		0 = Don't Take 1 = Take
--	--	----------------------------

Table 3: Variables and their Covariates used in the Multiple Classification Analysis

Variable		Covariates
Dependent	Independent	
Y = Blood Glucose Level		0 = Early Age 1 = Middle Age 2 = Older Age
	X <sub>1</sub> = Age of the Respondents	1 = Under Weight 2 = Over Weight 3 = Obesity
	X <sub>2</sub> = Body Mass Index	0 = Don't Take 1 = Medium Intake 2 = High Intake
	X <sub>3</sub> = Calorie Intake	1 = Illiterate 2 = Primary Level of Education
	X <sub>4</sub> = Educational Qualification	3 = Secondary Level of Education 4 = H.S.C Level of Education 5 = Graduation
	X <sub>5</sub> = Occupation	6 = Post Graduation Level of Education
	X <sub>6</sub> = Sugar level increased in relation to suppression	0 = Non- Professional 2 = Professional
	X <sub>7</sub> = Injection Intake	0 = NO 1 = Yes
	X <sub>8</sub> = Blood Pressure	0 = Don't take 1 = Take
	X <sub>9</sub> = Walking Distance Covered	0 = Normal 1 = High
X <sub>10</sub> = Tablet Intake	2 = Low 0 = Don't Walk 2 = Walk	

#### 4 INFLUENTIAL DETERMINANTS OF THE BLOOD GLUCOSE LEVEL

There are a variety of socio-demographic and health related factors that influence blood glucose level. To examine the differential patterns of mean level of the blood glucose among the patients, the well known Multiple Classification Analysis (MCA) has been employed. Table 2 shows the mean level of blood glucose of both unadjusted and adjusted by different socio-demographic and diabetes related characteristics with the values of  $\eta^2$  and  $\beta^2$  produced from multiple classification analysis.

As we can found from Table 2 that the mean level of blood glucose (Adjusted) for the early, middle and the older aged persons are 13.16, 12.39 and 12.83 respectively [Table 2]. At the early age due to have a sedentary life style blood glucose level remains uncontrolled, which might lead some sort of vulnerability to the young diabetic patients. Again, the mean level of blood glucose has been found to be a bit higher for the older aged people than that of the middle aged people. This refers that with the increase of the age patients' blood glucose is increased. This finding is supported by other studies, where the prevalence of the type-II diabetes in urban slum of Dhaka, Bangladesh have been determined and it has been found that increasing age, sex, literacy and waist to hip ratio for men as significant risk factors for increasing the blood glucose level [17].

Many researchers have found BMI as one of the most influential factors affecting blood glucose level. Some other studies shows that the risk factors for increasing blood glucose level are age, BMI and parity which are all positively associated with the prevalence of the type-II diabetes [18]. From our study we have noticed that over weighted and obese people's mean blood glucose level (Adjusted) are much higher (14.55 and 14.99 respectively) [Table 2] than that of the respondents with the normal weight (11.48) [Table 2].

Calorie intake per day is another important factor that often termed as the decider of the blood glucose level for the diabetes patients. Here, we could notice that the patients who used to follow the chart of medium and the high calorie have much lower mean level of blood glucose (12.52 and 13.32 respectively) [Table 2] than of those who don't follow any calorie chart referred by the physician from the diabetes

book (15.54) [Table 2].

The respondents with the post graduation level of education are found with a lowest mean glucose level (11.15) [Table 2] than of the other educational category. This result focuses that with the advanced educational background a people comes to know with various knowledge regarding diabetes through various accessories through accessing with the latest news and views about the various invariable knowledge of the diabetes. So, education has its own part to play in developing the knowledge and awareness about diabetes.

The mean glucose level (Adjusted) for the respondents with the professional background is 12.59 [Table 2] which is a bit higher than those of the respondents who are non-professional (12.56) [Table 2]. This might happen due to the matter of less physical work and more mental suppression on the professional respondents who are more used to be involved with various types of official jobs where the maximum part of the day have to be spent without doing any physical work as a result the weight gaining was ongoing that increase the blood glucose level. Type-II diabetes and the impaired fasting glucose (IFG) in the rural area of the Bangladesh had been investigated by the Sayeed and group and found that the prevalence of the diabetes and IFG in the rural population was increased, where, older ages, highest obesity and reduced physical activities proved significant risk factors for the diabetes and IFG [19].

Tension and the mental suppression play the pivotal role in increasing blood glucose level. From Table 2 we notice that the respondents whose blood glucose level increase at the time of being tensed are found to have the maximum mean blood glucose level (Adjusted) (13.0) [Table 2] comparing to those whose blood glucose level is not influenced by the mental suppression (12.04) [Table 2]. Scientifically as we know that excessive tension or mental agony cause the pancreas to exert more insulin through urine that in turn cause the deficit of insulin which influence blood glucose level [19].

The respondents who are used to take tablet and insulin to control their blood glucose level are noticed to have more adjusted mean glucose level (14.82 for the insulin intake and 14.30 for the tablet intake) [Table 2] than of those who don't control their blood glucose level through either of these process (10.65 and 10.63 for the tablet and insulin users respectively) [Table 2]. Here, more mean glucose level has been noticed for those who used to have the insulin as their medication of controlling diabetes.

Among 1,000 respondents the mean adjusted blood glucose level is high for the patients who have the high blood pressure (15.07) [Table 2] comparing to the mean adjusted blood glucose level to those of the respondents with normal blood pressure (10.55) [Table 2]. Here, from our study it has been found that the mean adjusted blood glucose level of the respondents who have regular walking habit is depicted as much lower (11.67) [Table 2] than of those who don't have any habit to walk at a regular basis (13.08) [Table 2].

#### **4.1 Intensity of effects of the various implied factors on blood glucose level**

In this section an attempt has been made to observe the extent of influences of the variables on blood glucose level. Table 3 produces the results of zero order correlation coefficients of blood glucose level with various socio- demographic and health related characteristics. These variables have to affect blood glucose level through one or more proximate determinants.

Table 2 shows that respondents' habit of taking insulin has a significant contribution on blood glucose level which has been noticed to have a positive association with blood glucose level. The correlation coefficient is found to be  $r = 0.343$  [Table 3]. Among the included variables respondents' insulin intake has the strongest influence on blood glucose level. The proportion of variance explained (unadjusted) by insulin intake is  $\eta^2 = 0.335$  [Table 2] and the proportion of variance explained (adjusted) by this variable is  $\beta^2 = 0.422$  [Table 2]. The indirect effect of insulin intake through calorie intake, BMI, and walking distance on the blood glucose level are 0.010, 0.032 and 0.005 respectively.

Blood pressure of the respondents has a significant contribution on blood glucose level. Blood pressure has a positive significant association ( $r = 0.046$ ) with blood glucose level [Table 3]. Among the included variables, blood pressure has the second strongest influence on blood glucose level. The proportion of variance explained (unadjusted) by blood pressure was  $\eta^2 = 0.117$  [Table 2] and the proportion of variance explained (adjusted) by this variable is  $\beta^2 = 0.122$  [Table 2]. The effect of blood pressure on blood glucose level through mental suppression, calories intake and the walking habit of the respondents is 0.003, 0.007, 0.00012 and 0.0046 respectively.

Mental tension has a positive significant association ( $r = 0.083$ ) with blood glucose level [Table 3]. The strength of explaining variability (unadjusted) is  $\eta^2 = 0.083$  [Table 2] and the strength of explaining variability (adjusted) is  $\beta^2 = 0.119$  [Table 2] which is the third most influential factors affected



the blood glucose level. The indirect effect of mental suppression of the respondents suffering from the diabetes on blood glucose level through body mass index is 0.013 [Table 2] and through education and age are 0.013 and 0.0009 respectively on the blood glucose level.

Daily tablet intake of the patients also has a significant contribution on blood glucose level. The tablet intake of the respondents has the negative significant association ( $r = -0.332$ ) [Table 3] with blood glucose level. The proportion of variance explained (unadjusted) by tablet intake of the respondents is  $\eta^2 = 0.124$  and the proportion of variance explained (adjusted) by this variable is  $\beta^2 = 0.324$  [Table 2]. Tablet intake by the diabetes patients affects blood glucose level through body mass index, blood pressure, calories intake and walking habit of the respondents with the value of 0.0096, 0.0043, 0.0026 and .0026 respectively.

Calorie intake of the respondents has a vital role to control the blood glucose level and has shown a considerable positive association with blood glucose level. The proportion of variance explained by the calorie intake is (unadjusted)  $\eta^2 = 0.054$  and the proportion of variance explained (adjusted) by this variable is  $\beta^2 = 0.048$  [Table 2].

relative influence of the variables on blood glucose level. The model shows that there is a positive significant correlation between education and occupation,  $r = 0.364$  [Table 3]. In addition, it can be mentioned that the educational qualification has the positive and significant association with the mental suppression, as we found from other study that the educated people are more likely to have high level of mental suppression [19]. Again, from the Table 3 we observe that education has the positive association ( $r = 0.048$ ) [Table 3] with the calorie intake and through the calorie intake education affect the blood glucose level that is the indirect effect of the education through calorie intake was 0.0019.

Walking habit of the respondents had four posterior factors: age, calorie intake, occupation and BMI. The extent of correlation between walking habit and age is  $-0.084$  [Table 3]. The result implies that as age increases the walking habit is reduced. For instance, in spite of having the desire, due to the physical inability an aged population couldn't be able to walk at a regular basis for a long distance. So walking habit also affects blood glucose level through age with the indirect effect of 0.0015.

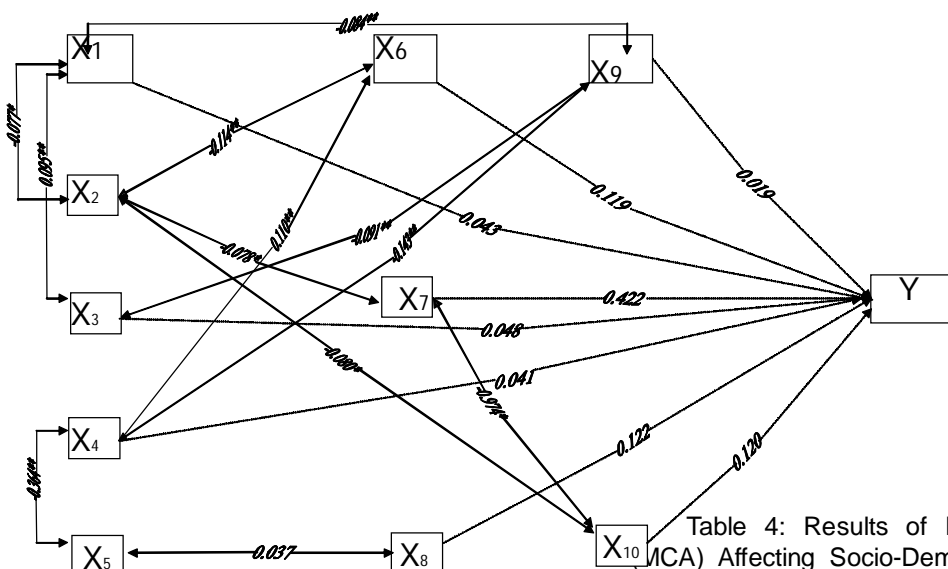


Table 4: Results of Multiple Classification Analysis (MCA) Affecting Socio-Demographic Covariates on Blood Glucose level of Diabetic Patients in Rajshai City, Bangladesh.

Characteristics	Unadjusted	Adjusted	$\eta^2$	$\beta^2$
<u>Age</u>				
Early Age	13.32	13.16	0.055	0.043
Middle Age	12.36	12.39		
Older Age	12.92	12.83		

Fig.1: Decomposing and synthesizing the relative influences of different variables on blood glucose level of the diabetic patients.

As there is no mechanical method for building a causal model (Srinivsan, 1981), it primarily depends on the substantive reasoning of the cause effect relationship. With these statistics, this part attempts to decompose and synthesize

<b>Body Mass Index (BMI)</b>				
Under Weight	13.08	13.17		
Normal Weight	11.08	11.48		
Over Weight	14.44	14.55	0.039	0.016
Obesity	14.71	14.98		
<b>Calorie Intake</b>				
1. Don't follow the calorie Chart	15.14	15.54		
2. Follow the Medium Calorie Chart	12.49	12.52	0.054	0.048
3. Follow the High Calorie Chart	13.80	13.32		
<b>Educational Qualification</b>				
1. Illiterate				
2. Primary Level of Education	12.44	12.49		
3. Secondary Level of Education	12.48	12.47		
4. Secondary Level of Education	12.73	12.65	0.061	0.041
5. Graduate Level of Education	12.21	12.77		
6. Post Graduate Level of Education	13.21	12.99		
7. Higher Education	11.01	11.15		
<b>Occupation</b>				
Professional	12.56	12.59	0.007	0.004
NonProfessional	12.48	12.56		
<b>Sugar Level increased with Mental Suppression</b>				
No	12.04	11.99		
Yes	12.96	13.00	0.083	0.119
<b>Insulin Intake</b>				
Don't take	10.63	10.13	0.335	0.422
Take	14.35	14.82		
<b>Blood Pressure</b>				
Normal	10.03	10.55		
High	14.88	15.07	0.117	0.122
Low	11.88	12.04		
<b>Walking Habit</b>				
Don't have regular Walking habit				
Having regular Walking habit	12.89	13.08	0.022	0.019
	11.43	11.67		
<b>Tablet Intake</b>				
Don't take	10.65	10.89	0.324	0.120
Take	14.14	14.30		

Grand Mean	12.55
Proportion of Variance Explained	0.367

The correlation between walking habit and calorie intake shows an insignificant association ( $r = -0.091$ ) [Table 3]. This implies that the respondents who are used to take high calorie are not used to walk at a regular basis that leads them to the obesity which in turn affects the blood glucose level [20]. So it is clear that walking habit also affects blood glucose level through calorie intake and this time the indirect effect through calorie intake is 0.0017. The more professional personnel have to occupy their most of the time doing many official works that don't allow them to walk at a sufficient rate of time and distance. So walking habit also affects blood glucose level through occupation as well. The association between the walking habits and occupation is 0.143 [Table 3] and has the significant association. The indirect effect of walking habit through occupation is 0.0027. The correlation between the walking habit and the BMI is -0.016 [Table 3] that reveals that the respondents who have the less regular habit of walking are more likely to have more BMI that produce the risk of gripping by the diabetes [21]. Here, in this case the negative effect of the walking habit through BMI is 0.0003. According to some other study, diabetes is associated with the age, BMI, blood pressure, HDL, cholesterol, education levels, and the family history [21].

**Table 5.** Zero order correlation coefficient of Socio-Demographic variables on the blood glucose level.

Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	X <sub>10</sub>
Y	10.024	0.014**	0.056	0.013	0.066	0.083**	0.343**	0.046**	-0.023	0.332**
X <sub>1</sub>	1	0.077*	0.095**	0.046	0.011	0.008	0.013	0.010	-0.084**	0.008
X <sub>2</sub>		1	0.044	0.046	0.024	0.114**	0.078**	0.062	0.016	0.080**
X <sub>3</sub>			1	0.048	0.048	0.027	0.024	0.001	-0.091**	-0.022
X <sub>4</sub>				1	0.364*	0.110**	0.030	0.037	0.026	0.022
X <sub>5</sub>					1	0.21**	0.011	0.037	0.143**	0.036
X <sub>6</sub>						1	0.075	0.025	-0.037	0.002
X <sub>7</sub>							1	0.033	-0.012	0.974**
X <sub>8</sub>								1	-0.038	0.036
X <sub>9</sub>									1	-0.022
X <sub>10</sub>										1

In our study the correlation between the age and blood glucose level is 0.004 [Table 3] that implies that as age increase the blood glucose level is more likely to increase. Again age of the respondents has three posterior factors: BMI, calorie intake and the walking distance. The correlation between age and BMI of the patients is observed to be significant ( $r = 0.077$ ) [Table 3] which implies that with the

increase of age the BMI decrease. So age affects blood glucose level through BMI. The indirect effect of age through BMI was 0.035. Age also affects blood glucose level through calorie intake and walking distance. We have found that there is a significant and positive association between the age and calorie intake ( $r= 0.095$ ) [Table 3], that refers that with the increase of age patients of our study take more calorie and in previous we have detected that with the increase of age the patients are less used to walk at a regular basis, so, more calorie consumption and less walking habit always create a huge risk to the prevalence of obesity that is the most influencing and effective factor in the prevalence of diabetes [22]. The effect of the age through calorie intake was 0.0036.

Again, the correlation between BMI and mental pressure and BMI and blood pressure are 0.114 and 0.062 respectively [Table 3], where, the association between the BMI and mental suppression has the significant association. This result implies that with the increase of BMI both the mental suppression and blood pressure both are increased. Here, the negative effect of the BMI and the blood pressure on the blood glucose level are 0.0018 and 0.0009 respectively.

Education and mental suppression have a significant positive association ( $r=0.110$ ) [Table 3]. This refers that with the advanced educational background people become more likely to grippe by the tension which is one of the most effective factor in the prevalence of the diabetes. Other study has reported as BMI associated risk of the diabetes was significant with NIDDM and hypertension [22]. The education has the negative effect on the blood glucose level through mental tension and BMI of 0.00451 and 0.0018 respectively.

## CONCLUSION

Insulin and Tablet intake and Blood pressure of the patients are most important influential factors that affect blood glucose level. As we can observe that mental tension has a positive and significant association with blood glucose level. we also have find that the early aged patients' mean blood glucose (Adjusted) is much higher than that of the older aged people and the patients who don't follow the calorie chart at all have the highest mean blood glucose level than of those who follow the medium and high calorie chart from their diabetes book. Multiple Classification Analysis (MCA) results deserve considerations from the viewpoint of policy implication. So, we could say that the early and middle aged population should be more and more conscious about controlling their weight and the older aged patients should maintain their blood glucose through dieting and doing

physical work as well and also they should take care of their calorie intake to keep themselves in safer zone.

## REFERENCES

- [1] C. Snehalatha, A. Kapur, and V. Vijay, *J. Assoc. Physicians India* 51, 766 (2001).
- [2] H. G. Allen, J. C. Allen, L. C. Boyd, and B. P. Alston-Mills *Can, Nutrition* 19, 584 (2003).
- [3] N. D. Kim, K. T. Mary, L. Karen, C. Gary, M. Neil, and Gsc. D. Francine, *Obstet Gynecol.* 194, 339 (2005).
- [4] *Diabetes - A brief historical aspect; A Handbook of Diabetes Mellitus*, New Mediwave Publication -LUPN 45 (2001).
- [5] A. Bener, M. Zirie, and A. Al-Rikabi, *Genetics, obesity, and environmental risk factors associated with type-II diabetic*, *Croat Med. J.*, 46, 302-307 (2005).
- [6] World Health Organization, *World Diabetic: A News Letter*, 3 (2002)
- [7] World Health Organization, *Regional Office for South East Asia*, New Delhi, 2002.
- [8] J. Lopatynski, G. Mardarowicz, and G. Szczesniak, *A comparative evaluation of waist circumference, waist-to-hip ratio, waist-to-height ratio and body mass index as indicator of impaired glucose tolerance and as risk factors for type-II.* *Ann. Univ. Mariae curie Skildowska*, 58, 413-419 (2003).
- [9] A. M. Habori, A. M. Mamari and A. A. Meeri, *Diabetic Res. Clin. Pract.* 65, 275 (2004).
- [10] N. D. Kim, K. T. Karen, C. Gary, M. Neil and Gs. D. Francine, *Am. J. Obset. Gynecol.* 194, 339 (2006).
- [11] L. N. Duc Son, T. T. Hanh, K. Kusama, D. Kunni, T. Sakai, N. T. Hung, and S. Yamamoto, *J. Am. Coll Nutr.* 24, 229 (2008).
- [12] C. G. Sonomon, F. B. Hu, A. Dunaif, J. Rich-Edwards, W. C. Willett, D. J. Hunter, G. A. Colditz, F. E. Speizer, and J. E. Manson, *JAMA* 286, 2421 (2004).
- [13] M. A. Sayeed, A. Banu, A. R. Khan, and M. Z. Hussain, *Diabetic Care* 18, 555 (1995).
- [14] H. King, R. E. Aubert, and W. H. Herman, *Diabetic Care* 16, 157 (1998).
- [15] Register book of Rajshahi Civil Surgeon Office, June 2008
- [16] Daroga Singh, and F. S. Chaudhary, *The Theory and Analysis of Sample Survey Designs*, 3<sup>rd</sup> Edition (New Age International (P) Limited, New Delhi, 1997).
- [17] M. A. Rahim, S. Vaaler, S. M. Keramat Ali, A. K. Khan, A. Hussain, and Q. Nahar, *Prevalence of type-II diabetic in urban slums of Dhaka, Bangladesh*, *Bangladesh Med. Res. Counc. Bull.*, 20, 60-70 (2004).
- [18] C. Snehalatha, A. Ramachandran, A. Kapur, and V. Vijay, *Age-specific prevalence and risk associations for impaired glucose tolerance in urban southern Indian population*, *J. Assoc. Physicians India*, 51, 766-769 (2003).
- [19] M. A. Sayeed, M. Hajera, A. K. Parvin, A. L. Zafar, S. M. A. Keramat, B. Akhtar, B. Ahren, and A. K. Azad, *Diabetic and impaired fasting glycemia in rural population of Bangladesh*, *Diabetic Care*, 26, 1034-1039 (2003).
- [20] T. Saito, Y. Shimazaki, Y. Kiyohara, I. Kato, M. Kubo, M. Iida and Y. Yamasita, *J. Periodontal Res.* 40, 346 (2005).



- [21] C. G. Sonomon, A. Dunaif, J. Rich-Edward, W. C. Willett, D. J. Hunter, G. A. Colditz, F. E. Speizer and J. E. Manson, J. A. M. A. 286, 2421 (2001).
- [22] H. G. Allen, J. C. Allen, L. C. Boyd and B. P. Alston-Mills, Nutrition 19, 584 (2003).