

Association between Body Mass Index and Diabetic Complications among Type-2 Diabetic Patients in Semi-Urban Area, Bangladesh

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Abstract

The purpose of the study was to estimate the association between body mass index and diabetic complications of patients with type 2 diabetes mellitus in the semi-urban area (Savar), Bangladesh. Methods: A cross-sectional study was conducted among 420 type-2 diabetic patients, picked up conveniently from Jahangirnagar University and nearest community, Savar, Dhaka. Body mass index (BMI) was calculated and categorized according to The WHO recommended Asian criteria. Diabetic complications were identified by clinical signs and symptoms using a questionnaire. Multiple logistic regression and Chi-square test were employed in data analysis.

Index terms— type-2 diabetes; BMI; hypertension; nephropathy; neuropathy.

1 Introduction

Diabetes has become a rapidly growing health burden worldwide. [1] American Diabetes Association (ADA) has defined Diabetes Mellitus (DM) as, "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both." [2] DM is a disease known since ancient times, cited by both the Greeks and Egyptians in as early as 4,500 BC. [3] An estimated 285 million people have type-2 diabetes globally, making up about 90 percent of all diabetes cases. [4] In the South Asian region, Bangladesh has the second largest number of diabetes patients with a prevalence rate of 11%. [5] Almost all of the complications of diabetes are caused by having too much blood glucose. [6] Type 2 diabetes mellitus (T2DM) and its macro- and microvascular complications are a major threat to global public health. [7] The Centers for Disease Control and Prevention (CDC) reported that adults with diabetes are three times more likely than those without diabetes to have a history of coronary artery disease, three times more likely to have a stroke, and two times more likely to have another heart condition. [8] It is one of the major causes of premature illness and death in most countries worldwide. The World Health Organization (WHO) reported that diabetes was the seventh leading cause of death and contributed to an estimated 1.6 million deaths in 2016. [9] Complications Like premature atherosclerotic cardiovascular diseases, nephropathy leading to renal failure and peripheral neuropathy, cardiovascular symptoms. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes. [10] Overweight and obesity are driving the global diabetes epidemic. They affect the majority of adults in most developed countries and are increasing rapidly in developing countries. [11] There are several studies indicating that weight loss and exercise may help in the treatment of diabetes. Weight loss and exercise have both been shown to decrease insulin resistance, a major physiological defect related to the development of diabetes, and to improve glycemic control. These interventions also ameliorate hypertension and lipid abnormalities and thus may contribute to a reduction in risk of coronary heart disease in individuals with T2DM. [12] Hypertension is a common problem in diabetic patients. Markedly increases the risk and accelerates the course of cardiac disease, peripheral vascular

disease, stroke, and nephropathy. Hypertension is approximately twice as frequent in patients with diabetes compared with patients without the disease. [13] The significance of the study is derived from the available statistics that reflect a high prevalence of DM in Bangladesh; more than 11 % and it will be increased 13% by 2030. [14] These huge number of people suffering from many kinds of diabetic complications which causes an increase in health care expenditures. So there is a need for research to reduce the diabetic morbidity. Moreover, to our knowledge, there is no study in a semi-urban area in Bangladesh that estimates of the association between a range of diabetes complications and Body Mass Index (BMI). Therefore, the current study aimed to estimate the association between diabetic complications and BMI at Jahangirnagar University and nearest Community, Savar, Bangladesh.

II.

3 Materials and Methods

4 a) Study design and population

It was a cross-sectional study conducted among diagnosed type-2 diabetic patients at Jahangirnagar University and the nearest community, Savar, Dhaka. The study was carried out in the year 2017 and 2018. A total of 420 patients with type-2 diabetes were selected conveniently. The sample size was determined by using the formula, $n = z^2 pq/d^2$.

5 b) Data collection

Before collection, informed consent was taken from each patient. The purpose of the interview was clearly explained to the study subjects. A semistructured questionnaire was used as the research instrument. Data were collected by face to face interview.

6 c) Measures

Weight, height, and blood pressure were measured by using valid equipment. This study adopted the BMI definition of the World Health Organization (2000). [15] Body weight was measured to the nearest 100 gm. A professional weight machine was used for body weight measurement. The height was measured in centimeter by using a measuring tape. Blood pressure (systolic and diastolic) recordings were made after the subjects had rested in the sitting position for 10 minutes using a validated sphygmomanometer. Three separate readings were taken, and their mean was recorded. [16] Nephropathy, neuropathy, and retinopathy were diagnosed by clinical signs and symptoms using questionnaire.

7 d) Data Analysis

Data were collected and analyzed using Statistical Package for Social Science (SPSS), version 20.0. Chi-square test was employed to test the association between variables. Linear multiple logistic regression was employed to identify predictors of diabetic complications. The statistically significant result means that the P-value is less or equal to 0.05.

III.

9 Results

A total of 420 patients with type-2 diabetes mellitus (T2DM) were interviewed in the present study. The basic socio-demographic characteristics of the patients were shown in Table-1. The mean BMI of the patients was 27.37 ± 5.04 Kg/m². According to the BMI category, out of 420 patients, 23.8% had normal weight, 44.8% were overweight, and 31.4% were obese. (Table -1) During the study period, blood pressure of the patients was measured. About 20% of the patients were found to be hypertensive. The patients were also asked about the complications they faced due to diabetes. The study found that 18.1% had diabetic neuropathy, 19.0% had diabetic nephropathy, and 21.9% of patients had diabetic retinopathy. (Table ??2)

The study found significant association between body mass index (BMI) and complications faced by the patients: BMI and hypertension ($\chi^2 = 14.987$, df = 2, p = 0.001); BMI and neuropathy ($\chi^2 = 14.697$, df = 2, p = 0.001); BMI and retinopathy ($\chi^2 = 9.412$, df = 2, p = 0.009); BMI and nephropathy ($\chi^2 = 25.503$, df = 2, p = 0.000). (Table -3) Logistic regression analysis further revealed that BMI was a significant predictor of complications arise among the patients with T2DM (p < .05). Obese patients were 3.3 times more (OR = 3.3, 95% CI = 1.629-6.699; p = 0.001) and overweight patients were 1.5 times more (OR = 1.5, 95% CI = 0.737-3.069; p = 0.001) likely to develop hypertension than patients with normal weight. Similarly, obese patients were at more risk to develop neuropathy than patients with normal weight (OR = 2.968, 95% CI = 1.516-5.811; p = 0.001). Patients who were overweight were more prone to develop retinopathy than those who were normal (OR = 2.804, 95% CI = 1.417-5.549; p = 0.011). The results also show that patients who were overweight were more likely to develop nephropathy than patients with normal weight (OR = 1.073, 95% CI = 0.512-2.249; p = 0.000). Similarly,

patients who were obese were about four times more likely to develop nephropathy than patients with normal weight (OR=3.667, 95% CI=1.815-7.409; p=0.000). (Table -4) IV.

10 Discussion

Diabetes mellitus is a leading contributor to death and disability worldwide. The prevalence of diabetes and overweight/obese have increased rapidly worldwide. [18,19] Similarly, the prevalence of diabetes and the percentage of people either overweight or obese have increased substantially in Bangladesh. [19] To our knowledge, there is no study in a semi-urban area in Bangladesh that estimates of the association between a range of diabetes complications and BMI. The present study provided the opportunity to estimate of the association between diabetic complications and BMI among Jahangirnagar University community and nearest community in Savar, Bangladesh.

This study found that more or less twenty percent of the patients had a range of diabetic complications, including hypertension, neuropathy, retinopathy, and nephropathy. Diabetic patients with long term uncontrolled blood sugar may develop various serious complications. Among the most prevalent complications are kidney disease, blindness, and amputations reported in previous studies. [20,21] Elevated blood pressure is observed in diabetic patients about 1.5 to 2 times more frequently than among non-diabetic patients. [22] The study estimated that almost half of the diabetic patients were overweight, whereas one-third of those were obese. Physical inactivity and patient's reluctances to follow dietary guideline may be the reasons for weight gain in Bangladesh.

Overweight and obesity are known to increase blood pressure, which is the leading cause of strokes. Excessive weight gain also increases the chances of developing other problems, including high cholesterol, high blood sugar, and heart disease. [23] Diabetic patients, either overweight or obese, are at increased risk of developing diabetic complications. Obesity accompanying with T2DM is known to be closely linked with insulin resistance and elevated sympathetic nervous activity. [24] It has been frequently reported in the literature that obesity, hypertension, and diabetes are high-risk factors for subsequent cardiovascular and renal complications. This study revealed that hypertension, neuropathy, retinopathy, and nephropathy were associated with BMI ($p<0.05$). More or less comparable results were reported in some previous studies. [22,24,25] Weight control is an important step for the management of diabetic complications. Physical activity helps to maintain a healthy weight. Regular exercise may bring about many possible health benefits, and contribute to weight loss, prevent weight regain, improve insulin sensitivity, glycaemic control. [26] V.

11 Conclusion

Globally the prevalence of diabetes and overweight/obese have been increasing rapidly. People who are either overweight or obese accompanied by diabetes are at increased risk of developing complications. Therefore, weight control may reduce the risk of developing diabetes and its complications.

12 VI.

13 Declarations

1

Variables	Frequency	Percentage (%)	Mean($\pm$ SD)
Socio-demographics			
Gender			
Male	248	59.0	
Female	172	41.0	
Age (years)			
30-40	60	14.3	
40-50 >50	204 156	48.6 37.1	47.2($\pm$ 6.4)
Education			
Low educated (1-9)	224	53.3	
High educated (>9)	196	46.7	
Employment status			
Unemployed	144	34.3	
Employed	276	65.7	
Marital status			
Unmarried	12	2.9	

Figure 1: Table 1 :

2

Complications	Frequency	Percentage (%)
Hypertension		
Yes	85	20.2
No	335	79.8
Neuropathy		
Yes	90	21.4
No	330	78.6
Retinopathy		
Yes	92	21.9
No	328	78.1
Nephropathy		
Yes	80	19.0
No	340	81.0

Figure 2: Table 2 :

3

Variables	Total (420); n (%)	Complications; n (%)	X ² test value	df	
BMI		Hypertension			
Normal	100(23.8)	12 (12.0%)			
Overweight	188(44.8)	32(17.0)	14.987	2	.001
Obese	132(31.4)	41(31.1%)			
BMI		Neuropathy			
Normal	100(23.8)	14(14.0%)			
Overweight	188(44.8)	33(17.6%)	14.697	2	.001
Obese	132(31.4)	43(32.6%)			
BMI		Retinopathy			
Normal	100(23.8)	12(12.0%)			
Overweight	188(44.8)	52(27.7%)	9.412	2	.009
Obese	132(31.4)	28(21.2%)			
BMI		Nephropathy			
Normal	100(23.8)	12(12.0%)			
Overweight	188(44.8)	24(12.8%)	25.503	2	.000
Obese	132(31.4)	44(33.3%)			

Figure 3: Table 3 :

4

Variables	Odds Ratio (OR)	Unadjusted Model 95% Confidence Interval (CI)	p-value
BMI	Hypertension		
Normal	Ref		
Overweight	1.504	(0.737-3.069)	.001
Obese	3.304	(1.629-6.699)	
BMI	Neuropathy		
Normal	Ref		
Overweight	1.308	(0.664-2.577)	.001
Obese	2.968	(1.516-5.811)	
BMI	Retinopathy		
Normal	Ref		
Overweight	2.804	(1.417-5.549)	.011
Obese	1.974	(0.948-4.111)	
BMI	Nephropathy		
Normal	Ref		
Overweight	1.073	(0.512-2.249)	.000
Obese	3.667	(1.815-7.409)	

Figure 4: Table 4 :

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.2 Funding

Self.

.3 Ethical issues

This study was conducted maintaining ethical standards to the highest possible extent. Before the assessment, informed consent was taken from all the patients, participated in this study. This study was approved by the Department of Public Health and Informatics, Jahangirnagar University, Savar, Dhaka. The study was also followed by "recommendations guiding physicians in biomedical research involving human subjects," adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964.

.4 Conflict of interest

No conflict of interest.

.5 Limitations

The study was not free of limitation. The population was selected conveniently, so there might be a chance of bias. Limited sample size due to selffunding may restrict for generalization. The limited resources such as reports, statistical data, books, and journals were also a limitation.

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