ORIGINAL RESEARCH

Study of association of BMI with glycemic control in type 2 diabetes mellitus patients at a tertiary hospital, West Bengal

Jayati Das[1], Rupali Thakur[2]

[1]Associate Professor, Department of Physiology, Deben Mahato Government Medical College and Hospital, Purulia,WestBengal.
[2]Assistant Professor, Department of Community Medicine, Burdwan Medical College and Hospital, PurbaBardhman, West Bengal.

ABSTRACT

Background: Diabetes mellitus (DM) is a heterogenous group of metabolic disorders with chronic hyperglycemia and glucose intolerance. Satisfactory glycemic and weight control in outpatient diabetic subjects is important. Present study was aimed to study association of BMI with glycemic control in type 2 diabetes mellitus patients at a tertiary hospital.
Material and Methods: Present study was hospital based, cross-sectional study, conducted in subjects (males and females between 26–45 years) attending outpatient department of Medicine, known diabetic patients, underwent BMI calculation and HBa1c estimation.
Results: In present study, total 150 subjects studied, 50 each from group A, B, C (depending on duration of diabetes), in each group 25 male & 25 female. Subjects were divided according to BMI values & compared with gender. There was no significant difference found in male & females according BMI distribution (p – 0.72). According to BMI majority were overweight (72 cases) followed by normal BMI (54 cases) & obese (24 cases). We noticed, HBA1C $\geq$ 8 commonly in overweight & obese subjects than normal BMI subjects, difference was statistically significant ($p<0.01$). Descriptive statistics calculated using Pearsons correlation. R values were 0.034, 0.242 & -0.022 for A,B,C groups respectively, which was significant in obese group. When we compared BMI and glycated Hb values within the three groups, a significant correlation was noted between BMI and glycated Hb values.
Conclusion: As BMI value rises, so does the HbA1c level. Majority of diabetic subjects with a BMI > 30 (obese group) had HbA1c levels greater than 8%. Statistical analysis reveals a substantial positive connection between BMI and HbA1c (p value 0.001).
Keywords: Body mass index; Glycemic control; Type 2 diabetes; body weight

Corresponding Author: Dr.Rupali Thakur, Assistant Professor, Department of Community Medicine, Burdwan Medical College and Hospital, PurbaBardhaman.
Email:rupalithakur23@gmail.com

INTRODUCTION

Diabetes mellitus (DM) is a heterogenous group of metabolic disorders with chronic hyperglycemia and glucose intolerance.[1]Non-modifiable risk factors for type 2 DM (T2DM) include race, genetic predisposition, and increasing age. Apart from non-modifiable risk factors, four key behavioral risk factors, namely, physical inactivity, unhealthy diet, tobacco consumption, and increasing use of alcohol are important modifiable risk factors for T2DM.[2,3]

Optimal glycemic control attainment in clinical practice is difficult and the reasons for its poor control are complex. Factors identified in influencing glycemic control include age, sex, education, marital status, BMI, smoking, diabetes duration, and type of medications.[4]Glycemic control is a phrase given for the level of blood sugar in diabetes patient, and good glycemic control avoids the severity of complications and increases cognitive functioning.[5]

Glycemic control can be evaluated by measuring the hemoglobin A1c (HbA1c) which notifies the average blood glucose level in the past 2-3 months.[6] Satisfactory glycemic and weight control in outpatient diabetic subjects is important. Present study was aimed to study association of BMI with glycemic control in type 2 diabetes mellitus patients at a tertiary hospital.

MATERIAL AND METHODS

Present study was hospital based, cross-sectional study, conducted in department of general medicine, at Deben Mahato Government Medical College and Hospital, Purulia, West Bengal. Study duration was of 2 years (January 2020 to December 2021). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Subjects (males and females between 26–45 years) attending outpatient department of Medicine, known diabetic patients, willing to participate in present study

Exclusion criteria

- Subjects taking steroids/females taking oral contraceptive pills,
- Known hypertensives,
- Subjects with on treatment for thyroid disorders

Study was explained to patients in local language & written consent was taken for participation & study. All patients underwent demographic data collection, history taking, general examination & details were noted in case record proforma. The height was measured using sliding stadiometer (Johnson and Johnson) with an accuracy of 0. 1mm.Weight was recorded using spring balance calibrated to 0.5kg accuracy. Body Mass Index (BMI) was calculated based on the WHO formula as

BMI = Weight in kg/Height in mt^2.

Patients were classified into group A, B, C depending on duration of diabetes.

- Group A consists of diabetics with 5 years duration,
- Group B consists of diabetics with 10 years and
- Group C consists of diabetics with 15 years duration.

Each subject was instructed to visit laboratory with 6 hours of fasting on a specific date, the blood samples (3 ml volume) was drawn for estimation glycated hemoglobin.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, total 150 subjects studied, 50 each from group A, B, C (depending on duration of diabetes), in each group 25 male & 25 female were present.

Table 1: Distribution of study subjects according toGender and body mass index distribution.

BMI (kg/m^2)	Male	Female	Total
	No. (%)	No. (%)	No. (%)
Underweight /Normal (<24.9)	29(38.67)	25(33.33)	54 (36)
Overweight (25-29.9)	35(46.67)	37(49.33)	72 (48)
Obese (>30)	11(14.67)	13(17.33)	24(16)
Total	75	75	150

In present study, according to BMI majority were overweight (72 cases) followed by underweight and normal BMI (54 cases) & obese (24 cases). Subjects were divided according to BMI values & compared with gender. We did not found any significant difference in BMI distribution and gender(p – 0.72).

Table 2: Correlation between BMI and HBA1C

BMI (kg/m^2)	< 6.5%	6.5-8%	8-10%	> 10%	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Underweight/Normal(<24.9)	23 (67.7)	17 (40.48)	9(21.43)	5(15.15)	54
Overweight(25-29.9)	10(30.3)	22(52.38)	23(54.76)	17(51.52)	72
Obese(>30)	0	3(7.14)	10(23.81)	11(33.33)	24
Total	33	42	42	33	150

We noticed, HBA1C ≥ 8 commonly in overweight & obese subjects than normal BMI subjects, difference was statistically significant (p<0.01).

Table 3: Correlation between BMI, HBA1C & duration of diabetes

Group	BMI	HbA1c	R value (correlation)	p-value
A	24.42 ± 3.84	7.54 ± 2.17	0.034	0.001
B	28.15 ± 3.48	8.39 ± 2.78	0.042	
C	26.55 ± 4.61	10.17 ± 2.61	-0.022	

Descriptive statistics calculated using Pearsons correlation. R values were 0.034, 0.242 & -0.022 for A,B,C groups respectively, which was significant in obese group. When we compared BMI and glycated Hb values within the three groups, a significant correlation was noted between BMI and glycated Hb values.

DISCUSSION

Diabetes mellitus created a great health and economic burden because of the direct costs of treatment, manhours lost due to the debilitating effect the disease on the individual and society at large in the world.[7] Socio-demographic factors like age, sex, body mass index (BMI), level of education, marital status, income and occupation, ethnicity and religion,

history of smoking, history of alcohol intake, family history of DM, medication adherence, duration of therapy, and drug utilization pattern (monotherapy, combined oral therapy or oral therapy along with insulin), complexity of therapeutic regimen, association with comorbidities, fear of side effects, job related factors, psychological issues, maintaining regular follow up with doctors are among the many variables which affect the level of glycemic control.[8]

Obesity is a complex disorder associated with variety of diseases such as cardiovascular disease (CVD), stroke, cancer, hypertension, diabetes, osteoarthritis and early death.[9] According to the World Health Organization (WHO), obesity is one of the common and most neglected public health problems in both developed and developing countries.[10] The risk of complication in type 2 DM is directly related to prior glucose control level. A study revealed that in patients with type 2 diabetes, HbA(1c) levels were associated with lower risks of macrovascular events and death down to a cutpoint of 7.0% while microvascular events down to a cutpoint of 6.5%.[11]

Ashish V. Paul et al.,[12] studied 79 diabetic patients, 41.8% were overweight, 50.6% belonged to the normal BMI range and 7.6% were underweight. There was no statistically significant association between BMI and glycemic control ($p = 0.39$). There was significant association between glycemic control and age of the patient ($p = 0.029$); with increasing age there was better glycemic control. There was no association between BMI and glycemic control of hospitalized type 2 diabetic patients. Glycemic control of diabetic patients was related to the age of the patient; with increasing age there was better glycemic control.

Goyal J et al.[13], studied 206 patients. Patients with BMI more than 30 had 4 times risk of having poor glycemic control as compared to those with BMI <25 (OR = 3.9, C.I. = 1.2-3.9, P =0.02). Glycemic control was affected by age, duration of diabetes, drug utilization patterns and BMI and a statistically significant association was found with these factors.

Kanyakumari D H et al.,[14] studied 90 diabetic patients of both sex. Three groups with different duration of diabetes were made. Anthropometric measurements were taken and glycemic control was measured in these patients. There was a no association between BMI and glycemic control in diabetic patients, which emphasizes the role of lifestyle modification in these patients.

Anari R et al.,[15] studied 157 Type 2 diabetic outpatients, mean age of participants was 54.47±9.39 years and mean BMI was 29.26±5.04 kg/m2. Poor glycemic control (HbA1c≥7%) was observed in 63.7% of participants. The rate of poor glycemic control in obese group was 60.3% and there was no correlation between obesity and poor HbA1c control using logistic regression we found no association between obesity and poor glycemic control (OR=0.796; p=0.504). Obese patients had lower education level than non-obese patients (p=0.035). Females had higher poor glycemic control than males; however, it was not significant (62% vs. 50% in obese and 68.5% vs. 62.2% in non-obese groups). More than half of participants had poor glycemic control. Obese patients had similar rate of hyperglycemia to non-obese ones.

In study by Subhash Chandra J et al.,[16] among 110 diabetes patients, 63.64 % were male. The majority of patients were overweight (BMI 25-29.9), accounting for about 60(54.55 percent) of all cases, followed by 40(36.36 percent) patients with Normal BMI (18.5-24.9) and 10(9.09 percent) patients with Obese (BMI>40). The BMI value rises, so does the HbA1c level. All individuals with a BMI more than 30 (obese group) had HbA1c levels greater than 8%. Statistical analysis reveals a substantial positive connection between BMI and HbA1c (p value 0.001). Similar findings were noted in present study.

Sisodia RK et al.,[17] studied 100 diabetic patients, 62 of them were male. Majority of patients were overweight (BMI 25-29.9) which is account to about 58 of total cases, 30 patients were normal BMI and 12 patients were obese. Statistical analysis a positive correlation found

between BMI and poor glycaemic control (HbA1c), which is significant. Thus, obesity (BMI) is associated with poor glycaemic control. Similar findings were noted in present study.
Obesity is the most powerful environmental risk factor for type 2 diabetes mellitus[18] and body mass index (BMI) is a standard predictor of diabetic status, plasma glucose and glycated haemoglobin (HbA1C) concentrations in populations at risk for type 2 diabetes mellitus.[18,19]
Evidence suggests that regular physical activity (PA) is not only associated with substantial decrease in cardiovascular and all-cause mortality, it also reduces the risk of T2DM, cardiovascular disease, and some types of cancer (breast or colon cancer) and improves wellbeing.[20.21] Comprehensive and appropriate management of patients with diabetes should include early screening for complications and optimize control of glucose, blood pressure and cholesterol.

CONCLUSION

As BMI value rises, so does the HbA1c level. Majority of diabetic subjects with a BMI > 30 (obese group) had HbA1c levels greater than 8%. Statistical analysis reveals a substantial positive connection between BMI and HbA1c (p value 0.001). The combination of a low-calorie diet, increased physical activity, and behavioral therapy as the first-line intervention for weight loss should be stressed for the effective management of T2DM.

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