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Original Research Article

The study of correlation between Body Mass Index and glycemic control-HbA1c in diabetes type 2 patients

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ABSTRACT

Background: Obesity has major adverse effects on health. Obesity is associated with an increase in mortality, with a 50-100% increased risk of death from all causes compared to normal-weight individuals, mostly due to cardiovascular causes. The aim of this study was to correlate Body Mass Index (BMI) and glycaemic control (HbA1c) in type 2 Diabetic patients.
Methods: In this study 100 patients of type 2 diabetic were subjected to detailed history, clinical examination, BMI, HbA1c and routine biochemical investigations.
Results: Out of 100 diabetic patients included in this study 62 of them were male and 38 were female. Among 100 patients. 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.
Conclusions: From this study it was concluded that obesity (BMI) is associated with poor glycaemic control.

Keywords: Body mass index, Diabetes type 2, Glycated haemoglobin, Obesity

INTRODUCTION

Diabetes Mellitus is the most common metabolic disorder characterized by a series of hormone induced metabolic abnormalities and long-term complication. The worldwide prevalence of Diabetes mellitus has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 415 million in 2017.[1] Obesity is a state of excess adipose tissue mass.[2] However, in the presence of nutritional abundance and a sedentary lifestyle, and influenced importantly by genetic endowment, this system increases adipose energy stores and produces adverse health consequences . According to WHO global obesity almost doubled between 1980 and 2008. There were >200 million obese men and almost 300 million obese women, 11% of adults worldwide, in 2008.[2] In developing countries, such as India obesity prevalence is rising (5%) with a greater tendency to harmful intraabdominal obesity at lower BMI in the population, and the consequences for metabolic and cardiovascular health are disproportionate to obesity prevalence.[2] Although not a direct measure of adiposity, the most widely used method to gauge obesity is the Body Mass Index (BMI), which is equal to weight/height (in kg/m^2). Glycated Hemoglobin (HbA1c) is a routinely used marker for long-term glycemic control.

In accordance with its function as an indicator for the mean blood glucose level, HbA1c predicts the risk for the development of diabetic complications in diabetic patients and may be suggested as diagnostic criteria that detects more diabetes and pre-diabetes cases than fasting glucose or oral glucose tolerance test OGTT.[3] Hyperinsulinemia and insulin resistance are pervasive features of obesity, increasing with weight gain and diminishing with weight loss.[2] The exact

pathogenesis of microvascular complications in Diabetes mellitus is unknown. Oxidative stress activated Renin-Angiotensin System (RAS), hyperglycemia, Advanced Glycosylation End-products (AGE), and oxidized low-density lipoproteins are factor contributing to initiation and progression of endothelial inflammation, ultimately leading to diabetic vascular complications.

The chronic hyperglycemia of Diabetes is associated with long-term damage, dysfunction, and failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels.[4]

METHODS

This was a cross sectional study done in the department of medicine GRMC Gwalior on 100 diabetic patients were diagnosed case of type 2 diabetes mellitus which were admitted and attend Medicine OPD in J.A. Group of Hospital over a period of one year. Patients who are diagnosed as Diabetes mellitus type 2 were included in the study and Patients with Urinary tract infection, obstructive uropathy and on statins were excluded.

Informed consent was taken from all the patients and each patient was subjected to detailed history and clinical examination and take BMI and HbA1c with routine investigations are done. Body height in centimeters and body weight in kilograms (kg) were measured with light clothes and bare feet, and BMI in kg/m^2 was calculated.

For the estimation of Glycated Hemoglobin (HbA1c) the blood collected in the EDTA vial was used and assayed manually by resin-exchange method. The patients were divided into three groups based on HbA1C values: 6.5-8, 8-10 and >10%.

Table 1: Criteria for the diagnosis of diabetes mellitus.[4]

Symptoms of diabetes plus random plasma glucose concentration >200 mg/dl (11.1 mmol/l). random is defined as any time of the day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss
OR
FPG =126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h.
OR
2-h post load glucose >200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 gm anhydrous glucose dissolved in water.
HbA1C> 6.5 %

For body mass index body height in centimeters and body weight in kilograms (kg) were measured with light clothes and bare feet, and BMI in kg/m2 was calculated.

Data analysis

Data analysis was done by software EPICAL and p value are measured in all statistics by Chi square (χ^2) test and ANOVA test, p value <0.05 was considered significant.

Table 2: Classification of weight status and risk of disease.[5]

	BMI (kg/m^2)	Obesity class	Risk of disease
Underweight	<18.5		
Healthy weight	18.5-24.9		
Overweight	25.0-29.9		Increased
Obesity	30.0-34.9	I	High
Obesity	35.0-39.9	II	Very high
Extreme Obesity	≥40	III	Extremely high

Source: Adapted from National Institutes of Health, National Heart, Lung, and Blood Institute: Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. US department of health and human services, Public Health Service, 1998

RESULTS

Out of 100 diabetic patients included in this study 62 of them were male and 38 were female. Majority of patients were overweight (BMI 25-29.9) which account to about 58 (58%) of total cases, followed by 30(30%) patients were Normal BMI (18.5-24.9) and followed by 12(12%) patients were Obese (BMI>40). Among 58 overweight patients, 33 (53.22%) patients were male and 25 (65.78%) patients were female. Normal BMI of 30 patients, 23 (37.09%) patients were male and 7(18.42%) patients were female. Obese 12 patients, 6 (9.67%) patients were male and 6 (15.78%) patients were female as shown in (Table 3) and (Figure 1).

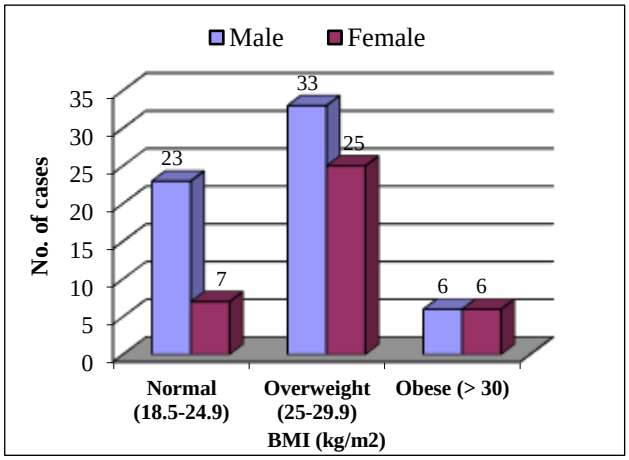

Figure 1: Body mass index distribution in cases.

Table 4 shows as BMI value increase, HbA1c also follows an increasing trend. All patients with BMI >30 (Obese group) were having HbA1c >8%. On statistical

analysis BMI shows a significant positive correlation with HbA1c (p value <0.001).

Table 3: Body mass index distribution in cases.

BMI (kg/m^2)	Male		Female		Total
	No.	%	No.	%	
Normal (18.5-24.9)	23	37.09	7	18.42	30
Overweight (25-29.9)	33	53.22	25	65.78	58
Obese (≥30)	6	9.67	6	15.78	12
Total	62	100	38	100	100

DISCUSSION

In present era diabetes is the most common endocrine disorder which prevalence is 6.5% of entire population worldwide is still on rise owing to the interaction of various host and changing environmental factors. India is the world capital of diabetes. Of the total 100 diabetic patients included in this study 62 of them were male and 38 were female. In this study 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 (Table 3).

Table 4: Correlation between BMI and HBA1C in cases.

BMI (KG/M^2)	HBA1C								Total
	< 6.5%		6.5-8%		8-10%		> 10%		
	No.	%	No.	%	No.	%	No.	%	
Normal (18.5-24.9)	2	50.00	14	43.73	6	18.75	8	25.00	30
Overweight (25-29.9)	2	50.00	18	56.25	25	78.12	13	40.62	58
Obese (≥30)	0	0	0	0	1	3.12	11	34.37	12
Total	4	100	32	100	32	100	32	100	100

In this study on statistical analysis a positive correlation found between BMI and HbA1c (p value <0.001) (Table 4), Which is significant. Tomic Martina et al, was found similar to our study that is, a significant positive correlation between BMI and HbA1c.[6] In another study carried out on the Western Indian population, Sheth et al, showed that the dyslipidemia obese subjects had significant linear association with HbA1c in T2DM subjects.[7] Obesity plays a central role in the pathophysiology of both type 2 diabetes and its macro vascular complications. Walid Gaafar Babikr et al, also found a positive correlation between BMI and HbA1c.[8]

CONCLUSION

The study entitled "The Study of correlation between Body Mass Index (BMI) and glycemic control (HbA1c) in diabetes type 2 Patients'' is of cross sectional for a sample of 100 patients of type 2 Diabetes mellitus revealed that abnormal BMI (Obesity) were is the statistically significant found correlation with poor glycemic control (HbA1c). The BMI and HbA1c should be kept under strict control so that complications associated with diabetes would be delayed. The glycemic control should be monitored regularly as it has been found that chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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