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To determine the correlation between BMI and Glycated Hemoglobin (HbA1c) Level in Patients of Type 2 Diabetes Mellitus

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ABSTRACT
Aim: To determine the correlation between BMI and Glycated Hemoglobin (HbA1c) Level in Patients of Type 2 Diabetes Mellitus.
Methods: This was a cross sectional study was conducted on 110 diabetic patients were diagnosed case of type 2 diabetes mellitus. Informed agreement was obtained from all patients, and each patient was exposed to a complete history and clinical examination, as well as BMI and HbA1c measurements and regular diagnostics. Body height in centimetres (cm) and weight in kilogrammes (kg) were measured while wearing light clothing and walking barefoot, and BMI in kg/m2 was determined. For the measurement of Glycated Hemoglobin (HbA1c), blood was taken in an EDTA vial and manually tested using the resin-exchange technique.
Results: This study comprised 110 diabetes patients, 63.64 percent of whom were male and 36.3 percent of whom were female. 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).
Conclusion: In a study of 110 people with type 2 diabetes, abnormal BMI (obesity) was found to be a statistically significant predictor of poor glycemic control (HbA1c). The BMI and HbA1c levels should be strictly monitored in order to postpone diabetic consequences.
Keywords: BMI, Glycated Hemoglobin (HbA1c) , Type 2 Diabetes Mellitus

Introduction

Diabetes mellitus is one of the most prevalent disorders today, defined by hyperglycemia caused by either insulin insufficiency or insulin resistance. Diabetes type 2 is also a major cause of coronary artery disease, peripheral artery disease, end-stage renal disease (ESRD), and adult blindness. Diabetes, which is becoming more common over the world, will be a primary cause of death and morbidity. [1] The rapid rise in the number of diabetics globally is a serious public health problem in both developing and affluent countries. Metabolic syndrome is also becoming more common. Numerous studies have found a correlation between the metabolic syndrome and insulin resistance, as well as a link between iron excess and the metabolic syndrome. Serum ferritin levels that are increased, indicating bodily iron overload, are frequently related with insulin resistance measures such as elevated blood glucose and insulin levels. [2] Obesity is defined as an excess of adipose tissue mass.3 However, in the face of food

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plenty and a sedentary lifestyle, as well as being significantly impacted by genetic endowment, this mechanism increases adipose energy storage and has negative health repercussions. According to the World Health Organization, worldwide obesity nearly quadrupled between 1980 and 2008. In 2008, there were over 200 million obese males and almost 300 million obese women, accounting for 11% of all people worldwide. [3]

Obesity prevalence is increasing (5%) in developing nations such as India, with a stronger predisposition to hazardous intraabdominal obesity at lower BMI in the population, and the repercussions for metabolic and cardiovascular health are disproportionate to obesity prevalence. [3] Although not a direct measure of obesity, the Body Mass Index (BMI), which is equal to weight/height (in kg/m2), is the most generally used tool to assess obesity.

HbA1c (glycated haemoglobin) is a commonly used measure for long-term glycemic management. As a result, the goal of our study was to find a link between BMI and glycated haemoglobin levels in type 2 diabetes patients. Diabetes mellitus (DM) is a collection of metabolic illnesses defined by hyperglycemia caused by insulin production, insulin action, or both. Reduced insulin, decreased glucose utilisation, and increased glucose production are all causes that might lead to hyperglycemia. Diabetes is a prominent source of illness and death in the human population. [4]

Material and methods

This was a cross sectional study done on 110 diabetic patients were diagnosed case of type 2 diabetes mellitus.

Inclusion criteria

Patients who are diagnosed as Diabetes mellitus type 2

Exclusion criteria

Patients with Urinary tract infection and Obstructive uropathy

Methodology

Informed agreement was obtained from all patients, and each patient was exposed to a complete history and clinical examination, as well as BMI and HbA1c measurements and regular diagnostics. Body height in centimetres (cm) and weight in kilogrammes (kg) were measured while wearing light clothing and walking barefoot, and BMI in kg/m2 was determined.

Table 1 shows the classification of weight status and illness risk.[6]

BMI (kg/m^2)	
Underweight	<18.5
Healthy weight	18.5-24.9
Overweight	25.0-29.9
Obesity class I	30.0-34.9
Obesity ClassII	35.0-39.9
Extreme Obesity Class III	≥40

For the measurement of Glycated Hemoglobin (HbA1c), blood was taken in an EDTA vial and manually tested using the resin-exchange technique. The patients were separated into three groups depending on their HbA1C levels: 6.5-8, 8-10, and >10%. Body mass index was estimated by measuring body height in centimetres and body weight in kilogrammes (kg) while wearing light clothing and walking barefoot. Diagnosis of diabetes mellitus based on FPG =126

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mg/dl (7.0 mmol/l) criteria. Fasting is defined as no caloric intake for at least 8 hours or a HbA1C level more than 6.5 percent). [5]

Results

This study comprised 110 diabetes patients, 63.64 percent of whom were male and 36.3 percent of whom were female. 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). There were 37 (52.86 percent) males and 23 (57.5 percent) females among the 60 overweight patients. Normal BMI of 40 patients, 25 (35.71%) of whom were male and 15 (37.5%) of whom were female. Obese 10 individuals, 8 (11.43 percent) were male and 2 (5 percent) were female.

Table 2 age and gender distribution of patients

Gender	Number of patients	Percentage
Male	70	63.64
Female	40	36.36
Age		
Below 25	5	4.55
25-40	35	31.82
40-55	55	50
Above 55	15	13.63

Table 3. Distribution of patients on the basis of BMI

BMI (kg/m^2)		
	Number	**Percentage**
Normal (18.5-24.9)	40	36.36
Overweight (25-29.9)	60	54.55
Obese ($\geq$30)	10	9.09

Table 4 demonstrates that when 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).

Table 4: Correlation between BMI and HBA1C in cases

BMI (KG/M^2)	**HBA1C**								**Total**
	< 6.5	**Percentage**	**6.5-8%**		**8-10%**		**> 10%**		
	N	**Percentage**	**N**	**Percentage**	**N**	**Percentage**	**N**	**Percentage**	
Normal (18.5-24.9)	3	60	15	42.86	10	28.57	12	34.29	40
Overweight (25-29.9)	2	40	20	57.14	24	68.57	14	40	60
Obese ($\geq$30)	0	0	0	0	1	2.86	9	25.71	10
Total	5	100	35	100	35	100	35	100	110

Discussion

Several previous large randomised prospective studies have connected a HbA1c goal of less than or equal to 7% to a significantly decreased risk of diabetes-related microvascular problems. Diabetes mellitus is quickly nearing epidemic proportions in India, with enormous morbidity and death linked with diabetes and its potential consequences. Diabetes has a substantial financial impact on individuals, families, culture, and the healthcare system in the United States. T2DM is becoming more frequent as obesity increases. Obesity has reached epidemic proportions, leading to an increase in the incidence and prevalence of type 2 diabetes in recent decades. Diabetes is the most prevalent endocrine illness in the modern period, with a prevalence of 6.5 percent of the global population, and its prevalence is continually increasing due to the interplay of many host and changing environmental variables. Diabetes is the world's most prevalent disease in India.

This study comprised 110 diabetes patients, 63.64 percent of whom were male and 36.3 percent of whom were female. 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). This study comprised 110 diabetes patients, 63.64 percent of whom were male and 36.3 percent of whom were female. This is comparable to previous research from our nation, such as Ramesh Chandra Thanna[7]'s work. In our investigation, it was shown that the majority of patients afflicted were males between the ages of 40 and 55 (50 percent), followed by those between the ages of 25 and 40 (31.82 percent), and those over 55 (55 percent) (13.63 percent). This is comparable to several other studies conducted in our nation, including one conducted by Ramesh Chandra Thanna et al [7] in which the mean age of the study group was 53.66±10.58 years, and another conducted by Poonam Arora et al[8] in which the mean age of diabetes patients was 52.37± 7.98 years.

According to the statistical analysis, there is a substantial positive association between BMI and HbA1c (p value 0.001). Tomic Martina et colleagues discovered a substantial positive association between BMI and HbA1c, which is comparable to our findings. [9] Sheth et al. found that dyslipidemia obese patients had a strong linear correlation with HbA1c in T2DM participants in another investigation on the Western Indian population. [10] Obesity is fundamental to the pathogenesis of type 2 diabetes and associated macrovascular consequences. Walid Gaafar Babikr et al. discovered a link between BMI and HbA1c. [11]

Conclusion

In a study of 110 people with type 2 diabetes, abnormal BMI (obesity) was found to be a statistically significant predictor of poor glycemic control (HbA1c). The BMI and HbA1c levels should be strictly monitored in order to postpone diabetic consequences. Glycemic control should be evaluated on a frequent basis since persistent hyperglycemia in diabetes has been linked to long-term damage, malfunction, and failure of different organs, including the eyes, kidneys, nerves, heart, and blood vessels.

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