

Does Body Mass Index Predict Glycemic Control Among Type 2 Diabetes Patients?

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Abstract: Diabetes mellitus is one of the major health problems in India which is rapidly reaching to potentially epidemic proportions. Obesity is one of the major risk factors for diabetes and impaired glucose regulation. In literature there are discrepant findings regarding association of body mass index (BMI) & glycemic control. The present study aims to explore relationship between BMI, glycosylated haemoglobin (HbA1c) and fasting blood glucose levels (FBG). Data of total 50 type 2 diabetics (male and female) patients on regular oral hypoglycaemic drugs with disease duration more than 2 year was analysed for glycemic control. The parameters were studied for correlation between BMI, HbA1c, & FBG. We found that the overall HbA1c & FBG values were higher than normal physiological limit. Though no significant difference was seen between overweight & normal weight diabetic patients mean HbA1c & FBG values were higher among overweight than normal weight diabetics. There was weak positive correlation seen between BMI, HbA1c & FBG. Percentage of poor glycemic control was higher among overweight than normal weight diabetics. Long term Poor glycemic control can predispose to macro & micro vascular complications; to prevent this, diabetic subjects should be encouraged for proper weight management.

Keywords: Body mass index, glycosylated haemoglobin, fasting blood sugar, diabetes, glycemic control.

INTRODUCTION

Diabetes mellitus is one of the major health problems throughout the world and its prevalence is rapidly increasing.

According to the International Diabetes Foundation, India is the capital of diabetes and has more diabetic patients than any other country in the world and rapidly it is reaching to potentially epidemic proportions [1]. It is a group of metabolic disease characterised by hyperglycaemia resulting from defect in insulin secretion, its action or both [2]. Obesity is one of the major risk factors for diabetes and impaired glucose regulation [3]. The increase in prevalence of diabetes parallels with that of obesity [4]. There are certain anthropometric measures which are important risk factors for development of type 2 diabetes mellitus. Body mass index (BMI) is one of the anthropometric indices routinely used to define overweight & classify obesity. Previous studies have shown that BMI as well as other anthropometric measurements are predictive of non-insulin dependent diabetes mellitus [5]. Oral glucose tolerance test (OGTT) & plasma blood glucose levels are measured as marker of short term glycemic control, glycosylated haemoglobin (HbA1c) is routinely used marker for long term glycemic control. In accordance with its function as an indicator for mean

blood glucose level, HbA1c predicts the risk for development of diabetic complications in patients. [6]. The HbA1c provides an index of average blood glucose level during past 2-3 months and considered to be the most objective and reliable measure of long term metabolic control of glucose [7]. Present study tried to explore relationship between body mass index, blood sugar levels, and glycated haemoglobin among diabetic patients.

MATERIALS AD METHODS

The present study was carried out at one of the tertiary health care centre of central India. Study subjects were recruited from the patients regularly attending daibetology clinic. On the occasion of world diabetes day, to promote awareness about diabetes in society free health check-up, motivational lectures and guidance camp was organised, which also included estimation of fasting blood sugar and glycosylated haemoglobin (HbA1c). Prior information about the event was given to the patient attending the diabetic OPD. The known diabetic patients who were willing to

participate in health check-up camp were registered and schedule of the event was explained. There general demographic parameters were recorded and written inform consent was taken. On the world diabetes day they were asked to come in the morning, overnight fasted to provide blood sample for blood sugar level & HbA1c estimation. The study subjects were having freedom to withdraw any point of time during the whole schedule. Those participants who turned up in the morning and provided the blood sample went through the various events of the camp. In the last part of event printed report of their biochemical parameters was given and participants had freedom to discuss the report with any of the consultants. After getting hospital ethics committee clearance, demographic & biochemical data of participants was used for analysis

Although total 200 patients had registered for the camp only 89 participants turned up for the event. Out of the total 89 participants the data of 50 middle age (male & female) patients was selected for the analysis. The inclusion criterion for the data selection was:

- Diabetics in the age range of 35-45 years
- Having disease duration of more than two years
- Who were regularly taking oral hypoglycaemic drug therapy.

The exclusion criterion for data selection was:

- Patients on insulin therapy
- Disease duration less than 2 years,
- Patients not maintaining overnight fasting,

- Over aged participants and those with any other major systemic illness.

Blood glucose was determined by using glucose oxidase method with routine biochemistry analyser. HbA1c was measured by high performance liquid chromatography with Bio-Rad D-10.

STATISTICAL ANALYSIS

Data compiled was checked for correctness and completeness. Body mass index was determined using standard formula (weight/ (height)²). Correlations between BMI, HbA1c, FBG was done using Pearson’s correlation coefficient. Depending on BMI two groups were formed, group 1 having BMI more than 25 kg/ m² (overweight) and group 2 having BMI less than 25 kg/ m² (normal weight), similarly HbA1c value more than 7% and less than 7% were used for comparisons. Differences between two groups were analysed using unpaired t-test. Odds ratio was determined to measure the strength of association.

RESULTS

All data was expressed as mean ± standard deviation (SD). Table 1 shows general and biochemical characteristic of diabetic patients. Correlations of HbA1c, fasting blood glucose and body mass index are shown in table 2. HbA1c and FBG values were stratified according to body mass index and their comparisons are shown in table 3. The level of glycaemic control between two BMI groups according to HbA1c levels and their strength of association is depicted in table 4.

Table-1: General characteristics of study subjects

Parameter	Mean	SD
Age (years)	38.58	2.58
Height (centimetres)	162.81	10.16
Weight (kilograms)	76.05	8.96
Body mass index (kg/ m ²)	28.94	4.28
Duration (years)	4.18	2.61
HbA1c (%)	9.11	2.45
Fasting sugar (mg/dl)	137.88	34.14

Table-2: Correlation of BMI, HbA1c and FBG

		FBG	BMI
HbA1c	Pearson correlation coefficient	0.33	0.238
	Sig. (2 tailed)	0.821	0.096
	N	50	50
FBG	Pearson correlation coefficient		0.35
	Sig. (2 tailed)		0.808
	N		50

Table-3: HbA1c and fasting blood glucose values stratified according to body mass index

	BMI groups				Unpaired t test
	Less than 25 kg/m ²		More than 25 kg/m ²		
	Mean	Standard deviation	Mean	Standard deviation	
HbA1c (%)	8.87	2.44	9.19	2.55	0.346
Fasting blood glucose (mg/dl)	143.08	44.72	136.24	30.62	0.550

Table-4: Glycemic control between two BMI groups

BMI Groups	HbA1c Groups		Odds Ratio
	More than 7%	Less than 7%	
	Number of subject and percentage	Number of subject and percentage	
More than 25 kg/m ² (Total 38)	30 (79%)	8 (21%)	1.8750 CI (0.4481-7.845)
Less than 25 kg/m ² (Total 12)	8 (67%)	4 (33%)	Z=0.861 P=0.389

DISCUSSION

In present cross-sectional study correlations between BMI, HbA1c and Fasting blood glucose were examined among patients with type-2 diabetes. Moderate strength positive correlation though not significant so was found between HbA1c & BMI ($R = 0.238$). Weak positive correlation was seen between HbA1c & fasting blood glucose ($R = 0.33$) (table 2). Reports in the literature are having varied conclusions; some studies [8-10] are in concordance with the findings from present study and shown positive correlations, while few authors in the past reported inverse correlations [11-14]. These discrepancies about varied conclusions between BMI, HbA1c and fasting blood glucose among diabetics may be because of geographical variations in diet and lifestyle.

As per American Diabetic Association (ADA) recommendations [15] the target HbA1c among diabetics should be maintained less than 7% as it indicates good glycemic control. [16] Considering this recommendations present study evaluated glycemic control using 7% as cut off value (table 4). Glycemic control was better (33%) with normal weight as compared with overweight (25%), when further analysed it was found that diabetics with BMI more than 25 were 1.8 times more associated with having poor glycemic control [17]. Thus obesity plays a central role in the glycemic control and hence in pathophysiology of macro & micro-vascular complications seen in diabetes. BMI as an indicator of obesity may provide clue to glycemic control [2].

In the present study, observed mean values of glycosylated haemoglobin & fasting blood sugar were further stratified according to BMI and it was seen that mean HbA1c & fasting blood glucose levels were higher than recommended normal levels for both the groups (table 3). It indicates that short as well as long term glycemic control was poor among diabetics. Although statistically significant difference was not observed between two groups the mean HbA1c & FBG values were higher in over weights (BMI>25%). These findings are similar to the observations of other researchers [18]. In agreement with previous workers, the present study state that the awareness should be encouraged among diabetic patients by giving stress on weight management & self-care which can help in reducing the complications seen during the course of

disease [19, 20]. With weight control there is reduction of BMI which lead to decreased insulin resistance that improves glycemic control. With improved glycemic control there is reduction of long term diabetes complications [21].

Within its limit the present study points out that BMI alone is not the only predictor of long term glycemic control, similarly few other coexistent factors like food, lifestyle and geographic location may be having input on glycemic control. Further we state that the outcome of present study could give more insight about relationship between these parameters using large number of study subjects.

CONCLUSION

We conclude that body mass index is one of the predictor of glycemic control and proper weight management should be encouraged in diabetic patients.

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