IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 11 Ver. 7 (November. 2018), PP 32-35
www.iosrjournals.org

Impact of Body Mass Index on Glycemic control in Type 2 Diabetes Mellitus

Dr. S. Kanchana Bobby[1] and Dr. N. Latha[2]
[1] *Assistant Professor, Department of Physiology, Coimbatore Medical College, Coimbatore*
[2] *Tutor/Assistant Professor, Department of Physiology, Coimbatore Medical College, Coimbatore*
Corresponding Author: Dr. N. Latha

***Abstract**: One of the challenges of the 21st century is the increasing prevalence of diabetes. Prolonged exposure to hyperglycemia is associated with both macrovascular and microvascular complications. We evaluated the relationship between BMI(Body Mass Index) and glycemic control. It is a cross sectional study conducted in 100 Type 2 Diabetes Mellitus(T2DM) subjects in the Department of Physiology and Diabetology in Coimbatore medical college hospital. Unpaired t test shows significant difference in the mean HbA1C values between normal and overweight subjects (p value=0.0012). Fishers Chi Square test shows significant association between BMI groups and glycemic control (X^2 = 23.971, p value =0.0000). Hence, the study concludes that, increase in BMI is associated with poor glycemic control. Strict control of BMI is necessary to maintain good glycemic control and thereby to prevent complications and maintain quality of life.*
***Key Words**: Body Mass Index, HbA1c,Glycemic control*

Date of Submission: 14-11-2018 Date of acceptance: 29-11-2018

I. Introduction

One of the most challenging problems of the 21st century with regard to health is diabetes mellitus(DM)[1]. It is a heterogenous group of metabolic disorders with chronic hyperglycemia and glucose intolerance[2]. According to recent analysis by International Diabetes Federation, about 382 million people suffer from diabetes, which is projected to reach about 592 million in 2035. The majority of this 382 million people fall under the age group of 40 to 59 years. India is the second leading country with 65.1 million people suffering from diabetes in 2013, which is expected to go up by 109 million by 2035[1].

The lethal effect of DM in renal, cardiac, retinal, and peripheral nervous system are well known and widely accepted[3]. The consistently high blood glucose level is a significant cause for the complications of diabetes[1].

Glycated haemoglobin (HbA1c) is a routinely used marker for long-term glycemic control[4]. 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[5].

% reduction in mean HbA1c level is associated with a 12 – 43% reduction of microvascular and macrovascular complications. So it is important to identify factors that influence the outcomes of glycemia in order to improve the quality of diabetic management. The knowledge of factors influencing glycemic control can be used by health professionals to provide targeted interventions to patients at greatest risk of diabetic complications[6]. The aim of the present study is to find the impact of body mass index with HbA1c in T2DM.

II. Materials and Methods

This is a cross-sectional study done in the Department of Physiology in association with Department of Diabetology in Coimbatore medical college hospital. 100 T2DM subjects of both sexes in the age group of 40-60 years on regular anti-diabetic medications were involved in this study. After obtaining clearance from the institutional ethical committee, the subjects were selected. The procedure was described in detail to the subjects and informed consent was obtained. HbA1c of the subjects were noted. According to American diabetes criteria, HbA1c of < 7% was considered as glycemic control goal for type 2 diabetes mellitus[7]. In this study, subjects with HbA1c of ≤7 are considered as good glycemic control and those with HbA1c >7 are considered as poor glycemic control. Type 1 Diabetes Mellitus, Gestational Diabetes Mellitus, Subjects with chronic illness, anemia and hypertension were excluded from the study.

A proforma was maintained to obtain detailed history. The subjects were instructed to wear light clothing and to stand erect with their arms relaxed at their side, with both feet close together. By using a portable standard weighing machine, weight in kilograms was recorded. Weight measured to nearest 0.5 kg. By

using a stadiometer, the vertical height of subject in centimeters was measured by asking the subject to stand erect. Height measured to nearest 0.5cm. BMI determined through Quetelet's Index. BMI = Weight (kg) / Height (m^2). WHO criteria was used to classify BMI. HbA1c was determined using turbidimetric immunoassay.

Statistical Analysis

Results of this study were statistically analysed using SPSS 16.0 software. The unpaired 't' test was used to find the relationship between the mean HbA1c values within BMI groups. Fischer's Chi-square test was used to find the association between BMI groups and subjects with good and poor glycemic control. A 'p'value of less than 0.05 was considered significant.

III. Results

Table I shows the clinical characteristics of the study subjects. Mean age of the subjects was 48.1 ± 4 years. 54% were males and 46% were females. Among the 100 T2DM subjects, 48% of them had good glycemic control and 52% of them had poor glycemic control. According to WHO criteria of BMI, 47% were normal, and 53% were overweight. There were no obese subjects.

Table I : The clinical characteristics of study subjects

		n
Age (years)	41-45	32
	46-50	38
	51-55	30
Sex	Male	54
	Female	46
Duration of Diabetes	≤ 5 years	54
	>5 years	46
Glycemic control	Good	48
	Poor	52
Body Mass Index	Normal	47
	Overweight	53

Table II compares mean HbA1c % within BMI groups. The mean HbA1c values in normal subjects is 7.97 ± 1.38 and the mean HbA1c values in overweight subjects is 9.02 ± 1.73. Unpaired 't' test shows significant difference in the mean HbA1c values (p value = 0.0012) which is less than 0.05.

Table II : **Comparison of Mean HbA1c % within BMI groups**

BMI (Body Mass Index)	HbA1c %	
	Mean	Standard deviation
Normal	7.97	1.38
Over weight	9.02	1.73
'p' value	0.0012	Significant(<0.05)

Table III represents the percentage of normal and obese subjects with good and poor glycemic control. Among the normal BMI subjects, 57% had good glycemic control and 43% had poor glycemic control and in the overweight BMI subjects, only 11% had good glycemic control and 89% had poor glycemic control.

Table III : **Percentage of subjects with good and poor glycemic control within BMI groups**

Percentage of subjects	Normal BMI	Overweight BMI
Good Glycemic control	57	11
Poor Glycemic control	43	89

Table IV : Fischer's Chi-square test was done within BMI groups who had good glycemic control and poor glycemic control. It shows the significant association between BMI groups and glycemic control. Chi-square value was 23.971 with p value = 0.0000.

Table IV : **Association between BMI groups and Glycemic control**

	Number of subjects		
	Good glycemic control	Poor glycemic control	Total
Normal BMI	27	20	47
Overweight BMI	6	47	53
	33	67	100
X^2 = 23.971 p value = 0.0000			

IV. Discussion

In the present study, 100 T2DM subjects in the age group of 40 to 60 years were involved. It was found that the mean HbA1c values were significantly higher in overweight subjects compared to normal subjects. 89% of overweight subjects had poor glycemic control compared to 43% in normal subjects. Chi-square test also revealed a significant association between BMI groups and glycemic control. This is consistent with various studies which also specified the significant relation between BMI and glycemic control.

A study done by Ninh T. Nguyen et al, exposed that the mean HbA1c levels were highest in overweight diabetic subjects [8].

J.P. Bae et al, analyzed the association between obesity and glycemic control in T2DM subjects, also revealed association between obesity and HbA1c >7% [9].

Walid Gaafar Babikr et al did a study to find the correlation of HbA1c with body mass index and HDL-Cholesterol in T2DM subjects. They found that body mass index was significantly correlated with poor glycemic control [5]. Henry et al described in his study that weight loss in overweight patients with T2DM rapidly reverses the state of insulin resistance and can restore normal blood glucose. T2DM subjects who succeed in weight loss enjoy greater improvements in glycemic control and cardiovascular risk profiles, provided the weight loss is maintained [10].

The possible mechanism behind the association of poor glycemic control with increased body mass index is due to aggravation of insulin resistance due to increased fat mass and visceral adiposity, which affect insulin sensitivity and cause insulin resistance [11]. Adiposity causes more release of adipokines like resistin, retinol binding protein-4 and reduced release of adiponectin and leptin into the circulation. Resistin is responsible for the insulin resistance. Usually leptin and adiponectin upsurges the insulin sensitivity by triggering the AMP activated protein kinase enzyme action. This protein kinase enzyme in turn stimulates fatty acid oxidation in the liver and skeletal muscle. Ultimately increased resistin and decreased adiponectin collectively decrease the insulin sensitivity in target tissues [12].

Although numerous studies support the association between body mass index and glycemic control, there are studies which do not support this relationship. Ashish V. Paul, Abraham M. Ittyachen, Anna Mathew and Saravana K.Velusamy did a study to find the association between body mass index and glycemic control in type 2 diabetes mellitus and found that there is no association between body mass index and glycemic control. Maya Savira and Rusdiana, Masafumi found no correlation between body mass index and HbA1c. Koga, Soeko Matsumoto, Hiroshi Saito and Soji Kasayama, also observed in their study that there is no relationship between body mass index and glycemic control [13-15].

From the results of various studies, it was found that the relationship between BMI and glycemic control was contradictory, so the present study was done to find the impact of BMI on glycemic control. Small sample size and the cross-sectional nature are the limitations of the study.

V. Conclusion

The current study implies that Body Mass Index is significantly related to glycemic control. As the Body Mass Index increases, the percentage of subjects with poor glycemic control also increases. Diabetes Mellitus and Body Mass Index are closely related to each other. Awareness should be made among diabetic subjects by diabetes management sessions so that they have proper self-care. Weight reduction and physical activity should be stressed in diabetic subjects.

References

[1]. International Diabetes Federation. IDF Diabetes Atlas, 6th edn. Brussels, Belgium: International Diabetes Federation; 2013.http://www.idf.org/diabetesatlas.
[2]. Umegaki H. Type 2 diabetes as a risk factor for cognitive impairment: current insights. Clinical Interventions in Aging. Dove Medical Press; 2014 Jun;(9):1011–9.
[3]. Kataria L, Pandya H, Shah S, Shah H, Gerg R. Prevalence and pattern of cognitive dysfunction in type 2 diabetes mellitus. International journal of medical and applied sciences. 2(4):245–52.
[4]. Rai R, Dahiya J, Chugh P, Sharma R, Chopra C. A Study on Correlation of Anthropometric measures and HbA1c in aymptomatic young adults. International journal of pharmaceutical and medicinal research. 2017;5(2):445-447.
[5]. Gaafar Babikr W, Saad Alturki Alshahrani A, Gumaa Mustafa Hamid H, Hassan Mohammed Khear Abdelraheem A, Helmy Faris Shalayel M. The correlation of HbA1c with body mass index and HDL-cholesterol in type 2 diabetic patients. Biomedical Research. 2016;27(4):1280-1283.
[6]. Juarez D, Sentell T, Tokumaru S, Goo R, Davis J, Mau M. Factors Associated With Poor Glycemic Control or Wide Glycemic Variability Among Diabetes Patients in Hawaii, 2006–2009. Preventing Chronic Disease. 2012;9.
[7]. American diabetes Association. Screening for type 2 diabetes. Diabetes care 2012;35:S11-S63
[8]. Nguyen N, Nguyen X, Lane J, Wang P. Relationship Between Obesity and Diabetes in a US Adult Population: Findings from the National Health and Nutrition Examination Survey, 1999-2006. Obesity Surgery. 2011:21(3):351-355
[9]. Bae J, Lage M, Mo D, Nelson D, Hoogwerf B. Obesity and glycemic control in patients with diabetes mellitus: Analysis of physicianelectronic health records in the US from 2009–2011. Journal of Diabetes and its Complications. 2016;30(2):212-220.
[10]. Kumar A. Prevalence of Glycemic Status, Obesity & Waist Circumference in Punjabi Type 2 Diabetics. Journal of Exercise Science and Physiotherapy. 2013;9(1):1.

[11]. Kamuhabwa A, Charles E. Predictors of poor glycemic control in type 2 diabetic patients attending public hospitals in Dar es Salaam. Drug, Healthcare and Patient Safety. 2014;:155.
[12]. Tripathy BB, RSSDI Text book of diabetes mellitus. 2nd Edition, 2012; vol 1,2.
[13]. Paul A, Ittyachen A, Mathew A, Velusamy S. Association between Body Mass Index (BMI) and Glycemic Control in Patients with Type 2 Diabetes Mellitus Admitted in a Rural Teaching Hospital in the State of Kerala, India – A Pilot Study. British Journal of Medicine and Medical Research. 2016;18(3):1-7.
[14]. Savira M. Correlation Between Body Mass Index and Glicosilat Haemoglobin(Hba1C) of Type 2 Diabetes Mellitus patients in Primary Health Care (PHC) in Binjai City, Sumatera Utara. International Journal of ChemTech Research. 2017;10(4):1-5.
[15]. Koga M, Matsumoto S, Saito H, Kasayama S. Body Mass Index Negatively Influences Glycated Albumin,but not Glycated Hemoglobin, in Diabetic Patients. Endocrine Journal. 2006;53(3):387-391.

Dr. S. Kanchana Bobby, "Impact of Body Mass Index on Glycemic control in Type 2 Diabetes Mellitus.". " IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 11, 2018, pp 32-35.