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A Cross-Sectional Study on Correlation between Body Mass Index and Glycemic Control in Diabetes Type-2 Patients in Rural Population

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ABSTRACT

Background: Diabetes Mellitus [DM] is the most prevalent metabolic disorder in the world, with micro and macrovascular complications that cause high mortality and morbidity rates as well as early death. Diabetes Mellitus, especially Type-2 diabetes, is usually linked with and obesity and has turned into a public health concern in recent years.

The Aim of The Work: To investigate an association between BMI and glycemic control, gauged using glycated hemoglobin as the marker, in type 2 diabetics.

Patients and Methods: A cross-sectional study was done in the department of medicine of St Peters Medical College Hospital and Research Centre, Hosur, Tamil Nadu, India. 482 patients with diagnosed cases of type 2 diabetes mellitus who attended and were admitted in the Medicine out-patient department [OPD] in the hospital from September 2021 to March 2022 were selected. Patients who are diagnosed with type 2 DM, both genders, and willing to participate were comprised in the study, and patients with gestational diabetes, type 1 diabetes, hypoproteinemia, malnutrition, malignancy, and chronic kidney disease were excluded. Patients were subjected to clinical examination and detailed history and BMI was calculated. Glycated hemoglobin [HbA1c] with routine investigations were done. Based on HbA1C levels: 6.5-8, 8-10, and >10 percent, the patients were classified into three groups.

Results: This study comprised 482 diabetes patients, 300 of whom were male and 182 of whom were female. 53.53% of the 482 patients were overweight [BMI 25-29.9], accounting for 258 of the total cases, 140 patients had a normal BMI, and 84 patients were obese. According to a statistical study, there is a substantial positive association between BMI and poor glycemic control [HbA1c].

Conclusion: According to the current study, obesity [BMI] is strongly correlated with poor glycemic control.

Keywords: Body mass index; Obesity; Glycated Hemoglobin; Type-2 Diabetes Mellitus.

INTRODUCTION

A set of metabolic disorders with diverse causes and characterized by sustained hyperglycemia or high blood glucose levels is called diabetes mellitus [DM]. Impaired insulin activity, secretion, or both are involved [1]. It is linked to major consequences that decreases the lifespan and lower their quality of life [2]. Obesity is linked with type-2 DM [T2DM] and cardiovascular disease, and with high risk of T2DM and pre-diabetes [3, 4].

According to studies, nearly one-third of the world's population is obese or overweight. Obesity is a risk factor for type-1 diabetes mellitus [T1DM] and [T2DM], additionally other chronic diseases such as cardiovascular disease, pulmonary disease, dyslipidemia, hyper-uricemia, osteoarthritis, and depression, according to a global research body [5]. According to some research, the risk of DM advances by 4.5 to 9% for every body weight gained in kilogram. Overweight or obese patients account for approximately 80% of T2DM patients [6-8].

PREDATORR study, a study conducted in adult Romanians, investigated the prevalence of prediabetes and DM, as well as their association with socio demographic, cardio-metabolic, and lifestyle risk factors from 2012 to 2014, and discovered a significant link between obesity and the presence of both pre-diabetes and DM [9]. Weight gain has been noted in numerous clinical trials to decrease glycemic control in individuals with T2DM and to increase the quantity of insulin needed in patients with T1DM [4-6].

Obesity has been proven to be a substantial risk factor for premature death in individuals with diabetes and cardiovascular disorders, according to research from around the world. Individuals with a healthy weight and good glycemic control are at a lesser risk [9-14].

The Body Mass Index [BMI], a ratio of weight to height in kilograms per square meter [kg/m^2]., is the most generally used means of measuring obesity, even though it directly does not measure adiposity. HbA1c, or glycated hemoglobin, is commonly used as for long-term glycemic control marker.

THE AIM OF THE WORK

With the above facts in general holds good in an urban population whereas our Institution serving a rural population with less incidence of sedentary lifestyle and obesity, hence we aimed to correlate BMI and glycemic control [HbA1c] in type-2 diabetics to look for the association between each in this group of population.

PATIENTS AND METHODS

A cross-sectional study was done in the Department of Medicine, St Peters Medical College Hospital and Research Centre, Hosur, Tamil Nadu, India for seven months. 482 diagnosed cases of T2DM, who were admitted or attended Medicine OPD in our hospital from September 2021 to March 2022, were selected. Patients who are diagnosed with T2DM, both genders, and willing to participate were included and patients with gestational diabetes, Type-1 DM, hypoproteinemia, malnutrition, malignancy, and chronic kidney disease were excluded from the study.

Table [1]: Diagnosis criteria for the of DM [15]

Diabetes symptoms plus a random blood sugar [RBS] value of more than 200 mg/dl [11.1 mmol/l]. Random is explained as any time of the day, regardless of how long it has been since the last meal. Unexplained weight loss, polydipsia and polyuria, and are all classic diabetes signs.
OR
Fasting blood sugar [FPS] more than 126 mg/dl [7.0 mmol/l] and or a 2 hr Post prandial sugar more than 126 mg/dl [11.1 mmol/l]. No calorie intake for atleast 8 Hours, is defined as fasting.
OR
During an oral glucose tolerance test [OGTT], glucose levels >200 mg/dl [11.1 mmol/l] 2 hours after a meal. According to the WHO, the test should be performed with a glucose load of 75 gm anhydrous glucose dissolved in water.
HbA1C> 6.5 %

Each patient was subjected to clinical examination followed by detailed history. HbA1c with routine investigations were done. Body height and body weight in centimeters [cm] and kilograms [kg] respectively were calculated with bare feet and light clothing, and then the BMI in kg/m^2 was obtained. The blood was collected in the Ethylene diamine tetra acetic acid [EDTA] vial and assayed manually by the resin-exchange method to estimate HbA1c. Based on HbA1C values: 6.5-8, 8-10, and >10%, the patients were allocated into three groups.

Prior to the trial, all patients signed a free written informed consent form. This is an Institutional Ethics Committee authorized study.

Statistical Analysis: EPICAL program was used to analyze data. P-values were calculated using the Chi-square [χ2] test and the ANOVA test in all statistics. P-values of less than 0.05 were considered significant.

RESULTS AND Discussion

Diabetes is the most prevalent endocrine condition in the modern age, with a prevalence of 6.5 percent of the global population and growing due to the interplay of several hosts and changing environmental variables. Among 482DM patients involved in the current study, 182 were female and 300 of them were male [Table 3]. As shown in the table. 4, majority of the participants affected were in the age group 51-60 years [150 patients], followed by 41-50 years [110 patients], > 60 years [102 patients], 31-40 years [80 patients], and 18-30 years [40 patients]. Most of them were between BMI 25-29.9 [overweight] and account for about 258 [53.53%] of total cases. 140

[29.04%] patients had normal BMI [18.5-24.9] followed by 84 [17.42%] obese patients [BMI>40]. Among 258 overweight patients, 183 [70.93%] patients were male and 75 [29.07%] patients were female. Normal BMI of 140 patients, 69[49.28%] patients were female and 71[50.71%] patients were male. Out of 84 obese patients, 38 [45.23%] patients were female and 46 [54.76%] patients were male [refer Table. 5].

Table [2]: Weight status category versus risk of disease [16]

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

Table [3]: Gender wise distribution

	No of patients [%]
Male	300[62.24]
Female	182[37.76]
Total	482[100]

Table [4]: Age-wise distribution

Age group [Years]	Male	Female	Total
18-30	28	12	40
31-40	60	20	80
41-50	70	40	110
51-60	85	65	150
>60	57	45	102
Total	300	182	482

Table [5]: BMI distribution among genders

BMI	Male		Female		Total
	No.	%	No.	%	
Normal [18.5-24.9]	71	23.66	69	37.91	140
Overweight [25-29.9]	183	61	75	41.2	258
Obese [>30]	46	15.33	38	20.89	84
Total	300	100	182	100	482

Table [6]: Correlation between BMI and HBA1C in cases

BMI [kg/m2]	HBA1C								Total
	<6.5%		6.5-8%		8-10%		> 10%		
	No.	%	No.	%	No.	%	No.	%	
Normal [18.5-24.9]	40	74.07	48	25	40	24.69	12	16.22	140
Overweight [25-29.9]	10	18.51	108	56.25	97	59.87	43	58.10	258
Obese [>30]	4	7.40	36	18.75	25	15.43	19	25.68	84
Total	54	100	192	100	162	100	74	100	100

As BMI values increase, HbA1c also follows an increasing trend. All patients with BMI >30 [obese group] were having HbA1c >8% [refer to Table. 6]. On statistical analysis, BMI shows a significant positive correlation with HbA1c [P-value<0.001]. From the statistical analysis of the present study, a strong positive correlation connecting HbA1c and BMI [P-value 0.001] was observed. Tomic Martina *et al.* was found similar to our study that is, a significant positive correlation between BMI and HbA1c [17]. In a study by Sheth *et al.*, it was found that dyslipidemic obese participants had a notable linear correlation with HbA1c in diabetes patients from Western Indian population. T2DM participants in another study conducted on by Sheth *et al.* [18] showed that, obesity is implicated in the pathophysiology of type-2 diabetes mellitus and associated macrovascular consequences.

Babikr *et al.* [19] also observed a positive correlation between BMI and HbA1c. Sisodia RK *et al.* was found similar to our study that is, a significant positive association between HbA1c and BMI [20].

BMI may be used to detect general obesity, while the waist circumference [WC] can be used to determine abdominal obesity. Several T2D risk prediction models incorporated BMI and WC as risk variables. The correlation of T2D with BMI or WC changed depending on ethnic groupings, according to an analysis of five cohort studies. An analysis of 16 cohort studies from seven Asian countries found that the relationship between obesity indicators and T2D varied with age, with T2D having a stronger relationship with waist-stature-ratio than BMI in people under 50, but no difference between T2D and central obesity indicators, including WC, in people over 50 [21]. The current study included participants from rural population of South India where there is less incidence of sedentary lifestyle and obesity. Taking all these points into consideration, we measured BMI as a parameter of obesity.

Conclusion: Our study depicts a similar scenario to western and urban populations, in rural populations also BMI plays a significant role for type-2 diabetes and it has

a strong correlation that high BMI has poor glycemic control. Hence lifestyle modification and prevention of childhood obesity is a notable health concern for the modern era.

Financial and Non-Financial Relationships and Activities, and Conflicts of Interest

None

REFERENCES

1. Ali Khan I. Do second generation sequencing techniques identify documented genetic markers for neonatal diabetes mellitus? Heliyon. 2021 Aug 30; 7[9]:e07903. DOI: 10.1016/j.heliyon.2021.e07903.
2. Al-Sharafi BA, Qais AA, Salem K, Bashaaib MO. Family History, Consanguinity and Other Risk Factors Affecting the Prevalence of Prediabetes and Undiagnosed Diabetes Mellitus in Overweight and Obese Yemeni Adults. Diabetes Metab Syndr Obes. 2021; 14:4853-4863. doi: 10.2147/DMSO. S344440.
3. Modi A, Gadhavi R, Pérez CM, Joshipura K. Longitudinal association between adiposity measures and regression of prediabetes/diabetes. Nutr Metab Cardiovasc Dis. 2021; 31 [11]:3085-3094. doi: 10.1016/j.numecd. 2021. 07.005.
4. Kowall B, Rathmann W, Kuss O, Herder C, Roden M, Stang A, et al. Reversion from prediabetes to normoglycaemia after weight change in older persons: The KORA F4/FF4 study. Nutr Metab Cardiovasc Dis. 2021; 31: 429–38. doi:10.1016/j.numecd.2020.09.008.
5. Bae JP, Lage MJ, Mo D, Nelson DR, Hoogwerf BJ. Obesity and glycemic control in patients with diabetes mellitus: Analysis of physician electronic health records in the US from 2009-2011. J Diabetes Complications. 2016 Mar; 30 [2]:212-20. doi: 10.1016/j.jdiacomp.2015.11.016.
6. Ganz ML, Wintfeld N, Li Q, Alas V, Langer J, Hammer M. The association of body mass index with the risk of type-2 diabetes: a case-control study nested in an electronic health records system in the United States. Diabetol Metab Syndr. 2014; 6 [1]: 50. doi: 10.1186/1758-5996-6-50.
7. Conway B, Miller RG, Costacou T, Fried L, Kelsey S, Evans RW, Orchard TJ. Temporal patterns in overweight and obesity in Type 1 diabetes. Diabet Med. 2010; 27[4]: 398-404. doi: 10.1111/j.1464-5491.2010.02956.x.
8. Mota M, Popa SG, Mota E, Mitrea A, Catrinoiu D, Cheta DM, *et al*. Prevalence of diabetes mellitus and prediabetes in the adult Romanian population: PREDATORR study. J Diabetes. 2016 May; 8[3]:336-44. doi: 10.1111/1753-0407.12297.
9. Scopinaro N, Adami GF, Papadia FS, Camerini G, Carlini F, Briatore L, *et al*. Effects of gastric bypass on type 2 diabetes in patients with BMI 30 to 35. Obes Surg. 2014 Jul; 24 [7]:1036-43. doi: 10.1007/s11695-014-1206-1.
10. Abdullah A, Stoelwinder J, Shortreed S, Wolfe R, Stevenson C, Walls H, de Courten M. The duration of obesity and the risk of type 2 diabetes. Public Health Nutr. 2011 Jan; 14[1]:119-26. doi: 10.1017/ S1368980010001813.
11. Diabetes Prevention Program Research Group, Knowler WC, Fowler SE, Hamman RF, Christophi CA, Hoffman HJ, Brenneman AT, *et al*. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. Lancet. 2009 Nov 14; 374 [9702]: 1677-86. doi: 10.1016/S0140-6736[09]61457-4.
12. El-Kebbi IM, Cook CB, Ziemer DC, Miller CD, Gallina DL, Phillips LS. Association of younger age with poor glycemic control and obesity in urban African Americans with type 2 diabetes. Arch Intern Med. 2003 Jan 13; 163[1]:69-75. doi: 10.1001/archinte.163.1.69.
13. Garber AJ. Obesity and type 2 diabetes: which patients are at risk? Diabetes Obes Metab. 2012 May; 14[5]:399-408. DOI: 10.1111/j.1463-1326.2011.01536.x.
14. Grandy S, Fox KM, Hardy E; SHIELD Study Group. Association of Weight Loss and Medication Adherence among Adults with Type 2 Diabetes Mellitus: SHIELD [Study to Help Improve Early evaluation and management of risk factors leading to Diabetes]. Curr Ther Res Clin Exp. 2013 Dec; 75:77-82. doi: 10.1016/j. curtheres.2013.06.004.
15. American Diabetes Association. Standards of medical care in diabetes--2008.Diabetes Care. 2008 Jan; 31Suppl 1:S12-54. doi: 10.2337/dc08-S012.
16. Robert F Kushner. Evaluation and management of obesity. In: Anthony S. Fauci, editor. Harrison's principles of internal medicine. 20thed. New Delhi: McGraw-Hill Education; 2018. p. 2844.
17. Tomić M, Tamara P, Pavlic-Renar I, Metelko Ž. Obesity-risk factor for microvascular and neuropathic complication in diabetes?. Diabetologia Croatica. 2003; 32 [3]:73-7. doi: 10.18203/2349-3933.ijam 20195228.
18. Sheth J, Shah A, Sheth F, Trivedi S, Nabar N, Shah N, Thakor P, Vaidya R. The association of dyslipidemia and obesity with glycated hemoglobin. Clin Diabetes Endocrinol. 2015 Jun 23; 1:6. doi: 10.1186/s40842-015-0004-6.
19. Babikr WG, Alshahrani AS, Hamid HG, Abdelraheem AH, Shalayel MH. The correlation of HbA1c with body mass index and HDL-cholesterol in type 2 diabetic patients. Biomed Res. 2016 Jan 1; 27[4]:1280-3.
20. Sisodia RK, Chouhan M. The study of the correlation between Body Mass Index and glycemic control-HbA1c in Diabetes type 2 patients. Int J Adv Med. 2019; 6: 1788-91. doi: 10.18203/2349-3933.ijam20195228
21. Alkhalidy H, Orabi A, Alnaser K, Al-Shami I, Alzboun T, Obeidat MD, Liu D. Obesity Measures as Predictors of Type 2 Diabetes and Cardiovascular Diseases among the Jordanian Population: A Cross-Sectional Study. Int J Environ Res Public Health. 2021 Nov 20; 18[22]:12187. doi: 10.3390/ijerph182212187.

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