Association of HbA1c with Metabolic Parameters in Patients with and Without Diabetes.

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ABSTRACT:

Diabetes mellitus, particularly Type 2 diabetes, is a global epidemic affecting millions worldwide. With the increasing prevalence of this condition, it has become a significant public health issue that necessitates the identification of biomarkers for early detection and effective management. Glycated Hemoglobin (HbA1c) has emerged as a crucial marker for assessing long-term blood glucose control, reflecting average blood glucose levels over a period of 2-3 months. This study focuses on understanding how HbA1c levels vary with gender and diabetes status (Type 1 and Type 2 diabetes), while also examining their associations with other metabolic parameters such as Body Mass Index (BMI), blood pressure, and lipid abnormalities. The study's aim is to determine whether there are gender-based variations in HbA1c levels and how these variations correlate with metabolic health. Our findings indicate significant differences in HbA1c between male and female participants and highlight the critical role of HbA1c in predicting metabolic disturbances and cardiovascular risks.

Keywords: HbA1c, Diabetes, Gender Differences, BMI, Metabolic Parameters, Glycaemic Control, Cardiovascular Risk, Diabetes Management

Introduction:

Diabetes mellitus has reached alarming stages of incidence globally. According to the International Diabetes Federation (IDF), as of 2020, an anticipated 10.Five% of the worldwide grownup population (aged 20-79 years) suffers from diabetes, with the overpowering majority of those times being Type 2 diabetes. This chronic scenario is marked by expanded blood glucose degrees because of both insulin resistance or an insufficient insulin reaction from the pancreas. Over time, unmanaged diabetes can result in debilitating headaches along with kidney disease, neuropathy, retinopathy, coronary heart illness, and stroke.

Glycated Haemoglobin (HbA1c) is a systematic biomarker used to measure lengthy-term blood glucose manage. It presentations the cumulative commonplace blood glucose ranges over a span of 2-3 months, providing a more correct picture of glycaemic manipulate than each day blood glucose measurements. HbA1c stages are at once related to the threat of developing prolonged-time period complications of diabetes, inclusive of cardiovascular illnesses and metabolic syndromes. In clinical exercise, HbA1c has turn out to be the gold fashionable for tracking the efficacy of diabetes manipulate and the effectiveness of treatment regimens. Furthermore, expanded HbA1c ranges, even in the absence of a right evaluation of diabetes, can anticipate the development of metabolic issues, along with hypertension, dyslipidaemia, and weight problems, which may be moreover associated with stepped forward cardiovascular threat.

However, but its massive use in diabetes care, the relationship amongst HbA1c stages, gender, and one-of-a-type metabolic factors isn't always virtually understood. It is essential to evaluate whether or not gender variations, together with hormonal variations or life-style conduct, ought to steer HbA1c tiers and metabolic consequences. Furthermore, information how HbA1c correlates with metabolic parameters like BMI, blood stress, and lipid degrees can manual healthcare professionals in enforcing greater targeted and customized remedy plans for diabetic and prediabetic sufferers. The number one reason of this study became to examine the model in HbA1c stages based totally on gender and diabetes popularity (Type 1 and Type 2), with a focus on statistics how those ranges relate to one of a kind metabolic parameters. The key goals protected assessing gender variations in HbA1c, evaluating ranges amongst diabetic and non-diabetic human beings, exploring the relationship among HbA1c and factors like BMI and blood strain, and comparing how gender affects the metabolic effects of HbA1c. The findings from this have a take a look at purpose to decorate our information of methods gender and diabetes fame effect HbA1c regulation, offering valuable insights for refining diabetes control strategies.

Methodology:

The study was designed as a clinical observational study and conducted at the Tashkent Medical Academy (TMA) clinic. A total of 70 patients participated in the study, divided into two primary groups: diabetic individuals (DM) and non-diabetic individuals (Non-DM). Of the 70 patients, 44 had diabetes (both Type 1 and Type 2), and 23 were non-diabetic. Both male and female patients were included in the study to explore potential gender-related differences in HbA1c levels. Data for this study were collected through clinical evaluations and laboratory tests, recording participants' demographic information, including age, gender, medical history, and lifestyle factors. Height, weight, and BMI were measured, and blood samples were drawn to assess HbA1c levels, lipid profiles, and blood glucose levels. Additionally, systolic and diastolic blood pressures were recorded to evaluate cardiovascular health. The study analysed key variables such as HbA1c levels (to assess long-term glucose control), BMI (as an indicator of body fat and obesity), systolic and diastolic blood pressure (for cardiovascular health), and age and gender (to explore their influence on HbA1c levels). Descriptive and inferential statistical methods were applied to analyse the data, including calculating means, standard deviations, and performing t-tests to compare HbA1c levels across genders and between diabetic and non-diabetic groups. Correlation coefficients were calculated to explore the relationships between HbA1c and other metabolic parameters, with a p-value of less than 0.05 considered statistically significant.

Results:- Gender Differences in HbA1c Levels:

The study found significant gender-based differences in HbA1c levels. For male participants, the mean HbA1c level was 5.809 ± 1.490, suggesting relatively good glycemic control but with noticeable variation. Female participants had a higher mean HbA1c of 6.769 ± 1.985, which was significantly higher than that of males ($p = 0.049$). This difference points to poorer long-term glucose control in females compared to males. Several factors could explain this difference, including hormonal variations such as higher estrogen levels in women, which may influence insulin sensitivity and glucose metabolism. Additionally, lifestyle factors such as diet, physical activity, and body composition differences between males and females may also contribute to these observed variations.

Diabetes Status and HbA1c Levels:

As expected, HbA1c levels were significantly higher in diabetic patients compared to non-diabetic individuals. Diabetic patients had an average HbA1c level of 8.848 ± 0.994, significantly higher than the 5.202 ± 0.508 observed in non-diabetic individuals ($p < 0.001$). This reinforces the utility of HbA1c as a reliable marker for diagnosing and managing diabetes, highlighting its role in identifying long-term hyperglycemia. Elevated HbA1c levels in diabetic individuals indicate poor glycemic control, which is associated with chronic complications such as neuropathy, retinopathy, and cardiovascular diseases.

Metabolic Parameters and Their Correlation with HbA1c:

The study also examined the relationship between HbA1c levels and other metabolic parameters such as BMI and blood pressure. Diabetic patients had a higher mean BMI (27.648 ± 4.502) compared to non-diabetic individuals (25.916 ± 4.256), though the difference did not reach statistical significance ($p = 0.128$). However, there was a positive correlation between HbA1c levels and BMI, suggesting that individuals with higher HbA1c levels tend to have higher BMIs. This reflects the strong association between poor glycemic control and obesity, which is a significant risk factor for Type 2 diabetes. Additionally, while systolic and diastolic blood pressures did not show significant differences between diabetic and non-diabetic individuals, elevated HbA1c levels were generally associated with higher blood pressure, aligning with the known risks of hypertension in diabetic patients.

Discussion:

Gender-Based Differences in HbA1c: The have a study's findings of vast variations in HbA1c ranges among men and women advise that gender performs an vital function in metabolic fitness. Hormonal differences, in particular the effects of estrogen and progesterone, possibly effect insulin sensitivity and glucose metabolism in girls, important to better HbA1c tiers compared to guys. Beyond hormones, way of life elements collectively with bodily interest, dietary behavior, and body fats distribution also can make contributions to those gender differences. Women frequently revel in versions in metabolic law because of hormonal changes inside the route of menstrual cycles, pregnancy, and menopause, all of that can impact insulin sensitivity and glucose control. HbA1c and Diabetes Status:The test reinforces the set up understanding that diabetic people show off substantially higher HbA1c degrees, confirming its function as an crucial marker for assessing glycemic manipulate. Elevated HbA1c degrees in diabetic people are indicative of prolonged intervals of hyperglycemia, which increase the chance of developing complications together with cardiovascular illnesses, kidney failure, and diabetic neuropathy. The courting amongst HbA1c and the onset of diabetes-associated complications underscores the importance of ordinary tracking and manipulate to save you the improvement of those health issues.

Metabolic Implications: The positioned immoderate top notch correlation among HbA1c and BMI in every diabetic and non-diabetic people highlights the interconnection amongst horrific glycemic manage and obesity. Obesity itself is a well-mounted danger element for insulin resistance and Type 2 diabetes, and this check further helps the belief that advanced HbA1c is associated with metabolic imbalances, together with multiplied frame fat and high blood strain. These findings advise that addressing weight issues and handling BMI are critical components of diabetes prevention and remedy techniques.

Conclusion:

In forestall, this examine underscores the importance of tracking HbA1c levels in every diabetic and non-diabetic people as a way to evaluate extended-time period glycemic control and are searching forward to the danger of growing metabolic complications. The massive variations decided in HbA1c levels amongst genders highlight the want for further exploration into the hormonal, way of existence, and genetic factors contributing to those versions. Additionally, the take a look at affirms the characteristic of HbA1c as a essential marker in diabetes manipulate, with direct implications for early detection and the prevention of cardiovascular risks and special metabolic troubles. Future studies have to attention on knowledge the underlying mechanisms at the back of gender-based totally versions in HbA1c stages, that could motive more customized, gender-particular techniques to diabetes control and the prevention of associated health headaches. The information were analyzed the use of descriptive and inferential information. The mean and brand new deviation (SD) of every variable had been calculated. T-assessments had been used to study HbA1c degrees across genders and amongst diabetic and non-diabetic people. Correlation coefficients have been calculated to examine the connection among HbA1c tiers and one of a kind metabolic parameters, along with BMI and blood stress. A p-price of lots plenty less than 0.05 changed into considered statistically huge.

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