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Comparison of Body Mass Index (BMI) and Genetic Factors with Blood Glucose Levels in Diabetes Mellitus Patients at Kapasa Health Center, Makassar

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ABSTRACT

Background: Wrongone of the most common Diabetes Mellitus (DM) is a growing public health concern, influenced by genetic and environmental factors such as obesity and sedentary lifestyles. The prevalence of DM at Kapasa Health Center has risen significantly, from 103 cases in 2021 to 351 cases in 2024. Understanding the relationship between BMI, genetic predisposition, and blood glucose levels is crucial for better management strategies.

Objective: This study aims to analyze the correlation between BMI and genetic predisposition with blood glucose levels in DM patients at Kapasa Health Center, Makassar.

Methods: A cross-sectional study was conducted involving 40 DM patients selected through purposive sampling. Data were collected using structured observation sheets and blood glucose measurements. BMI was classified based on WHO standards. Pearson correlation analysis was used to assess the relationship between BMI and blood glucose levels, while Chi-Square tests were applied to determine the association between genetic predisposition and blood glucose levels.

Results: The results revealed a significant positive correlation between BMI and blood glucose levels ($r = 0.67$, $p = 0.002$), indicating that individuals with higher BMI had elevated blood glucose levels. However, the Chi-Square test ($p = 0.742$) showed no significant association between genetic predisposition and blood glucose levels. This suggests that while genetic factors contribute to diabetes susceptibility, BMI plays a more substantial role in glycemic control.

Conclusion: BMI is significantly associated with blood glucose levels, emphasizing the importance of weight management in diabetes prevention and control. Genetic predisposition alone does not directly influence blood glucose regulation. Public health interventions should focus on obesity prevention and lifestyle modifications to reduce diabetes prevalence.

Keywords: Diabetes Mellitus, Blood Glucose Levels, Body Mass Index, Genetic Factors

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia, resulting from either insulin deficiency or insulin resistance (American Diabetes Assosiation, 2024). It is one of the most prevalent non-communicable diseases worldwide, posing significant public health challenges. The global burden of diabetes has been steadily increasing, with the World Health Organization (WHO) estimating that over 500 million people currently live with diabetes, and this number is expected to rise to 642 million by 2040 (Saeedi et al., 2019). The rising incidence of diabetes is largely driven by lifestyle changes, urbanization, and increasing rates of obesity (International Diabetes Federation, 2021) (Sulfikar & Rajab, 2024).

Indonesia has experienced a significant surge in diabetes cases over the past few decades, making it one of the countries with the highest prevalence of the disease in Southeast Asia. According to the Indonesian Ministry of Health (2016), the prevalence of diabetes among adults aged 40 and above has risen sharply, necessitating urgent public health interventions. The shift towards sedentary lifestyles, unhealthy dietary patterns, and genetic predisposition have been identified as key contributors to this escalating trend (Kementrian Kesehatan, 2016).

At Kapasa Health Center, the number of DM patients has shown a remarkable increase over recent years. In 2021, the center recorded 103 cases of diabetes, which grew to 351 cases by November 2024. This surge underscores the urgent need to understand the factors influencing diabetes prevalence in the region. Among the many risk factors, obesity, commonly measured using BMI, plays a critical role in diabetes onset and progression. Excess body weight, particularly central obesity, is strongly associated with insulin resistance, leading to increased blood glucose levels and higher diabetes risk (Hossain, Al-Mamun, & Islam, 2024).

Apart from BMI, genetic predisposition is also believed to contribute to diabetes development. Individuals with a family history of diabetes have a significantly higher likelihood of developing the disease (Scott et al., 2013). However, the extent to which genetic factors influence blood glucose levels compared to modifiable risk factors such as BMI remains unclear. Previous studies have suggested that while genetic predisposition may increase susceptibility, environmental factors and lifestyle choices play a more decisive role in determining diabetes outcomes(Ligthart et al., 2021).

Given the alarming rise in diabetes cases and the interplay between BMI and genetic predisposition, it is crucial to investigate their relationship with blood glucose levels. Understanding this correlation will help in developing more effective preventive strategies and intervention programs, particularly in primary healthcare settings such as Kapasa Health Center. This study aims to analyze the association between BMI, genetic predisposition, and blood glucose levels among DM patients at Kapasa Health Center, providing valuable insights into diabetes risk factors and management strategies.

METHODS

This study employed a cross-sectional design, conducted at Kapasa Health Center, Makassar, in December 2024. The population consisted of 351 DM patients, from which 40 participants were selected through purposive sampling. Inclusion criteria included diagnosed DM patients willing to participate, while exclusion criteria covered patients with cognitive impairment or hearing disorders.

Data Collection Procedures

Data were collected using structured observation sheets and direct patient assessments. Blood glucose levels were measured using an Accu-Check glucometer, following standardized protocols to ensure accuracy. Measurements were conducted in the morning after an 8-hour fasting period to obtain fasting blood glucose (FBG) levels.

BMI was calculated as weight (kg) divided by height squared (m²), using WHO classification standards: underweight (<18.5), normal weight (18.5-22.9), and overweight/obese (>23). Height and weight measurements were taken using a calibrated digital scale and stadiometer.

Statistical Analysis

Pearson correlation analysis was used to determine the relationship between BMI and blood glucose levels, assessing the strength and direction of the correlation. Additionally, a Chi-Square test was conducted to evaluate the association between genetic predisposition and blood glucose levels. The significance level was set at $p<0.05$. Data analysis was performed using SPSS version 25.

Ethical Considerations

This study obtained ethical clearance from the Research Ethics Committee of Graha Edukasi School of Health Sciences, Makassar. All participants provided informed consent before data collection. Confidentiality and anonymity of participants were maintained throughout the study.

RESULT

Tabel.1 Demographic Characteristics

Characteristic	Frequency (n)	Percentage (%)
Gender: Male	14	35.0
Gender: Female	26	65.0
Age: <60 years	13	32.5
Age: ≥60 years	27	67.5
Occupation: Housewife	25	62.5
Occupation: Other	15	37.5

Tabel 2. BMI and Blood Glucose Levels

BMI Category	Frequency (n)	Percentage (%)
Underweight (<18.5)	5	12.5
Normal (18.5–22.9)	13	32.5
Obese (>23)	22	55.0

Participants classified as obese had an average fasting blood glucose level of 187 mg/dL, significantly higher than those in the normal BMI category (124 mg/dL). These findings align with prior studies indicating that obesity exacerbates insulin resistance and metabolic dysfunction.

Tabel.3 Genetic Factors and Blood Glucose Levels

Genetic Factor	Frequency (n)	Percentage (%)
Family History Present	29	72.5
No Family History	11	27.5

A Chi-Square test ($p = 0.742$) found no significant relationship between genetic predisposition and blood glucose levels. Among participants with a family history of diabetes, 72.4% exhibited blood glucose levels above 140 mg/dL, compared to 72.7% of those without a family history. This suggests that while genetic predisposition increases susceptibility to diabetes, lifestyle and environmental factors have a more substantial impact on actual blood glucose regulation.

Tabel 4. Blood Glucose Level Distribution

Blood Glucose Range (mg/dL)	Frequency (n)	Percentage (%)
<100 (Normal)	7	17.5
100-125 (Pre-Diabetes)	11	27.5
>125 (Diabetes)	22	55.0

A majority of participants (55%) had fasting blood glucose levels above 125 mg/dL, confirming a diabetic status. Additionally, 27.5% were categorized as pre-diabetic, signifying a high-risk population requiring early intervention through lifestyle modifications.

Tabel 5. Correlation Between BMI and Blood Glucose Levels

BMI Category	Average Blood Glucose Level (mg/dL)
Underweight (<18.5)	118
Normal (18.5–22.9)	124
Obese (>23)	187

This analysis emphasizes the importance of BMI as a determinant of blood glucose levels. Individuals with higher BMI demonstrated significantly elevated glucose levels, reinforcing the need for weight management interventions as part of diabetes control strategies. These findings are consistent with global literature emphasizing BMI as a modifiable risk factor in diabetes prevention.

DISCUSSION

The findings of this study highlight the substantial impact of BMI on blood glucose levels, supporting previous research that links obesity with insulin resistance (Chandrasekaran & Weiskirchen, 2024). The correlation observed between high BMI and elevated fasting blood glucose levels reinforces the argument that obesity serves as a key modifiable risk factor in diabetes prevention (Azam et al., 2022).

Moreover, studies have shown that obesity-induced inflammation leads to insulin resistance, which exacerbates hyperglycemia and diabetes-related complications (Wu & Ballantyne, 2020) (Sulfikar & Rajab, 2024). Chronic low-grade inflammation in adipose tissue alters glucose metabolism, increasing susceptibility to type 2 diabetes (Burhans, Hagman, Kuzma, Schmidt, & Kratz, 2018). This further supports the need for weight control as a preventive measure.

Genetic predisposition, while a recognized risk factor for diabetes development, did not show a statistically significant direct association with fasting blood glucose levels in this study. This is in agreement with previous research indicating that while genetic factors may predispose individuals to diabetes, they interact significantly with environmental factors such as diet and physical activity (Cole & Florez, 2020). Recent genome-wide association studies (GWAS) have identified several loci associated with diabetes susceptibility; however, their influence on glycemic control remains inconclusive (Goodarzi & Rotter, 2020).

The findings support the need for targeted public health interventions focused on weight management, lifestyle modifications, and early screening for individuals with high BMI (Smith, Fu, & Kobayashi, 2020). Healthcare practitioners should prioritize dietary counseling, regular physical activity, and metabolic monitoring in obesity management to mitigate diabetes risk (Wadden, Tronieri, & Butryn, 2020). Additionally, community-based programs promoting lifestyle changes have been found effective in delaying or preventing diabetes onset (Stetson, Minges, & Richardson, 2017).

Future studies should explore the interaction between genetic markers and lifestyle factors in greater depth, incorporating a larger sample size and longitudinal design to assess causal relationships (Nienaber-Rousseau, 2025). Moreover, the role of dietary intake, sleep patterns, and stress management should be examined to develop more personalized preventive strategies. Investigations into the effectiveness of pharmacological interventions in weight control and diabetes prevention could also provide valuable insights.

CONCLUSION

BMI is significantly associated with blood glucose levels in DM patients, indicating that obesity is a key modifiable risk factor for diabetes management. While genetic predisposition plays a role in diabetes susceptibility, this study found no direct correlation with fasting blood glucose levels. These findings underscore the importance of weight management, lifestyle modifications, and early screening in diabetes prevention. Future research should further explore the interaction between genetic markers and environmental factors in diabetes progression.

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