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Academic Stress and Blood Glucose Levels: A Correlational Study Among Medical Laboratory Technology Students

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Abstract

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels, often influenced by various physiological and psychological factors. One such factor is stress, particularly academic stress among university students. This study aims to explore the potential correlation between academic stress levels and random blood glucose levels among Medical Laboratory Technology (D.IV) students at Kadiri University. A cross-sectional, quantitative approach was used in this study. A total of 28 eligible students participated. Academic stress levels were assessed using the Perceived Sources of Academic Stress (PSAS) questionnaire, while random blood glucose levels were measured using spectrophotometric methods with glucose GOD FS reagents. Data were analyzed using the Pearson correlation test to determine the relationship between the two variables. The majority of students experienced moderate academic stress (71.43%), while the rest (28.57%) experienced high stress. No students reported low stress levels. Regarding blood glucose, 53.57% of participants had normal levels, and 46.43% had elevated levels. The Pearson correlation coefficient was 0.045 with a p-value of 0.819, indicating no statistically significant relationship between academic stress levels and blood glucose levels. Regression analysis also confirmed that while there was a slight positive trend (suggesting that higher stress may slightly raise glucose levels), the effect was negligible and not statistically significant. This study found no significant correlation between academic stress and random blood glucose levels among Medical Laboratory Technology students. Although stress may contribute to changes in glucose levels through hormonal mechanisms, other factors—such as diet, physical activity, and individual coping strategies—likely play a more substantial role. Interventions focusing on stress management, healthy lifestyle habits, and regular health monitoring are recommended to maintain both psychological well-being and metabolic health in students.

Keywords: academic stress; blood glucose; university students; Medical Laboratory Technology; correlation study.

Abbreviations: Adrenocorticotropic Hormone (ACTH), a hormone involved in stress response and glucose regulation; Diabetes Mellitus (DM), a chronic metabolic disorder characterized by high blood glucose levels; Diploma IV (D.IV), referring to the four-year undergraduate equivalent program; Glucose (GLU), the parameter code used on the photometer for blood glucose measurement; Glucose Oxidase (GOD), an enzyme-based reagent used in glucose testing; International Diabetes Federation (IDF), a global organization focusing on diabetes awareness and data; Medical Laboratory Technology (MLT), the academic program of the student participants; Probability Value (p-value), used to assess statistical significance in hypothesis testing; Perceived Sources of Academic Stress (PSAS), the questionnaire used to measure academic stress; Revolutions per Minute (rpm), indicating the speed setting used in the centrifuge during serum preparation; and Statistical Package for the Social Sciences (SPSS), the software used for data analysis.

INTRODUCTION

Diabetes mellitus (DM) is a chronic condition characterized by elevated blood glucose levels due to impaired insulin function, which normally helps regulate blood sugar to maintain the body's homeostasis. DM is classified into two main types: Type 1, which requires external insulin (e.g., injections) due to the body's inability to produce insulin, and Type 2, which results from the body's reduced sensitivity to insulin. Type 2 is often associated with weight gain and requires lifelong management through healthy eating, regular exercise, and the prevention of hypoglycemia or hyperglycemia (Nursucita & Handayani, 2022).

According to the International Diabetes Federation (IDF, 2021), approximately 537 million adults (ages 20–79) worldwide are living with diabetes—equivalent to 1 in 10 people—resulting in 6.7 million deaths annually, or one death every 5 seconds. Indonesia ranks fifth globally, with 19.47 million people diagnosed out of a population of 179.72 million, indicating a national prevalence rate of 10.6%. The IDF also reports that 81% of people with diabetes live in low- and middle-income countries, and 44% of adults with diabetes remain undiagnosed (Simarmata & Prabawati, 2024). Riskesdas (2018) data

shows that the prevalence of diagnosed diabetes in Indonesians aged 15 and older was 2%, up from 1.5% in 2013. Based on blood glucose tests, the prevalence increased from 6.9% in 2013 to 8.5% in 2018. Only about 25% of people with diabetes are aware of their condition. East Java ranks fifth among Indonesian provinces with the highest number of diabetes cases (Kusuma et al., 2024).

Blood glucose comes from the carbohydrates we eat, which are stored as glycogen in the liver and skeletal muscles. In people with diabetes, blood sugar levels can rise due to various factors such as diet, physical inactivity, medication, obesity, genetics, and stress. Stress can trigger the release of hormones like adrenaline, glucagon, and cortisol, which increase blood sugar levels by reducing insulin sensitivity (Fatih, 2023). Stress is a physical or emotional response to events or thoughts that cause feelings of sadness, anger, or anxiety. It activates the nervous system, heightens sensory awareness, increases circulation, deepens breathing, and tenses muscles (Wilujeng et al., 2023). Academic stress refers to stress triggered by academic pressures, such as excessive assignments, tight schedules, unsatisfactory grades, or anxiety about exams (Barseli et al., 2017).

A study by Ramadhani & Mastuti (2022) involving 146 students found that 34% experienced moderate stress, 29% high stress, and 6% very high stress. Academic load, environmental pressure, and individual personality traits can all contribute to student stress. Prolonged stress can increase cortisol levels, which in turn raises blood sugar as the body prepares for increased physical and mental demands (Caesaria et al., 2021). Meanwhile, a study by Natalansyah et al. (2020) involving 39 students showed that among 27 students experiencing moderate stress, 23 had high blood glucose levels. Chi-square test results indicated a significant relationship between stress and blood glucose levels ($p = 0.006$). However, another study by Caesaria et al. (2021) on 40 third-year Medical Laboratory Technology (D.III) students at Poltekkes Kemenkes Palembang showed different findings. Average blood glucose levels across different stress levels did not significantly differ ($p = 0.98$), indicating no correlation between student stress levels and blood glucose.

MATERIALS AND METHODS

Research Design

This study is a quantitative, non-experimental research using a cross-sectional design, which observes the relationship between dependent and independent variables by collecting data at a single point in time (Yunitasari et al., 2020).

Tools and Materials

To assess academic stress levels, the materials used included the Perceived Sources of Academic Stress (PSAS) questionnaire developed by Bedewy & Gabriel (2015) and pens.

For blood glucose testing, the equipment included a One Tech Medical Komodo 200 photometer, DLAB clinical centrifuge, Onemed 3 cc syringe, tourniquet, Onemed clot activator blood tubes (red), Socorex micropipettes, medical gloves, plasters, yellow and blue pipette tips, and a proper medical waste disposal container.

The materials used included 70% alcohol swabs, blood serum, and Glucose GOD FS reagent for glucose measurement.

Procedure

Academic Stress Assessment Procedure

The research began by requesting formal approval from Kadiri University, followed by obtaining ethical clearance from the Research Ethics Committee to ensure the study met ethical standards. Once permission was granted, the researcher approached potential participants, explained the study's purpose and procedure, and obtained their informed consent. Participants were then given the PSAS questionnaire to complete by marking checkboxes that best represented their experiences of academic stress. Completed questionnaires were collected, coded for confidentiality, and scored to determine each respondent's academic stress level based on their responses.

Blood Glucose Measurement Procedure

The blood glucose testing began by preparing all necessary tools and materials (e.g., syringe, alcohol swab, tourniquet, plaster, vacuum tube). After handwashing and patient identification, the researcher explained the blood draw procedure to the participant. The participant was seated comfortably, the puncture site was cleaned, and a tourniquet was applied. Using a 15–45° angle, blood was drawn into a syringe. The tourniquet was released, the needle removed, and pressure applied to stop bleeding. A plaster was placed over the puncture site for about 5 minutes. The collected blood was transferred into a labeled clot activator tube and left at room temperature for 15 minutes, then centrifuged at 3000–3500 rpm for 15 minutes to separate the serum. To measure glucose levels, the One Tech Medical Komodo 200 photometer was turned on and set to the "Analysis" mode with the "GLU" parameter selected. The device was rinsed with distilled water. A standard solution was prepared using 1000 µL glucose reagent + 10 µL standard, and a sample solution using 1000 µL glucose reagent + 10 µL serum. A blank was made using 1000 µL reagent only. All mixtures were incubated at room temperature for 15 minutes. After incubation, readings were taken using the photometer: first zeroing the instrument with distilled water, then measuring the blank, standard, and sample in order. The resulting glucose levels were recorded by the researcher.

Data Analysis Techniques

The study employed bivariate analysis to examine the relationship between two variables (Sataloff et al., 2018). Since the data included ordinal and ratio scales, correlation tests were used. Prior to correlation analysis, normality and homogeneity tests were conducted. If the data were not normally distributed, Spearman's rank correlation was applied. If the data met normality assumptions, Pearson's correlation was used to examine the relationship between academic stress and blood glucose levels. All statistical analyses were performed using SPSS version 24, with a 95% confidence level ($\alpha = 0.05$).

RESULTS AND DISCUSSION

Results

Pearson correlation is a statistical method used to evaluate the linear relationship between two variables—typically one dependent and one independent. This analysis produces a correlation coefficient to measure the strength of that relationship. A significance value (p-value) greater than 0.05 indicates that there is no statistically significant correlation between the two variables. Conversely, a p-value less than 0.05 suggests a statistically significant correlation (Jabnabillah & Margina, 2022).

Based on the Pearson correlation test, the correlation coefficient was 0.045 with a p-value of 0.819, indicating no significant relationship between academic stress levels and blood glucose levels. Since the p-value is greater than 0.05, the result is not statistically significant, meaning there's insufficient evidence to confirm a real correlation between the two variables in this population.

Regression analysis is another statistical method used to examine relationships and predict outcomes between variables. In this context, linear regression helps assess how an independent variable influences a dependent variable and whether the effect is positive or negative (Refiantoro, 2022). The regression analysis showed that when the total stress score is zero, the initial blood glucose level (intercept) is 1.400. The regression coefficient for total stress was 0.050, meaning that for every one-unit increase in stress, blood glucose is estimated to increase by 0.050 units. However, the significance value of 0.819 shows that this influence is not statistically significant (as it exceeds 0.05), and the t-value of 0.231 also confirms that the stress level does not significantly impact blood glucose. In conclusion, the results suggest no meaningful relationship or effect between academic stress and blood glucose levels among the students in this study.

Discussion

Out of 32 respondents, 28 students met the inclusion and exclusion criteria. According to the findings, no students experienced mild stress, 20 students (71.43%) experienced moderate stress, and 8 students (28.57%) experienced severe stress. This indicates that most Medical Laboratory Technology (MLT) students at Kadiri University experienced moderate academic stress, with a smaller portion reporting high stress. Common sources of academic stress include learning demands, pressure to perform, time constraints, numerous assignments, unsatisfactory grades, and exam anxiety (Barseli et al., 2017).

These results align with a study by Mutaqqin et al. (2021) on 75 medical students at FK UNPRI, where 74.7% of respondents experienced moderate stress, 6.7% high stress, and 18.7% low stress, suggesting that moderate stress levels are common among university students. Blood glucose testing (Table 5.2) showed that 15 students (53.57%) had normal glucose levels, while 13 students (46.43%) had high glucose levels. This may be because most students are in the 18–25 age range, a period where metabolism tends to function well. Physical activity helps regulate blood glucose by improving circulation, enhancing muscle mass, and boosting metabolism (Setianto et al., 2023).

The finding that nearly half of the students had elevated glucose is consistent with Sayekti & Yulistari (2022), who found that 10 of their participants had high glucose levels. A hectic academic schedule can lead students to adopt unhealthy habits, including poor eating patterns, irregular sleep, and a lack of exercise. Consumption of sugary foods, fast food, and soft drinks is common, often without the balance of physical activity—factors that can lead to higher blood glucose (Sattu et al., 2024).

Normality and homogeneity tests confirmed that the data were normally distributed and homogeneous. The Pearson correlation test again showed no significant relationship between academic stress and blood glucose ($r = 0.045$; $p = 0.819$). This aligns with research by Sayekti & Yulistari (2022) on sixth-semester MLT students at ITSK Insan Cendekia Medika Jombang. Of 26 students, 3 had normal stress, 3 low, 5 moderate, 11 high, and 4 very high. Meanwhile, 16 students (61.5%) had normal blood glucose, and 10 (38.5%) had high levels. A Spearman rank test yielded a p-value of 0.54 (> 0.05), indicating no significant correlation. The regression analysis also supported this, with an intercept of 1.400 and a coefficient of 0.050, suggesting that each unit increase in stress could increase glucose by 0.050 units—but again, the p-value of 0.819 and t-value of 0.231 confirm that this effect is not statistically significant. Further breakdown showed that: 12 students with moderate stress had normal glucose levels, likely due to good physical fitness and healthy habits, 8 students with moderate stress had high glucose, possibly due to poor diet and lack of activity, 3 students with high stress had low glucose, likely from healthy behavior and regular exercise, and 5 students with high stress had high glucose, likely caused by elevated ACTH levels, which stimulate glucocorticoids, leading to increased

gluconeogenesis and higher blood glucose (Saputra & Muflihatin, 2020).

Academic stress is a common issue among students and can affect both physical and emotional well-being. Causes range from lack of guidance and unsatisfactory academic performance to intense exam pressure and unsupportive environments. Stress may manifest in various ways, including low self-confidence, poor focus, social withdrawal, irritability, frustration, and in some cases, depression (Rahmawati et al., 2021).

According to Sari et al. (2024), stress is one of several factors that can elevate blood glucose levels, primarily by triggering the sympathetic nervous system and neuroendocrine responses. Stress leads to the release of norepinephrine and epinephrine, which increase heart rate and stimulate glycogenolysis in the liver, resulting in rapid glucose release into the bloodstream (Jasmine, 2023).

Based on these findings, the researcher suggests that other factors—such as diet, physical activity, genetics, and individual stress coping ability—may have influenced students' blood glucose more than stress alone. Many students with moderate stress still managed to maintain stable glucose levels through good time management, social support, and effective coping strategies. In conclusion, academic stress does not appear to significantly affect blood glucose levels. However, lifestyle factors like diet and exercise play a protective role in maintaining glucose balance. Individuals experiencing moderate to high stress are encouraged to adopt healthy eating habits and regular physical activity to prevent long-term metabolic complications from elevated blood sugar. This study highlights the importance of psychosocial support and stress management education for students—especially those at risk for diabetes. Regular blood glucose screening is also recommended for students with high stress levels to allow for early detection and preventive care.

CONCLUSIONS

Based on the findings of the study, the academic stress levels among Medical Laboratory Technology (TLM) students at Kadiri University were as follows: none of the students experienced low stress (0%), 20 students (71.43%) experienced moderate stress, and 8 students (28.57%) experienced high stress. Regarding blood glucose levels, 15 students (53.57%) had normal levels, while 13 students (46.43%) had elevated levels. The Pearson correlation test showed a correlation coefficient of 0.045 with a p-value of 0.819, indicating no significant relationship between academic stress levels and blood glucose levels. While the positive regression coefficient suggests a slight tendency for blood glucose to increase with higher stress levels, this effect is minimal and statistically insignificant.

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