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Differences Between Blood Glucose Testing Using POCT and Photometer Methods at STIKESMAS Abdi Nusa Palembang

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Abstract: *Blood glucose is the body's main source of energy derived from carbohydrate metabolism, and its examination is important for monitoring and diagnosis, especially in critical conditions. Glucose testing can be performed using Point of Care Testing (POCT) or a photometer. This study aims to determine the differences in blood glucose test results using these two devices. The study employed a cross-sectional design involving 31 fifth-semester students from STIKESMAS Abdi Nusa through total sampling. Blood glucose testing was performed using glass blood samples for POCT and venous blood serum samples for photometers. Data analysis used the Kolmogorov–Smirnov test and independent t-test. The results of the analysis showed a p-value of 0.29 (>0.05), which means that there was no significant difference between the blood glucose test results using POCT and photometers. These findings indicate that POCT can be used as a tool for monitoring and screening blood glucose, while photometers remain the primary reference for diagnosis. Further research is recommended to compare different devices or use a larger sample size to increase the strength of the analysis.*

Keywords*: Blood glucose, point of Care Testing (POCT), Spectrofotometer*

Abstrak: Glukosa darah merupakan sumber energi utama tubuh yang berasal dari metabolisme karbohidrat, dan pemeriksaannya penting untuk pemantauan maupun penegakan diagnosis, terutama pada kondisi kritis. Pemeriksaan glukosa dapat dilakukan menggunakan Point of Care Testing (POCT) untuk darah kapiler maupun fotometer untuk sampel darah vena. Penelitian ini bertujuan mengetahui perbedaan hasil pemeriksaan glukosa darah menggunakan kedua alat tersebut. Penelitian menggunakan desain cross-sectional dengan melibatkan 31 responden mahasiswa semester V STIKESMAS Abdi Nusa melalui total sampling. Pemeriksaan glukosa darah dilakukan menggunakan sampel darah kaca untuk POCT dan sampel serum darah vena untuk fotometer. Analisis data menggunakan uji Kolmogorov–Smirnov dan uji t independen. Hasil analisis menunjukkan nilai p = 0,29 (>0,05), yang berarti tidak terdapat perbedaan yang signifikan antara hasil pemeriksaan glukosa darah menggunakan POCT dan fotometer. Temuan ini menunjukkan bahwa POCT dapat digunakan sebagai alat pemantauan dan skrining glukosa darah, sementara fotometer tetap menjadi acuan utama dalam diagnosis. Penelitian selanjutnya menyarankan membandingkan alat yang berbeda atau menggunakan jumlah sampel lebih besar untuk meningkatkan kekuatan analisis.

Kata kunci: Gula Darah; POCT; Spektrofotometer

1. INTRODUCTION

Blood glucose is the sugar in the blood derived from carbohydrates in food, which is stored as glycogen in the liver and skeletal muscles. The main fuel for metabolism to produce the brain's primary energy source comes from glucose (Smaglyuk, 2024). Blood glucose levels are regulated by homeostatic mechanisms. Under normal conditions, the concentration of blood glucose is usually between 80–90 mg/100 mL of blood, measured before breakfast. After the first hour of eating, the concentration of glucose increases to 120–140 mg/100 mL. The increased glucose level after the first hour of eating will return to its control value through a feedback system that regulates blood glucose levels (Zhedanov, 2021; Awan et al., 2025).

Glucose is a source of energy for humans, formed from consumed carbohydrates and stored as glycogen in the liver and muscles. Several factors influence glucose levels, including endogenous factors, namely humoral factors such as the hormones insulin, glucagon, and cortisol, which act as receptor systems in muscle or liver cells (Mohajan, 2025). Blood glucose testing under certain conditions becomes very important to perform quickly, such as in critically ill patients. The patient's blood sugar levels can change rapidly due to stress or medications. Patients with hyperglycemia and

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hypoglycemia also require rapid blood glucose testing. This is especially important for hypoglycemic patients, as hypoglycemia is an emergency condition requiring prompt management to prevent organ and brain damage as well as death (Alshalawi et al., 2025; Shabestari et al., 2025; Zeynali et al., 2025).

Blood glucose levels can be measured using various methods, with the gold standard being the photometer method. The photometer works by absorbing light at a specific wavelength by the tested sample. This test uses serum as the sample. The instrument is an advanced laboratory device designed to work with high precision, speed, and the capacity to process many samples automatically at once. Although this method is highly accurate and reliable, it requires complex maintenance and the reagents are relatively expensive (Ashraf et al., 2023; Hatakeyama-Sato et al., 2025)

A commonly used and easy tool for glucose screening is Point of Care Testing (POCT), which only requires a small blood sample and can be performed outside the laboratory, near the patient, with rapid results. However, this method has limited testing variations, lower accuracy, and reduced precision (Plebani et al., 2025). POCT is widely used because of its relatively low cost and ease of operation. It is also often used in rural health centers that lack advanced equipment. However, there are concerns regarding the accuracy of its test results. Based on these considerations, the researcher aims to determine whether there is a difference in blood glucose test results between POCT and the photometer, which serves as the gold standard (Han et al., 2025;Hoang et al., 2025).

A previous study conducted by Kley et al., (2024) on differences in blood glucose levels using photometer and POCT at UPTD Puskesmas Sukajaya, Sabang City, with 24 samples, found a significant difference between fasting blood glucose levels measured by photometer compared to POCT in patients undergoing tests at the health center. Another study conducted by Falih & Tahir, (2025) on the comparison of glucose and uric acid levels in venous blood using POCT and photometer at Puskesmas Gamping II with 15 samples concluded that there was no significant difference between glucose test results obtained with POCT and photometer. Based on the above background, the researcher is interested in conducting a study on “The Differences in Blood Glucose Test Results Using POCT and Photometer Methods at STIKesMas Abdi Nusa Palembang, 2024.”

2. METHOD

This study applied an observational analytic research design with a cross-sectional approach. The cross-sectional method emphasizes data measurement and observation at a single point in time for both independent and dependent variables. This design was chosen to identify the relationship and differences in blood glucose levels measured by photometer and Point of Care Testing (POCT). The study was conducted at the Laboratory of STIKesMas Abdi Nusa Palembang during March–April 2024. The inclusion criteria in this study were all sixth-semester students of the Diploma III Medical Laboratory Technology Program, STIKesMas Abdi Nusa Palembang, who were willing to participate and provided informed consent. The exclusion criteria were students who were absent during the study period or had health conditions that could affect blood glucose levels.

The study used an observational analytic design with a cross-sectional approach. The quality of the research was maintained by applying standardized laboratory procedures, using validated instruments (photometer and POCT), and ensuring all samples were examined under the same conditions. Studies or data not meeting the inclusion criteria were excluded. No external audit was performed; however, internal supervision and peer review by laboratory lecturers were carried out to ensure validity and reliability. This study employed an observational analytic design with a cross-sectional approach, emphasizing one-time data measurement of both independent and dependent variables. The research was conducted at the Laboratory of STIKesMas Abdi Nusa Palembang from March to April 2024. The study population consisted of all sixth-semester students of the Diploma III Medical Laboratory Technology Program, totaling 31 students, with total sampling used. Blood glucose levels were measured using photometer and POCT.

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Before the procedure, participants were informed about the purpose of blood collection and examination. The data were analyzed using the independent t-test to determine whether there was a significant difference between glucose measurements obtained by photometer and POCT.

3. RESULTS AND DISCUSSION

This study was conducted using primary data collection from respondents who had been predetermined and agreed to participate. Venous blood samples were examined using POCT, while capillary blood samples were analyzed with a spectrophotometer at STIKesMas Abdi Nusa Palembang.

Table 1.Mean results of blood glucose examination using POCT and Spectrophotometer

Method	Mean (mg/dL)
POCT	93.39
Spectrophotometer	89.87

The examination using POCT showed a mean result of 93.39 mg/dL, while blood glucose examination using a spectrophotometer showed a mean result of 89.87 mg/dL.

Table 2. Normality Test Using One-Sample-Smirnov Test

Test	Asymp. Sig.	Interpretation
One-Sample Smirnov	0.20	Data are normally distributed

The normality test using the One-Sample Kolmogorov-Smirnov Test showed a p-value of 0.20 (>0.05), indicating that the data were normally distributed. Therefore, an independent t-test was performed.

Table 3.Independent t-test Results of Blood Glucose Examination

Method	Mean (mg/dL)	SD	N	%	p-value
POCT	93.38	6.5	31	100%	0.29
Spectrophotometer	89.87	5.8	31	100%	

The average result of blood glucose examination using POCT was 93.38 mg/dL with a standard deviation (SD) of 6.5, while the spectrophotometer method yielded a mean of 89.87 mg/dL with an SD of 5.8. The independent t-test produced a p-value of 0.29 ($> \alpha = 0.05$), indicating that there was no statistically significant difference between blood glucose examination results obtained using POCT and spectrophotometer.

This study shows that the average blood glucose levels measured using POCT (93.38 mg/dL) were slightly higher compared to the spectrophotometer (89.87 mg/dL). However, this difference was not statistically significant ($p = 0.29$), which indicates that both methods provide essentially equivalent results in the context of this study among Diploma III Medical Laboratory Technology students at STIKesMas Abdi Nusa. The data were also normally distributed based on the Kolmogorov-Smirnov test (Asymp.Sig = 0.20), supporting the validity of applying the independent t-test.

These findings are consistent with several international studies showing that POCT can provide glucose results comparable to standard laboratory methods under certain conditions. For example, the study *"Comparing the accuracy of point-of-care with laboratory (capillary, venous, and arterial) blood glucose levels in critically ill patients"* published in Alshaer et al., (2022) reported no significant differences between POCT and laboratory results for venous and capillary samples in critically ill patients without shock. Another study, *"A Comparison of Venous versus Capillary Blood Samples when Measuring Blood Glucose Using a Point-of-Care, Capillary-Based Glucometer"* Topping et al., (2019), also found only small statistical differences, although variations may have some clinical implications.

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On the other hand, some previous research has reported different outcomes. For instance, a study conducted on type II diabetes patients at Grandmed Hospital, Lubuk Pakam, showed a significant difference between venous and capillary glucose levels tested with POCT ($p < 0.05$), with capillary samples tending to yield higher results under certain conditions Simamora & Harefa, (2023) Similarly, the ICU study *"Reliability of arterial, capillary and venous point-of-care glucose measurements"* Szabó et al., (2020) revealed that the accuracy and precision of POCT depend on the sample source (capillary vs venous vs arterial), and the method may be less reliable in patients under tight glucose control.

Several factors may explain why this study did not detect a significant difference. First, the study population consisted of relatively healthy students with stable physiological conditions, resulting in lower biological variability and fewer interfering factors. Second, the sample collection and testing procedures were carefully performed in an educational laboratory setting, ensuring consistent and high-quality implementation. Third, the sample size ($n = 31$), although adequate for detecting moderate differences, may have been insufficient to capture small differences that could be clinically relevant.

The strengths of this study include the use of clearly defined primary samples (students who gave consent), simultaneous testing with two methods (POCT for capillary blood, while spectrophotometers are used for venous blood.) at the same site, and appropriate statistical testing (normality test followed by independent t-test). However, there are limitations, such as the sample being restricted to students from a single semester and one academic institution, which means the findings may not be generalizable to clinical populations with more complex medical conditions. Additionally, only one type of POCT device and one spectrophotometer were used, so differences between instruments could not be assessed.

4. CONCLUSIONS

This study concludes that blood glucose levels measured using POCT (93.38 mg/dL) and spectrophotometer (89.87 mg/dL) showed no statistically significant difference ($p = 0.29$), indicating that both methods provide comparable results in healthy student populations. These findings support the potential use of POCT as a practical alternative to standard laboratory testing in certain contexts, although further research with larger and more diverse clinical populations is recommended to validate its broader applicability.

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