



Comparison Of Fasting Blood Glucose Levels Between Immediate And Delayed Testing In Patients With Diabetes Mellitus At Karisma Hospital

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Abstract

Fasting blood glucose testing is a crucial laboratory procedure for diagnosing diabetes mellitus. Test result accuracy is influenced by the pre-analytical phase; specifically, delays in testing can lead to a decrease in glucose levels due to glycolysis. This study aimed to determine the difference in fasting blood glucose levels between immediate testing and testing delayed by three hours in patients with diabetes mellitus at Karisma Cimareme Hospital. An observational analytic design with a comparative approach was employed, involving 30 patients with diabetes mellitus. Fasting blood glucose levels were measured using the Glucose Oxidase Peroxidase Aminoantipyrine (GOD-PAP) method. Data were analyzed using the Shapiro-Wilk normality test followed by a paired-sample t-test. The results showed that the mean fasting blood glucose level was 180.27 mg/dL for immediate testing and 165.53 mg/dL for testing delayed by three hours, representing a mean decrease of 14.73 mg/dL. The paired-sample t-test yielded a p-value of <0.001 ($p < 0.05$), indicating a significant difference between the two testing conditions. The study demonstrates that a three-hour delay in testing contributes to a reduction in fasting blood glucose levels; therefore, testing should be performed promptly.

Keywords: Fasting Blood Glucose, Testing Delay, Serum, Diabetes Mellitus, GOD-PAP

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1. Introduction

Diabetes mellitus is a non-communicable disease that continues to pose a major health challenge because the number of affected individuals is steadily increasing. The disease occurs as a result of impaired insulin production, decreased insulin sensitivity, or a combination of both, leading to elevated blood glucose levels. If not managed optimally, this condition may lead to various complications, including cardiovascular disease, nephropathy, neuropathy, and retinopathy (Aswandi et al., 2024). According to the International Diabetes Federation (IDF), approximately 463 million adults worldwide were living with diabetes mellitus in 2019, with a prevalence of 9.3%. Approximately 50.1% of diabetes cases remained undiagnosed, potentially increasing the risk of various complications. These data indicate that diabetes mellitus remains a public health problem requiring serious attention (Almaliah & Sudrajat, 2024).

Indonesia ranked fifth among the ten countries with the highest number of people with diabetes worldwide in the 20-79-year age group, with 19.5 million cases in 2021. This number is projected to increase to 28.6 million by 2045, and Indonesia is expected to remain fifth globally. The increasing number of people with diabetes is influenced by various factors, including obesity, insufficient physical activity, unhealthy dietary patterns, low fiber intake, smoking habits, and lack of exercise. This condition indicates that diabetes mellitus remains a health problem requiring prevention, early detection, and optimal management (IDF, 2021).

One of the blood glucose tests commonly performed is fasting blood glucose testing. Blood glucose is a parameter used to identify diabetes mellitus and, historically, was measured using whole-blood specimens. A random blood glucose value of ≥ 140 mg/dL or a fasting blood glucose value of >120 mg/dL is established as a diagnosis of diabetes mellitus. The specimens most frequently used for blood glucose testing are serum and plasma. Serum contains more water than whole blood and therefore contains more glucose than whole blood (Putri Andani, D, 2023). In hospital laboratory services, not all samples can be tested immediately after blood collection. High specimen volumes, laboratory workload, and limited human resources often result in delays in testing. Such delays allow glycolysis to continue, causing serum glucose concentrations to decrease and potentially producing results that are lower than the actual glucose level (Arlitha Deka Yana & Irna Yuliana, 2021).

Previous studies have shown that delays in testing affect blood glucose results. Almaliah and Sudrajat (2024) reported differences in blood glucose levels between immediate testing and testing delayed for two hours. Meanwhile, Hayati et al. (2024) found decreases in glucose levels after delays of 8 and 12 hours, whereas Rahmatunisa et al. (2021) reported a decrease in glucose levels after a 24-hour delay. These findings indicate that the longer the delay, the greater the likelihood of a decrease in blood glucose levels.

Although several studies have reported that delayed testing can cause changes in blood glucose levels, most studies have evaluated delays of only 1 hour, 2 hours, 8 hours, 12 hours, or up to 24 hours. Studies specifically evaluating a three-hour delay, which may occur in laboratory services because of high workloads and large sample volumes, remain limited. In addition, delayed blood glucose testing using the Glucose Oxidase Peroxidase Aminoantipyrine (GOD-PAP) method on a Sysmex BX-3010 automated chemistry analyzer among patients with diabetes mellitus at Karisma Cimate Hospital has not previously been reported.

The novelty of this study lies in evaluating differences in fasting blood glucose levels between samples tested immediately and those tested after a three-hour delay in patients with diabetes mellitus using the Glucose Oxidase Peroxidase Aminoantipyrine (GOD-PAP) method on a Sysmex BX-3010 automated chemistry analyzer. The findings are expected to provide a basis for strengthening quality control in the pre-analytical phase of laboratory testing, particularly by





minimizing testing delays so that blood glucose results are more accurate and can support clinical decision-making.

2. Research Methods

This quantitative study employed a comparative analytical design with a paired approach to compare fasting blood glucose levels measured immediately and after a three-hour delay. The study was conducted at the Laboratory of Karisma Cimareme Hospital, West Bandung Regency, on July 1, 2026. The accessible population comprised 43 patients with diabetes mellitus. Although the minimum sample size calculated using the Slovin formula was 39, only 30 patients met the eligibility criteria and were included through purposive sampling. Eligible participants had diabetes mellitus, underwent fasting blood glucose testing, provided consent, and had serum samples suitable for both testing conditions.

Primary data consisted of fasting blood glucose measurements using the Glucose Oxidase Peroxidase Aminoantipyrine (GOD-PAP) method with a Sysmex BX-3010 analyzer and DiaSys Glucose GOD-PAP FS reagent. Each serum sample was tested immediately after centrifugation and retested after a three-hour delay in the original primary tube, using the same method, instrument, and reagent. The results were compared to assess differences between the two testing conditions.

Data were analyzed using descriptive statistics, including minimum, maximum, mean, and standard deviation. The Shapiro–Wilk test assessed normality. Differences between paired measurements were analyzed using the paired-samples t-test for normally distributed data or the Wilcoxon signed-rank test for non-normally distributed data. Statistical significance was set at $\alpha = 0.05$, with a 95% confidence level; p-values below 0.05 indicated statistically significant differences.

3. Results and Discussion

a. Results

Descriptive analysis was performed to describe fasting blood glucose values obtained from immediate testing and testing after a three-hour delay, including minimum, maximum, and mean values.

Table 1. Descriptive Analysis of Fasting Blood Glucose Levels

Variable	N	Minimum (mg/dL)	Maximum (mg/dL)	Mean (mg/dL)
Immediate testing	30	88	272	180.27
Delayed testing	30	78	258	165.53

Fasting blood glucose testing in 30 respondents showed that immediate sample testing yielded a minimum value of 88 mg/dL, a maximum value of 272 mg/dL, and a mean value of 180.27 mg/dL. In samples tested after a three-hour delay, the minimum value was 78 mg/dL, the maximum value was 258 mg/dL, and the mean value was 165.53 mg/dL. These findings show that the mean fasting blood glucose level after a three-hour delay was lower than that obtained from immediate testing. A normality test was performed to determine the data distribution as the basis for selecting the appropriate statistical test. Because the sample size was fewer than 50, normality was assessed using the Shapiro-Wilk test.



**Table 2.** Normality Test

Variable	Shapiro-Wilk Statistic	df	Sig.	Interpretation
Immediate testing	0.998	30	1.000	Normal
Delayed testing	0.988	30	0.980	Normal

Based on the normality test, fasting blood glucose data from both immediate and delayed testing were normally distributed. The Shapiro-Wilk test yielded significance values of 1.000 for immediate testing and 0.980 for delayed testing. Both values were greater than 0.05 ($p > 0.05$), indicating a normal distribution. Therefore, subsequent analysis could be conducted using the parametric paired-sample t-test to determine differences in fasting blood glucose levels between immediate and delayed testing.

Because both datasets were normally distributed, the paired-sample t-test was used to analyze differences in fasting blood glucose levels between immediate testing and testing after a three-hour delay in the same subjects.

Table 3. Paired-Sample t-Test

Variable	Mean	Std. Deviation	Mean Difference	p-value
Immediate testing	180.27	43.84	14.73	<0.001
Delayed testing	165.53	44.86	14.73	<0.001

The paired-sample t-test yielded $p < 0.001$ ($p < 0.05$), indicating a statistically significant difference between fasting blood glucose levels obtained from immediate testing and testing after a three-hour delay. The mean fasting blood glucose level was 180.27 mg/dL with a standard deviation of 43.84 mg/dL for immediate testing, whereas the mean after a three-hour delay was 165.53 mg/dL with a standard deviation of 44.86 mg/dL. The mean difference of 14.73 mg/dL indicates that fasting blood glucose levels after a three-hour delay were lower than those obtained from immediate testing.

b. Discussion

Among the 30 patients with diabetes mellitus at Karisma Cimareme Hospital who met the inclusion criteria, the mean fasting blood glucose level was 180.27 mg/dL for immediate testing and 165.53 mg/dL after a three-hour delay, representing a mean decrease of 14.73 mg/dL. The paired-sample t-test yielded $p < 0.001$ ($p < 0.05$), indicating a significant difference between immediate fasting blood glucose testing and testing delayed for three hours. These findings show that testing delay is a pre-analytical factor that affects fasting blood glucose levels.

Biologically, the decrease in blood glucose levels observed in this study was caused by glycolysis that continued after blood collection. Erythrocytes, leukocytes, and platelets continue to use glucose as an energy source, causing serum glucose concentrations to decline when testing is not performed immediately. The longer the delay, the more glucose is consumed by blood cells, resulting in measured values that are lower than the actual glucose concentration.

The magnitude of the decrease in glucose levels in this study differed from that reported in several previous studies. These differences may have been influenced by respondents' initial glucose levels, duration of testing delay, type of specimen used, storage temperature, and variations in blood-cell metabolic activity among individuals. These factors may influence the rate of glycolysis and consequently produce different magnitudes of glucose reduction across studies.

The findings emphasize the importance of controlling the pre-analytical phase of laboratory testing. Fasting blood glucose testing should be performed as soon as possible after





serum is obtained, or the serum should be promptly separated from cellular components to minimize glycolysis. In this way, glucose stability can be maintained, allowing more accurate results that can appropriately support clinical decision-making.

These findings are consistent with Azizah, Haryanto, and Astuti (2023), who reported that delayed serum separation caused a significant decrease in glucose levels ($p < 0.001$) because glycolysis continued. The findings are also supported by Evriarti and Lumban Toruan (2024), who showed that serum glucose levels decreased from 94.8 mg/dL to 87.7 mg/dL after a one-hour delay and to 81.7 mg/dL after two hours, indicating that longer delays were associated with greater reductions in glucose levels.

Pudjiastuty et al. (2024) reported similar findings, with glucose levels decreasing by 7.39%, 14.91%, 22.56%, and 30.40% after delays of 40, 80, 120, and 160 minutes, respectively. These results indicate that the longer the delay, the greater the reduction in glucose caused by ongoing glycolysis. This finding is further supported by Asrori et al. (2023), who reported a significant difference in fasting blood glucose levels between serum and sodium fluoride (NaF) plasma specimens ($p < 0.001$). Their study explained that serum glucose levels tend to be lower because glycolysis continues, whereas NaF plasma can inhibit glycolysis and thereby maintain more stable glucose concentrations. In addition, Sutrisno and Sudrajat (2024) reported that delaying serum testing for three hours caused a significant decrease in glucose levels due to ongoing blood-cell metabolic activity.

Although all of these studies showed a similar direction of effect, the magnitude of the decrease in glucose levels was not always the same. These differences may have been influenced by respondent characteristics, initial glucose levels, specimen type, storage conditions, and the duration of the delay before testing. In the present study, all respondents were patients with diabetes mellitus with relatively high initial glucose levels, so the decrease in glucose after a three-hour delay appeared greater than that reported in several previous studies.

4. Conclusion

The study results demonstrated a significant difference in fasting blood glucose levels between immediate testing (180.27 mg/dL) and testing delayed for three hours (165.53 mg/dL), with a mean difference of 14.73 mg/dL and $p < 0.001$. This decrease may be attributed to ongoing glycolysis, in which blood cells continue to consume glucose after collection. These findings are consistent with previous studies reporting decreased glucose levels following delayed testing. The magnitude of the decrease may vary depending on initial glucose levels, specimen type, storage conditions, and testing delay. Therefore, fasting blood glucose testing should be performed promptly after sample collection, or serum should be separated from blood cells as soon as possible to minimize glycolysis and ensure reliable laboratory results for clinical decision-making.

5. Compliance with Ethical Standards

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Disclosure of conflict of interest

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Statement of informed consent

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