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DIFFERENCE IN URIC ACID TEST RESULTS USING PLAIN AND CLOT ACTIVATOR VACUTAINER TUBES

Anak Agung Gede Denny Dwi Permana[1*], Anak Agung Ayu Eka Cahyani[2], Ni Luh Gede Puspita Yanti[3]
[1]Program Studi Teknologi Laboratorium Medis Program Sarjana Terapan, STIKES Wira Medika Bali
Email: gungwik130@gmail.com
[2]Program Studi Teknologi Laboratorium Medis Program Sarjana Terapan, STIKES Wira Medika Bali
Email: ekacahyani@stikeswiramedika.ac.id
[3]Program Studi Teknologi Laboratorium Medis Program Sarjana Terapan, STIKES Wira Medika Bali
Email: puspitayanti@stikeswiramedika.ac.id

*email Koresponden: gungwik130@gmail.com

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Abstract
Laboratory examinations play an important role in supporting disease diagnosis and treatment, one of which is the measurement of uric acid levels. The accuracy of laboratory results is significantly influenced by the pre-analytical stage, including the type of blood collection tube used. Two commonly used tubes are the plain vacutainer and the clot activator vacutainer, each with different additives that may affect blood clotting time and test results. This study aimed to determine the differences in uric acid test results and clotting time using these two types of tubes. A simple experimental method with a comparative design was conducted at Klinik Pratama Rawat Jalan Mambal Medical Care from March to April 2025. The sample consisted of 15 respondents, each undergoing two blood draws using both tube types. The results showed that the average clotting time for the clot activator tube was 9.27 minutes, while for the plain tube it was 24.67 minutes. The average uric acid level measured using the clot activator tube was 5.27 mg/dL, compared to 5.14 mg/dL using the plain tube. Statistical analysis using the Wilcoxon signed-rank test indicated a significant difference in clotting time but no significant difference in uric acid levels ($p > 0.05$). It can be concluded that the use of clot activator vacutainer tubes accelerates the blood clotting process but does not significantly affect uric acid levels compared to plain tubes.

Keywords : Clotting Time, Uric Acid, Vacutainer Tube

Abstrak
Pemeriksaan laboratorium memiliki peran penting dalam mendukung diagnosis dan pengobatan penyakit, salah satunya adalah pemeriksaan kadar asam urat. Akurasi hasil pemeriksaan sangat dipengaruhi oleh tahap pra-analitik, termasuk jenis tabung yang digunakan untuk penampungan darah. Dua jenis tabung yang umum digunakan adalah vacutainer plain dan clot activator. Perbedaan kandungan dalam kedua tabung ini dapat memengaruhi waktu pembekuan darah dan hasil pemeriksaan. Penelitian ini bertujuan untuk mengetahui perbedaan hasil pemeriksaan kadar asam urat dan waktu pembekuan darah menggunakan kedua jenis tabung tersebut. Penelitian dilakukan secara eksperimental sederhana dengan desain

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komparatif di Klinik Pratama Rawat Jalan Mambal Medical Care, pada bulan Maret hingga April 2025. Sampel terdiri dari 15 responden dengan masing masing dua kali pengambilan darah menggunakan kedua jenis tabung. Hasil menunjukkan bahwa rata-rata waktu pembekuan darah pada tabung clot activator adalah 9,27 menit, sedangkan pada tabung plain sebesar 24,67 menit. Rata-rata kadar asam urat pada tabung clot activator adalah 5,27 mg/dl dan pada tabung plain sebesar 5,14 mg/dl. Analisis statistik menggunakan uji Wilcoxon signed-rank test menunjukkan terdapat perbedaan yang signifikan pada waktu pembekuan, namun tidak signifikan terhadap kadar asam urat ($p > 0,05$). Kesimpulan dari penelitian ini adalah bahwa penggunaan tabung vacutainer clot activator mempercepat proses pembekuan darah, namun tidak memberikan perbedaan bermakna pada hasil kadar asam urat dibandingkan dengan tabung plain.
Kata Kunci : Asam Urat, Tabung Vacutainer, Waktu Pembekuan

1. INTRODUCTION

A Clinical Laboratory is a health facility that conducts clinical specimen examinations to support disease diagnosis and health recovery efforts (Agung et al., 2022). The clinical laboratory is an integral part of healthcare services. Laboratory examinations are essential in screening, diagnosing, monitoring diseases, and assessing treatment progress. Laboratories are expected to deliver results that are accurate, quick, and reliable. The laboratory examination process consists of three stages: pre-analytical, analytical, and post-analytical (Purwaningsih et al., 2020).

The pre-analytical stage includes patient preparation, specimen labeling, specimen collection and handling, transportation, and processing. The next stage is analytical, which includes specimen testing, equipment maintenance, calibration, reagent quality testing, and precision and accuracy testing. The final stage is post-analytical, which involves recording results, interpreting them, and reporting the findings (Djohan et al., 2023). The pre-analytical stage contributes 61%, the analytical stage 25%, and the post-analytical stage 14% of the total errors (Purwaningsih, 2020).

In the pre-analytical process, particularly for blood specimen collection, a vacutainer tube is required. The types of vacutainer tubes include the red-top tube, which has no anticoagulant and is frequently used for blood chemistry tests. The blue-top tube contains sodium citrate as an anticoagulant and is used for PTT APTT tests. The purple-top tube contains EDTA as an anticoagulant and is used for hematology tests. The yellow-top tube has a gel activator that acts as a separator between the blood and serum during centrifugation. The green-top tube contains heparin as an anticoagulant and is used for blood chemistry and AGD tests (Apriansyah, 2020). The plain vacutainer tube is a blood collection tube that contains no additives or gel activators. On the other hand, the vacutainer clot activator tube is a vacuum plastic tube that contains a clotting activator (Amanatullah et al., 2025).

The advantage of using the plain vacutainer tube is its lower cost compared to the serum separator vacutainer tube. However, a disadvantage is that the sample takes approximately 60 minutes to clot properly, and centrifugation takes longer, which can slow down the testing process (Amanatullah et al., 2025). In contrast, the clot activator vacutainer tube is slightly

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more expensive but allows for faster clotting, taking approximately 15 minutes, while the plain vacutainer tube averages 35 minutes. The clot activator tube contains silica additives sprayed on its inner walls to accelerate the clotting process (Djohan et al., 2023).

According to data from the World Health Organization (WHO) in 2017, the global prevalence of gout reached 34.2%. In the United States, the prevalence was 26.3% of the total population. The incidence of gout is rising not only in developed countries but also in developing countries, including Indonesia (Fitriani, 2021). The incidence of gout in Indonesia is relatively high, with WHO reporting a prevalence of 81%, making it the country with the highest number of gout patients in Asia. The prevalence of hyperuricemia and gout in Southeast Asia ranges between 13-25% over the past decade. The number of gout patients continues to rise every year. Nationwide, the prevalence of hyperuricemia is recorded at 30.3%. Eleven provinces in Indonesia, including Bengkulu, Nanggroe Aceh Darussalam, West Sumatra, West Java, East Java, West Papua, West Nusa Tenggara, East Nusa Tenggara, South Kalimantan, and Bali, have reported high incidences of gout (Urbaningrum et al., 2023).

Uric acid testing is one of the common laboratory examinations. This test can help diagnose and manage conditions like arthritis or kidney stones. Uric acid testing is not only relevant for diagnosing gout but also holds prognostic value for cardiovascular diseases, chronic kidney disease, and metabolic syndrome. The accuracy of uric acid test results directly impacts clinical decisions, including treatment management and therapy evaluation. Ensuring accurate results through selecting the appropriate tube type has a direct impact on patient care quality (Amanatullah et al., 2025). Uric acid testing is one of the most frequently requested laboratory tests, so optimizing accurate and efficient testing methods significantly impacts overall healthcare services (Kurniawan & Kartinah, 2023).

Gout can cause kidney damage, reducing the kidney's ability to excrete uric acid. Uric acid crystals can form in areas such as the interstitium medulla, papilla, and renal pyramids, ultimately leading to proteinuria and mild hypertension. Kidney stones formed due to uric acid accumulation can also occur as a secondary effect of gout. The kidneys function to maintain uric acid balance in the body, with most uric acid being excreted through urine. When uric acid levels exceed the kidney's capacity to regulate them, uric acid accumulates in the joints and tissues, causing severe pain, particularly in the joints. These uric acid crystals can damage the endothelial lining of blood vessels, including those in the coronary arteries (Prasetyaningrum & Amalia, 2018).

A study by Amanatullah (2025) involving 35 subjects for uric acid testing using plain and SST tubes concluded that there were significant differences in the results of uric acid tests between the plain and SST tubes. Djohan's (2023) research indicated differences in clotting time between the plain vacutainer tube and the clot activator tube. Hayati's (2023) study on the effect of blood storage time and tube type on platelet values using EDTA microtubes and vacutainer EDTA tubes showed that specimens collected in glass tubes had significantly lower leukocyte, erythrocyte, platelet, and reticulocyte counts compared to plastic tubes, but there were no significant clinical differences. Based on this background, the researcher aims to

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further explore the differences in uric acid test results using plain vacutainer tubes and clot activator vacutainer tubes.

2. RESEARCH METHOD

This study employed a simple experimental method with a comparative design. The research was conducted at *Klinik Pratama Rawat Jalan Mambal Medical Care*, Bali, from March to April 2025.

Population and Sample: The study population consisted of students from the Applied Bachelor Program in Medical Laboratory Technology, STIKes Wira Medika Bali. A total of 15 respondents were selected using an accidental sampling technique, in which each respondent underwent two blood collections: one using a plain vacutainer tube and another using a clot activator vacutainer tube, resulting in 30 total specimens.

Variables:

- Independent variable: type of vacutainer tube (plain vs. clot activator)
- Dependent variables: clotting time and uric acid levels

Procedure: Blood specimens were collected following standard venipuncture procedures. Clotting time was recorded, and uric acid levels were measured using a Chemistry Analyzer with enzymatic uricase method.

Data Analysis: Data were processed and analyzed using the *Wilcoxon signed-rank test* with a 95% confidence level ($\alpha = 0.05$) to determine significant differences in clotting time and uric acid levels between the two tube types.

3. RESULTS AND DISCUSSION

Results

This study involved 15 respondents who met the inclusion criteria. All participants were apparently healthy adults aged 21–23 years. Each respondent provided two venous blood samples: one collected using a plain vacutainer tube and one using a clot activator vacutainer tube, resulting in a total of 30 samples. The analysis focused on two main parameters: clotting time and uric acid concentration.

Table 1. Comparation of Clotting Time and Uric Acid Levels Between Tube Types

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	8	53.3
	Female	7	46.7
Age (years)	21–23	15	100
	Healthy, non-medicated	15	100

All respondents were students of STIKes Wira Medika Bali who volunteered to participate.

The sample consisted of an equal distribution of male and female respondents. All participants were in the early adult age group and did not report any known metabolic disorders that could affect uric acid levels.

Table 2. Comparison of Clotting Time Between Tube Types

Parameter	Plain Tube (Mean ± SD)	Clot Activator Tube (Mean ± SD)	*p*-value

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Clotting Time (minutes)	24.67 ± 2.31	9.27 ± 1.54	< 0.05*

Wilcoxon signed-rank test, significant at p < 0.05.

The average clotting time of blood collected in the plain tube was 24.67 minutes, whereas that in the clot activator tube was 9.27 minutes. Statistical analysis revealed a significant difference ($p < 0.05$), indicating that clot activator tubes greatly accelerate coagulation due to the presence of silica particles that serve as surface activators in the intrinsic pathway of coagulation.

Table 3. Comparison of Uric Acid Levels Between Tube Types

Parameter	Plain Tube (Mean ± SD)	Clot Activator Tube (Mean ± SD)	*p*-value
Uric Acid (mg/dL)	5.14 ± 0.62	5.27 ± 0.58	> 0.05

Wilcoxon signed-rank test, not significant at p > 0.05

The mean uric acid concentration obtained from the clot activator tube (5.27 mg/dL) was slightly higher than that from the plain tube (5.14 mg/dL), but the difference was not statistically significant ($p > 0.05$). This suggests that the silica additive in the clot activator tube does not interfere with the enzymatic uricase reaction used in uric acid measurement.

Discussion of Results

The findings of this study show that the use of clot activator vacutainer tubes significantly reduces blood clotting time compared to plain tubes. This result supports previous research by (Djohan et al., 2023), which reported that silica particles coated inside clot activator tubes enhance the activation of coagulation factors, thereby shortening the clotting process. Faster clot formation allows quicker serum separation, improving the efficiency of clinical laboratory workflows.

Although the clotting time differed significantly, uric acid levels measured from both tube types were statistically similar. This finding agrees with the study by (Amanatullah et al., 2025), which showed that clot activator and plain tubes produce comparable uric acid results when analyzed with the enzymatic uricase method. The result implies that silica-based clot activators have no chemical interference with uric acid reagents, maintaining the accuracy of measurement.

In this research, the minor difference in uric acid concentration between the two tubes may be attributed to natural biological variation or minimal pre-analytical factors such as sample handling and clotting duration. The results confirm that both tube types are reliable for uric acid testing, provided that standard laboratory procedures are followed. However, from a practical standpoint, the clot activator tube is advantageous for reducing processing time, enabling faster turnaround for biochemical testing.

Furthermore, the findings emphasize the importance of pre-analytical control in laboratory medicine. Although analytical methods such as the uricase enzymatic assay are

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standardized, variations in sample preparation can influence test reliability. Selecting an appropriate collection tube is therefore essential to ensure both accuracy and efficiency in laboratory diagnostics.

4. CONCLUSION

This study concluded that there was a significant difference in clotting time between plain and clot activator vacutainer tubes, where the clot activator tube demonstrated a faster coagulation process due to the presence of silica particles. However, there was no significant difference in uric acid levels between the two tube types. These findings indicate that both plain and clot activator tubes can be used reliably for uric acid testing, provided that pre-analytical procedures are properly controlled. Nevertheless, the use of clot activator vacutainer tubes is recommended in clinical laboratories as it offers shorter processing time and greater efficiency without compromising the accuracy of test results.

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