



Differences in Using Plain Vacutainer and Clot Activators Tubes on Total Cholesterol Examination Results

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Abstract

Total cholesterol examination can use serum or plasma samples Li-heparin and K2-EDTA. The use of serum is preferred in clinical examinations over plasma. Manufacturers have produced various tubes that provide high-quality separation between serum or plasma and cells to reduce waiting time (Turn Around Time) and cellular intent. The study aims to determine the difference in using Vacutainer Plain and Clot Activator Tubes on Total Cholesterol Examination Results. The research method used was an experiment with a comparative design with 30 respondents from Wira Medika Bali Collage of Health Sciences students where the examination was carried out at the Kerthi Bali Sadhajiwa Health Laboratory Center, Bali Province in July - August 2024. The results showed a significant difference between total cholesterol levels using serum vacutainer plain and clot activators tubes ($p = 0.000$). The results showed a mean difference of 5.6 mg/dl where the examination with the clot activator tube was higher than the vacutainer plain tube.

Key words: Cholesterol, Lipid, Vacutainer Tubes.

1. Introduction

The 2018 Basic Health Research Report by the Indonesian Ministry of Health (Riskesmas) indicated that 28.8% of the Indonesian population had elevated total cholesterol levels, based on a combination of individuals categorized as borderline (total cholesterol levels of 200–239 mg/dL) and high (total cholesterol levels >240 mg/dL) [1]. Total cholesterol testing can be performed using serum samples or plasma collected with Li-heparin or K2-EDTA anticoagulants [2]. Serum is generally preferred in clinical testing over plasma, as it does not contain added anticoagulants, thereby minimizing interference with the activity and reactivity of serum components during analysis [3].

Manufacturers have developed various blood collection tubes that ensure high-quality separation of serum or plasma from blood cells, aiming to reduce turnaround time and minimize



cellular interference [4]. Plain vacutainer tubes are glass vacuum tubes that do not contain any additives. In contrast, clot activator vacutainer tubes are plastic tubes containing a clot activator agent [5].

The primary difference between plain and clot activator vacutainer tubes lies in the blood clotting process. In plain vacutainer tubes, clotting occurs naturally over 15–30 minutes. Comparatively, clot activator tubes offer faster clotting due to the presence of silica particles sprayed onto the inner wall of the tube to accelerate coagulation [5]

Blood collection tubes also have certain limitations, including suboptimal performance in long-term blood sample storage and difficulty in achieving optimal separation of serum from red blood cells [3]. Djohan (2023) reported significant differences in clotting time and fasting blood glucose results between plain and clot activator vacutainer tubes [5]. Noviana (2021) concluded that there were differences in total cholesterol test results when comparing fresh serum to 24-hour delayed serum samples.

Based on this background, the researcher is interested in conducting a study on the **Effect of Using Plain vs. Clot Activator Vacutainer Tubes on Total Cholesterol Test Results.**

2. Method

This study employed an analytical observational approach with a cross-sectional design. The research was conducted at the UPTD Balai Laboratorium Kesehatan Kerthi Bali Sadhajiwa, Bali Province, from July to August 2024. The study population consisted of students from STIKES Wira Medika Bali. A total of 30 blood samples were randomly selected from students with no history of dyslipidemia, using a 90% confidence interval and a significance level of $\alpha = 0.05$. Primary data were collected through direct blood sampling and laboratory testing.

Ethical approval and institutional permissions were obtained prior to data collection. Each participant provided written informed consent. From each subject, 6 mL of venous blood was collected—3 mL into a plain vacutainer and 3 mL into a clot activator vacutainer. Total cholesterol levels were analyzed from both samples. Data were analyzed using univariate and bivariate methods. The Shapiro–Wilk test was used to assess normality; results indicated that both groups were normally distributed ($p = 0.166$ for plain vacutainer and $p = 0.218$ for clot activator).



Consequently, the Paired Sample T-test was employed to compare total cholesterol levels between the two types of collection tubes..

3. Result and Discussion

Results and discussion can be made as a whole that contains research findings and explanations.

3.1. Results

The data in this study were primary data obtained from total cholesterol testing of 30 respondents.

Tabel 1. Data Deskriptif Rerata Kadar Kolesterol Total Tabung Vacutainer Plain Dan Clot Activator

Variable	N	Total Cholesterol levels			Mean difference (mg/dl)
		Mean	Min	Max	
Plain	30	163.87	123	231	5,6 mg/dl
Clot_activator	30	168.20	128	235	

Table 1 presents the descriptive data of total cholesterol levels measured using serum from plain and clot activator vacutainer tubes. The mean total cholesterol level from the plain vacutainer tube was 163.87 mg/dL, with a minimum value of 123 mg/dL and a maximum of 231 mg/dL. In comparison, the clot activator vacutainer tube yielded a higher mean value of 168.20 mg/dL, ranging from 128 mg/dL to 235 mg/dL. The mean difference between the two methods was 5.6 mg/dL.

Normality testing was performed to determine whether the data were normally distributed using the Shapiro–Wilk test. Data were considered normally distributed if the p-value was greater than 0.05. The results of the normality test showed p-values of 0.166 for total cholesterol levels from the plain vacutainer tube and 0.218 for the clot activator tube, indicating that both datasets were normally distributed. Therefore, further analysis was conducted using the Paired Sample T-test.

Table 2. Paired Sample T-test Results

Variable	p-value	Correlation Coefficient (r)
Plain	0.000	0.997
Clot Activator		

Based on Table 2, the bivariate analysis using the Paired Sample T-test showed a p-value of 0.000 ($p < 0.05$), indicating a statistically significant difference in total cholesterol levels between



the plain and clot activator vacutainer tubes. The correlation coefficient of 0.997 suggests a very strong positive correlation between the two measurements.

3.2. Create a Discussion

The use of serum in several laboratories is more common than plasma because serum has become the universal specimen for blood chemistry tests. The difference between plain vacutainer tubes and clot activator tubes lies in the blood clotting process. In plain vacutainer tubes, blood clots naturally within 15–30 minutes [6]. Compared to this, the clotting process in clot activator tubes is faster and more efficient due to the presence of clot activators. A study by Djohan (2023) reported significant differences in clotting time and fasting blood glucose test results between plain and clot activator vacutainer tubes at Sultan Syarif Mohamad Alkadrie Hospital[5].

In contrast, a study by Nurmubasyiroh (2018) found no significant differences in fasting blood glucose levels between serum prepared in plain (no additive) and clot activator vacutainer tubes. Meanwhile, Noviana (2021) concluded that there were differences in total cholesterol test results between fresh serum and serum that had been stored for 24 hours.

Recent studies have indicated that the type of blood collection tube can influence total cholesterol test results. A study conducted in Palembang compared fasting total cholesterol levels between serum and EDTA plasma samples using the BA200 system, revealing a significant difference with a p-value of 0.00. This suggests that the choice of collection tube may impact cholesterol measurements[7]. Similarly, Sisilia (2022) found variations in total cholesterol levels between plain vacutainer tubes and serum separator tubes, although these differences were not always clinically significant. These findings underscore the importance of selecting appropriate blood collection tubes to ensure accurate cholesterol testing results [8].

4. Conclusion

Based on the results of this study, it can be concluded that there is a statistically significant difference in total cholesterol levels between serum samples collected using plain vacutainer tubes and those collected using clot activator tubes. The mean difference observed was 5.6 mg/dL, with cholesterol measurements from clot activator tubes consistently higher than those obtained from plain vacutainer tubes. This finding suggests that the type of blood collection tube used can influence the accuracy and reliability of cholesterol test results. Therefore, careful consideration



should be given to the selection of blood collection tubes in clinical and laboratory settings to ensure consistent and accurate lipid profile assessments.

5. References

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