



EFFECT OF DELAY TIME IN URINE EXAMINATION ON ALCOHOL CONCENTRATION

PENGARUH WAKTU PENUNDAAN PEMERIKSAAN URIN TERHADAP NILAI ALKOHOL

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DOI: <https://doi.org/10.62567/micjo.v2i4.1283>

Abstract

Urine alcohol testing plays a vital role in detecting alcohol consumption for clinical and forensic purposes, yet its results may be influenced by pre-analytical factors such as the delay between sample collection and laboratory analysis. This study aimed to evaluate the effect of delay time before urine examination on alcohol concentration. An experimental One-Shot Case Study design was conducted involving 44 participants in Denpasar who had consumed alcohol. Alcohol concentration was measured immediately, after a 2-hour delay, and after a 4-hour delay using the Alcohol Urine Rapid Test Dipstick Allchek, and the data were analyzed using the Kruskal-Wallis test. The findings showed that average urine alcohol levels increased numerically after a 2- and 4-hour delay compared to immediate testing; however, this change was not statistically significant ($p=0.131$). These results confirm that delaying urine alcohol examination up to 4 hours does not significantly alter detectable alcohol concentrations, although prompt testing is still recommended to ensure result accuracy and minimize the risk of false positives. This study provides important insights for the development of standard operating procedures regarding urine alcohol analysis in laboratory practice.

Keywords : Alcohol, Urine, Delay Time, Rapid Test, Laboratory

Abstrak

Pemeriksaan kadar alkohol urin memiliki peran penting dalam deteksi konsumsi alkohol secara klinis dan forensik, namun hasilnya dapat dipengaruhi oleh faktor praanalitik seperti waktu penundaan antara pengambilan dan pemeriksaan sampel. Penelitian ini bertujuan mengevaluasi pengaruh waktu penundaan pemeriksaan terhadap konsentrasi alkohol dalam urin. Sebanyak 44 responden di Denpasar yang telah mengonsumsi alkohol diikutsertakan dalam penelitian eksperimental dengan desain One-Shot Case Study. Pengujian dilakukan segera setelah pengambilan sampel, setelah penundaan 2 jam, dan 4 jam menggunakan Alcohol Urine Rapid



Test Dipstick Allcek, serta analisis statistik dengan uji Kruskal-Wallis. Hasil penelitian menunjukkan rata-rata kadar alkohol urin meningkat secara numerik pada penundaan 2 dan 4 jam dibandingkan pemeriksaan segera, namun secara statistik perubahan ini tidak signifikan ($p=0,131$). Temuan ini menegaskan bahwa penundaan pemeriksaan hingga 4 jam tidak memberikan perubahan signifikan terhadap konsentrasi alkohol urin yang terdeteksi, kendati disarankan agar pemeriksaan tetap dilaksanakan segera untuk memastikan akurasi hasil dan meminimalkan risiko hasil positif palsu. Penelitian ini memberikan gambaran penting untuk pengembangan prosedur operasional standar pada pemeriksaan alkohol urin di laboratorium.

Kata Kunci : Alkohol, Urin, Waktu Penundaan, Rapid Test, Laboratorium

1. INTRODUCTION

Urinalysis plays a critical role in clinical diagnostics, therapy monitoring, and health screening. Among its various applications, alcohol detection in urine is particularly significant for forensic and medical purposes. Urine is commonly chosen as a specimen due to its ease of collection, non-invasive nature, and ability to reflect both physiological and pathological conditions (Smith et al., 2022). Moreover, alcohol metabolites are more stable in urine than in blood, making urine a preferred medium for alcohol testing (Jones & Evans, 2021).

Alcohol (ethanol) is a psychoactive substance that affects the central nervous system, impairing motor coordination and cognitive functions. This makes alcohol testing essential, particularly in legal and medical contexts. While blood, breath, saliva, and urine can all be used for alcohol detection, urine offers practical advantages such as easier collection and no need for medical supervision (Miller et al., 2020).

However, the accuracy of urine alcohol tests is influenced by pre-analytical factors, particularly the time delay between sample collection and analysis. Delays can lead to chemical changes, including increased pH, microbial growth, and degradation of compounds like alcohol, potentially causing false-positive results (Thompson et al., 2021; Kim, 2020). For instance, microbial fermentation in stored urine can produce endogenous alcohol, further complicating the interpretation of test results (Harrison, 2022).

Recent studies have shown that urine stored at 2–8°C for 2 to 4 hours can maintain chemical stability, while room temperature storage accelerates degradation (Patel et al., 2023). Additionally, alcohol concentration in urine is highest within the first few hours after consumption, emphasizing the importance of prompt testing (Nguyen & Lee, 2021). Despite these insights, regional laboratories often face challenges in adhering to standardized specimen handling protocols, leading to concerns about the validity of test results, especially in areas like Denpasar (Anderson et al., 2022).

Given these considerations, further research is necessary to assess the impact of delay time on urine alcohol concentration. The findings of this study aim to provide evidence that can guide laboratory practices, improve standard operating procedures for alcohol testing, and inform both clinical and legal decision-making processes.

2. RESEARCH METHOD

This study employed an experimental design with a One-Shot Case Study approach to evaluate the effect of examination delay time on urine alcohol concentration. The research was conducted in Denpasar, targeting respondents who had recently consumed alcohol. A total of



44 participants were selected through purposive sampling, ensuring all met inclusion and exclusion criteria related to recent alcohol consumption.

Urine samples were collected in three conditions: (1) immediate examination after collection, (2) after a 2-hour delay, and (3) after a 4-hour delay. All samples were analyzed using the Alcohol Urine Rapid Test Dipstick Allchek to measure alcohol concentration. Data collection procedures strictly adhered to standard laboratory handling protocols to minimize confounding pre-analytical errors (Kamil, 2017; Dewanti et al., 2019).

For statistical analysis, the measured alcohol concentrations across different delay times were compared using the Kruskal-Wallis test, which is appropriate for non-parametric data and repeated measures among the same subjects. The significance level was set at $p < 0.05$. All work complied with institutional ethical guidelines and included proper participant consent and data anonymization.

3. RESULTS AND DISCUSSION

Results

Table 1. Respondent Characteristics by Age, Gender, and Type of Alcoholic Beverage Consumed

Respondent Characteristics	Criteria	Frequency	Percentage
Age	18	6	13.6%
	19	6	13.6%
	20	7	15.9%
	21	4	9.1%
	22	5	11.4%
	23	3	6.8%
	24	3	6.8%
	25	3	6.8%
	26	4	9.1%
	29	2	4.5%
	30	1	2.3%
Gender	Laki-laki	33	75%
	Perempuan	11	25%
Beverage Type	Arak	24	54.5%
	Bir	11	25%
	Kawa-Kawa	9	20.5%
Total		44	100%

The majority of respondents were 20 years old, male, and preferred arak as their alcoholic beverage. This distribution reflects a tendency for traditional alcohol consumption among productive-age males in the study population. Such demographic factors may influence metabolic processes and physiological responses to alcohol.

Table 2. Alcohol Test Positivity by Examination Timing

Examination Timing	Number of Positive	Positive Rate (out of 44)
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	Samples	samples)
Immediate	4	9.1%
2-hour delay	10	22.7%
4-hour delay	10	22.7%

There was an increase in positive samples with delayed examination compared to immediate measurement. Although the positive rate increased numerically after 2 and 4 hours, this change was not statistically significant. This may relate to endogenous fermentation or alcohol stability during sample storage, yet results remained consistent and did not impact clinical diagnostic reliability.

Table 3. Shapiro Wilk Normality Test

Alcohol Measurement Timing	Sig.	Decision
Immediate	0.000	Not Normal
2-hour delay	0.000	Not Normal
4-hour delay	0.000	Not Normal

Sig. values below 0.05 for all time points indicate that blood alcohol data for each group are not normally distributed. Thus, subsequent statistical analysis uses non-parametric approaches like the Kruskal-Wallis test for methodological validity.

Table 4. Homogeneity Test (Levene's Test)

Levene Stat.	Sig.	Conclusion
8.357	0.000	Not homogeneous

This table shows there is significant variance between examination groups, supporting the use of non-parametric statistical tests in the analysis.

Table 5. Kruskal-Wallis Hypothesis Test

Alcohol Measurement Timing	Sig.	Conclusion
Immediate, 2-hour, 4-hour delay	0.000	Not homogeneous

The Kruskal-Wallis test yielded a sig. value of 0.131 (>0.05), confirming there is no significant difference between immediate, 2-hour, and 4-hour delayed urine alcohol examinations. This finding demonstrates that up to a 4-hour delay in urine testing does not significantly affect detectable alcohol levels, ensuring result stability within rapid test protocols for this interval.

Discussion of Results

Changes in Urine Alcohol Levels in Immediately Tested Samples



The first objective of this study was to examine changes in urine alcohol concentrations in samples tested immediately after collection. The results revealed that alcohol concentrations were lower in fresh urine samples, reflecting the accurate measurement of alcohol levels before any degradation could occur. As alcohol is quickly absorbed and excreted into urine in a stable form, immediate testing ensures the most reliable results (Patel et al., 2022). This finding aligns with previous studies indicating that immediate urine analysis yields the most accurate representation of alcohol concentration, avoiding potential alterations from degradation or microbial fermentation (Nguyen & Lee, 2021).

Immediate testing also eliminates potential errors due to microbial activity or chemical changes that might occur if the urine is delayed. Therefore, it is concluded that immediate urine alcohol analysis remains the most accurate method for detecting alcohol concentrations shortly after consumption.

Changes in Urine Alcohol Values in Samples Examined after 2 and 4-Hour Delays

The second objective was to evaluate changes in alcohol levels in samples tested after 2 and 4-hour delays. The results showed a numerical increase in alcohol concentrations with longer delays, suggesting that time delays allow for microbial fermentation, which can generate additional alcohol from other compounds (Harrison, 2023). This phenomenon, known as endogenous fermentation, can lead to false positives, particularly in delayed samples that have not been properly stored (Kim, 2020).

Studies by Kamil et al. (2021) support these findings, showing that room temperature storage accelerates microbial growth and alcohol degradation, further impacting the accuracy of test results. In contrast, storing urine at lower temperatures (2–8°C) may slow down these processes, but as observed by Pinontoan et al. (2023), not all urine parameters are significantly affected by time delays. This highlights the complexity of urine alcohol testing, where the effect of delays can vary based on storage conditions and the specific compounds being measured.

While the changes in alcohol levels were not statistically significant in this study, the observed numerical increases underline the importance of minimizing time delays to maintain the accuracy and reliability of urine alcohol tests, especially in forensic and clinical applications.

Immediate, 2-Hour, and 4-Hour Testing and the Effect on Urine Alcohol Levels

The third objective was to compare the effects of different delay times (immediate, 2-hour, and 4-hour) on urine alcohol concentrations. Statistical analysis using the Kruskal-Wallis test revealed no significant differences ($p=0.131$) between the groups. Although numerical increases in alcohol concentrations were noted with longer delays, these changes were not substantial enough to affect the overall accuracy of the test results.

This suggests that while delays may have a minor effect on alcohol levels, the changes do not significantly alter the outcome of the test, supporting previous research that found no significant impact of delay on alcohol measurements (Thompson et al., 2022). However, it is important to note that pre-analytical factors such as sample storage conditions can still influence the results, and minimizing delays is crucial for optimal test accuracy (Khotimah & Sun, 2022).

The findings of this study emphasize the importance of maintaining standardized procedures for urine sample handling, even if the impact of delay is not statistically significant.



As delays may still lead to minor changes in alcohol concentrations, prompt testing is recommended to avoid any risk of compromising the accuracy of forensic and clinical results.

4. CONCLUSION

Based on the results of this research, it can be concluded that immediate urine alcohol testing yields very low alcohol values, reflecting the fresh condition of the specimen and the absence of degradation or chemical changes caused by delay. When urine alcohol testing is conducted after delays of 2 and 4 hours, there is a gradual increase in detected alcohol values, suggesting that longer delays may facilitate endogenous fermentation by microorganisms in the urine and thus elevate measured alcohol levels. However, statistical analysis using the Kruskal-Wallis test showed a significance value of 0.131 (> 0.05), indicating that the differences between immediate, 2-hour, and 4-hour delayed examinations are not statistically significant. Therefore, while minor numerical increases in alcohol values may occur with prolonged time delay, these changes do not have a significant statistical impact on the reliability and interpretation of urine alcohol test results.

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