Vol. 3 No. 4 Edisi Agustus - Oktober 2026 E. ISSN. 3032-2472
Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

DURATION OF STRANGE DURATION ON GLUCOSE AND ALCOHOL CONTENT IN SWEET TUAK (PALM WINE) IN JENEPONTO REGENCY

DURASI LAMA PENYIMPANAN TERHADAP KADAR GLUKOSA DAN ALKOHOL PADA TUAK MANIS DI KABUPATEN JENEPONTO

Sulfia Basir[1*], Rachmat Kasmad[2], Nurfaidah[3], Guruh Amir Putra[4]

[1*]Universitas Negeri Makassar, Email : fsulfiabasir@gmail.com
[2]Universitas Negeri Makassar, Email : m.rachmat.k@unm.ac.id
[3]Universitas Negeri Makassar, Email : nur.faidah@unm.ac.id
[4]Universitas Negeri Makassar, Email : guruh.amirputra@unm.ac.id

*email koresponden: fsulfiabasir@gmail.com

DOI: https://doi.org/10.62567/micjo.v3i4.3436

Abstract

The Effect of Storage Duration on Glucose and Alcohol Contents of Sweet Palm Wine in Jeneponto Regency. Undergraduate Thesis. Nutrition Study Program, Department of Nutrition, Faculty of Sports Science and Health, Universitas Negeri Makassar (supervised by M. Rachmat Kasmad and Nurfaidah). Palm sap (Borassus flabellifer L.) is a sweet liquid tapped from palm flowers, widely used by the community of Jeneponto Regency, particularly Tamalatea Subdistrict, as a traditional beverage known as sweet palm wine (ballo te'ne). This sap undergoes spontaneous fermentation by naturally occurring microorganisms, especially the yeast Saccharomyces cerevisiae, causing its glucose and alcohol content to change with storage duration. This study aimed to determine the effect of storage duration on the glucose and alcohol content of sweet palm wine in Jeneponto Regency. This was a laboratory experimental study using a one-factor Completely Randomized Design (CRD), with storage durations of 1, 2, 3, and 4 days at room temperature. Samples were obtained from a single tapping source and analyzed at the Makassar Public Health Laboratory Center; glucose content was measured using the titrimetric method and alcohol content using the spectrophotometric method. The results showed glucose content decreased consistently from 7.80% on the first day to 2.68%, 1.46%, and 1.22% on the fourth day, while alcohol content increased from 2.76% v/v to 5.20% v/v, 5.71% v/v, and 6.24% v/v on the fourth day. This inverse pattern indicates that longer storage leads to more intensive fermentation, converting glucose into ethanol. These findings confirm that storage duration significantly affects changes in glucose and alcohol content in sweet palm wine, providing a scientific basis for determining appropriate storage limits to maintain flavor quality and consumption safety, as well as serving as a reference for future research on fermented products derived from palm sap.

Keywords : Sweet Palm Wine, Storage Duration, Glucose, Alcohol, Fermentation.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Abstrak

Pengaruh Lama Penyimpanan terhadap Kadar Glukosa dan Alkohol pada Tuak Manis di Kabupaten Jeneponto. Skripsi. Program Studi Gizi, Jurusan Gizi, Fakultas Ilmu Keolahragaan dan Kesehatan, Universitas Negeri Makassar (dibimbing oleh M. Rachmat Kasmad dan Nurfaidah). Nira lontar (Borassus flabellifer L.) merupakan cairan manis hasil sadapan bunga lontar yang banyak dimanfaatkan masyarakat Kabupaten Jeneponto, khususnya Kecamatan Tamalatea, sebagai minuman tradisional bernama tuak manis (ballo te'ne). Nira ini bersifat mudah difermentasi secara spontan oleh mikroorganisme alami, terutama khamir Saccharomyces cerevisiae, sehingga kandungan glukosa dan alkoholnya berubah seiring lama penyimpanan. Penelitian ini bertujuan mengetahui pengaruh lama penyimpanan terhadap kadar glukosa dan kadar alkohol pada tuak manis di Kabupaten Jeneponto. Penelitian merupakan eksperimen laboratorium menggunakan Rancangan Acak Lengkap (RAL) satu faktor, yaitu lama penyimpanan 1, 2, 3, dan 4 hari pada suhu ruang. Sampel diperoleh dari satu sumber penyadap dan dianalisis di Balai Besar Laboratorium Kesehatan Masyarakat Makassar; kadar glukosa diukur dengan metode titrimetri dan kadar alkohol dengan metode spektrofotometri. Hasil menunjukkan kadar glukosa menurun secara konsisten dari 7,80% pada hari pertama menjadi 2,68%, 1,46%, dan 1,22% pada hari keempat, sementara kadar alkohol meningkat dari 2,76% v/v menjadi 5,20% v/v, 5,71% v/v, dan 6,24% v/v pada hari keempat. Pola berbanding terbalik ini menunjukkan bahwa semakin lama penyimpanan, semakin intensif proses fermentasi yang mengonversi glukosa menjadi etanol. Hasil ini menegaskan bahwa lama penyimpanan berpengaruh nyata terhadap perubahan kadar glukosa dan alkohol pada tuak manis, dan dapat menjadi dasar ilmiah dalam menentukan batas waktu penyimpanan yang tepat guna menjaga kualitas rasa dan keamanan konsumsi, serta menjadi referensi bagi penelitian produk fermentasi berbahan dasar nira lontar selanjutnya.

Kata Kunci : Tuak Manis, Lama Penyimpanan, Glukosa, Alkohol, Fermentasi.

1. INTRODUCTION

The palmyra palm (Borassus flabellifer L.) is a natural resource with significant ecological, social, cultural, and economic value in Indonesia, particularly South Sulawesi. Almost all parts of the palmyra palm are useful, especially the sap obtained from the flowers, which is used as a raw material for various products such as brown sugar, vinegar, and traditional drinks. In Jeneponto Regency, communities utilize palmyra sap as a source of livelihood and as an integral part of their social and cultural life. Sweet palmyra palm wine (je'ne tala te'ne) is fresh sap tapped from the palmyra palm's inflorescence and used as the raw material for making palm wine through a fermentation process (Dirawan et al., 2022).

Fresh palmyra sap has a sweet taste, distinctive aroma, clear color, and contains sugars in the form of sucrose, glucose, and fructose, which serve as substrates for fermentative microorganisms. The activity of these microorganisms, primarily the yeast Saccharomyces cerevisiae and lactic acid bacteria, breaks down the sugars and produces ethanol. As a result, the initially sweet, low-alcohol palm sap will experience an increase in alcohol content during storage (Klau et al., 2021; Karamoke et al., 2023). In Tamalatea District, Jeneponto Regency, palm wine production is still carried out traditionally by the community, with tapping generally carried out twice daily using simple equipment (Hidayati, 2024).

The main problem with palmyra sap is its relatively short shelf life, approximately 24–36 hours when fresh. During storage, natural fermentation causes changes in its chemical composition, primarily a decrease in sugar content and an increase in alcohol content. Even without the addition of preservatives, the alcohol content can increase significantly within 15–20 hours of storage (Tambunan et al., 2023). This is important to consider because the increase in alcohol content can affect the taste, quality, and safety of palmyra consumption. Research in Binamu District, Jeneponto Regency, also

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

demonstrated high public interest in palm wine (palm palm wine), thus requiring alcohol content testing to determine changes in alcohol content during storage (Hasan et al., 2023).

Changes in glucose and alcohol levels during storage have an inverse relationship. The longer the storage period, the more glucose is broken down by microorganisms into ethanol, resulting in decreased glucose levels and increased alcohol levels. This makes storage duration a critical factor in determining the quality and characteristics of palm wine (Mahulette et al., 2023). Therefore, this study was conducted to analyze the effect of storage duration on glucose and alcohol levels in palm wine (ballo' tanning) produced by the community in Tamalatea District, Jeneponto Regency. The results are expected to provide information on changes in glucose and alcohol levels based on storage duration and to inform the public and businesses in determining appropriate storage and consumption times.

This study aimed to determine and analyze the effect of storage duration on glucose and alcohol levels in palm wine and to analyze changes in both parameters over storage time. Theoretically, this research is expected to contribute to the development of food science, particularly regarding chemical changes during fermentation and storage of palm sap-based products. Practically, the research findings can inform farmers and MSMEs on maintaining the quality and selling value of palm wine. They can also serve as learning materials and case studies for the application of glucose, alcohol, and food quality parameter analysis in academic settings.

2. RESEARCH METHOD

This is an experimental laboratory study aimed at analyzing the effect of storage time on glucose and alcohol levels in sweet palm wine (palm wine). The study was conducted from July 20–24, 2026, at the Makassar Public Health Laboratory Center. A completely randomized design (CRD) was used, with storage time as one treatment factor. The study sample consisted of palm wine obtained from a local producer/tapper in a single, homogeneous production batch. The samples were divided based on storage time: days 1, 2, 3, and 4, with four replications for each treatment. The samples were stored in closed containers at room temperature and coded for easy identification.

The independent variable in this study was storage time, while the dependent variables were glucose and alcohol levels. Storage time was calculated from the time the palm wine was obtained until laboratory testing. Glucose content is the glucose content in the palm wine sample, measured through laboratory analysis and expressed as a percentage (%), while alcohol content is the ethanol content formed during the fermentation process and expressed as a percentage by volume (%v/v). Parameter measurements were conducted in accordance with laboratory analysis procedures and food analysis standards (Sugiyono, 2015; AOAC, 2020).

The equipment used included sample bottles, measuring cylinders, droppers, test tubes and tube racks, titration equipment, a spectrophotometer, a stopwatch/clock, a thermometer, and documentation tools. The research materials consisted of fresh palm wine, alcohol for sterilization, and cotton or tissue. Samples were taken from a single, homogeneous production batch, then packaged and transported to the laboratory. The samples were then divided according to storage period and stored at room temperature. At each observation time, glucose, pH, and alcohol levels were tested. Glucose levels were measured using established laboratory analysis methods, while alcohol levels were analyzed using methods in accordance with laboratory procedures. pH measurements were performed using a calibrated pH meter.

All sampling, storage, and laboratory examinations were documented through photographs and laboratory records. Measurement data were recorded on an observation sheet containing the sample code, storage period, storage conditions, glucose, pH, and alcohol levels. This data was then used to analyze changes in glucose and alcohol levels in palm wine based on storage period.

3. RESULT AND DISCCUSSION

This study aimed to determine the effect of storage duration on glucose and alcohol levels in sweet palm wine. Samples were obtained from a single production source in Tamalatea District,

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Jeneponto Regency and tested at the Makassar I Public Health Laboratory (Labkesmas) on July 20–27, 2026. Observations were made on four storage duration groups, namely days 1, 2, 3, and 4. Glucose levels were analyzed using the titrimetric method, while alcohol levels were analyzed using the spectrophotometric method.

Table 1. Results of Sweet Palm Wine Glucose Level Measurement Based on Storage Period

Sample Code	Storage Time (days)	Glucose Levels (%)	Glucose Level (Grams)	Test Method
1	1	7,80	3,90	Titrimetri
2	2	2,68	1,34	Titrimetri
3	3	1,46	0,73	Titrimetri
4	4	1,22	0,61	Titrimetri

The measurement results showed that glucose levels decreased consistently from 7.80% on the first day to 2.68% on the second day, 1.46% on the third day, and 1.22% on the fourth day. Conversely, alcohol levels increased from 2.76% v/v on the first day to 5.20% on the second day, 5.71% on the third day, and 6.24% v/v on the fourth day. Thus, the longer the storage period, the lower the glucose levels while the higher the alcohol levels, indicating an inverse relationship between the two parameters.

Table 2. Results of Measurement of Alcohol Content of Sweet Palm Wine Based on Storage Period

Sample Code	Storage Time (days)	Alcohol Content (%v/v)	Alcohol Content (mL)	Test Method
1	1	2,76	1,38	Spektrofometri
2	2	5,20	2,60	Spektrofometri
3	3	5,71	2,86	Spektrofometri
4	4	6,24	3,12	Spektrofometri

Source: Researcher's Primary Data, 2026

The greatest changes occurred from the first to the second day. Glucose levels decreased by 5.12%, while alcohol levels increased by 2.44% v/v. On the third and fourth days, the changes began to level off. This indicates that fermentation was active at the beginning of storage, then slowed down as sugar substrates became increasingly limited and the accumulation of alcohol inhibited yeast activity. The decrease in glucose levels occurred because natural microorganisms, particularly Saccharomyces cerevisiae, utilized the sugars in the sap as a substrate for growth and fermentation. The invertase enzyme breaks down sucrose into glucose and fructose, then the zymase enzyme helps convert these sugars into ethanol and carbon dioxide (Prabawa et al., 2021). Saccharomyces activity causes glucose levels to decrease and alcohol levels to increase during storage (Mussa et al., 2020). During further fermentation, bacteria such as Acetobacter aceti can convert alcohol to acetic acid, further changing the characteristics of palm wine (Ali et al., 2026). Biochemically, this relationship can be explained through the alcohol fermentation reaction:

$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$$

Glucose undergoes glycolysis to form pyruvic acid, then produces acetaldehyde and finally ethanol with the help of enzymes in Saccharomyces cerevisiae. This process explains the pattern in the study: as glucose decreases, alcohol levels increase. The sharpest decrease in glucose occurs on the first to second day, followed by the largest increase in alcohol levels over the same period. The slowing of the change on the third and fourth days is related to the increasingly limited glucose substrate available to microorganisms (Nurwahyu, 2023; Alharbi et al., 2022; Febriyanti et al., 2022). These results align with the research of Pambudiarto et al. (2025) on palm wine, which showed that with longer storage, microbial activity increases and glucose levels decrease. The increase in alcohol levels in this study is also consistent with the research of Kolo et al. (2023), Aisyah et al. (2021), and

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Ningrum et al. (2022) showed that the alcohol content of palm-based beverages tends to increase with storage time due to ongoing fermentation.

Changes in glucose and alcohol levels also have implications for the characteristics of palm wine. During short storage periods, glucose levels remain relatively high, resulting in a more dominant sweet taste, while longer fermentation causes sugar levels to decrease and alcohol levels to increase. This study showed that four days of storage resulted in the lowest glucose level of 1.22% and the highest alcohol level of 6.24% v/v. These findings suggest that storage time is a significant factor in changing the chemical characteristics of sweet palm wine. Based on the classification used in the study, the alcohol content on the first day was 2.76% v/v, still below 5%. Starting on the second day, the alcohol content reached 5.20% v/v and continued to increase to 6.24% v/v on the fourth day. Therefore, changes in alcohol content require attention during the storage and consumption of palm wine. Previous research also showed that increasing the fermentation duration can increase the alcohol content and change the characteristics of palm wine (Fraza et al., 2024; Osuji et al., 2024).

Overall, the study showed that the longer the sweet palm wine was stored, the lower the glucose content and the higher the alcohol content. This relationship occurs because glucose is used as a substrate in the fermentation process by microorganisms, particularly Saccharomyces cerevisiae. These results provide information for the community and MSMEs producing palm wine regarding changes in chemical characteristics during storage, while also demonstrating the importance of controlling storage duration according to the desired product characteristics.

This study has limitations because the samples came from only one production batch and one tapping source in Tamalatea District, thus not reflecting variations due to differences in trees, tapping techniques, or production locations. Furthermore, observations were only conducted from days 1 to 4 at room temperature without comparison to other storage conditions, and the sample size was limited. These limitations need to be considered when generalizing the study results and can serve as a basis for further research with a wider sample size, production sources, and a wider variety of storage conditions.

4. CONCLUSION

Based on the research results and discussion regarding the effect of storage time on glucose and alcohol levels in sweet palm wine (tuak manis) in Tamalatea District, Jeneponto Regency, the following conclusions can be drawn:

1. Storage time decreases glucose levels in sweet palm wine.
2. Storage time increases alcohol levels in sweet palm wine.

5. REFERENCES

Ali, S. S., Lasindrang, M., Antuli, Z. A. K., Kasim, R., & Engelen, A. (2026). Studi pembuatan cuka berbahan dasar pisang dengan varietas berbeda menggunakan *Saccharomyces cerevisiae* dan *Acetobacter aceti*. *Jambura Journal of Food Technology*, 8(1), 67.

Dirawan, G. D., Amir, F., & Pertiwi, N. (2022). Status Konservasi Pohon Lontar (Borassus flabellifer Linn) Di Kabupaten Jeneponto, Sulawesi Selatan, Indonesia. Jurnal Ilmu Tanaman Tropis, 3(1), 1–6.

Hasan. (2021). Pengaruh Lama Fermentasi Terhadap Kadar Alkohol Arak (Ballo') di Kecamatan Binamu Kabupaten Jeneponto. Jurnal Analis Medika Biosains (JAMBS), Poltekkes Kemenkes Mataram.

Hidayati, S. (2024). Analisis Kandungan Alkohol pada Tuak Lontar (*Borassus flabellifer L.*) yang Beredar di Kecamatan Binamu Kabupaten Jeneponto dengan Menggunakan Metode Kromatografi Gas. Jurnal Teknologi Pertanian, 32–39.

Karamoko, D., Deni, N. T., Moroh, J.-L. A., Bouatenin, K. M. J.-P., & Dje, K. M. (2023) Sifat biokimia dan mikrobiologis nira kelapa sawit: Pengaruh lama penyadapan dan perbedaan varietas. *Food and Nutrition Sciences*, 7, 763–771.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Mahulette, F., Rupilu, Z., & Pattipeilohy, M. (2023). Pengaruh Lama Penyimpanan dan Bahan Pengawet terhadap Karakteristik Fisikokimia Nira Aren (Arenga pinnata Merr). Jurnal Pangan dan Agroindustri, 8(4), 219–225.

Mussa, R. (2024). Kajian Tentang Lama Fermentasi Nira Aren (Arenga pinnata) terhadap Kelimpahan Mikroba dan Kualitas Organoleptik Tuak. Biopendix, 1(1), 56–60.

Pambudiarto., & Manzil, L.D.B. A. (2024). Studi reaksi fermentasi pada minuman legen. *Jurnal Integrasi Proses dan Lingkungan*, 2(1), 80–86.

Prabawa, A. A., Utomo, E. H., & Abdullah. (2021). Produksi enzim invertase oleh Saccharomyces cerevisiae menggunakan substrat gula dengan sistem fermentasi cair. *Jurnal Teknologi Kimia dan Industri*, 1(1).

Tambunan, P. (2023). Potensi dan Kebijakan Pengembangan Lontar untuk Menambah Pendapatan Penduduk. Jurnal Analisis Kebijakan Kehutanan, 7(1), 27–45.