JPPIPA 12(10) (2026)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Effects of Refrigerated Storage on Lactic Acid Bacteria Viability and Antioxidant Activity of Goat Milk Yogurt Fortified with White Rice Bran Flour

Ajeng Erika Prihastuti Haskito[1*], Salma Fauziyyah[2], Citra Sari[1], Agri Kaltaria Anisa[3]

[1] Veterinary Public Health Laboratory, Faculty of Veterinary Medicine, Universitas Brawijaya, Puncak Dieng Eksklusif, Malang, Indonesia.
[2] Student of Veterinary Medicine, Faculty of Veterinary Medicine, Universitas Brawijaya, Puncak Dieng Eksklusif, Malang, Indonesia.
[3] Veterinary Pharmacology Laboratory, Faculty of Veterinary Medicine, Universitas Brawijaya, Puncak Dieng Eksklusif, Malang, Indonesia.

Received: July 10, 2026
Revised: September 21, 2026
Accepted: October 29, 2026
Published: October 31, 2026

Corresponding Author:
Ajeng Erika Prihastuti Haskito
drhajengerika@ub.ac.id

DOI: 10.29303/jppipa.v12i10.15627

Open Access

© 2026 The Authors. This open access article is distributed under a (CC-BY License)

Abstract: White rice bran flour is a potential functional ingredient due to its dietary fiber and antioxidant compounds. This study evaluated the effects of refrigerated storage on the viability of lactic acid bacteria (LAB) and antioxidant activity of goat milk yogurt fortified with white rice bran flour. Goat milk yogurt supplemented with 4% white rice bran flour was stored at 4°C for 0, 1, 2, 3, and 4 weeks using a completely randomized design with four replications. LAB viability was determined by the Total Plate Count method, while antioxidant activity was measured using the DPPH assay and expressed as IC_{50} values. Data were analyzed using one-way ANOVA followed by Duncan's test. Storage period significantly affected LAB viability and antioxidant activity ($p < 0.05$). LAB counts decreased from 2.57×10^7 CFU/mL at week 0 to 4.90×10^6 CFU/mL at week 2, although a slight increase occurred at week 3. Antioxidant activity increased during storage, indicated by a decrease in IC_{50} values from 226.85 to 64.98 µg/mL. Refrigerated storage reduced LAB viability but enhanced antioxidant activity. Storage for up to two weeks is recommended to maintain the functional quality of white rice bran-fortified goat milk yogurt.

Keywords: Antioxidant activity; Goat milk yogurt; LAB viability; Refrigerated storage; White rice bran flour

Introduction

The increasing public awareness of healthy lifestyles has encouraged the development of functional foods that provide not only basic nutrition but also additional physiological benefits (Suciati & Safitri, 2021). Milk and fermented milk products are important sources of animal protein and are widely recognised for their nutritional value (Liston et al., 2024). In Indonesia, milk consumption has gradually increased in recent years, although it remains relatively low compared with several neighboring Southeast Asian countries. Therefore, diversification of dairy-based functional products is important to improve consumer acceptance and expand the utilization of local dairy resources.

Peranakan Etawah (PE) goat milk is a promising dairy resource because of its favorable nutritional properties and potential health benefits. Goat milk contains smaller fat globules, higher proportions of short- and medium-chain fatty acids, and better digestibility than cow milk. It has also been reported to be more suitable for some individuals with cow milk intolerance and may contribute to digestive health, immune function, and metabolic regulation (Arief et al., 2018, 2020; Pramono et al., 2024). However, despite these advantages, the wider utilisation of goat milk is still limited by its distinctive "goaty" flavour and aroma, which may reduce consumer preference and market acceptance (Anjarwati et al., 2022). This limitation provides a logical basis for processing goat milk into

How to Cite:
Haskito, A. E. P., Fauziyyah, S., Sari, C., & Anisa, A. K. (2026). Effects of Refrigerated Storage on Lactic Acid Bacteria Viability and Antioxidant Activity of Goat Milk Yogurt Fortified with White Rice Bran Flour. *Jurnal Penelitian Pendidikan IPA*, *12*(10), 235–542. https://doi.org/10.29303/jppipa.v12i10.15627

more acceptable and value-added products, such as yogurt.

Fermentation into yogurt is an effective strategy to improve the sensory acceptability, shelf life, and functional value of goat milk. Yogurt is produced through the metabolic activity of lactic acid bacteria (LAB), particularly Lactobacillus bulgaricus, Streptococcus thermophilus, and Lactobacillus acidophilus (Sampurno & Cahyanti, 2017). As a functional food, yogurt helps support immune function and promote gastrointestinal health (Maulidina et al., 2026). Furthermore, yoghurt is well suited for individuals with lactase deficiency (lactose intolerance). During fermentation, lactic acid bacteria (LAB) hydrolyse lactose into glucose and galactose for subsequent metabolism, thereby reducing the lactose content of yoghurt by up to 40% (Sibuea & Siantar, 2022).

During fermentation, LAB contributes to acid production, flavour development, and the formation of bioactive compounds, including peptides with antioxidant properties. Antioxidant activity has also been demonstrated in cell-free supernatants of LAB isolated from soygurt, indicating the potential contribution of LAB-associated extracellular products to radical-scavenging activity (Siahaan et al., 2023). The viability of LAB is a major quality indicator of yogurt because it is closely related to probiotic functionality and potential health benefits (Akan, 2022). However, LAB viability and antioxidant activity may change during refrigerated storage. Therefore, maintaining microbiological stability and functional activity during storage is an important challenge in the development of functional goat milk yogurt.

The use of local plant ingredients to modify fiber content and antioxidant activity has been explored in other food systems, including analog rice formulated with moringa, purple sweet potato, and cassava flours (Chaniago et al., 2025). The antioxidant properties of yoghurt products can be enhanced by incorporating plant-derived ingredients containing bioactive compounds (Sinaga et al., 2023). In this context, rice bran has attracted attention as a potential fortifying ingredient in goat milk yogurt because it may influence physicochemical, organoleptic, and microbiological quality during storage (Haskito et al., 2023, 2024a).

Rice bran is a major by-product of rice milling and is abundantly available in Indonesia, but its utilisation remains limited and is still largely directed toward animal feed. Rice bran contains phenolic acids, flavonoids, tocopherols, tocotrienols, γ-oryzanol, and phytic acid, which are associated with antioxidant activity (Faizah et al., 2020). Compounds such as flavonoids, saponins, and other phenolic constituents may confer health benefits by scavenging free radicals, thereby helping to prevent degenerative diseases. Antioxidants, including polyphenols such as flavonoids and other phenolic compounds, exhibit strong free radical-scavenging activity, which may contribute to a reduced risk of chronic diseases, including cardiovascular disease, cancer, and neurological disorders (Wijayanti et al., 2024). Compositional analysis has also identified soluble and insoluble dietary fiber and a range of amino acids in rice bran, supporting interest in its use as a nutritionally valuable ingredient (Nur et al., 2026).

In addition, white rice bran contains dietary fiber components such as cellulose, hemicellulose, arabinoxylans, pectin, lignin, and β-glucan (Manzoor et al., 2023). These components may act as prebiotic substrates that support LAB growth and survival during fermentation and refrigerated storage. Thus, white rice bran flour has potential as a functional ingredient that may improve both the microbiological quality and antioxidant properties of goat milk yogurt.

Several studies have examined the use of rice bran in functional food products. Anggraini & Widjanarko (2018) reported that rice bran extracts increased antioxidant activity, total phenol, and flavonoid content in a functional beverage. In goat milk yogurt, Jangnga et al. (2023) showed that the addition of red rice bran flour increased LAB populations and antioxidant activity during refrigerated storage. Haskito et al. (2024b) also reported that refrigerated storage affected the quality characteristics of goat milk yogurt supplemented with red rice bran flour. However, most available studies have focused on red rice bran or on general quality parameters, while information on the effect of white rice bran flour supplementation on LAB viability and antioxidant activity of goat milk yogurt during refrigerated storage remains limited.

This research is important because white rice bran differs from red rice bran in its dietary fiber composition and bioactive pigment content, which may result in different effects on LAB viability and antioxidant activity during storage. In addition, the use of white rice bran flour may provide added value to an underutilised local agricultural by-product while supporting the development of functional goat milk yogurt with improved stability and health-related properties. Evaluating the changes in LAB viability and antioxidant activity during refrigerated storage is also essential because yogurt quality must be maintained not only immediately after production but also throughout the storage period.

The novelty of this study lies in its specific evaluation of white rice bran flour as a functional fortificant in PE goat milk yogurt, with emphasis on two important functional quality indicators: LAB viability and antioxidant activity during refrigerated storage at 4°C. Unlike previous studies that mainly examined red

rice bran supplementation, this study focuses on white rice bran flour and its potential role in maintaining microbiological stability and antioxidant capacity of goat milk yogurt during storage. Therefore, this study aimed to evaluate the effect of white rice bran flour supplementation on LAB viability and antioxidant activity of goat milk yogurt during refrigerated storage at 4°C. The findings are expected to provide scientific evidence for the application of white rice bran flour as a functional ingredient in goat milk yogurt and to support the development of value-added dairy products based on local resources.

Method

Materials

The materials used in this study included fresh Peranakan Etawa (PE) goat milk, commercial yogurt starter culture (Yogourmet®, Canada) containing *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, and *Streptococcus thermophilus*, white rice bran flour, de Man Rogosa Sharpe Agar (MRSA), Buffered Peptone Water (BPW) 0.10%, ethanol (99%), DPPH (2,2-diphenyl-1-picrylhydrazyl), distilled water, and pH buffer solutions.

Preparation of Goat Milk Yogurt Fortified with White Rice Bran Flour

A mother culture was prepared by pasteurizing 1 L of PE goat milk at 72°C for 15 s using the High-Temperature Short-Time (HTST) method. After cooling to approximately 40°C, 3 g of Yogourmet® starter culture was added and incubated at 40°C for 4–5 h until active fermentation was achieved. For yogurt production, 800 mL of PE goat milk was pasteurized at 72°C for 15 s and cooled to 45°C. Subsequently, 3% (v/v) mother culture and 4% (w/v) white rice bran flour was added and homogenized thoroughly. The mixture was incubated at 45°C for approximately 3 h until the pH reached 4.5. The resulting yogurt was aseptically transferred into sterile glass bottles (40 mL per bottle) and stored at 4°C according to the designated treatment groups. The formulation was adapted from previous studies on goat milk yogurt fortified with rice bran flour.

Enumeration of Lactic Acid Bacteria

Total LAB counts were determined using the Total Plate Count (TPC) method. One milliliter of yogurt sample was transferred into 9 mL of sterile BPW 0.1% and serially diluted up to 10^{-7}. Aliquots (0.1 mL) from dilutions 10^{-5}, 10^{-6}, and 10^{-7} were spread onto MRSA plates in duplicate. The inoculated plates were incubated at 37°C for 24–48 h under aerobic conditions. Colonies ranging from 30 to 300 CFU per plate were counted and expressed as colony-forming units per milliliter (CFU/mL). LAB counts were calculated using the Standard Plate Count formula (Munthe et al., 2025):

$$\text{LAB Count (CFU/mL)} = \frac{\Sigma C}{\{(1 \times n_{1)} + (0.01 \times n_2) \times d} \quad (1)$$

where:
ΣC = total colonies counted on all selected plates;
n_1 = number of plates at the first selected dilution;
n_2 = number of plates at the second selected dilution;
d = dilution factor corresponding to the first selected dilution.

Determination of Antioxidant Activity

Antioxidant activity was determined using the DPPH radical scavenging assay. Yogurt samples were extracted by mixing 2.5 mL of yogurt with ethanol up to a final volume of 25 mL. The mixture was macerated for 2 h and filtered. Different sample concentrations were prepared by diluting the filtrate to obtain volumes of 3.5, 4.0, 4.5, and 5.0 mL. One milliliter of each dilution was mixed with 7 mL of ethanol and 2 mL of DPPH solution (0.2 mM). The mixture was vortexed and incubated at room temperature in the dark for 30 min. Absorbance was measured at 517 nm using a UV–Visible spectrophotometer. Radical scavenging activity was calculated using the following equation (Amaliah et al., 2025):

$$\%\text{Inhibition} = \frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \times 100 \quad (2)$$

where A_{control} is the absorbance of the control solution and A_{sample} is the absorbance of the tested sample.

IC_{50}, defined as the sample concentration required to achieve 50% DPPH radical inhibition, was estimated from the linear regression of percentage inhibition against sample concentration (Lindawati et al., 2026).

Statistical Analysis

Data were expressed as mean ± standard deviation (SD). Normality and homogeneity of variance were evaluated prior to statistical analysis. Differences among storage periods were analyzed using one-way analysis of variance (ANOVA). When significant differences were detected ($p<0.05$), Duncan's Multiple Range Test (DMRT) was performed as a post hoc analysis. All statistical analyses were conducted using IBM SPSS Statistics version 25.

Results and Discussion

Viable Lactic Acid Bacteria (LAB) Count

Refrigerated storage significantly affected the viable lactic acid bacteria count in goat milk yoghurt fortified with white rice bran flour ($p<0.05$). The highest LAB

count was recorded at week 0, whereas lower counts were observed during storage, particularly at weeks 2 and 4. The LAB count decreased from 2.57 × 10^7 CFU/mL at week 0 to 4.90 × 10^6 CFU/mL at week 2, increased again at week 3, and declined to 5.52 × 10^6 CFU/mL at week 4. From a microbiological perspective, yoghurt contains high concentrations of viable lactic acid bacteria (≥10^6 CFU/mL), which may confer probiotic health benefits by helping maintain a balanced gut microbiota and supporting immune function. However, viable bacterial counts may fluctuate during storage depending on storage temperature and duration (Rahmiati et al., 2025). These findings indicate that LAB viability was not stable during refrigerated storage and tended to decline compared with the initial value.

Table 1. Average viable Lactic Acid Bacteria (LAB) count of goat milk yogurt fortified with white rice bran flour during refrigerated storage

Storage Period	Average Viability of LAB ± SD (CFU/mL)
Week 0	(2.57 ± 5.5) x $10^{7\,c}$
Week 1	(1.35 ± 6.6) x $10^{7\,ab}$
Week 2	(4.9 ± 3.14) x $10^{6\,a}$
Week 3	(1.72 ± 7.9) x $10^{7\,b}$
Week 4	(5.52 ± 2.1) x $10^{6\,a}$

Note: Superscript letters a, b, and c indicate significant differences between treatment groups ($p<0.05$).

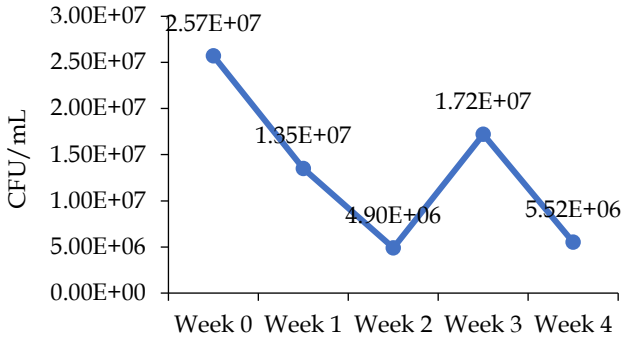


Figure 1. Graphic of average viability of Lactic Acid Bacteria (LAB)

The reduction in LAB viability during refrigerated storage is consistent with the natural growth cycle of lactic acid bacteria. During fermentation and subsequent storage, LAB continuously metabolize available substrates, resulting in nutrient depletion and accumulation of metabolic by-products, particularly lactic acid. As storage progresses, the acidic environment becomes less favorable for bacterial survival, leading to a gradual decline in viable cell numbers (Wu et al., 2025). The response to acidic conditions can vary among LAB isolates. Tsaaqifah et al. (2023) observed isolate-dependent reductions in viable counts under acidic conditions in LAB obtained from cocoa fermentation. Similar findings have been reported in previous studies evaluating probiotic yogurt during cold storage, where LAB populations decreased due to reduced nutrient availability and increasing acidity (Haskito et al., 2024b).

The relatively high LAB count at week 0 may reflect bacterial proliferation during fermentation before refrigerated storage. Hozzein et al. (2023) demonstrated the growth of lactic acid bacteria during fermentation of rice milk supplemented with skim milk, with growth and acidification characteristics differing among the tested starter cultures. In addition, white rice bran flour may have contributed to bacterial growth by providing fermentable carbohydrates and dietary fiber that can serve as additional substrates for microbial metabolism. Prebiotic components contained in rice bran have been reported to support the growth and survival of probiotic bacteria during fermentation and storage (Ferronatto et al., 2021).

The temporary increase in LAB count observed at week 3 differs from the general trend expected during yogurt storage. Previous studies have shown that LAB populations typically decline continuously with increasing storage time. This fluctuation may be attributed to residual nutrients that remained available for bacterial metabolism, allowing certain bacterial populations to continue growing despite refrigeration (Hasani et al., 2016). Another possible explanation is methodological variation during serial dilution, plating, or colony counting procedures, which may influence the estimated bacterial concentration. Therefore, the increase observed at week 3 should be interpreted cautiously.

Despite the observed decline, LAB counts remained within the minimum range recommended for probiotic products. According to the Indonesian National Standard 2981:2009 about yogurt (BSNI, 2009), yogurt should contain at least 10^7 CFU/mL LAB, while the Food and Agriculture Organization (FAO) (2002), recommends viable probiotic counts of approximately 10^6–10^8 CFU/mL to provide health benefits. The results indicate that goat milk yogurt fortified with white rice bran flour was able to maintain an adequate population of beneficial bacteria throughout most of the storage period, thereby preserving its probiotic potential. Refrigerated storage at 4°C plays an important role in extending yogurt shelf life by slowing bacterial metabolism and fermentation activity. Low temperatures reduce enzymatic activity and microbial growth rates, thereby delaying the transition from the stationary phase to the death phase. However, prolonged storage still results in gradual quality deterioration, including reduced bacterial viability and changes in sensory properties such as increased acidity,

stronger fermented aroma, and thicker texture (Pangestu et al., 2021).

Antioxidant Activity

Storage duration also significantly affected the antioxidant activity of goat milk yogurt fortified with white rice bran flour ($p<0.05$). The IC_{50} value decreased progressively from 226.85 µg/mL at week 0 to 64.98 µg/mL at week 4. The IC_{50} value represents the concentration of an antioxidant required to scavenge 50% of free radicals. Percentage inhibition, meanwhile, measures the effectiveness of a compound in neutralizing free radicals or inhibiting oxidation (Istikomah et al., 2026). Since lower IC_{50} values indicate stronger antioxidant activity, these results demonstrate that the antioxidant capacity of the yogurt increased during refrigerated storage. An increase in antioxidant activity during storage is not universal. Lavlinesia et al. (2023) reported decreased antioxidant activity and increased IC_{50} values in purple yam flour during room-temperature storage, contrasting with the trend observed in the present yogurt formulation. Hidayati et al. (2025) also reported differences in pumpkin seed oil antioxidant activity with fruit storage duration; however, their findings concern fruit and seed maturation rather than refrigerated dairy fermentation.

Table 2. Average antioxidant activity of goat milk yogurt fortified with white rice bran flour during refrigerated storage

Storage Period	Average Antioxidant Activity ± SD (IC_{50})
Week 0	226.85 ± 7.76[d]
Week 1	157.73 ± 9.75[c]
Week 2	119.75 ± 5.98[b]
Week 3	69.18 ± 4.96[a]
Week 4	64.98 ± 4.72[a]

Note: Superscript letters a, b, and c indicate significant differences between treatment groups ($p<0.05$).

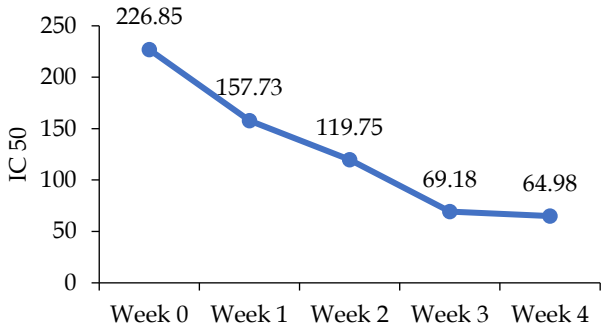


Figure 2. Graphic of average antioxidant activity

The enhancement of antioxidant activity during storage can be attributed to biochemical changes occurring during fermentation. Goat milk contains several bioactive compounds, including vitamins C and E, flavonoids, and casein-derived peptides, which contribute to antioxidant activity. Among milk proteins, β-casein is particularly abundant in goat milk and serves as a precursor of bioactive peptides released through microbial proteolysis. As fermentation continues during storage, LAB proteolytic enzymes hydrolyze milk proteins into smaller peptides and amino acids, many of which exhibit antioxidant properties (Stobiecka et al., 2022; Guha et al., 2021).

White rice bran flour also plays an important role in improving antioxidant activity. Rice bran contains phenolic compounds, tocopherols, tocotrienols, and γ-oryzanol, which are recognized as potent natural antioxidants (Faizah et al., 2020). During fermentation, cellulolytic and glycosidic enzymes produced by LAB partially degrade fiber components in rice bran. This process disrupts the covalent bonds between phenolic compounds and structural polysaccharides, thereby increasing the release and bioavailability of antioxidant compounds. Consequently, the concentration of free phenolic compounds increases during storage, resulting in stronger radical-scavenging activity (Le et al., 2019). The release of phenolic compounds may contribute to the observed increase in antioxidant activity, although this mechanism was not directly evaluated in the present study. Yendriani et al. (2026) reported a weak, non-significant relationship between total phenolic content and IC_{50} in saga seed extracts, indicating that total phenolic content alone may not explain antioxidant activity.

The antioxidant classification based on IC_{50} values indicates that the yogurt exhibited moderate antioxidant activity at week 0 and progressively improved to strong antioxidant activity by weeks 3 and 4. This finding suggests that continued fermentation during cold storage enhanced the formation and release of antioxidant compounds (Saritas et al., 2024). Similar observations have been reported in fermented dairy products supplemented with plant-derived ingredients, where prolonged storage promoted the accumulation of bioactive metabolites with antioxidant properties (Raikos et al., 2019).

Although the strongest antioxidant activity was observed in week 4, the optimal storage period should not be determined solely based on antioxidant capacity. LAB viability and sensory quality must also be considered. Extended storage is associated with declining bacterial populations and undesirable sensory changes, including excessive acidity and increased viscosity. Therefore, from a practical and consumer acceptance perspective, yogurt stored for up to two weeks may represent the most appropriate balance between probiotic viability, antioxidant activity, and organoleptic quality. However, if antioxidant functionality is prioritized, storage up to three or four

weeks may provide greater antioxidant benefits (Zhang et al., 2023).

The increase in antioxidant activity observed throughout storage demonstrates the synergistic interaction between goat milk components and white rice bran flour during fermentation. These findings highlight the potential of white rice bran as a functional ingredient for the development of probiotic dairy products with enhanced antioxidant properties and added nutritional value. Nevertheless, antioxidant activity measured in vitro should be complemented by safety assessment. Noviatri et al. (2023) reported increased hepatic malondialdehyde levels at the two higher tested doses and increased liver degeneration and focal necrosis scores at all tested doses in mice receiving yoghurt fortified with ethanolic roselle flower extract. Although the fortificant and experimental conditions differed from those of the present study, these findings highlight the importance of formulation-specific safety evaluation.

Conclusion

Storage duration significantly influenced LAB viability and antioxidant activity of goat milk yogurt fortified with white rice bran flour. LAB viability showed an overall decreasing trend during refrigerated storage, whereas antioxidant activity increased as indicated by lower IC_{50} values. The findings suggest that white rice bran flour can be utilized as a functional ingredient to enhance the probiotic and antioxidant properties of goat milk yogurt. Based on the combined evaluation of LAB viability and antioxidant activity, storage for up to two weeks is recommended to obtain optimal product quality and functionality.

Acknowledgments

The authors gratefully acknowledge the financial support provided by the Faculty of Veterinary Medicine. The authors also express their sincere appreciation to the Veterinary Public Health Laboratory, Faculty of Veterinary Medicine, Universitas Brawijaya for providing laboratory facilities and technical support throughout this research.

Author Contributions

A.E.P.H. developed the research concept; S.F. performed data collection and analysis; C.S. and A.K.A. reviewed the methodology applied in this study; A.E.P.H. and S.F. jointly contributed to the writing, review, and revision of the manuscript. All authors read and approved the final version of the manuscript.

Funding

This research was financially supported by the DPP/SPP Grant Program for Fiscal Year 2022 from Faculty of Veterinary Medicine Universitas Brawijaya.

Conflicts of Interest

The authors declare no conflicts of interest related to this study.

References

Akan, E. (2022). The Effect of Fermentation Time and Yogurt Bacteria on the Physicochemical, Microbiological and Antioxidant Properties of Probiotic Goat Yogurts. *Anais Da Academia Brasileira de Ciencias*, *94*(3), 1–16. https://doi.org/10.1590/0001-3765202220210875

Amaliah, P., Yuningtyas, S., & Noviardi, H. (2025). Aktivitas Antioksidan dan Karakteristik dari Yoghurt Sari Kedelai dengan Penambahan Sari Jahe Merah (Zingiber officinale var Rubrum). *Jurnal Farmamedika*, *10*(1), 107–113. https://doi.org/10.47219/ath.v10i1.446

Anggraini, R. F., & Widjanarko, S. B. (2018). Effect of Rice Bran Extract to Antioxidant Activity, Total Phenolic, and Flavonoid Content from Functional Drink Corn Juice-Rice Bran Extract. *Jurnal Pangan dan Agroindustri*, *6*(1), 53–63. https://doi.org/10.21776/ub.jpa.2018.006.01.7

Anjarwati, S., Permadi, E., & Lestari, R. B. (2022). Sifat Organoleptik Yoghurt Susu Kambing dengan Suplementasi Ekstrak Buah Lakum (Cayratia trifolia (L.) domin). *Jurnal Peternakan Borneo*, *1*(1), 25–32. https://doi.org/10.26418/jpb.v1i1.0000

Arief, R. W., Santri, N., & Asnawi, R. (2018). Introduction of Goat Milk Processing in Sub-District of Sukadana, District of East Lampung of The Lampung Province. *Jurnal Teknologi & Industri Hasil Pertanian*, *23*(1), 45–56. https://doi.org/10.23960/jtihp.v23i1.45-56

Arief, A., Rusdimansyah, R., Sowmen, S., Pazla, R., & Rizqan, R. (2020). Milk Production and Quality of Etawa Crossbreed Dairy Goat that Given Tithonia diversifolia, Corn Waste and Concentrate Based Palm Kernel Cake. *Biodiversitas*, *21*(9), 4004–4009. https://doi.org/10.13057/biodiv/d210910

Chaniago, R., Nursusmawati, N., Sabariyah, S., Lamusu, D., & Basrin, F. (2025). Antioxidants and Fiber Rice Analog Based on Composite Flour (Moringa, Purple Sweet Potato, and Cassava) as Local Food Diversification. *Jurnal Penelitian Pendidikan IPA*, *11*(3), 275–281. https://doi.org/10.29303/jppipa.v11i3.10518

Faizah, F., Kusnandar, F., & Nurjanah, S. (2020). Phenolic Compounds, Oryzanol, and Antioxidant Activity of Fermented Rice Bran Using Rhizopus oryzae. *Jurnal Teknologi dan Industri Pangan*, *31*(1), 86–94. https://doi.org/10.6066/jtip.2020.31.1.86

Ferronatto, A. N., Rossi, R., Laura, M. N. P., & Garavaglia, J. (2021). Development of a Freeze-Dried Symbiotic Obtained from Rice Bran.

Biotechnology Reports, *30*, 1–7. https://doi.org/10.1016/j.btre.2021.e00636

Guha, S., Sharma, H., Deshwal, G. K., & Rao, P. S. (2021). A Comprehensive Review on Bioactive Peptides Derived from Milk and Milk Products of Minor Dairy Species. *Food Production, Processing and Nutrition*, *3*(1), 1–21. https://doi.org/10.1186/s43014-020-00045-7

Hasani, S., Khodadadi, I., & Heshmati, A. (2016). Viability of Lactobacillus acidophilus in Rice Bran-Enriched Stirred Yoghurt and the Physicochemical and Sensory Characteristics of Product During Refrigerated Storage. *International Journal of Food Science and Technology*, *51*(11), 2485–2492. https://doi.org/10.1111/ijfs.13230

Haskito, A. E. P., Fatra, I. M., Mahdi, C., Noviatri, A., & Adrenalin, S. L. (2024a). Acidity and Alcohol Levels of Goat's Milk Yoghurt with the Addition of Black Rice Bran Flour During Cold Storage. *Jurnal Ilmiah Peternakan Terpadu*, *12*(3), 354. https://doi.org/10.23960/jipt.v12i3.p354-366

Haskito, A. E. P., Mahdi, C., Almara, F. T., & Bina, R. W. (2023). The Effect of Storage Time of Fortified Goat Milk Yoghurt White Rice Bran Flour on Organoleptic Physical Characteristics, pH Value, Amount of Coliform and Salmonella sp. Contamination. *Jurnal Medik Veteriner*, *6*(1), 51–65. https://doi.org/10.20473/jmv.vol6.iss1.2023.51-65

Haskito, A. E. P., Mahdi, C., Mawarni, R. E., & Immauliate, S. M. (2024b). The Effect of Refrigeration Storage Temperature on the Organoleptic Physical Characteristics, pH Value, Coliform and Salmonella spp., Contamination, of Goat Milk Yogurt with Added Red Rice Bran Flour. *Jurnal Kajian Veteriner*, *12*(1), 122–140. https://doi.org/10.35508/jkv.v12i1.7946

Hidayati, N. R., Ratih, P. D., & Wuryandari, T. (2025). The Effect of Fruit Storage Time on the Characteristics and Antioxidant Activity of Pumpkin Seed Oil (Cucurbita moschata) "Butternut Type." *Jurnal Penelitian Pendidikan IPA*, *11*(1), 1261–1269. https://doi.org/10.29303/jppipa.v11i1.10165

Hozzein, W. N., Hisham, S. M., & Alkhalifah, D. H. M. (2023). A Sustainable Method: Production of the Fermented Rice Milk Yogurt by Using Three Efficient Lactic Acid Bacteria. *Applied Sciences (Switzerland)*, *13*(2), 1–10. https://doi.org/10.3390/app13020907

Istikomah, N., Husna, A., & Warkoyo, W. (2026). Aktivitas Antioksidan dan Karakterisitik Fisikokimia, Mikrobiologis Yoghurt Kombinasi Ubi Jalar Ungu dan Nanas Madu. *Food Technology and Halal Science Journal*, *9*(1), 13–24. https://doi.org/10.22219/fths.v9i1.41761

Jangnga, I. P., Haskito, A. E. P., Sari, C., & Adrenalin, S. L. (2023). Total Lactic Acid Bacteria (LAB) and Antioxidant Activity of Goat's Milk Yoghurt with the Addition of Red Bran During Refrigeration Storage. *Journal of Applied Veterinary Science and Technology*, *4*(2), 61–66. https://doi.org/10.20473/javest.v4.i2.2023.61-66

Lavlinesia, L., Monica, E., & Ulyarti, U. (2023). Antioxidant Activity of Fresh Yam and Its Changes During Processing into Flour and Storage. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 8686–8694. https://doi.org/10.29303/jppipa.v9i10.3752

Le, B., Anh, P. T. N., Kim, J. E., Cheng, J., & Yang, S. H. (2019). Rice Bran Fermentation by Lactic Acid Bacteria to Enhance Antioxidant Activities and Increase the Ferulic Acid, P-Coumaric Acid, and γ-Oryzanol Content. *Journal of Applied Biological Chemistry*, *62*(3), 257–264. https://doi.org/10.3839/jabc.2019.035

Lindawati, N. Y., Utami, N., Cahyadi, D. N., & Murtisiwi, L. (2026). Optimization of Essence Formulation Containing Purified Extract of Purple Rosella (Hibiscus sabdariffa L.) and Evaluation of Its Antioxidant Activity Using DPPH Method. *Jurnal Penelitian Pendidikan IPA*, *12*(4), 889–901. https://doi.org/10.29303/jppipa.v12i4.13517

Liston, L., Sihombing, J. M., & Berutu, K. M. (2024). Evaluation of pH Quality and Water Capacity of Yogurt of Etawa Goat Milk with the Addition of Mangga Golek Fruit Juice. *Jurnal Peternakan Integratif*, *11*(3), 126–133. https://doi.org/10.32734/jpi.v11i3.15110

Manzoor, A., Pandey, V. K., Dar, A. H., Fayaz, U., Dash, K. K., Shams, R., Ahmad, S., Bashir, I., Fayaz, J., Singh, P., Khan, S. A., & Ganaie, T. A. (2023). Rice Bran: Nutritional, Phytochemical, and Pharmacological Profile and Its Contribution to Human Health Promotion. *Food Chemistry Advances*, *2*(2), 1–12. https://doi.org/10.1016/j.focha.2023.100296

Maulidina, A., Jabbar, A. B. K., Wahyuningtyas, A. N., & Chaniago, R. A. (2026). Karakteristik Organoleptik Yogurt Fortifikasi Bunga Telang dan Stevia. *Agrisosco Jurnal Riset Multidisiplin*, *4*(1), 54–61. https://doi.org/10.61316/jrma.v4i1.230

Munthe, P. A., Nasution, S., & Marvie, I. (2025). The Effect of Cassava Starch Concentration and Storage Time on Total Lactic Acid Bacteria (LAB), pH, Total Acid, and Viscosity in Skimmed Milk Yoghurt. *Jurnal Teknologi Hasil Peternakan*, *6*(2), 1–20. https://doi.org/10.24198/jthp.v6i2.62745

Noviatri, A., Setianingrum, A., & Tulak, N. E. (2023). Elevation of MDA Levels and Change in

Histopathological of Balb/c Mice's Liver on Acute Test of Fortification of Ethanolic Roselle Flower (Hibiscus sabdariffa L.) Extract in Yogurt. *Jurnal Penelitian Pendidikan IPA*, *9*(12), 11749–11753. https://doi.org/10.29303/jppipa.v9i12.6140

Nur, M. F., Ramadani, D., Baharuddin, M. F., Khairana, A. D., Fiddaroini, S., Sabarudin, A., Safitri, A., Riawan, W., Wuragil, D. K., Nurmahdi, H., & Aulanni'am, A. (2026). Antihypertensive Effect of Rice Bran Derived Amino Acids Through Modulation of iNOS Expression and Renal Histopathology in DOCA Salt Induced Hypertensive Rats. *Jurnal Penelitian Pendidikan IPA*, *12*(1), 62–71. https://doi.org/10.29303/jppipa.v12i1.13491

Pangestu, A. D., Kurniawan, K., & Supriyadi, S. (2021). The Effect of Temperature Variation and Storage Time on the Viability of Latic Acid Bacteria (LAB) and pH Value of Yoghurt. *Borneo Journal of Medical Laboratory Technology*, *3*(2), 231–236. https://doi.org/10.33084/bjmlt.v3i2.2169

Pramono, A., Muhammad, M., Riyadi, F. I., & Cahyadi, M. (2024). The Effects of Protected Feed Supplements on Estrus Response, Milk Production and Composition of Sapera Dairy Goats. *Buletin Peternakan*, *48*(1), 42–47. https://doi.org/10.21059/buletinpeternak.v48i1.86664

Rahmiati, R., Situmorang, T. S., Simanjuntak, H. A., Pasaribu, S. F., Lestari, W., Sianturi, A. E., & Amanzino, R. A. (2025). Analisis Karakteristik Organoleptik, pH, dan Total Bakteri pada Yoghurt Susu Sapi. *Herbal Medicine Journal*, *8*(2), 79–84. https://doi.org/10.58996/hmj.v8i2.185

Raikos, V., Ni, H., Hayes, H., & Ranawana, V. (2019). Antioxidant Properties of a Yogurt Beverage Enriched with Salal (Gaultheria shallon) Berries and Blackcurrant (Ribes nigrum) Pomace During Cold Storage. *Beverages*, *5*(1), 1–11. https://doi.org/10.3390/beverages5010002

Sampurno, A., & Cahyanti, A. N. (2017). Characteristics of Yogurt Goat Milk Based with Addition of Various Types of Brown Sugar. *Jurnal Teknologi Pangan dan Hasil Pertanian*, *1*(12), 22–31. https://doi.org/10.26623/jtphp.v12i1.478

Saritas, S., Portocarrero, A. C. M., Lopez, J. M. M., Lombardo, M., Koch, W., Raposo, A., El-Seedi, H. R., Alves, J. L. D. B., Esatbeyoglu, T., Karav, S., & Witkowska, A. M. (2024). The Impact of Fermentation on the Antioxidant Activity of Food Products. *Molecules*, *29*(16), 1–29. https://doi.org/10.3390/molecules29163941

Siahaan, C. O., Lister, I. N. M., Girsang, E., & Fachrial, E. (2023). Test of Antioxidants and Alpha-Glucosidase Inhibitors from Lactic Acid Bacteria in Fermentation of Soy Milk (Soygurt). *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7000–7013. https://doi.org/10.29303/jppipa.v9i9.4663

Sibuea, P., & Siantar, V. N. L. (2022). Antioxidant Activity of Yoghurt with the Addition of Beetroot (Beta vulgaris L.) Fruit Extract and the Probiotics Quality Produced. *Jurnal Riset Teknologi Pangan dan Hasil Pertanian*, *3*(1), 22–29. https://doi.org/10.54367/retipa.v3i1.2243

Sinaga, H., Suryanto, D., & Dary, R. (2023). Effect of the Addition of Guava Leaf Extract (Psidium guajava L.) to Coconut Milk Yoghurt (Niyoghurt) as a Functional Food. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 585–591. https://doi.org/10.29303/jppipa.v9ispecialissue.6261

Stobiecka, M., Król, J., & Brodziak, A. (2022). Antioxidant Activity of Milk and Dairy Products. *Animals*, *12*(3), 1–27. https://doi.org/10.3390/ani12030245

Suciati, F., & Safitri, L. S. (2021). Milk Based Functional Food and Its Derivative Products. *Journal of Sustainable Research in Management of Agroindustry (SURIMI)*, *1*(1), 13–19. https://doi.org/10.35970/surimi.v1i1.535

Tsaaqifah, H., Fahrurrozi, F., & Meryandini, A. (2023). Selection of Lactic Acid Bacteria as Starter Culture for Cocoa Fermentation (Theobroma Cacao L.). *Jurnal Penelitian Pendidikan IPA*, *9*(2), 825–831. https://doi.org/10.29303/jppipa.v9i2.3045

Wijayanti, A. R. N., Khusania, M., Safitri, Z. A., Rizqiati, H., & Pramono, Y. B. (2024). Antioxidant Activities, Total Acids, Protein Levels, and Favorite Levels of Corn Yogurt with Addition of Parijoto Juice (Medinilla Speciosa B.). *Jurnal Teknologi Pangan*, *8*(2), 15–20. https://doi.org/10.14710/jtp.2024.28225

Wu, J., Wang, Z., Hu, J., Liu, J., Han, X., Chen, H., Zhu, S., & Deng, J. (2025). Bacillus Subtilis-Derived Postbiotics as a Multifunctional Bio-Catalyst for Enhancing Lactic Acid Bacteria Viability and Yogurt Quality. *Foods*, *14*(10), 1–19. https://doi.org/10.3390/foods14101806

Yendriani, Y., Djufri, D., Safirda, S., Puspa, V. R., & Zumaidar, Z. (2026). Antioxidant Effectiveness and Phenolic Content of Saga Seed (Adenanthera pavonina) Extracts in Vitro Using DPPH and ABTS Methods. *Jurnal Penelitian Pendidikan IPA*, *12*(3), 565–569. https://doi.org/10.29303/jppipa.v12i3.14293

Zhang, T., Geng, S., Cheng, T., Mao, K., Chitrakar, B., Gao, J., & Sang, Y. (2023). From the Past to the Future: Fermented Milks and Their Health Effects Against Human Diseases. *Food Frontiers*, *4*(4), 1747–1777. https://doi.org/10.1002/fft2.304