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Physical and Microbiological Milk Quality of Ettawa Crossbreed Goats in Sempu District, Banyuwangi

Kualitas Fisik dan Mikrobiologi Susu Kambing Peranakan Ettawa di Kecamatan Sempu, Banyuwangi

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Abstrak

Penelitian ini yang bertujuan untuk mengevaluasi kualitas susu kambing Peranakan Ettawa di Kecamatan Sempu, Banyuwangi, dengan tipe studi observasional deskriptif. Metode pengambilan sampel yang digunakan dalam penelitian ini adalah *purposive sampling,* dimana sebanyak 30 sampel susu segar diambil dari kambing Peranakan Ettawa berumur 3-4 tahun yang berasal dari enam peternakan berbeda. Metode uji organoleptik digunakan untuk menilai karakteristik fisik sampel dan dilanjutkan dengan pengukuran nilai berat jenis dan pH susu. Selanjutnya, uji *Total Plate Count* (TPC) dan *Most Probable Number* (MPN) digunakan untuk untuk menilai jumlah bakteri yang ada. Uji organoleptik menunjukkan bahwa sampel susu kambing telah memenuhi Standar Nasional Indonesia (SNI) 01-3141-2011 untuk susu secara umum dan *Thai Agricultural* Standard (TAS) 6006-2008 khusus untuk susu kambing. Berat jenis rata-rata susu sampel adalah 1,0316 g/mL, sedangkan nilai pH rata-rata adalah 6,45. Hasil penelitian menunjukkan bahwa berat jenis memenuhi persyaratan yang ditetapkan oleh TAS 6006-2008. Nilai rata rata pH 6,45 berarti di bawah tingkat yang ditentukan oleh TAS. Hasil rata-rata TPC memenuhi Batas Standar SNI, yaitu di bawah $1x10^6$ CFU/mL. Rerata jumlah coliform pada susu kambing memenuhi standar SNI (di bawah 1 x 10^2 CFU/mL). Data ini menunjukkan bahwa susu kambing perah Peranakan Ettawa di Kecamatan Sempu, Kabupaten Banyuwangi, telah memenuhi persyaratan minimum yang ditetapkan oleh TAS (2008) dan SNI 7388-2009. Meskipun kadar coliform memenuhi standar rata-rata, data penelitian ini menunjukkan bahwa coliform masih terdeteksi di beberapa peternakan. Sangat penting untuk memberikan perlakuan panas atau pasteurisasi pada susu sebelum dikonsumsi oleh masyarakat umum. Sangat penting untuk meningkatkan standar higienis pemerahan dan sanitasi tempat pemerahan untuk mendapatkan susu dengan kualitas unggul yang baik untuk konsumsi masyarakat.

Kata kunci: kambing peranakan ettawa; susu kambing; kualitas susu; kesehatan masyarakat.

Abstract

This study aimed to evaluate the milk quality of Peranakan Ettawa goats in Sempu District, Banyuwangi, using a descriptive observational study type. The sampling method used in this study was purposive sampling, where 30 fresh milk samples were taken from 3-4-year-old Ettawa crossbreed goats from six different farms. Organoleptic tests showed that the goat milk samples met the Indonesian National Standard (SNI) 01-3141-2011 for milk in general and Thai Agricultural Standard (TAS) 6006-2008 specifically for goat milk. The mean

specific gravity of goat's milk is 1.0316 g/mL, whereas the average pH value is 6.45. The findings indicate that the specific gravity meets the criteria set out by the TAS 6006-2008. The pH value of 6.45 is below the threshold established by TAS. The mean TPC result complies with the Standard Limit SNI, which is under $1x10^6$ CFU/mL. Coliform levels in the milk samples adhere to SNI requirements (below 1 x 10^2 CFU/mL). The statistics indicate that the milk from the Ettawa crossbreed in Sempu District, Banyuwangi, satisfies the minimal standards set by TAS (2008) and SNI 7388-2009. Despite coliform levels conforming to the average standard, this examination indicated the presence of coliforms in multiple farms. Therefore, it is essential to provide heat treatment or pasteurization to the milk before its ingestion by the general populace.

Keywords: Ettawa crossbreed; goat milk; milk quality; public health

Introduction

According to data from the Indonesian Food and Drug Authority (BPOM) more than 40% of food poisoning outbreaks, known as Extraordinary Events incidents (Kejadian Luar Biasa), were attributed to unregistered home industries producing milk. Snack foods accounted for around 16% of these cases (BPOM, 2020). The Case Fatality Rate (CFR) for diarrhea induced by Extraordinary Events in 2018 was 4,76%, an increase compared to the previous year's rate of 1,97% (Ministry of Health of the Republic of Indonesia, 2019). The prevalence of milk poisoning cases has underscored the significance of maintaining good health and obtaining proper nutrition from animal-derived dietary sources. Animal protein obtained from milk is essential for promoting public health and facilitating bone development, particularly in youngsters during their growth phase. As the community's standard of life improves, there is a growing demand for animal-based protein. Milk is a highly nutritious food readily digested and absorbed by the bloodstream. Multiple categories of milk-producing animals exist, among which dairy goats are included. Goat milk has certain benefits over cow's milk due to its smaller fat globules and relatively high concentration of fatty acids, contributing to its easy digestibility (Utami *et al*., 2020). According to SNI 3141.1-2011, fresh milk must meet specified requirements and constraints. These include conducting organoleptic tests to assess color, odor, taste, and viscosity, ensuring no changes are observed. The minimum specific gravity should also be 1,0270 gr/mL, and the pH level should fall from 6,3 to 6,8. According to the Thai Agricultural Standard (2008), the minimum specific gravity of goat milk is 1,0280 gr/mL, and the pH of goat milk should fall within the range of 6,5 to 6,8.

Raw goat milk is a livestock commodity that experiences increased production and domestic use because of its notable features, such as small milk fat granules, easy digestibility, and popularity in cosmetic applications. Currently, no established standard explicitly specifies the criteria for the quality and safety of raw goat milk for commercial use. Hence, the Ministry of Agriculture and Cooperatives deems it imperative to institute a benchmark for unprocessed goat milk to serve as a reference for farmers, entrepreneurs, and relevant organizations in the production and trade sectors. This standard would guarantee the provision of high-quality raw materials for subsequent processing. According to the specifications outlined in SNI 7388-2009, the acceptable levels of contamination in fresh milk are as follows: Total Plate Count (TPC) should not exceed 1 x 10^6 colony-forming units per milliliter (CFU/mL), Coliform should not exceed 2 x 10^1 CFU/mL, *Escherichia coli* should be less than 3 CFU/mL, Salmonella sp. should not be detected in 25 mL of milk, and Staphylococcus aureus should not exceed 1 x 10^2 CFU/mL. The Thai Agricultural Standard (2008) classifies milk quality based on specific criteria. For goat milk, the standards are as follows: Total Plate Count (TPC) should not exceed 2.0 x 10^5 CFU/mL, the somatic cell count should not exceed 1,5 x 10^6 cells/mL, protein content should be 3,4%, fat content should be 3,5%, and the dry matter content should be 12%. The bacterial count in milk might serve as an indicator of milk contamination and quality. Some examples of bacteria that can serve as markers of milk quality are *E. coli, Salmonella*

sp, Staphylococcus aureus, and *Streptobacillus sp*. According to the above description, it is necessary to conduct a microbiological analysis on freshly obtained cow's milk directly from farmers or those who have undergone treatment during the procedure (Shari *et al*., 2023).

Sempu sub-district is situated at the base of Mount Raung in Banyuwangi Regency. This location makes it highly conducive to the advancement of animal husbandry. According to information obtained by the Banyuwangi district from the Central Bureau of Statistics (2021), there are 2,492 goats in the Sempu sub-district. The milk management practices on specific farms in the Sempu Subdistrict lack proper sanitation protocols for cages and still rely on traditional methods of raising. Traditional milk management systems, often characterized by minimal hygiene practices, pose a significant risk for pathogen contamination. Bacteria such as *Escherichia coli*, Salmonella spp., and Staphylococcus aureus can easily contaminate milk during milking and storage due to inadequate sanitation. This contamination can lead to foodborne illnesses such as diarrhea, which has been a major cause of foodborne outbreaks (Dimitrakopoulou *et al*., 2024). According to research by Agatha *et al*., (2023), E. coli was detected in 100% (34/34) of Ettawa crossbreed milk samples in Blitar, East Java, Indonesia. Individuals residing in the Sempu Subdistrict frequently consume unpasteurized fresh goat milk.The food safety of goat milk is of utmost importance to the surrounding community who consume it.

Based on the description above, the lack of proper sanitation and reliance on traditional farming methods in certain dairy farms has led to a significant risk of milk contamination. This contamination can negatively impact the physical and microbiological quality of the milk, posing health risks to consumers. The presence of pathogens such as *Escherichia coli* and other coliform bacteria indicates inadequate hygiene practices during milking and storage processes. To address this issue, quality testing of goat milk, particularly through organoleptic tests, provides a practical solution. These tests assess the sensory attributes of milk, such as color, smell, taste, and consistency, which are crucial indicators of milk quality and potential contamination. By implementing organoleptic tests, farmers can ensure that the milk meets the required quality standards and is safe for public consumption. Quality testing of goat milk is crucial to ensure that it meets the Indonesian government's physical and microbiological quality standards for public consumption.

Materials and Methods

Ethical Approval

This study did not require ethical approval because animals were not treated.

Study Period and Location

The research was conducted between January to April 2023 at the Laboratory of Veterinary Public Health, Faculty of Health, Medicine, and Life Sciences, Universitas Airlangga. This study was a descriptive observational study type. Sampling used a purposive sampling method where milk samples were obtained from healthy lactating Ettawa crossbred goats aged 3 to 4 years, totaling 30 samples sourced from various groups of farmers.

Organoleptic Test of Milk Samples

Organoleptic studies are conducted to evaluate the properties of raw goat milk. This involves putting the milk into a container and examining its smell, color, consistency, and external appearance (Thai, 2008).

Determination of Specific gravity (BJ) and pH of milk

Raw milk is subjected to a specific gravity test using a lactodensimeter. The milk samples are poured into a 100 ml cylinder, and then the lactodensimeter (Funke-Gerber®) is carefully immersed in the milk in the tube so that it floats. It is essential to ensure that the lactodensimeter does not touch the inner surface of the cylinder when reading to avoid any errors. Take measurements and interpret the displayed scale. The lactometer displays the specific gravity up to the second and third decimal places, excluding the value of 1,0. For instance, if the reading is 28, the specific gravity is 1,028 (Thai, 2008).

Total Plate Count Test

Fresh goat milk's Total Plate Count (TPC) was assessed according to the National Standardization Agency of Indonesia (BSN) 2897:2008 criteria. The milk was initially homogenized and then analyzed for bacterial contamination levels using the TPC pour method. 25 ml of a 10^{-1} dilution suspension was added to 225 ml of a 0,1% Buffered Peptone Water (BPW) solution in an Erlenmeyer tube. Next, transfer 1 ml of the mixture diluted at a ratio of 10^{-1} into the tube containing the 10^{-2} dilution, continuing this process until the 10^{-3} dilution is achieved. In addition, each dilution is collected. Duplicate Petri dishes were prepared by adding 1 ml of the suspension to each dish. The dishes were then filled with 15 ml of Plate Count Agar (PCA) medium (Himedia®) and cooled to around 45°C. The Petri dishes were incubated at 37°C for 24 hours.

Most Probable Number Test

The MPN of fresh goat milk was evaluated based on the parameters outlined in the BSN 2897:2008 standard. The MPN method comprises a preliminary test and a confirmatory test, utilizing liquid media in test tubes to determine the number of positive tubes. The presence of gas in the Durham tube indicates the identification of positive tubes. To create a 10^{-1} dilution suspension, 25 ml is mixed with 225 ml of a 0,1% BPW diluent solution in an Erlenmeyer tube. Transfer 1 milliliter of the suspension that has been diluted by a factor of 10^{-1} into the tube that has been diluted by a factor of 10^{-2}, continuing this process until the suspension has been diluted by a factor of 10^{-3}. Following the dilution, proceed with the presumptive test by utilizing three tubes. Each dilution was aliquoted to a volume of 1 ml and added to three sets of Lauryl Sulfate Tryptose Broth (LSTB) tubes, each having Durham tubes. The tubes were then incubated at 35°C for 24 to 48 hours. Next, carefully examine the gas produced in the Durham tube. The formation of gas indicates a positive test result.

Following a positive declaration, a confirmation test is conducted by transferring the positive culture from the LSTB tube to a Brilliant Green Lactose Bile Broth (BGLBB) tube that contains a Durham tube, using an inoculation needle. Subsequently, the sample was incubated at a temperature of 37°C for a duration ranging from 24 to 48 hours. Next, carefully examine the gas produced in the Durham tube. The formation of gas indicates a positive test result. Utilize the MPN table to ascertain the MPN (Most Probable Number) value by correlating it with the number of positive BGLBB (Brilliant Green Lactose Bile Broth) tubes (Figure 3), which represents the number of coliforms per milliliter.

Results and Discussion

Organoleptic Test

The organoleptic test result of 30 goat milk samples in the Sempu sub-district indicated that all of the goat milk had a yellowish-white tint. The scent exhibited a characteristic fragrance reminiscent of goat milk. Elevated lactose levels and reduced chloride content are responsible for the distinctive odor commonly associated with goat milk. The goat milk tested exhibited a savory taste, and the fresh milk had a thin consistency, both of which complied with TAS 6006-2008. The outcomes of organoleptic tests are summarized in Table 1.

Table 1. Organoleptic test results of goat milk

Organoleptic Test	N	Test Results
Color	30	Cream/yellowish white color
Smell	30	fresh goat milk
Taste	30	savory taste
Viscosity	30	Viscosity

N = Jumlah sampel

Milk color depends on the livestock breed, feed, fat, solids, and color-forming ingredients. The white appearance of milk results from the scattering of colloidal fat particles and the presence of casein, calcium phosphate, and calcium caseinate (Maulani *et al*., 2022, Park, 2011). The yellow hue of milk is attributed to the existence of lipophilic compounds, such as carotene, which are acquired from the diet of animals (Sholeh *et al*., 2021). Apart from that, based on Hammam *et al*., (2021) the yellow color in milk is caused by fat and riboflavin). The fat content in goat milk generally ranges from 3.09% to 5.04% (Tatar *et al*., 2015). As

per the Indonesian National Standard (SNI) 01-3141-2011, milk is considered to have a typical color if there are no deviations from the standard color of milk (SNI, 2011).

The yellow color is caused by fat and soluble carotenoids and riboflavin (Hammam *et al*., 2021 Carotene is the primary yellow pigment of milk fat metabolized to form two white to golden-yellow vitamin molecules, resulting in milk being yellowish (Asmaq and Marisa, 2020). The organoleptic test conducted regarding the response to the smell and taste of goat's milk obtained the results of the typical smell of fresh goat's milk, no sour or rancid smell, and savory taste of goat's milk. Factors that can affect the smell and taste of milk are feeding, the type of feed ingredients given, and the preparation of goats to be milked (Shodiq *et al*., 2023). The flavor of milk based on fresh milk standards does not change. Goat milk has a strong taste due to its short fatty acids. Furthermore, the consistency of goat milk was liquid or watery. The consistency of milk is influenced by casein, fat grains, and acidity. Good milk has a normal consistency, is not runny, is not concentrated, and has no separation of any form (Budhi *et al*., 2020).

The fragrant scent of milk is attributed to the enzymatic degradation of proteins into amino acids (Sholeh *et al*., 2021). Goat's milk has a unique smell, specifically a subtle "*prengus*" odor, due to its high concentration of caprylic acid compounds and lauric fatty acids, which are the fatty acids found in the most incredible abundance in goat's milk (Suherlan *et al*., 2023). This results in a more pronounced aroma if the milk is stored at ambient temperature (Sholeh *et al*., 2021). As per the guidelines outlined in SNI 01-3141-2011, regular fresh milk does not undergo any alteration in its scent. Therefore, the milk obtained from the milking process of Peranakan Ettawa (PE) dairy goats on various farms in Sempu District, Banyuwangi, complies with the Indonesian National Standard (SNI) 01-3141-2011.

Handika *et al.,* (2020) emphasized that maintaining cage cleanliness is crucial for reducing microbial contamination of milk and preventing illness transmission among cows. It is essential to keep milk clean to prevent it from becoming a hazardous food component for human consumption. The taste of milk from different livestock varies due to variations in lactose levels, which directly impact the milk's flavor. Fresh milk tastes slightly sweet primarily because of lactose (Christi *et al*., 2024). The taste can be further influenced by feeding the livestock propionic acid-containing feed (Christi *et al.*, 2022). The milk in this study meets the criteria set by the Indonesian National Standard (SNI) 3141.1-2011 as it maintains its original taste and pleasant flavor. The viscosity of milk is a crucial indicator of its quality. Milk can be classified as regular milk suitable for ingestion if it has a liquid consistency and does not coagulate (Rizqan *et al*., 2019).

Milk defects caused by coliform bacteria are: Flavor defects: Coliforms can give milk unpleasant tastes, such as sour, bitter, or rancid ones, which are bad for milk's acceptability and quality among consumers, 2. Odor Defects can cause milk to smell bad, such as rotten, musty, or sour, which can detract from the product's overall sensory experience. 3. Body Defects lead to modifications in the milk's body, such as gelation, which can produce a curdled or thick consistency and worsen the product's sensory quality (Martin *et al*., 2016).

Average Specific Gravity and pH values of goat milk

The specific gravity of milk is determined by comparing the dry weight and liquid volume of milk. According to the data presented in Table 2, the specific gravity of the six farms in the Sempu sub-district remained under the average threshold, measuring 1,0316. The dry matter value of milk is directly proportional to its specific gravity. The specific gravity of milk is profoundly affected by the dry matter it contains. The dry matter of milk consists of carbohydrates, lipids, proteins, vitamins, and minerals. Moreover, the specific gravity value is also affected by factors such as race, birth period, physiological condition, diet, and milking duration (Christi *et al*., 2022). Water content additionally affects milk-specific gravity, excessive water content leads to a reduction in the specific gravity of milk (Vujadinović, *et al.,* 2017).

According to Widodo *et al*. (2020), providing various types of food will result in varying specific gravity values. In addition, the short interval between morning and evening milking typically results in variations in nutrient composition, particularly in specific gravity (Wiranti *et al*., 2022). This is due to the limited time for alveolar cells to generate milk. The substantial level of milk production is also accompanied by the quality of the nutrients (Adyatama, 2024). The milk fat content significantly affects the specific gravity values of milk, as it is the primary component of milk's nutritious makeup. The specific gravity of milk is determined by the fat content and solid components present in the milk, as the specific gravity of fat is lower than that of water (Prayitno et al., 2021). Various factors, including temperature, influence the specific gravity of milk. Higher temperatures result in a lower specific gravity, whereas colder temperatures lead to a higher and denser specific gravity (Sholeh *et al*., 2021). Differences in milk's mineral salts, fat, protein, and lactose composition can lead to variations in its specific gravity.

The pH range of goat milk, as per TAS 2006-2008, is 6,5 to 6,8. According to the results indicated in Table 2. The milk sample exhibits an average pH value of 6.45. This is due to milk's low lactose content, which can influence its pH value. As the bacterial population proliferates, milk lactose will be metabolized into lactic acid, leading to the souring of milk (Rahman *et al*., 2023). The deviation from the mean pH value was likely attributable to factors including the utilization of fresh milk, milking hygiene, prolonged transportation during testing, and bacterial presence in the milk that could modify the pH level, hindering it from attaining the acceptable range of 6,5 - 6,8 (Yusuf *et al*., 2021).

Table 2. Average Specific Gravity and pH values of goat milk

Farm	N	Specific Gravity (g/mL)	pH
BJ	5	1,0329	6,42*
BM	5	1,0307	6,38*
BP	5	1,0327	6,39*
BR	5	1,0301	6,40*
BK	5	1,0296	6,58
BZ	5	1,0336	6,55
Total	30	1,0316	6,45*

*Exceed TAS6006-2008 limit for pH

Total Plate Numbers and Most Probable Numbers Total Plate Count Test

The examination of the number of bacteria that grew showed that the average TPC value of goat milk in Table 3, samples at Sempu Subdistrict, Banyuwangi Regency, was $2,5 \times 10^3$ CFU/mL. The mean Total Plate Count (TPC) values on farms BJ, BM, BP, BR, BK, and BZ are $3,3 \times 10^3$ CFU/mL, $6,2 \times 10^3$ CFU/mL, $3,2 \times 10^3$ CFU/mL, $5,2 \times 10^2$ CFU/mL, $1,0 \times 10^3$ CFU/mL, and $1,0 \times 10^3$ CFU/mL, respectively. Total Plate Count (TPC) is a test method to assess milk management and quality by estimating the total amount of microbial contamination present in milk (Handika *et al*., 2020). All 30 samples collected from the 6 farms had a Total Plate Count (TPC) value < $1x10^6$ CFU/mL, which is the standard limit for bacteria in goat milk (Thai, 2008). Growth of bacterial colonies in PCA media, as illustrated in Figure 1. Table 3 summarizes the bacterial count findings obtained using the TPC method (Thai, 2008).

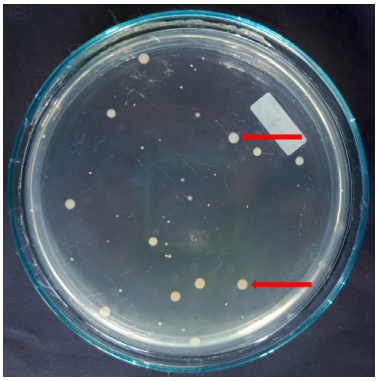

Figure 1. Bacterial colony growth (red arrow) on PCA Media

Factors influencing the elevation of Total Plate Count (TPC) include inadequate temperature and time parameters (Rachmawati, 2024) as well as substandard storage conditions and compromised sample quality (Latief et al., 2023). Furthermore, the factors that decrease the TPC value are good sanitation and hygiene products, optimal storage conditions, and proper refrigeration (Latief et al., 2023); (Aminullah, 2020). Studies indicate that adequate chilling can avert fish deterioration and impede enzymatic activity, leading to a reduction in TPC (Rachmawati, 2024).

Most Probable Number Test

A sample is deemed positive if there is a discernible color change (turbidity) and gas production in the Durham tube within LSTB media. Conversely, the absence of color change and gas production is deemed negative, as illustrated in Figure 2. We proceeded with confirmation tests utilizing the BGLBB medium, observing a positive result indicated by a noticeable color change (turbidity) in the medium and gas production in the Durham tube (Figure 3).

Figure 2. Coliform presumptive test results on Lauryl Sulfate Tryptose Broth (LSTB) Media

Figure 3. Coliform Confirmation test results on BGLBB Media

The coliform levels in Ettawa Crossbreed goat's milk from farms in Sempu District, Banyuwangi Regency, comply with SNI standards (below 1 x 10^2 CFU/mL). It is important to mention that there exists a farm with elevated coliform levels in its goat milk. One PE goat farm, identified as 'BM', reported aberrant coliform counts, with two goats producing milk exhibiting abnormal coliform levels, representing 40% of the total. The cause 'BM' Farm has coliform results with a high percentage because it is influenced by various factors, one of which is cage sanitation, sanitation during milking, and cleanliness factor of individual goats (Table 3). Goat milking in the Sempu area of Banyuwangi commences in the morning between 06:00 and 07:00. The milking procedure employs the five-finger technique (whole hand). Observations of goat milking producers' practices revealed that 6 out of 3 farmers cleaned the cage daily, 2 farmers cleaned it every three days, and 1 farmer cleaned it weekly. The cage sanitation performed solely involves sweeping the floor of the cage. The manure beneath the cage is consolidated in one location for one month, contingent upon the availability of each farmer, to be utilized as fertilizer. It can promote the proliferation of germs and influence the bacterial count in milk. The supporting data indicate that the coliform value in Ettawa goats within this sub-district is favorable, several criteria contribute to this assessment: The nutrient profile of Ettawa

Table 3. Results of Total Plate Count and Most Probable Number calculations on goat milk in Sempu District, Banyuwangi Regency

Farm	N	TPC		Coliform	
		Mean (CFU/mL)	Positive sample (%)	Mean (CFU/mL)	Positive sample (%)
BJ	5	$3{,}3\times10^3$	0(0%)	< 3	0(0%)
BM	5	$6{,}2\times10^3$	0(0%)	240*	2(40%)
BP	5	$3{,}2\times10^3$	0(0%)	7;4	0(0%)
BR	5	$5{,}2\times10^2$	0(0%)	< 3	0(0%)
BK	5	$1{,}0\times10^3$	0(0%)	3	0(0%)
BZ	5	$1{,}0\times10^3$	0(0%)		0(0%)

Standard Limit: TPC: 1x 10^6 (CFU/mL) and Coliform: 1x10^2 (CFU/mL) (SNI)
***exceeds the standard limit**

goat milk has distinct characteristics, featuring elevated levels of short- and medium-chain fatty acids with antibacterial capabilities that can suppress the proliferation of harmful bacteria, including coliforms (Wibowo and Yuniarti, 2023), it also has a lower pH. Goat milk typically exhibits a marginally lower pH than cow milk, resulting in a less favorable environment for the proliferation of coliform bacteria. Moreover, the antibacterial characteristics of goat milk include natural antibacterial compounds such as lysozyme and lactoferrin (Paramasivam *et al*., 2023), which can assist in the fight against bacterial illnesses, representing nonspecific defense mechanisms (Tanhaeian *et al*., 2018)

Moreover, coliform bacteria serve as a critical signal for assessing bacterial contamination, inadequate sanitary conditions in food products, and the hygienic standards of milk production (Alifia and Aji, 2020). Coliform bacteria comprise *E. coli*, Klebsiella species, and Enterobacter species (Wiliantari *et al*., 2018). These microorganisms may induce foodborne disease. In 2017, food poisoning cases affected 2,041 individuals, resulting in 3 fatalities, with 13,71% attributed to microbial contamination in food (Hidayati *et al*., 2022). This research on the presence of coliform that can spread to another goat cage makes the researcher conclude that the results of the study involving the milk of Peranakan Ettawa goats included six farms (BJ, BM, BP, BR, BK, BZ) but none of the six farms had resulted following the standard coliform limit ($1x10^2$ CFU/mL) so that no farm was positive from exceeding the coliform limit. This could be due to the six farms having a good sanitation system. From this research, it is important to knowingly the impact of Coliform bacteria degradation is a crucial step in sludge treatment that is required to lower the risk of pathogen transmission and improve the end product quality (Balkrishna *et al*., 2024). The cost of handling organoleptic, and coliform examination important in some circumstances, organoleptic testing can be done with minimal cost in preventing milk deterioration and quality, but for coliform TPC and MPN testing still needs to be done, or other more effective methods. Chemical treatment degrades coliform bacteria using chlorine or ozone, which can be effective but also expensive and produce harmful by-products. Moreover, the use of chemicals might hurt the environment (Mukai, 2024).

Conclusion

The milk produced by the Peranakan Ettawa goats in Sempu District, Banyuwangi Regency, has been found to meet the minimum standards established by TAS (2008) and SNI 7388-2009. Exhibiting normal color, odor, flavor, and viscosity values; with the average specific gravity of the sample milk being 1.0316 g/mL. Although the coliform levels met the average standard, this analysis revealed that coliforms were still detected in some farms. Hence, it is crucial to subject the milk to heat treatment or pasteurization before consumption. Furthermore, it is essential to improve the hygiene protocols in both milking pens and milking sheds to provide milk of superior quality that is safe for public consumption.

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