

(RESEARCH ARTICLE)



Improving microbiological quality of Etawa goat milk with dates (*Phoenix dactylifera*) and cloves (*Syzygium aromaticum*) extract

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Abstract

Etawa Goat Milk can meet the body's vitamin and mineral needs. In Indonesia, Etawa goat milk is commonly sold and consumed fresh without adequate sterilization. As a result, this raw milk is at risk of contamination by various microorganisms. To address this issue and improve the microbial quality of Etawa goat milk, a study was carried out to evaluate the effect of incorporating an aqueous extract of dates and clove on the microbial quality of fresh Etawa goat milk. The Experimental design of this study is a completely randomized design consisting of 5 groups. Each group contains 25 mL fresh Etawa milk, and add with various volumes: 0.5 ml, 1.0 ml, 1.5 ml, 2.0 ml, and 2.5 ml of dates and cloves extract. The method used is the total plate count method. The identification of bacteria in untreated milk shows the presence of *Escherichia coli*, *Flavobacterium sp*, *Kingella sp*, *Lactobacillus sp*, *Proteus sp*, *Pseudomonas sp*, and *Staphylococcus sp*. The results indicate a reduction in the microbial count in milk treated with plant extract across all dosage ranges. The highest reduction was observed at the dosage of 2.5 ml, with a decrease of 44.3% (874,238 CFU/ml). The T-test yielded a P-value of 0.000, indicating a significant difference between the treated and untreated samples. This study found that date and clove extracts can improve the microbiological quality of fresh Etawa goat milk.

Keywords: Etawa goat milk; Dates; Cloves

1. Introduction

Etawa goat milk is a fresh beverage known for its health benefits. It is widely consumed because of its numerous advantages, such as its potential to treat high blood pressure and tuberculosis [1]. Producers of fresh Etawa goat milk do not pasteurize their milk, which can lead to a decline in its quality due to bacterial contamination. These contaminants can degrade the milk's quality by fermenting it and damaging its protein content [2]. Before being marketed to consumers, milk products should ideally undergo pasteurization to protect consumers from harmful bacteria that can reduce the quality of Etawa goat milk and compromise its nutritional value [3].

The use of natural plant products capable of killing bacteria in milk is expected to provide a solution for obtaining fresh milk products without heating, thereby enhancing microbiological quality by reducing the amount of contaminating bacteria. Additionally, natural plant ingredients can enhance the flavor and benefits of milk [4]. Several studies have been conducted on the addition of dates and clove flowers. For example, research by [5] and [6] showed that roselle flower extract at a dose of 40 mg/ml deactivated *Staphylococcus aureus* after 168 hours in skim milk and whole milk, and *Escherichia coli* was inactive after 96 hours in a 60 mg/ml extract at all fat levels. These findings demonstrate the potential use of extracts to prevent pathogen growth in food and beverages. [7] studied the Viability and Antibacterial Activity of *Bifidobacterium bifidum* in Bifidus Milk with Clove Extract (*Syzygium aromaticum*).

The study showed varying percentages of total bacterial reduction before and after fermentation of the two Bifidus milk products. Dates extract has a strong ability to inhibit microbial infectivity. Based on research by [8], the largest inhibitory

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zone tested with organic extract was obtained with date seed extract against *Escherichia coli* (20.3 ± 0.5 mm) and met requirements with a strong antimicrobial effect against Gram-positive bacteria, *Enterococcus faecalis* (20.5 ± 0.71 mm), *Staphylococcus aureus* (19.50 ± 0.71 mm), and Methicillin-resistant *Staphylococcus aureus* (MRSA) (20 ± 0 mm). This study utilizes dates and cloves aqueous extract. Based on previous research, researchers identified a research gap in the use of natural plant materials such as dates and cloves to improve the microbiological quality of milk without pasteurization. Therefore, this study aims to further utilize the active ingredients of dates and cloves by evaluating the microbiological quality of fresh Etawa goat milk with dates and cloves using the total plate count method at doses of 0.5 mL, 1.0 mL, 1.5 mL, 2.0 mL, and 2.5 mL.

2. Material and methods

2.1. Fresh Goat Milk, Dates, and Cloves Material

Fresh Etawa goat milk was collected from a dairy goat farm located in Sungai Langka Village, Gedong Tataan District, Pesawaran Regency, Lampung Province, Indonesia. Dates and cloves were obtained from the market in Bandar Lampung, Lampung Province, Indonesia.

2.2. Chemicals and Reagents

2.2.1. Dates and Cloves Extraction

Dates and Cloves were extracted with equates through the decoction method with a ratio of 1:4. The concentrated extract underwent filtration, and the resulting filtrate was utilized as a stock solution.

2.2.2. Experimental Design

The Experimental design of this study is a completely randomized design consisting of 5 groups. Each group contains 25 mL fresh Etawa milk, and add with various volumes: 0.5 ml, 1.0 ml, 1.5 ml, 2.0 ml, and 2.5 ml of dates and cloves aqueous extract.

2.2.3. Identification of Bacteria Test

Bacteria identification of fresh Etawa milk was conducted by a series of morphological and biochemical tests. After inoculation and incubation for 24 hours, the cultures were examined, and Gram staining was conducted.

2.2.4. Total Plate Count (TPC) Test

Transfer 1 ml of a 10^2 dilution suspension using a sterile pipette into 9 ml of 0.1% BPW solution to achieve a 10^2 dilution; create dilutions of 10^3 , 10^4 , 10^5 , and so forth as in point (a); take 1 mL each of the solutions in duplicate petri dishes; add 20 mL of PCA and after solidification, incubate at a temperature of approximately 36°C for 24-48 hours; select Petri dishes with a total colony count of 25-250; determine the average number of organisms per 1 gram (CFU/gram) of colony count.

2.3. Statistical Analysis

Statistical analysis was carried out using one-way analysis of variance (ANOVA). Post hoc analysis was done with Least Significant Difference (LSD)

3. Results and discussion

3.1. Identification of Bacteria

The fresh Etawa milk contains several types of pathogenic bacteria. The result of bacterial identification presented in Table 1.

The bacteria that contaminate milk are grouped into two categories: pathogenic bacteria and spoilage bacteria [9]. Table 1 shows the bacteria contained in fresh Etawa goat milk. Based on these results, it is known that the milk samples contain several pathogenic species harmful to human health. *Escherichia coli* species found in raw cow's milk, raw goat's milk, and buffalo milk have been associated with STEC (*Shiga toxin-producing Escherichia coli*) infections [10]. The toxin produced can cause mild diarrhea to more serious illnesses such as hemolytic uremic syndrome (HUS), which can lead

to kidney failure. Contamination of milk by *Staphylococcus aureus* can endanger consumers because it produces heat-resistant toxins [11]

Table 1 Type of bacteria content on fresh Etawa milk

No	Family Level	Bacterial Species	Type
1	Enterobacteriaceae	<i>Escherichia coli</i>	Gram Negative
2	Flavobacteriaceae	<i>Flavobacterium sp</i>	Gram Negative
3	Neisseriaceae	<i>Kingella sp</i>	Gram Negative
4	Lactobacillaceae	<i>Lactobacillus sp</i>	Gram Positive
5	Enterobacteriaceae	<i>Proteus sp</i>	Gram Negative
6	Pseudomonadaceae	<i>Pseudomonas sp</i>	Gram Negative
7	Staphylococcaceae	<i>Staphylococcus aureus</i>	Gram Negative

Staphylococcus aureus produces enterotoxins that cause nausea, vomiting, and diarrhea, and such cases are referred to as intoxication. *Pseudomonas sp.* will break down proteins into amino acids and degrade fats with the enzyme lipase, causing the milk to become acidic and slimy [9]. Milk contamination can be minimized by enhancing the processes of receiving fresh milk, handling, processing, storage, and consumption. Safe milk for consumption is obtained from healthy cows and is either pasteurized or processed at ultra-high temperatures (UHT). Selain mengandung bakteri patogen, susu segar kambing etawa pada penelitian ini juga teridentifikasi mengandung *Lactobacillus sp.* *Lactobacillus* is one of the most important genera of lactic acid bacteria (LAB). They are categorized as generally recognized as safe (GRAS) organisms and can be safely used as probiotics for medical and veterinary purposes [12]

3.2. Total Plate Count Test

The effect of dates and cloves extract on the reduction of bacterial count can be seen in Figure 1. The bacterial count after the addition of extract at each volume is compared to the control (bacterial count in fresh Etawa goat milk).

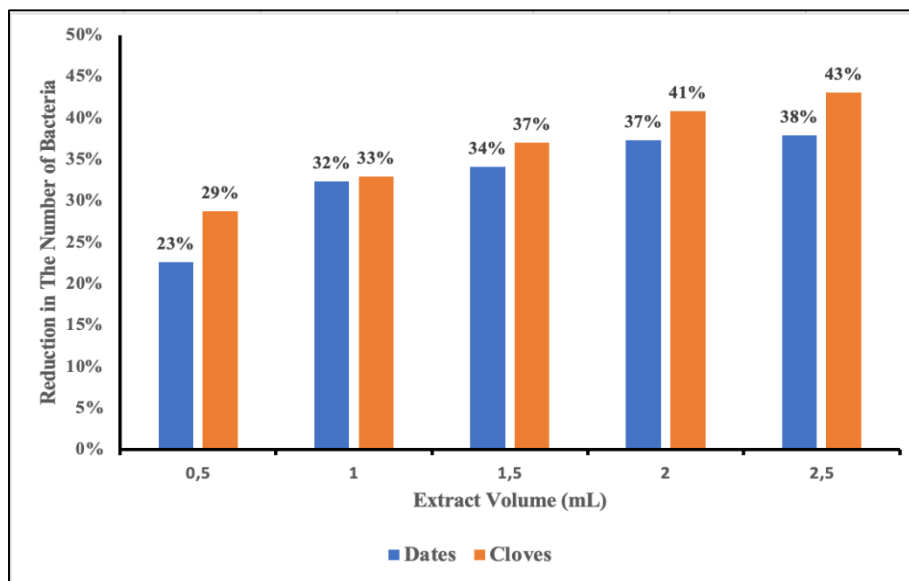


Figure 1 Effect of Dates and Cloves Extract on Reduduction in The Number of Bacteria

Figure 1 shows the percentage reduction in bacteria with the addition of 2.5 mL of cloves extract, amounting to 40.8%. The decrease in bacterial count in fresh Etawa goat milk after the addition of cloves is due to the presence of saponins, tannins, flavonoids, and polyphenols in clove flowers. According to the research by [13], cloves can aid in the wound healing process. Saponins, tannins, flavonoids, and polyphenols, which are active compounds in clove flowers, are

capable of killing bacteria present in fresh Etawa goat milk [14]. The research by Anindita & Anwar [7] supports the conclusion that products containing clove extract have a greater reduction in total bacteria compared to products without clove extract at the end of fermentation. The treatment with 2.5 ml of date extract showed a reduction in bacterial count by 37.3%. The ability of dates to reduce bacterial count in fresh Etawa goat milk is due to their high flavonoid content, which actively plays a role in activating macrophages to fight pathogenic bacteria and enhancing macrophage activity in phagocytosing pathogenic bacteria [15]. Another study conducted by Al-Tamimi *et al.* [8] supports the notion that dates have antimicrobial properties.

4. Conclusion

This study indicates that fresh Etawa goat milk with the addition of 2.5 mL each of dates and cloves aqueous extract can reduce the number of bacteria. The results demonstrate that the use of dates and cloves is effective in improving the microbiological quality of the milk, making it safe for public consumption.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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