Total bacteria and pH changes of matoa leaf-pasteurized milk in refrigerator storage

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Abstract. This study aimed to determine the shelf life of pasteurized milk with the addition of matoa leaf extract over a certain period of time and at 4°C. The material used in this study was 0.1% matoa leaf extract which was added to pasteurized milk. This study used a completely randomized design with five treatments and three replications. The treatment storage consisted of P₀ (0 day); P₁ (3 days); P₂ (6 days); P₃ (9 days); P₄ (12 days). The parameters measured were the Total Plate Count (TPC) and pH values. The results of this study showed that the addition of matoa leaf extract did not significantly influence the decrease in the number of bacteria during storage process. Conversely, the addition of matoa leaf extract significantly influenced the pH during the storage period.

1. Introduction

Dairy products are still the people's choice in consuming animal protein, especially in developing areas [1–4]. Full cream is one example of dairy products that are made according to the needs of certain consumers. Full cream is milk with a high-fat content of no less than 26% [5]. Fatty and high protein products are easily damaged by the oxidation process. The oxidation process is influenced by several factors such as light, temperature, heating, bacteria, and enzymes. Pasteurization is also one method that can accelerate the oxidation process due to heating [6].

The low consumption of pasteurized milk in the community is due to its relatively short shelf life. Another thing is public perception considers that pasteurization products are less safe and difficult handling [7, 8]. Pasteurized milk still has a short shelf life caused by the heating process of milk which only kills some pathogenic bacteria that cause damage to milk products. Therefore, it needs the addition of materials that are functional to minimize bacterial growth [8]. The addition of functional additives is also expected to be able to minimize the causes of oxidation in fat and protein in milk [9]. One of the potential ingredients is the addition of matoa leaf extract which is known as a leaf that is rich in antioxidants and has antibacterial properties. This product is antibacterial because it contains saponins, tannins and flavonoids [10, 11].

Preventive measures against the dangers of milk consumption due to pathogenic microbes can also be dealt with by heating during processing. Pathogenic bacteria in milk can cause damage to milk besides causing health hazards for those who consume them [12–14]. Pasteurized milk in sealed packages and stored at 4°C has a shelf life of 7 days [15]. But other researchers claim it can be stored for up to 12 days [16]. Whereas pasteurized milk stored at room temperature only has a shelf life of 1–
9 hours [17]. Pasteurized milk stored at 4°C is expected to extend the shelf life of milk. Therefore it is necessary to know how much the total microbes and how changes in the pH of pasteurized milk after matoa leaves are added and stored at 4°C.

2. Materials and methods

2.1. Research and procedure
Fresh matoa leaves that have been selected as much as 5 kg were washed and then dried at room temperature for 5 days. Dried matoa leaves were cut into small pieces and then crushed using a blender in form of powder. A total of 50 g matoa leaf powder was diluted in 500 mL of distilled water (1:10 ratio) in a closed beaker glass then refrigerated and macerated for 2’24 hours. During the maceration process, the stirring process was carried out every 4 hours for 5 minutes. 10% reconciliation milk with 0.1 g matoa leaf extract added. Subsequently, the 10% reconstituted milk with matoa leaf extract was pasteurized by the HTST method (±72°C for 15 seconds). The pasteurized milk samples were then stored at 4oC each for 0 days, 3 days, 6 days, 9 days and 12 days.

2.2. Parameter measured
The parameters measured in this study were the Total Plate Count (TPC) and the pH values.

2.3. Data analysis
The data were analyzed by variance analyzed by SPSS 16. Values that had a significant effect were followed by Duncan's test.

3. Result and discussion

3.1. Total Plate Count (TPC)
The results obtained in this study are pasteurized milk added with matoa leaf extract at 0–12 days storage, can only be consumed up to 3 days storage. The addition of matoa leaf extract did not significantly affect the decrease in the number of bacteria in pasteurized milk during storage although it inhibited growth compared to milk without the addition of matoa leaf extract. In figure 1 we can see that the TPC shows that the increase in the number of bacteria is increasing along with an increase in milk storage time. Total bacteria on day 0 as the lowest value is 0 CFU/mL, on day 3 with a result of 2.9 log CFU/mL. Nevertheless, the number of microbes is still following the Indonesian National Standard because it does not exceed the maximum limit of pasteurized milk microbial contamination, which is 3x104 (CFU/mL) or 4.47 (log CFU/mL) [18].

![Figure 1. Total plate count (TPC).](image-url)
bacteria. At pasteurization temperature, there are spire-shaped bacteria that can survive at cooling temperatures so that in pasteurized milk these bacteria can develop during storage and produce toxic substances (enterotoxins) [19].

3.2. pH (Hydrogen potential)

The results obtained in this study were changes in pH in pasteurized milk with the addition of matoa leaf extract in storage 0 days to 12 days. Matoa leaf extract in this study significantly affected pH changes. However, the process and duration of storage also play a role in changing the pH value of milk. The value of changes in milk pH in figure 2 shown that the pH has increased to 3 days storage and decreased on days 6–12 days.

![Figure 2. Hydrogen Potential.](image)

Changes in pH that occur during storage are indicated by the metabolic processes resulting from lactic acid formed by lactic acid bacteria that increase during storage. Generally, fresh milk has a pH of around 6.5–6.7 [20]. The pH value decreases due to bacterial activity along with the storage time [21]. In their research found that the pH and acidity of pasteurized milk had changed during the 5-day cooling because the metabolic processes produced by organic acids, especially lactic acid, increased with increasing storage period [22]. This is also following the milk quality requirements that milk pH ranges from 6–7 [23].

4. Conclusion

The quality of matoa leaf pasteurized milk following with SNI quality standards when viewed from the value of the TPC and the pH values. However, based on the TPC value, this type of pasteurized milk can only be stored for 3 days. It is recommended that further research increase the level of matoa leaf extract to extend the shelf life of pasteurized milk at 4°C.

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