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Effect of Various Turmeric extract concentrations on ph, color an organoleptic Pasteurized Goat milk

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Abstract
This study aimed to evaluate the effect of various concentrations of turmeric extract (*Curcuma longa L.*) on pH, color, and organoleptic properties of pasteurized goat milk. The experiment was conducted using a Completely Randomized Design (CRD) with three levels of turmeric extract concentration: 5%, 10%, and 15%. Pasteurization was carried out at 65°C for 30 minutes. The parameters observed included pH, color (L*, a*, b* values), and organoleptic attributes (aroma, taste, texture, color, and overall acceptability). The results showed that increasing turmeric extract concentrations not significantly effec the pH of pasteurized goat milk. The color analysis indicated that increasing turmeric concentration significantly ($p<0.05$) reduced lightness (L*), increased redness (a*), and enhanced yellowness (b*). Organoleptic evaluation demonstrated that higher turmeric concentrations improved the sensory attributes, especially in terms of color and taste, without negatively affecting aroma and texture. Overall, the study suggests that turmeric extract at concentrations of up to 15% can be used as a natural additive to enhance the sensory and visual quality of pasteurized goat milk.

Keywords: turmeric extract, goat milk, pH, color, organoleptic properties, pasteurization

Introduction

Goat milk is one of the animal-based food sources with high nutritional value, rich in protein, fat, vitamins, and minerals beneficial for human health (Park, 2006) [11]. Moreover, goat milk is known for its better digestibility compared to cow milk, making it a potential alternative for consumers with lactose intolerance or allergies to cow milk proteins. However, the development of goat milk-based processed products still faces several challenges, particularly regarding its distinctive flavor and limited shelf life (Ribeiro *et al*, 2010) [12].

One widely adopted approach to improving the sensory quality and health functions of dairy products is the incorporation of natural ingredients with bioactive potential. Herbal plant extracts have become an attractive choice as they not only enrich the functional value but also influence the physical and sensory characteristics of the products (Wazzan *et al*., 2024) [14]. Among the various plants that have been studied, turmeric (Curcuma longa L.) stands out as a rich source of bioactive compounds, particularly curcumin, known for its antioxidant, antimicrobial, and anti-inflammatory properties (Hewlings & Kalman, 2017) [6]. In addition to contributing to health benefits, the incorporation of turmeric extract into food products has been reported to affect parameters such as color and pH (Akbari *et al*., 2022) [1].

Changes in pH in milk can potentially affect the stability, safety, and shelf life of the product. Meanwhile, color serves as a crucial visual attribute that significantly influences initial consumer perception and preference (Kavita *et al*, 2016) [9]. Furthermore, organoleptic evaluation—including aroma, taste, color, and overall acceptability—is an essential aspect to ensure that the addition of turmeric extract does not reduce consumer acceptance of the product (Wazzan *et al*., 2024) [14].

Previous studies have investigated the use of turmeric extract in various food products, such as yogurt, cheese, and dairy-based beverages (Akbari *et al*., 2022; Kavita *et al*., 2016) [2, 9]. However, research on the effect of turmeric extract concentration on goat milk remains relatively limited. Therefore, this study aimed to evaluate the effect of different concentrations of turmeric extract on the pH, color, and organoleptic characteristics of goat milk, with the expectation of contributing to the development of functional goat milk products with greater market acceptance.

Materials and Methods

The research was conducted using a Completely Randomized Design (CRD) consisting of three treatments and six replications, resulting in a total of 18 experimental units. The treatments applied involved the addition of turmeric extract at different concentrations in the goat milk, as follows:

P1: Pasteurized goat milk with 5% turmeric extract
P2: Pasteurized goat milk with 10% turmeric extract
P3: Pasteurized goat milk with 15% turmeric extract

Preparation of Turmeric Extract The preparation of turmeric extract was carried out using the following procedure: Fresh turmeric rhizomes were thoroughly cleaned from dirt and outer skin, then washed under running water until clean. The rhizomes were then sliced or cut into small pieces, dried, and ground using a blender until a fine powder was obtained. The resulting turmeric powder was mixed with distilled water in a 1:1 ratio and heated at 80°C for 30 minutes to produce the turmeric extract. Preparation of Pasteurized Goat Milk with Turmeric Extract The process of making pasteurized goat milk with added turmeric extract was as follows: One liter of goat milk was

pasteurized at 65°C for 30 minutes (Hartati *et al*, 2019) [4, 5]. After pasteurization, the milk was mixed with turmeric extract according to the respective treatment concentrations (5%, 10%, and 15%).

Results and Discussion

pH Value

pH is one of the essential parameters used as an indicator of milk quality, as it plays a significant role in determining freshness level, physical stability, and the potential for microbial growth during storage and processing (Hartati *et al*, 2019) [4, 5]

Table 1: pH Value of Pasteurized Goat Milk with the Addition of Turmeric Extract

Treatment	pH
P1	6,27[a]
P2	6,11[a]
P3	6,13[a]

The pH values of pasteurized goat milk did not differ significantly among treatments, indicating that the addition of turmeric extract at the concentrations used in this study did not produce a significant effect on the pH of pasteurized goat milk.

The pH of fresh milk was recorded at 6.3, while the pH of turmeric extract was 5.8. The addition of turmeric extract tended to lower the pH of pasteurized goat milk. This may be related to the organic acids and phenolic compounds in turmeric, such as curcumin, which possess mildly acidic properties and can increase acidity in dairy products. Similar findings have been reported in previous studies, showing that the addition of spices (such as turmeric, ginger, or cinnamon) to pasteurized milk could reduce its pH value (Hanum, 2022) [3]. Furthermore, other studies on animal-based food products also revealed that the addition of white turmeric extract could decrease pH levels, associated with the acidic nature of turmeric's active compounds (Sharifi-Rad *et al*, 2020) [13].

Color Characteristics

The data show that the addition of turmeric extract significantly affected the L*, a*, and b* color parameters of pasteurized goat milk. The L* value (lightness) decreased noticeably with the increasing concentration of turmeric extract, indicating that higher turmeric extract levels resulted in darker milk color. Meanwhile, the a* value (red-green tendency) increased, showing a shift from greenish hues towards a more neutral tone. The b* value (yellow-blue tendency) also significantly increased, reflecting a higher yellow color intensity in the milk with more turmeric extract.

Table 2: Color of Pasteurized Goat Milk with Turmeric Extract

Treatment	L	A	B
P1 (5%)	69,10[c]	-3,27[c]	23,90[a]
P2 (10%)	64,83[b]	-1,22[b]	30,03[b]
P3 (15%)	62,98[a]	-0,25[a]	32,71[c]

These findings are consistent with previous research indicating that spice additions, particularly turmeric, have a significant effect on color changes in dairy products. Similar results were reported by Nisa *et al*. (2022) [10], Sharifi-Rad (2020) [13], and Junaedia (2024) [8].

Organoleptic Test Results

Based on the organoleptic test data for goat milk with turmeric extract at three treatment levels, there was a noticeable trend of increased scores across nearly all parameters with the rising concentration of turmeric extract. Aroma, taste, texture, and color all showed improvements with higher turmeric extract concentrations. Total acceptance by panelists also rose, indicating that turmeric extract addition up to 10–15% could enhance consumer acceptance of pasteurized goat milk. These findings are showing the positive effects of turmeric on the organoleptic characteristics and physical quality of dairy products.

Table 3: Sensory Evaluation Results of Pasteurized Goat Milk with Turmeric Extract

Treatment	P1	P2	P3
Aroma	3.00	3.5	3.25
Taste	1.20	3	3.75
Textur	2.75	3	4
Colour	2.50	3,25	3.75
Overall Acceptability	2.75	3,5	3,5

Conclusion

The addition of turmeric extract at various concentrations had a noticeable impact on the color and organoleptic properties of pasteurized goat milk, while its effect on pH was not statistically significant. Increasing the concentration of turmeric extract significantly enhanced the yellow color intensity (b* value) and reduced the lightness (L* value) of the milk, making it visually more attractive. Furthermore, turmeric extract, up to a concentration of 15%, can be used as a natural additive to improve the visual appeal and sensory quality of pasteurized goat milk.

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