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QUALITY OF CRUDE PROTEIN AND ORGANOLEPTIC PROPERTIES OF FRIED MILK MADE FROM GOAT MILK WITH PLAIN YOGURT AS A COAGULANT

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Abstract-Fried milk is a traditional dairy product made from goat's milk. This research was conducted at the Animal Products Technology Laboratory, Department of Animal Science, Faculty of Agriculture, Universitas Negeri Gorontalo, from October to November 2025. The purpose of this study was to determine the effect of using papain as a coagulant on the crude protein and organoleptic properties of fried milk made from goat's milk. The research used a Completely Randomized Design (CRD) with 4 treatments and 3 replications. The treatments were as follows: P1: Papaya sap 0.05% + plain yogurt 1% of milk volume, P2: Papaya sap 0.05% + plain yogurt 1.5% of milk volume, P3: Papaya sap 0.5% + plain yogurt 2% of milk volume, P4: Papaya sap 0.5% + plain yogurt 2.5% of milk volume. The variables studied include crude protein content and organoleptic tests (color, taste, aroma, and texture). The research results show that the treatment significantly affects crude protein ($P<0.05$) and produces a slightly fine texture, color, taste, and aroma of fried milk that is preferred by the panelists. The best results for fried milk were obtained with treatment P3: 0.5% Papaya sap + 2% plain yogurt by milk volume, and P4: 0.5% Papaya sap + 2.5% plain yogurt by milk volume.

Key words **- Crude Protein, Organoleptic, Goat Milk, Plain Yogurt**

I. PRELIMINARY

Due to its great nutritional value, milk is a source of animal protein that the human body needs (Koesmara et al., 2021). Milk is one of the livestock products that can be processed into various processed products with economic value and used to create contemporary food items. Fried milk and ice cream are just two examples of the many modern food products that may be made from milk (Nisa and Dasmadi, 2022).

High levels of macronutrients, minerals, vitamins, short-chain fatty acids that are easier to digest, and health-promoting bioactive substances are among the nutritional benefits of goat's milk (Ramadhanti et al., 2025). Its nutritional content can vary depending on environmental and production factors, but it is generally easier to digest, less allergenic, and richer in healthy fatty acids than cow's milk.

Fried milk is one of the traditional milk products of the Rote people in East Nusa Tenggara. During the processing of fried milk, there is a coagulation process, or the process of clumping milk protein thru heating, which results in the final products of curd and whey. Theoretically, the coagulation process can be accelerated by adding coagulant compounds, including acids and proteolytic enzymes such as papain, bromelain, and rennin. One of the easily obtained and utilized proteolytic enzymes in the production of fried milk is papain, which is derived from papaya sap (Carica papaya). According to Puspitasari et al., (2013), papain has a larger pH range, is purer than bromelain and rennin, and is more resistant to processing temperatures than other proteolytic agents.

The high-temperature frying process can reduce the nutritional value of the food, so coagulation can shorten the cooking process because most of the water in the milk separates during coagulation. The coagulation material used in this study was papaya sap (papain enzyme) combined with plain yogurt. Based on this claim, additional research will be done on the chemical and organoleptic characteristics of the fried milk produced.

II. RESEARCH METHODS

A. Time and place of the research

This research was conducted at the Animal Products Technology Laboratory, Animal Science Department, Faculty of Agriculture, Universitas Negeri Gorontalo, from October to November 2025.

B. Tools and Materials

The tools used in this study were a 5 kg x 1 kg WJ-B05 analytical balance, a 100g/0.001 g digital analytical gram balance, 1-liter beakers (Pyrex), a water temperature mercury thermometer, a water bath, a pH meter, 20 ml syringes, 1900 ml cups, a Hock stove, pots, pans, knives, spatulas, cutting boards, large trays, sieves, writing materials, and a camera.

The material used in this study was 12 liters of Segardi goat milk obtained from Pancakarsa Village, Taluditi District, Pohuwato Regency. Papaya sap obtained from tapping papaya fruit sap, yogurt, brown sugar, and distilled water.

This research method is an experimental method using a completely randomized design (CRD) with 4 treatments of papaya sap papain yogurt as the coagulant being tested:

P1: Papaya sap 0.05% + plain yogurt 1% of milk volume
P2: Papaya sap 0.05% + plain yogurt 1.5% of milk volume
P3: Papaya sap 0.5% + plain yogurt 2% of milk volume
P4: Papaya sap 0.5% + plain yogurt 2.5% of milk volume

Each treatment was repeated 3 times, resulting in 12 experimental units. Each experimental unit used 1,000 ml (1 liter) of fresh goat's milk.

C. Prosedur Research

a) Preparation of papaya fruit sap

Papaya fruit sap is obtained by tapping. The maximum number of cuts that can be made on a single papaya is five, with a distance of 1-2 cm (Cahyono, 2013). Dried papaya sap is ground using a mortar, sieved, and papain is ready to use.

b) Preparation of papaya sap solution

Mansyur (2019), states that this entails weighing five grams of papaya sap, dissolving it in one hundred milliliters of distilled water, stirring for five minutes, and then letting it sit for fifteen minutes.

c) Curd Making

According to Pulungan et al., (2020), which involves putting the milk in a saucepan and then submerging it in water that has been heated over a burner. For fifteen minutes, stir the milk that has been indirectly heated until it reaches 70°C. Pour the milk into a separate container, cool it to a temperature range of 50-60℃, then add papaya sap and plain yogurt according to the treatment. Stir the mixture with a spoon, let it sit until curds form, then separate the curds from the whey using a cheesecloth. Weigh the curd produced and calculate its yield. The curd is ready to be processed.

d) Making Fried Milk

Weigh the curd to be processed, weigh out sugar at 105% of the curd's volume, add the sugar and curd simultaneously to a clean pan, and heat over low heat while stirring continuously. Color changes will occur during heating, resulting in a caramel brown color with a solid and dry consistency. The fried milk is ready, and we will proceed with weighing the fried milk and calculating its yield.

D. Measurd Variables

The variables measured in this study are crude protein and organoleptic properties. The organoleptic aspects of fried milk made from goat's milk include taste, aroma, color, and texture, with 20 panelists consisting of 12 female panelists and 8 male panelists from semesters 3, 5, 7, and 8. According to Tasirin and Aditama (2025), organoleptic testing is a technique for assessing food products' quality based on human sensory perception, including aspects like color, scent, taste, and texture.

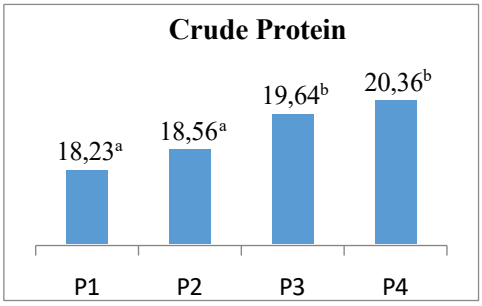
E. Data Analisys

The data obtained were analyzed using one-way analysis of variance (ANOVA). If there is a significant difference, it will be followed by the least significant difference (LSD) test at a 5% level. Organoleptic data was analyzed based on the most preferred trends according to the panelists' choices.

III. RESULTS AND DISCUSSION

Crude Protein

The average crude protein content of fried milk obtained in this study ranged from 18.23 to 20.36. The use of 0.5% papaya sap and 2.5% plain yogurt resulted in the highest crude protein content of fried milk, which was 20.36%, and the lowest, which was with the use of 0.5% papaya sap and 1% plain yogurt. Based on the analysis of variance, the results show that the concentration of papaya sap and plain yogurt significantly ($P<0.05$) affects the crude protein content of fried milk.



Different letters on the bar chart indic icate significant differences ($P<0.05$) based on the Honestly Significant Difference (HSD) test.

The protein content in milk and processed products is one of the important nutrients for the body.

In contrast, Lay et al. (2024) discovered that the protein level of fried milk was 18.937%. Therefore, it can be concluded that the protein content produced in this study is still considered higher, at 20.36%. The pasteurization temperature and duration have an impact on milk quality. The protein content is one of these, and cooking can alter it (Fatisa, 2011).

Organoleptic Properties of Fried Milk

Organoleptic testing is the evaluation of food based on preference and desire for a product. Organoleptic testing is commonly referred to as sensory testing, using trained or untrained panelists.

The organoleptic properties of fried milk made from goat's milk, including color, taste, aroma, and texture, obtained from this study are presented in Table 1.

Table 1. Color, Taste, Aroma, and Texture of Fried Milk

Parameters	Treatment			
	P1(1%)	P2(1.5%)	P3(2%)	P4(2.5%)
Color	4.15 Browning	4.25 Dark chocolate	3.56 Dark chocolate	3,95 Caramel chocolate
Aroma	2,16 Milky unflavored	2,21 Slightly milky flavored	2,28 Slightly milky flavored	2,42 Milky flavored
Texture	2.3c A bit rough	3.11b A bit rough	3.25b Somewhat subtle	4.17a Somewhat subtle
Taste	2.25b Slightly bitter	2.55b Slightly bitter	3.11a Slightly sweet	3.35a Sweet

Caption: abc) Different superscripts on the same line show a difference (P<0.05). Organoleptic description: Color: (1) brownish-yellow (2) brownish (3) light brown (4) dark brown (5) caramel brown, Taste: (1) bitter (2) slightly bitter (3) slightly sweet (4) sweet (5) very sweet, Aroma: (1) unflavored milky (2) slightly milky flavored (3) slightly milky flavored (4) milky flavored (5) highly milky flavored, Texture: (1) coarse (2) slightly coarse (3) slightly smooth (4) smooth (5) very smooth.

Influence of Treatment on the Color of Fried Milk

The average fried milk color scores obtained in this study ranged from 3.56 to 4.25 (caramel brown). The results of the variance analysis showed that the use of papaya sap and plain yogurt had a non-significant effect (P>0.05) on the color of fried milk. This means that using papain as a coagulant results in fried milk with a more uniform color. The presence of the caramel brown color is due to the non-enzymatic browning process of the sugar contained in the fried milk, which occurs during cooking, especially during frying. Murhadi's (2005) assertion that caramelization is a reaction in sugar caused by heating at high temperatures, which produces complex compounds driven by a tiny amount of acid from the sugar and results in changes in flavor and color, lends credence to this. The results of this study show that the fried milk produced is normal in color, dark brown and caramel brown.

Influence of Treatment on the Aroma of Fried

The smell of a product is very important for getting customers to buy it. Rismawati et al. (2015), assert that the incorporation of particular food ingredients in product manufacturing may affect its ultimate aroma or generate a unique scent. The average score for fried milk color obtained in this study ranged from 2.16 to 2.42 (no milk aroma and milk aroma). The results of the variance analysis showed that the concentration of papaya sap and plain yogurt had no significant effect (P>0.05) on the aroma of fried milk.

Based on the results of the variance analysis, it can be concluded that the use of papaya sap and plain yogurt with a score of 2.42 is the best level evaluated by the panelists because it produces a fried milk aroma with a goat's milk scent. Aroma plays a very important role in a food product because it helps determine consumer acceptance of the product.

The Effect of Treatment on the Texture of Fried Milk

Texture is a physical form related to the roughness or smoothness of a product (Sakul and Komansilan, 2018). The research results show that the texture of fried milk ranges from 2.3 to 4.17 (somewhat rough and somewhat smooth). The results of the variance analysis showed that the use of papaya sap and plain yogurt had a significant effect ($P < 0.05$) on the level of texture preference.

Further analysis using the Honestly Significant Difference (HSD) test revealed that P1 was significantly different ($P<0.05$) from P2, P3, and P4. P2 and P3 were not significantly different from each other, but were highly significantly different ($P<0.05$) from P4. This is influenced by the different treatments applied to each sample, resulting in a fried milk texture that is somewhat coarse and somewhat smooth. In this study, the panelists' acceptance of the fried milk texture ranged from 3.11 to 3.25, equivalent to somewhat coarse and somewhat smooth.

The Effect of Treatment on the Taste of Fried Milk

The research results show that the texture of fried milk ranges from 2.25 to 3.35 (slightly bitter and sweet). The results of the variance analysis showed that the use of papaya sap and yogurt cake had a highly significant effect ($P < 0.05$) on taste preference.

Further analysis using the Honestly Significant Difference (HSD) test revealed that P1 was not significantly different ($P>0.05$) from P2 but was highly significantly different ($P<0.05$) from P3 and P4. This is influenced by the different treatments each person uses, resulting in a slightly bitter and sweet taste for the fried milk. In this study, the panelists' acceptance of the fried milk flavor was rated at 3.35, indicating a sweet taste for the fried milk

IV. CONCLUSION

The use of papaya sap and plain yogurt can increase the crude protein content in fried milk. The use of P4: 0.5% Papaya sap + 2.5% plain yogurt by volume of milk resulted in the best lever produced. The best physical and organoleptic characteristics of fried milk were obtained in treatments P4 (0.5% Papaya sap + 2.5% plain yogurt by volume of milk) and P3 (0.5% Papaya sap + 2% plain yogurt by volume of milk), which produced a taste, aroma, color, and texture preferred by the panelists.

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