

# The Use of Blondo (by Product from Lauric Acid Production) for Cheese Fruiterers: The Study Ratio of Milk with Blondo and Citric Acid Concentration as a Coagulant

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## ABSTRACT

The processing of coconut milk into lauric acid produced Blondo as a by-product. Blondo was rich in protein, oil (fat), carbohydrates, vitamins, and minerals. In addition, the fatty acids from coconut milk blondo were short and medium chains of saturated fatty acids, which were very beneficial for health. From the nutritional content and physical properties, blondo had similarities with cow's milk. Thus, blondo had the potential to be processed into cheese. This study aimed to study the effect of the ratio of cow's milk with blondo and citric acid concentration as a coagulant on the quality of cheese. This research method used factorial RAK (Randomized Block Design). There were 2 factorial, namely the proportion of milk with coconut milk cream (25:75, 50:50, 75:25, 100:0) and citric acid concentration (2% and 4%). The results showed that the proportion of milk with blondo and citric acid concentration was significantly affected in the water content and protein content. However, it did not significantly affect fat content, pH value, and organoleptic taste, aroma, texture, and color.

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## 1. INTRODUCTION

Coconut milk that is squeezed without water contains 4.2 g of protein, 5.6 g of carbohydrates, 34.3 g of fat, 14 mg of calcium, 45 mg of phosphorus, and 2 mg of iron. Besides that, coconut milk contains 0.02 mg of vitamin B1 and 2 mg of vitamin C [1].

Lauric acid is made from coconut milk with hydrolysis method using the endogenous lipase enzyme. Coconut milk is enzymatically hydrolyzed for 48 hours, then it will be separated into three fractions, namely oil, cream, and skim (water) fractions. The oil fraction is further processed into lauric acid [2]. The cream fraction is a by-product of lauric acid production, usually called blondo. Until now, blondo has not been utilized optimally.

Blondo is the white part with protein in the form of cream often called coconut milk core. The nutritional content of blondo per 100 g includes calories 243.68, carbohydrates 13.98, fat 17.17, protein 8.31, calcium 0.11, phosphorus 0.19, Fe 0.054, Zn 0.223, Iodine 2.4, Potassium 3.11, Sodium 3.2, Vitamin A 0.002 and Water 49.80 [3].

Besides it is obtained from the by-product of lauric acid production, blondo is also obtained from the wet method of coconut oil production (from coconut milk). Blondo contains 45.6% protein, 6.5% water, 0.79% fat, 8.8% ash, and 36.6% carbohydrates [4].

Blondo is a by-product of processing virgin coconut oil (VCO) using physical methods (oil application); the protein is separated into protein isolate. The isoelectric point of protein isolate from blondo is at pH 4. The protein isolate is dried so that it becomes dry protein isolate. The protein content in dry protein isolate is 95.12%. Meanwhile, VCO is processed enzymatically, and the protein content in the protein isolate is 90.71%. VCO is processed chemically (acidification method), and the protein isolate has a protein content of 86.26% [5].

Blondo, which is analyzed using HPLC, will be known for its amino acid composition. Blondo contains 14 types of amino acids in sequence based on peak number, namely aspartic acid (1), glutamine (2), serine (3), histidine (4), glycine (5), arginine (6), alanine (7), tyrosine (8), methionine (9), valine (10), phenylalanine (11), isoleucine (12),

leucine (13) and lysine (14) with relative percentages according to peak height [6].

Besides being rich in protein, minerals, and vitamins, blondo also contains fat. The type of fatty acids in coconut milk are very good for health. The fatty acids in coconut milk are short-chain and medium-chain saturated fatty acids, namely caproic acid, caprylic acid, capric acid, lauric acid, and myristic acid. The highest fatty acid in coconut milk is lauric acid, which is 50.45%. Other fatty acids are caproic acid 0.11%, caprylic acid 5.52%, capric acid 6.46%, and myristic acid 17.52% [7].

Lauric acid (in the form of free fatty acids) that has been isolated from coconut milk can inhibit the growth of *Salmonella* sp., *E. Coli*, *Staphylococcus aureus*, *Micrococcus*, *Bacillus stearothermophilus* and *Pseudomonas* bacteria [2]. Lauric acid, capric acid, and myristic acid are very useful as antibacterials [8] and can inhibit the development of the HIV virus [9]. According to Kabara *et al.* [10], lauric acid and other short-chain fatty acids such as capric acid, myristic acid, palmitic acid, linoleic acid, and linolenic acid can inhibit the growth of *Pneumococci*, *streptococcus*, *Micrococci*, *Candida*, *S. aureus*, *S. Epidermis* bacteria.

Cow's milk has a fat content of 1.42%–1.96% and a protein content of 3.01%–3.59%. Calcium 0.14%–0.18%. Phosphorus levels 0.1%–0.11% [11]. The fat content of fresh milk in the city and district of Kediri is between 2.95%–3.28%. Meanwhile, the protein content of fresh milk is between 2.10%–2.18% [12]. According to Christi *et al.* [13], pure fire milk has a protein content of 2.57 g, fat 4.86 g, and lactose 3.85 g.

One of the most popular foods people in urban areas is cheese. Cheese is a dairy dairy product that has a complete and balanced nutritional content. Cheese has several advantages over fresh milk, including the nutritional content of cheese, which is not inferior to fresh milk, can be consumed by people suffering from lactose intolerance, and contains protein with essential amino acids needed by the body [14].

The nutritional content of 100 g of cheese is 22.8 g protein, 25.5 g fat, 0.4 mg iron, 0.06 mg vitamin B1, 155 RE vitamin A, and 285 calories of energy [15].

To overcome the problem of lactose intolerance and casein allergies, substitution of cow's milk by other ingredients is necessary in cheese making. One of the alternative ingredients that can be used for cheese making is coconut milk. This is because coconut milk does not contain lactose like cow's milk, so coconut milk can be consumed by lactose intolerant patients.

Previous researchers have carried out several studies on making cheese from coconut milk [16]. Conducted cheese-making research, comparing cow's milk with coconut milk using acidification treatment. The results showed that the addition of coconut milk with various variations could reduce protein content and increase the fat content. The best cheese formulation ratio of cow's milk and coconut milk was 85:15.

Cheese is made using pure coconut milk with the treatment of concentrated coconut milk and unconcentrated coconut milk. Furthermore, the cheese is stored at room temperature for 0–3 months. The results of this study show

that the product contains moisture content, ash content, fat content, and carbohydrate content, which refers to SNI, and can be categorized as meeting quality requirements, except for protein content. The longer the product is stored, the higher the free fatty acid and TPC content, but still below the required threshold. Organoleptic test showed that in the 3rd month of storage, the product was still favoured by the panelists [1].

Cheese made from a mixture of coconut milk and cow's milk uses lactic acid bacteria (LAB) as coagulation, which is obtained from curd. The research used a treatment ratio of coconut milk and milk, namely 20:0, 17:3, 14:6, and 11:9, and the use of flavor with a concentration of 0%, 0.5%, 1%, 1.5%, and 2%. The results of the hedonic test showed that the sample most liked by the panelists was the sample with the formula 11:9 (coconut milk versus milk) and a flavor of 0.5%. The cream cheese characteristics of this formulation have a water content of 48.65%, ash content of 0.34%, protein content of 6.80%, and fat content of 31.68% [17].

The addition of coconut milk to cheese-making can affect the yield, fat content, aroma, color, taste, and texture of the cheese. The addition of coconut milk to cheese products reduces yield and increases fat content, aroma, color, taste, and texture [18].

Research on the manufacture of coconut cheese (coco cheese) from blondo (white), a by-product of the Virgin Coconut Oil (VCO) manufacturing process by spontaneous fermentation. The fermented white blonde is obtained from two different media formulas, namely "coconut water" and "water coconut plus mineral water." Coco cheese is made by mixing fermented white blondo with a binder of pregelatinized starch (1:1) and added chewing ingredients such as 1% STPP, 2% table salt, 1% annatto coloring, and 0.15% propionate acid; the mixture is then aged for 72 hours at room temperature (27 °C–31 °C). "Coconut water and coconut mineral water coco cheese" are preferred in terms of the organoleptic parameters of color, taste, and texture. However, the aroma parameter of "coconut water coco cheese" is preferred [19].

Research on making cheese from blondo (by-product of lauric acid production) mixed with cow's milk has not been reported. Blondo has different nutritional components from cow's milk, especially the amount and type of protein. This difference will affect on protein agglomeration in the formation of yogurt. Protein clumping in the formation of yogurt can use the enzyme renin or acid. So, it is necessary to study the ratio of cow's milk to blondo and the concentration of citric acid in making cheese from blondo.

## 2. MATERIALS AND METHODS

This research was conducted at the Processing Laboratory and Chemical Laboratory, Faculty of Agriculture, Widyagama University, Malang.

Materials used in the manufacture of products in the study were pure cow's milk, coconut, yogurt plan, citric acid, salt. The materials used for the physical and chemical testing of products in the study were distilled water, hexane solution, biuret solution, BSA solution, and NaOH.

The tools used in this research were thermometers, drop-per pipettes, measuring pipettes, enlemeyer tubes, ovens, stoves, LPJ gas, pans, analytical scales, cloth filters, basins, cheese molds, knives, freezers, wooden spatulas, spoons, glasses, plastic filter, aluminum paper, scissors. Meanwhile, tools for physical and chemical testing of products in this study are oven, tweezers, desiccator, analytical balance, cup, watch glass, tissue, spatula spoon, Soxhlet tool, fat flask, round bottom fat flask, filter paper, pH meter, beaker glass, measuring flask, test tube, water bath, fortex, spectrophotometry, Erlemeyer tube.

### 2.1. Research Methods

This research was conducted using experimental methods and using a randomized block design (RAK) experiment arranged factorial, consisting of 2 factors. The first factor was the ratio of cow's milk to blondo (cream and water fraction) consisting of 25:75, 50:50, and 75:25. The second factor was the concentration of citric acid as a thickener consisting of (2% and 4%). The study was repeated three times.

The research data was tested using Analysis of Variance (ANOVA). If there was a real difference, continue with the BNT or DUNCAN test.

### 2.2. Research Implementation

#### 2.2.1. Making of Coconut Milk Cream (Blondo)

Old coconut was first cleaned of its skin (epidermis), then washed and then grated. The shredded coconut was added to water in a ratio of 1:1. Then, it was squeezed and filtered until it became thick coconut milk.

The coconut milk was then incubated at 50 °C for 24 hours. After incubating for 24 hours, the coconut milk will form three fractions, namely oil (top), cream (middle), and skim (water) at the bottom. The oil layer (lauric acid) was separated, and cream and water were remaining. This cream and water fractions were used in cheese making, hereafter referred to as Blondo in this study.

#### 2.3. Making of Cheese from Blondo

Pure cow's milk and blondo (cream and water fraction) were mixed with a ratio of 25:75, 50:50, 75:25, and 100:0 (according to the treatment) until homogeneous. Next, the mixture of cow's milk and blondo was heated until the temperature reached 80 °C (pasteurization temperature). Furthermore, the mixture of cow's milk and blondo was cooled to a temperature of (30 °C–32 °C). Then, citric acid was added as much as 2% or 4% (according to treatment) and stirred slowly and evenly using a stirrer.

After evenly mixing, they were allowed to stand for 10–15 minutes for the coagulation process. After coagulating, the curd was cut vertically and horizontally to remove the water trapped in the cheese clumps.

Then, keep it stirred and reheated at 40 °C. The clumps formed were then filtered using a filter cloth to separate the water (whey). The clumps formed were called curd. The Curd (cheese) was then weighed, packaged, and ready for analysis.

## 3. RESULTS AND DISCUSSION

### 3.1. Amount of Blondo (Cream and Water Fraction)

After incubating the coconut milk for 24 hours at 50 °C, the oil fraction was separated, leaving the cream and water. The oil fraction will then be processed into lauric acid, while cream and water (blondo) are used in cheese making. The amount of blondo (cream and water fraction) obtained from the study was 82.39% of the total coconut milk. While, the oil fraction was 17.61%.

The amount of oil fractions produced in this study was almost the same as the results of research [20], which made virgin coconut oil (VCO) from coconut milk. Making VCO using tempeh yeast obtained oil of 13.24%–16.02% calculated from the volume of coconut milk cream. If the oil fraction was almost the same, then the amount of blondo was also close to the same. This is because the rest of the oil fraction was blondo.

Meanwhile, making VCO from coconut milk using the centrifugation method, the oil yield ranged from 20.12%–26.99% with an average yield 23.47%. The yield was determined by calculating the amount of oil produced and then comparing it with the weight of the coconut milk cream used [21].

### 3.2. Cheese from Blondo and Cow's Milk

#### 3.2.1. Rendement

The amount of cheese obtained from blondo mixture with cow's milk ranged from 7.99%–10.11%. The lowest yield was in the treatment cow's milk: blondo (25:75) with 2% citric acid concentration. While the highest yield was in the treatment of 100% milk with 4% citric acid concentration. The results of research [22] show that the yield of soft cheese from cow's milk is  $9.44\% \pm 0.488\%$  with a range between  $7.75\% \pm$  to  $10.29\%$ . Thus, the cheese yield from this study was close to soft cheese from cow's milk.

Based on analysis of variance results, it showed that the ratio of cow's milk to blondo, citric acid concentration and their interaction did not significantly affect cheese yield. This was because the amount of solid (protein, fat, carbohydrates) in cow's and blondo was not much different. In addition, the addition of citric acid between 2% and 4% was thought to cause almost the same level of cheese clumping.

According to Christi *et al.* [13], pure cow's milk has 2.57 g protein, 4.86 g fat, and 3.85 g lactose.

Meanwhile, blondo protein content was 8.31%, and oil was 17.17%, with water content of 49.8% [3]. If the water content of blondo was the same as that of milk, the amount of blondo solid was close to the same as that of cow's milk. At 0% moisture content (dry basis), the amount of solid material in cow's milk was 58.3%. While blondo, the amount of solid material was 40.79%.

#### 3.2.2. Moisture Content

The moisture content of cheese from cow's milk with blondo ranged from 50.6%–77.5%. The lowest moisture content was obtained in the ratio of milk to blondo (50:50) with the addition of 2% citric acid as a coagulant. The highest moisture content was found in the ratio of milk to blondo (50:5) with the addition of 2% citric acid.

TABLE I: MOISTURE CONTENT OF CHEESE AT DIFFERENT RATIO OF COW'S MILK TO BLONDO

Ratio of cow's milk with blondo	Moisture content (%)
50:50	54.4 a
75:25	61.4 ab
25:75	74.0 bc
100:0	76.3 c

Note: Numbers with different notations are significantly different.

The dry matter content of soft cheese made from cow's milk with 0%–5% strawberry fruit paste was 44.68% to 48.40% [23]. Thus, the moisture content of these cheeses ranged from 51.6%–55.32%. Therefore, the moisture content of cow's milk cheese with blondo (in this study) was close to the moisture content of cow's milk cheese with adding strawberry paste.

The results of analysis of variance showed that the ratio of cow's milk to blondo had a significantly influenced on the moisture content. Meanwhile, citric acid concentration and their interaction did not significantly affect the moisture content. The moisture content of cheese at different ratios of cow's milk to blondo can be seen in Table I.

Based on Table I, it was known that the higher the amount of cow's milk, the higher the moisture content of cheese. This was because the moisture content of milk was higher than the moisture content of blondo. Cow's milk had a water content of (87.82%) [24]. While blondo had a moisture content of 49.8% [3].

### 3.2.3. Protein Content

The data showed that the average protein content of cheese was between 2.12%–40.3%. The lowest protein content was 2.12% in the treatment of milk and blondo ratio (25:75) with the addition of 2% citric acid. Meanwhile, the highest protein content of 40.3%, was found in the treatment of milk and blondo ratio (100:0) with the addition of 4% citric acid.

The protein content of cheese from cow's milk with lime and pineapple extract acidifiers ranged from 40.6% to 50.0% [22].

Based on the results of analysis of variance, the ratio of cow's milk and blondo significantly influenced the protein content. Meanwhile, citric acid concentration and their interaction did not significantly affect protein content.

Based on Table II, it was found that the higher the amount of cow's milk, the higher the protein content of cheese. Pure cow's milk had a protein content of 2.57 g [13]. Meanwhile, the protein content of blondo in the form of cream was 8.31%, with a moisture content of 49.8% [3]. If the moisture content of cow's and blondo's milk was made the same, namely 0% moisture content (dry basis), the protein content of cow's milk was 27.34%. While blondo, the protein content was 16.55%.

Since the amount of protein in cow's milk was greater than blondo, the higher the amount of cow's milk, the greater the protein content of the cheese.

### 3.2.4. Fat Content

The fat content of the cheese ranged from 2.57%–9.30%. The lowest fat content was obtained in the ratio of milk

TABLE II: PROTEIN CONTENT OF CHEESE AT DIFFERENT RATIO OF COW'S MILK TO BLONDO

Ratio of cow's milk with blondo	Protein (%)
25:75	13.49 b
50:50	10.49 a
75:25	23.90 c
100:0	39.88 d

Note: Numbers with different notations are significantly different.

TABLE III: PH VALUES OF CHEESE IN DIFFERENT RATIO OF COW'S MILK TO BLONDO

Ratio of cow's milk with blondo	pH
25:75	6.23 a
50:50	6.23 a
75:25	6.33 ab
100:0	6.53 b

Note: Numbers with different notations are significantly different.

to blondo (100:0) with the addition of 2% citric acid. Meanwhile, the highest fat content was obtained in the ratio of milk to blondo (25:75) with the addition of 2% citric acid. According to Yulia *et al.* [25], the fat content of mozzarella cheese from buffalo milk was 8.47%. Thus, the fat content of cheese from this study was close to that of buffalo milk mozzarella cheese.

The results of the analysis of variance showed that the ratio of cow's milk to blonde and the concentration of citric acid addition and their interaction did not have a significant effect on the fat content.

In the cheese-making process, citric acid coagulates the casein (protein) to form cheese clumps. Proteins coagulation by vinegar or citric acid would take place rapidly and simultaneously throughout the milk liquid so that some of the proteins originally mixed in the milk would be trapped in it and would coagulate in the presence of acid to release water (whey). Meanwhile, fat was not much affected by the clumping process, so the amount of fat trapped in the cheese did not vary.

### 3.2.5. pH Value

Research data showed that the pH value range of cheese from milk and blondo was around 6.2–6.6. The lowest pH value was obtained in the treatment of milk and blondo (100:0) and 2% citric acid. The highest pH value in the treatment of milk and blondo (25:75) and 4% citric acid.

Based on the results of analysis of variance, the ratio of cow's milk to blondo significantly influenced on the pH of the cheese. Meanwhile, citric acid concentration and their interaction did not significantly affect the pH value. The pH value of cheese in different ratio of cow's milk to blondo can be seen in Table III.

The higher the amount of cow's milk, the higher the pH value of the cheese. The difference in cheese pH was influenced by the moisture content of the cheese. Based on Table I, the higher the amount of cow's milk, the higher the moisture content of the cheese. Thus, the higher the moisture content in the cheese, the smaller the acid concentration, and thus the higher the pH.



### 3.2.6. Organoleptic Test

Testing was done using a sensory test, which was a test method for measuring human acceptance of the products. This test used a score from 1 to 5 with the provisions of 1 (don't like), 2 (less like), 3 (normal/neutral), 4 (like) and 5 (very like).

### 3.2.7. Flavour

From the results of the cheese flavour liking test obtained a score between 2.8 (neutral) to 4.2 (like). The lowest score was in the treatment of cow's milk and blondo (25:75) and 2% citric acid. The highest score was for the treatment of cow's milk and blondo (100:0) and 2% citric acid.

Based on the results of analysis of variance, it showed that the ratio of cow's milk with blondo and the addition of citric acid as well as their interaction did not significantly affect on the organoleptic flavour. It was assumed that cheese flavour was more influenced by milk flavour. Therefore, the addition of blondo from 0% to 75% did not differ in flavour.

### 3.2.8. Aroma

From the results of the cheese aroma liking test, it was obtained a score ranging from 3 (neutral) to 3.7 (like). The lowest score was obtained in the treatment of milk and blondo (50:50) and 4% citric acid. Meanwhile, the highest score was obtained from the milk and blondo treatment (75:25) and 2% citric acid.

Based on the results of analysis of variance, it showed that the ratio between cow's milk and blondo and the addition of citric acid and their interaction did not significantly affect on the organoleptic aroma of cheese.

This was because the aroma of cheese tends to be influenced by the milk aroma. Presumably, the addition of blondo up to 75% did not affect the aroma of the cheese.

### 3.2.9. Colour

From the results of the cheese colour liking test, it was obtained the score ranged from 3.3 (neutral) to 3.7 (like). The lowest score was in the cow's milk and blondo treatment (50:50) and 2% citric acid. Meanwhile, the highest score was in the cow's milk and blondo treatment (100:0) and 2% citric acid.

Based on the results of the analysis of variance, it showed that the ratio of cow's milk and blondo and the concentration of citric acid and their interaction did not have a significantly effect on the organoleptic colour of the cheese. This was because the colours of milk and coconut cream were not much different, thus resulting the colours were not much different too.

## 4. CONCLUSION

The ratio of cow's milk with blondo and the addition of citric acid had a significant effect on moisture content and protein content. Meanwhile, the fat content, pH value, and organoleptic properties had no significant effect.

Cheese from cow's milk and blondo had the lowest moisture content of 50.6% and the highest was 77.5%. Meanwhile, the fat content ranged from 2.75% to 9.30%,

pH ranged from 6.2 to 6.6. The lowest protein content was 2.04%, and the highest was 40.4%. Organoleptic test of flavour average 5.1, aroma average 5.1, texture average 4.1, and colour average 5.1.

## 5. SUGGESTION

It was needed to do more to continue the study for testing the fatty acid composition in the cheese from cow's milk and coconut blondo.

## CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

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