

The using of extract rabbits stomach in the making goat milk cheese ripened with *Lactobacillus acidophilus*

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ABSTRACT: The aim of this research was to study the chemical physical quality of goat milk cheese that was made from extract rabbits stomach as coagulant and ripened with *Lactobacillus acidophilus* during 42 days. There are three groups of cheese ripening: 0 day, 21 days, and 42 days. The chemical qualities of milk cheese were pH, acidity, free fatty acid, and water content, whereas the physical quality was texture or cheese hardness. The chemical and physical data was analyzed with completely randomized design. The result showed that ripening treatment has significant effects ($P \leq 0,05$) on goat milk cheese acidity, free fatty acid, water content, and texture. During the day of 0, 21, and 42 ripening, the average of cheese acidity were 0.26%, 0.35%, 0.40%, free fatty acid were 1.32%, 2.28%, 2.23% 44.87%, water content were 42.10%, 39.10%, and texture were 62.07N, 120.21N, 312.52 N respectively. The pH of goat milk cheese was not affected by ripening treatment, and the average of pH was 5.85. In conclusion, goat milk cheese that was made from extract of rabbit stomach as coagulant and ripened with *Lactobacillus acidophilus* for 42 days was classified in hard cheese. There was increasing of cheese acidity, free fatty acid and texture/ hardness, whereas the water content decreased during ripening.

Key words: Goat's milk cheese, Extract rabbits stomach, Ripening, *Lactobacillus acidophilus*

INTRODUCTION

The development of cheese industry in Indonesia is still obstructed by the need of coagulant agent for shaping the curd. Coagulant of milk agent in processing cheese can be made from proteolytic enzyme or by acid. Quality of cheese including the texture will be influenced by variety of enzyme. It is because; each of proteolytic enzymes has certain specification to their substrate, so the breakdown result of the protein will be different. Such also if acid was used as milk coagulant, will produce different texture from enzyme coagulant. Ideally, good cheese is made by rennin enzyme or chymosin because they have limited proteolytic activities (Fox and Mc Sweeney, 1998). However, it is impossible if processing cheese must slaughter the young ruminant (calf) to get extract rennin enzyme. Because of that, many methods has been done to research the other rennet, for example rennin enzyme from microbe, plants and product rennet by genetic engineering. Nowadays, almost of 50% chymosin is produced by genetic engineering product.

Rabbit is pseudoruminansia. The stomach of young rabbits contains most of the lipolytic activity and 45.7% of the total proteolytic activity of the digestive tract. Proteolytic activity in digestion of rabbit aged 4 weeks in gastric, small intestine, caecum and colon continued were 1550, 662, 908 and 272 mg azocasein decomposed/ hour (Marounek and Vovk, 1995). Proteolytic activity in gastric is the biggest, so according to the quality of enzyme total become large.

Many areas in Indonesia, people usually take rabbits meat and generally make a dish rabbit catay. Rabbit stomach from slaughtering product is wasted. If rabbit's stomach with relative large size can coagulate milk, it is expected, this will be an alternative way to solve the need of milk coagulant agent in processing cheese.

Quality of cheese that was made with extract rabbit stomach have not been researched, so the aim of this research was to study the quality of goat milk cheese ripened with *Lactobacillus acidophilus* and coagulant extract of rabbit stomach.

MATERIALS AND METHODS

Rabbit's stomach was extracted using acetyl acid and NaCl salt (Utama, 1985). First, process of making cheese, was done by pasteurizing of goat milk on temperature 72°C for 15 second with added CaCl₂ 0.06%. The temperature of milk was cooled down in 33-35°C and added starter *Lactobacillus acidophilus* 1%. The milk was incubated for 1 hour with temperature 37°C. Extract of rabbit stomach were added on milk with the amount of 3% and waited for 25 minutes until curd is formed. After the curd forceful, it is ready for cutting. First cutting was done gently for 5 minutes and the second cutting is done faster for 3 minutes. Separate the whey from the curd as many as 1/3 volume of the whey. Next step the curd was cooked and washed (scalding) by sterile hot water. The first cooking of the curd is done for 3 minutes and keep the scalding temperature at 33-34°C. The second scalding was for 5 minutes with temperature 30-40°C. The curd is then ready for shaped and pressed. Press the curd for 10 minutes with load as heavy as the curd. After shaped, curd was brined in salt liquid with concentration 18%.

The testing quality of cheese included pH, acidity, water content, free fatty acid, texture and pH value was tested by pHmeter. Water content, free fatty acid was tested according to Sudarmadji *et al* (1989). Acidity of cheese was tested according to SNI (1992), but testing the texture of cheese by using Universal Testing Machine. The working principal of this machine is to know how big the force that is needed to press and shatter the sample (Zwick, 2002). Testing the quality of cheese was done to the cheese that ripened during 0, 21, and 42 days at temperature 4°C and relative humidity in 53%. Each of ripening treatment was used three sample replications. The data quality of cheese were analyzed with completely randomized design (CRD) following Astuti (1981).

RESULTS AND DISCUSSION

Rendement of Cheese

The average rendement of goat milk cheese in 0 day with coagulant of extract rabbit stomach can be showed in Table 1.

Table 1. Average of rendemen goat milk cheese with coagulant of extract rabbit's stomach

Replication	Rendemen %
1	22,10
2	23,33
3	19,10
Average	21,51

The average rendement of goat milk cheese that was coagulated 21, 51%. Rendement of goat milk cheese was bigger than fresh cheese from cow milk and coagulant by lemon juice result from Purwadi's research (2008) was 12, 88%. Domiati fresh cheese that was made in Egypt with coagulant by commercial rennet, rendement was 29.30% (Salwa and Galal, 2002). Rendement of Domiati cheese was bigger than from this research, it was caused by protein content of buffalo milk more than protein of goat milk (Murtaza *et al.*, 2008). Some of variety goat milk had not alfa s-1 casein or lower in protein of milk, whereas cow milk has the most of alfa s-1 casein content (Maree, 2003; Moatsou *et al.*, 2008).

Value and Acidity

The influence of ripening to pH value goat milk cheese that was made from extract rabbit stomach and starter *Lactobacillus acidophilus* was presented in Table 2.

In the result and analyzing Table 2 shows that, long time of ripening did not affect the pH value of cheese. In this case, possibly it was caused by low temperature (4°C) and lower acidity that formed

during ripening. Because of that, to increase the production of acid needs more time in fermentation step. The study was done by Murtaza *et al* (2008), that pH of buffalo milk cheese or cow milk cheese that ripened 0 day was significant with pH value ripening cheese 60 days or 120 days with temperature 4°C. The pH value buffalo milk cheese was ripened 0, 60, 120 days continued were 5.34, 5.25 and 5.18.

Table 2. Average pH value of goat milk cheese during ripening

Replication	Ripening (days)		
	0	21	42
1	5,87	5,71	5,97
2	5,52	5,90	5,84
3	5,97	6,08	5,91
Average ^{ns}	5,78	5,89	5,90

^{ns} not significant

The acidity in goat milk cheese by lactic acid percentage in this study showed that ripening 0 day were significantly different to ripening in 21 and 42 days ($P \leq 0.05$). But acidity 21 days was not significantly different to ripening 42 days. The average acidity of cheese, range about 0, 26%-0.40% and presented the data that was showed in Table 3. The study before also showed buffalo milk cheese that ripened 0 day (acidity 0,89%) and were significantly different with ripening 120 days (acidity 0,96%) (Murtaza *et al.*, 2008). The average of acidity goat milk cheese was showed with lower comparison better than buffalo milk cheese. It was caused by different starter that used for ripening. Ripening buffalo milk cheese used 2 variety starter which are *Lactobacillus lactic ssp. Cremoris* and *Lactococcus lactic ssp. Lactic* (Murtaza *et al.*, 2008), but goat milk cheese in this study used *Lactobacillus acidophilus* starter.

Table 3. Average acidity (%) goat milk cheese during ripening

Replication	Ripening (days)		
	0	21	42
1	0,22	0,35	0,35
2	0,31	0,39	0,44
3	0,25	0,32	0,41
Average	0,26 ^a	0,35 ^b	0,40 ^b

^{a,b} Different superscripts in the same rows and column were showed significant difference ($P \leq 0.01$)

Free Fatty Acid

The average free fatty acids in goat milk cheese during ripening were presented in Table 4.

Tabel 4. Average free fatty acid (%) goat milk cheese during ripening

Replication	Ripening (days)		
	0	21	42
1	1,40	2,56	2,16
2	1,33	2,46	2,07
3	1,26	1,84	2,46
Average	1,32 ^a	2,28 ^b	2,23 ^b

^{a,b} Different superscripts in the same rows and column were showed significant difference ($P \leq 0.01$)

Based on Table 4, percentage free fatty acid as a oleic acid in goat milk cheese has increased in ripening 21 days ($P < 0.05$), and fixed until 42 days. According Lopez *et al* (2006), Emmental cheese that ripened during 8-28 days at room temperature contains more 1% free fatty acid. Percentages of

fatty acid were short chains (C4-18), medium chains (C10-C14) and long chain (\geq C16) was increased 15-30% during ripening cheese (Chavarri *et al.*, 1999). The development amount of free fatty acid with range 1, 9-4, 4% in Cheddar Cheese has relation increased rancidity flavor (Bynum *et al.*, 1984). Free fatty acid in goat milk cheese in this research has average range 1,325-2, 23% during ripening 42 days at temperature 4°C.

Water Content

Water content in cheese can be used as one of the way for cheese classification. The average water content in goat milk cheese that ripened with *Lactobacillus acidophilus* is presented in the Table 5

Table 5. Average water content (%) goat milk cheese during ripening

Replication	Ripening (days)		
	0	21	42
1	57,53	51,16	49,08
2	40,16	39,87	36,90
3	36,94	35,28	31,33
Average	44,87 ^a	42,10 ^b	39,10 ^c

^{a,b,c} Different superscripts in the same rows and column were showed significant difference ($P \leq 0.01$)

Average water content in goat milk cheese during ripening showed significant difference ($P < 0.05$) between 0, 21, and 42 days. This decrease is caused by the occurrence of water evaporation during the ripening process which causes the surface of the cheese to be dry. Ripening cheese in this study were done at low temperature (4°C) and low humidity (53%), so that the evaporation of water become significant, and range of the water content is 39,10 - 44.87% and classified as hard type cheese.

Texture of Cheese

Texture or hardness of goat milk cheese that analyzed from amount of stress resultant (Newton) that needed until press the cheese can be shown in the Table 6.

Table 6. Average the texture goat milk cheese (on Newton) during ripening

Replication	Ripening (days)		
	0	21	42
1	59,76	170,55	174,39
2	71,01	114,52	400,14
3	55,46	77,21	363,52
Average	62,07 ^a	120,21 ^a	312,52 ^b

^{a,b} Different superscripts in the same rows and column were showed significant difference ($P \leq 0.01$)

The data in Table 6 showed long time ripening on 21 days did not have any influence yet in the texture, but ripening on 42 days have significant influence to the texture of goat milk cheese. Cheeses that ripened on 42 days and before ripened (0 days) have texture more softy better than cheese that ripened on 42 days. The larger stress force needed to press the cheese until shattered means the texture of cheese becomes more and more hard. The texture described structure or solidity the cheese. Consistency of cheese generally vary from like a stone (Edammer cheese), rubbery and plastics (Emmentaler cheese), crumbly and fragile (goat milk cheese) (Walstra, 1999). Usually, young cheese

has consistency like rubbery and become plastics after maturation. The process of making curd and form changes will determine the texture of cheese. (Daulay, 1991)

CONCLUSIONS

Goat milk cheese with extract of rabbit stomach that was ripened using *Lactobacillus acidophilus* starter during 42 days produced hard type cheese. During ripening goat milk cheese, there were increase of acidity, free fatty acid and hardness of cheese, and also decreased of water content.

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