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Organoleptic Test on Fresh Cheese and Papain Enzyme Rennet Coagulant from Goat's Milk Based on Storage Time

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Abstract. Innovations in milk processing include making it into fresh cheese using local coagulant. This study aims to determine the effect of papain enzyme levels on the coagulation process of milk formaking fresh cheese. This research method used a 4 x 4 factorial completely randomized design with 2 replications of factor A giving papain enzyme levels, namely A0 = 0.2 g (using commercial rennet), A1 = 0.1 g papain enzyme rennet, A2 = 0.2 g papain enzyme rennet, A3 = 0.3 g papain enzyme rennet, and factor B storage time B0 = 0 days B1 = 5 days B2 = 10 days and B3 = 15 days. The variables measured were organoleptic tests including color, aroma, and preference. Based on the results of the study, it was found that from the addition of four levels of papain enzyme used and four variations of storage time, the administration of papain enzyme 0.3 g (A3) and storage time of 15 days (B3) was the optimal treatment to increase color, aroma, and preference for cheese and can be used as an alternative to the use of rennet.

Keywords: innovation, goat's milk, level, papain enzyme, organoleptic test

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1. Introduction

Cheese is a type of food that comes from milk and has been known since ancient times. According to the World Food and Agriculture Organization (FAO), cheese is a fresh or ripe product produced by separation of liquid (whey) from coagulant after coagulation of milk [1].

Coagulation is one of the defects in milk. Milk that undergoes coagulation will coagulate (in the form of a gel). Coagulation in milk can be caused by the addition of rennet, salt or heating. Coagulation is not expected in some dairy products, but in certain products coagulation in milk has a very important role. Examples of dairy products that apply coagulation are cheese and yogurt [2].

Rennet enzyme is a protease enzyme obtained from the stomach of calves 3-4 weeks old [3]. Rennet plays a role in hydrolyzing casein, especially kappa casein which functions to defend milk from freezing. In the process of making cheese, Indonesia still imports the rennet enzyme from countries on the European continent, therefore it is necessary to have an alternative substitute for the rennet enzyme in cheese making to reduce the cost of cheese production. One alternative to the

rennet enzyme is papain enzyme from the papaya fruit plant (*Carica Papaya* L.). It is suspected that papaya (*Carica Papaya* L.) contains enzymes that can coagulate milk protein.Cheese consumption in Indonesia in 2013 reached 19,000 tons and the need for cheese was partially met by imports, imports of Indonesian cheese from the United States amounted to 3,060 tons. Cheese imports continued to increase by 5.96% per year [4]. In this case, the role of rennet is needed in making cheese so that vegetable rennet from the papain enzyme is one solution that can be used by the community.

2. Materials and Method

2.1. Materials

Cheese is made from pasteurized fresh milk, which is heated at a pasteurized temperature of Low Temperature Long Time (LTLT, 62.8^0C for 30 minutes). The addition of papain enzyme rennet with levels of 0.2 g, 0.3 g, 0.4 g, and 0.5 g into milk heated by pasteurization until it thickens. After coagulating, 1% each salt was added and then the whey and curd were separated. The curd is put into a mold that has been lined with gauze, then pressed to remove the remaining whey. Furthermore, the curd was packed with aluminum foil, then stored in (0 days, 5 days, 10 days and 15 days).

2.2. Methods

The research design used was a factorial completely randomized design with two replications, which were tested with the following treatments:

Factor A (level of papain enzyme administration)

A0 = 0.2 g (using commercial rennet)

A1 = 0.1 g of papain enzyme rennet

A2 = 0.2 g of papain enzyme rennet

A3 = 0.3 g of papain enzyme rennet

Factor B (storage time)

B0 = 0 day storage time

B1 = 5 days storage time

B2 = 10 days storage time

B3 = 15 days storage time

3. Results and Discussion

3.1. Color

The results of color organoleptic test scores on cheese from goat's milk with 0.2 g of commercial rennet and several levels of papain enzyme rennet 0.1g, 0.2g, 0.3g and storage time of 0, 5, 10, 15 days are presented in “Table 1”.

Table 1. Color

Level rennet enzim papain (A)	Storage time (B)				Average
	B_0 (0 day)	B_1 (5 days)	B_2 (10 days)	B_3 (15 days)	
A_0	$1,58^{cD}$	$1,63^{cC}$	$1,75^{cB}$	$2,15^{cA}$	1,77
A_1	$1,45^{cD}$	$2,10^{cC}$	$2,25^{cB}$	$2,20^{cA}$	2,00
A_2	$1,35^{bD}$	$1,80^{bC}$	$2,65^{bB}$	$2,30^{bA}$	2,02
A_3	$1,40^{aD}$	$1,75^{aC}$	$3,20^{aB}$	$3,45^{aA}$	2,45
Average	1,44	1,82	2,23	2,27	

Note: Different superscripts in the same row and column show significantly different results ($P < 0.05$).

From the table above, the color score of cheese with commercial rennet coagulation with variations in storage time ranges from 1.44 to 2.27 while the color score of cheese with papain enzyme rennet coagulation level ranges from 1.77 to 2.45.

The results of the analysis of variance in treatments A0, A1, A2, A3 showed that the color scores on cheese showed significantly different results ($P < 0.05$). From the panelists' observations, the highest average score was in the A3 treatment of 2.45 while the lowest value in the cheese color score was at A0 of 1.77. This is presumably due to the insoluble pigment carotene in milk and the increasing dose of papain enzyme rennet as a coagulant resulted in white color. The same thing also happened in Sorkarto's study [5] that the higher the level of agglomerating material, the more opaque the resulting white color will be.

The table data above shows that the length of storage of cheese shows a significant effect ($P < 0.05$). The interaction between the level of papain enzyme rennet administration and the storage time of cheese had a significant effect ($P < 0.05$). This was presumably due to storage at room temperature at 2oC - 15oC and storage for 0 days, 5 days, 10 days and 15 days respectively. days because according to Qarnaini [6] the color of cheese is formed by various factors including the milk pigment beta carotene. Changes in the color of cheese can be attributed to the biochemical activity of native microflora, such as processing technology and ripening or storage techniques.

3.2. Aromatic

The results of the organoleptic aroma test scores on cheese with 0.2g commercial rennet and several levels of papain enzyme rennet 0.2g, 0.1g and 0.2g and 0.3g and storage time of 0, 5, 10, 15 days are presented in “Table 2”.

Table 2. Aromatic

Level rennet enzim papain (A)	Storage time (B)				Average
	B_0 (0 day)	B_1 (5 days)	B_2 (10 days)	B_3 (15 days)	
A_0	$1{,}00^{dA}$	$1{,}00^{dB}$	$1{,}00^{dB}$	$1{,}00^{dB}$	1,00
A_1	$2{,}60^{cA}$	$2{,}30^{cB}$	$2{,}30^{cB}$	$2{,}40^{cB}$	2,4
A_2	$3{,}30^{bA}$	$2{,}90^{bB}$	$2{,}93^{bB}$	$3{,}30^{bB}$	3,10
A_3	$4{,}05^{aA}$	$3{,}90^{aB}$	$3{,}60^{aB}$	$3{,}90^{aB}$	3,86
Average	2,73	2,52	2,45	2,65	

Note: Different superscripts in the same row and column show significantly different results ($P < 0.05$).

From the table above, the aroma score of cheese with commercial rennet coagulation with dosage variations of commercial rennet with storage time ranges from 2.45 to 2.73 while the aroma score of cheese with papain enzyme rennet coagulation with variations in papain enzyme rennet dosage ranges from 1.00 to 3 ,86. The highest aroma score was found in treatment A3 with an average of 3.86 while the lowest aroma score was in treatment A0 with an average of 1.00 producing an aroma that smelled typical of milk. The more doses of papain enzyme rennet the lower the score of the cheese aroma.

Based on the results listed in the table, there was no significant effect ($P < 0.05$) so it could be concluded that there was an insignificant difference in the average aroma of cheese between treatments. It can be seen from the average assessment of the cheese aroma which is relatively the same between treatments. In addition, in the cheese processing process glycolysis and proteolysis occur which play a role in the formation of cheese aroma. Aroma is the smell caused by chemical stimuli that are smelled by the olfactory nerves in the nasal cavity, the aroma in cheese is produced by the work of lactic acid bacteria which play a role in causing aroma and acid. [7] in the cheese processing process in general there are 3 important metabolic processes, namely glycolysis, proteolysis, and lipolysis. Glycolysis is the fermentation of lactose by lactic acid bacteria which is used to produce lactic acid, acetic acid, CO2 and diacetyl. Proteolysis is the process of breaking down protein (casein) into peptides then into amino acids which are aroma precursors while lipolysis is the process of breaking down fat into free fatty acids in cheese which is an indicator of cheese ripening and plays a role in the formation of cheese aroma.

3.3. Flavor

The results of taste organoleptic test scores on cheese from goat's milk with 0.2 g of commercial rennet and several levels of papain enzyme rennet 0.1g, 0.2g, 0.3g and storage time of 0, 5, 10, 15 days are presented in “Table 3”.

Table 3. Flavor

Level rennet enzim papain (A)	Storage time (B)				Average
	B_0 (0 day)	B_1 (5 days)	B_2 (10 days)	B_3 (15 days)	
A_0	$2,48^{cA}$	$2,90^{cA}$	$2,63^{cA}$	$2,63^{cA}$	2,66
A_1	$2,83^{bA}$	$3,08^{bA}$	$3,15^{bA}$	$3,18^{bA}$	3,06
A_2	$3,20^{bA}$	$3,28^{bA}$	$2,98^{bA}$	$2,75^{bA}$	3,05
A_3	$3,03^{aA}$	$3,25^{aA}$	$3,55^{aA}$	$3,83^{aA}$	3,41
Average	2,88	3,13	3,08	3,09	

Note: Different superscripts in the same row and column show significantly different results ($P < 0.05$).

From the table above, the taste score for cheese with commercial rennet coagulation with dosage variations of commercial rennet with storage time ranges from 2.88 to 3.13 while the taste score in cheese with papain enzyme rennet coagulation with variations in papain enzyme rennet dosage ranges from 2.66 - 3 ,41. The highest average score of taste was in treatment A3 using rennet 0.3 g with an average of 3.41 while the lowest score of aroma was in treatment A0 with an average of 2.66.

Based on the results listed in the table, it shows a significant effect ($P < 0.05$) so that the taste organoleptic test with variations in dosage and storage time provides a significant difference in taste between treatments. [8] stated that there was a change in dairy products such as Cheese is caused by the fermentation of lactose, citrate, and other organic compounds into various acids, esters, alcohols and volatile flavor and aroma-forming compounds.

3.4. Preferences

The results of organoleptic test scores on cheese from goat's milk with 0.2 g of commercial rennet and several levels of papain enzyme rennet 0.1g, 0.2g, 0.3g and storage time of 0, 5, 10, 15 days are presented in “Table 4”.

Table 4. The results of organoleptic test scores on cheese preferences

Level rennet enzim papain (A)	Storage time (B)				Average
	B_0 (0 day)	B_1 (5 days)	B_2 (10 days)	B_3 (15 days)	
A_0	$2,50^{cA}$	$2,93^{cA}$	$2,60^{cA}$	$2,63^{cA}$	2,66
A_1	$2,80^{bA}$	$3,10^{bA}$	$3,15^{bA}$	$3,20^{bA}$	3,06
A_2	$3,20^{bA}$	$3,25^{bA}$	$2,95^{bA}$	$2,80^{bA}$	3,05
A_3	$3,05^{aA}$	$3,30^{aA}$	$3,50^{aA}$	$3,85^{aA}$	3,42
Average	2,88	3,14	3,05	3,12	

Note: Different superscripts in the same row and column show significantly different results ($P < 0.05$).

From the table above, the preference score for cheese with commercial rennet coagulation with variations in the dose of papain rennet with storage time ranges from 2.88 to 3.14 while the preference score for cheese with papain enzyme rennet coagulation with a variation of papain rennet enzyme dosage ranges from 2.66 to 3 ,42. The highest preference score was in the treatment

using papain enzyme rennet 0.3 g with an average of 3.42 while the lowest preference score was in the A0 treatment with an average of 2.66.

The level of papain enzyme administration showed a significant effect ($P < 0.05$) on the preference score for cheese. The variation in the scores obtained was caused by the panelists who carried out organoleptic tests in this study consisting of various kinds of different humans, some of whom were already accustomed to consuming cheese and for preference depending on taste. Taste is the level of liking that is observed with the sense of taste [9].

4. Conclusion

Based on the results of the study, it was found that from the addition of papain enzyme rennet used and four variations of storage time, the administration of papain enzyme level 15% (A3) and storage time of 15 days (B3) was the optimal treatment to improve the performance of color, aroma, taste, texture and preference for cheese and can be an alternative to the use of rennet.

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