Analysis Quality of Soft Cheese Cottage with Additional of Pineapple Juice (*Ananas Comusus* (L.) Merr) and *Lactobacillus Fabifermentans*

Analysis Quality of Soft Cheese Cottage with Additional of Pineapple Juice (*Ananas Comusus* (L.) Merr) and *Lactobacillus Fabifermentans*

Andi Sukainah[1(a)], Ratnawaty Fadilah[1], Reski Praja Putra[1] and Akifah[2]

[1]Agricultural Technology Education Study Program, Faculty of Engineering, Universitas Negeri Makassar, Makassar, Indonesia
[2] Alumni of Agricultural Technology Education Study Program, Faculty of Engineering, Universitas Negeri Makassar, Makassar, Indonesia
[(a)] Corresponding author: andi.sukainah@unm.ac.id

Abstract. Soft cheese that has been produced with the addition of three types of coagulant namely pineapple juice, lactic acid bacteria *Lactobacillus fabifermentans* (*Lactobacillus fabifermentans* culture in isolation from the results of corn flour fermentation), and a mixture of pineapple juice and *Lactobacillus fabifermentans*. The best soft cheese obtained from the treatment of a mixture of pineapple juice 40% with lactic acid bacteria *Lactobacillus fabifermentans* 8%. Furthermore, to improve the quality of soft cheese produced, then add 1% salt. The quality of the resulting cheese includes curd yield 23.17%. water content 68.03%, protein content 8.27%, fat content 5.46%, pH 4.14%, total acid 1.66%. Based on the results of the organoleptic test on the resulting soft cheese obtained the taste, aroma, texture, and color preferred by the panelists.

1. Introduction

Milk is a type of product produced by livestock such as cattle, goats, or buffalo. Milk is a liquid derived from udder healthy and clean dairy cattle that are obtained through proper milking and following operational standards [1]. Milk is one of the products that is easily damaged so that it has a relatively short shelf life. Every province in Indonesia has the potential to produce milk, one of which is the province of South Sulawesi. Based on [2], milk production in South Sulawesi Province in 2015 reached 2,727 tons and in 2016 increased to 2,795 tons. Some dairy producing areas in South Sulawesi Province include Sinjai and Enrekang districts.

The composition of milk is very diverse and depends on several factors, but the average number for all types and conditions of milk is 3.90% fat, 3.40% protein, 4.80% lactose, 0.72% ash and 87.10% water. In addition to the above substances, milk also contains other ingredients in small amounts such as citrate, enzymes, vitamin A, vitamin B, and vitamin C. High nutritional content in milk and its less durable nature causes the processing of milk into a product that has endurance long time is very necessary.

One product that is produced with milk ingredients is cheese. Cheese is one of the processed products made from milk, either cow, goat or buffalo milk. One type of cheese that is often used by people in everyday life is soft cheese. Soft cheese is cheese without ripening (raw cheese). Soft cheese such as cottage cheese contains more than 52% to 80% water with low-fat content [3]. High water content causes this cheese to have a soft texture. In general, people consume soft cheese directly or consumed with other products such as bread instead of jam.

The process of making cheese uses an enzyme called rennet obtained from the stomach of a calf. This enzyme plays a role in coagulating milk so that cheese product is obtained [4]. Enzymes play an important role in making cheese, especially proteolytic enzymes. According to [5], the process of milk coagulation by rennin is carried out through the enzymatic conversion process from casein to paracasein and the chemical deposition of paracasein by calcium contained in milk. Rennet which is used in making cheese has stronger working power than other enzymes so it is needed in small amounts. Production of 10 kg of cheese from 100 liters of milk only requires 10-45 ml of lumps (0.01-0.045%) [6].

The rennet enzyme is expensive and is very difficult to find, so another alternative is needed to coagulate milk. The enzyme that can be used as an alternative to replacing the function of rennet is the bromelain enzyme. This is because both are proteolytic enzymes or proteases that can play an important role in the process of milk clumping. Bromelain can be obtained from pineapple plants from different stems, skins, leaves, fruits, and stems.

In addition to using enzymes, the process of making cheese can use Lactic Acid Bacteria (LAB). The most widely used microorganisms in starters, especially cheese starters, are the LAB group that produces acids, especially lactic acid through lactose fermentation [7]. One type of LAB that can be utilized is *Lactobacillus fabifermentans*. The culture of *L. fabifermentans* used in this study was isolated from the fermentation results of cornflour obtained from the research results of [8]. This bacterium can ferment the lactose content in milk and then produce lactic acid so that the fermented milk is in acidic condition. This acid also preserves milk and degrades lactose (milk sugar) [9].

The slightly acidic condition makes it difficult for dangerous bacteria to grow. The low pH value of cheese (5.0-5.2) helps suppress the growth of pathogenic bacteria and spoilage bacteria. Lower pH values cause the minimization of growth and damage by microbes to the product. Making cheese is based on the principle of clumping casein either by reducing the pH mechanism until the protein reaches the isoelectric point (zero-charged macromolecules) then clumping or by administering the enzyme protease. This study aims to determine the effect of the addition of pineapple juice and *L. fabifermentans* on the quality of cottage cheese soft cheese.

2. Materials and Methods

This type of research is quantitative research using experimental methods and laboratory analysis. The study used ANOVA analysis, namely a completely randomized design (CRD) of one factor with 3 treatments and 3 replications.

The study was conducted in two stages, namely preliminary research and primary research. Preliminary research was conducted to determine the concentration of coagulant or clot material that will be used in the process of making soft cheese. The best concentration resulting from preliminary research will be the concentration used in the main research. The coagulant used in this preliminary study is pineapple juice with concentration of 10%, 20%, 30%, 40%, and 50%, while the concentration of *L. fabifermentans*, namely 4%, 6%, 8%, 10%, 12%, 14%, and 16%.

The main research consisted of 3 treatments. The first treatment is making soft cheese with the addition of *L. fabifermentans*. Before the culture is used, the first rejuvenation of the starter is carried out followed by incubation for 48 hours. After that, the starter is applied to milk and then fermented for 21 hours [10]. The second treatment is making soft cheese with the addition of pineapple juice, 1 L of cow's milk which has been pasteurized, and pineapple juice is added as much as 40% (400 mL). After that, this mixture is stirred until homogeneous and heated to form lumps at 80°C. The third treatment is a combination of the two previous treatments. For this treatment, soft cheese is made by adding pineapple juice. Next, the process continues with the addition of the *L. fabifermentans* starter. After that, filtering and adding 1% of salt in each treatment was carried out. Analysis of the observed product quality is the yield of curd, water content, protein content, fat content, pH, total acid and hedonic tests namely taste, aroma, texture, and color.

3. Results and Discussions

3.1. Preliminary research

Preliminary research was conducted to determine the concentration of coagulants in the process of making soft cheese. The coagulant used is pineapple juice and LAB type *L. fabifermentans*. Preliminary research results show that soft cheese with an appropriate texture is obtained from the treatment of pineapple juice concentration of 40% and the treatment of *L. fabifermentans* 8%. Therefore, these two concentrations are used in primary research to make soft cheese

3.2. Main research

The results showed that the type of coagulant was very influential on the resulting soft cheese. The type of coagulant influences the chemical quality of soft cheese, namely water content, protein content, pH value, and total titrated acid content but does not affect the yield value and fat content of soft cheese produced (Table 1). The type of coagulant also affects the hedonic quality, especially in terms of aroma.

Table 1. Yield curd and chemical properties of soft cheese

Treatment of coagulant	Yield Curd (%)	Water Content (%)	Protein (%)	Fat (%)	pH	Value of Titrated Acid (%)
Pineapple juice 40%	21.59±2.70 a	67.32±0.45 a	8.55±0.47 a	4.93±0.13 a	4.77±0.09 a	1.26±0.07 a
L. fabifermentans 8%	23.17±1.10 a	72.23±0.81 b	7.29±0.14 b	5.32±0.37 a	4.7±0.14 a	1.38±0.05 b
Pineapple juice 40% + *L. fabifermentans* 8%	21.82±2.91 a	68.03±0.25 a	8.27±0.27 a	5.46±0.24 a	4.14±0.12 b	1.66±0.06 c

3.2.1. Yield curd

Yield Curd is a comparison of the amount of curd produced with the amount of raw milk used and expressed in percent (%).The results of the yield of curd from various treatments can be seen in Table 1. The results showed that the type of coagulant used did not affect the yield of curd soft cheese. *L. fabifermentans* culture can be used as a starter in producing soft cheese because these bacteria produce lactic acid during the fermentation process. Lactic acid formed has an impact on the coagulation of curd forming casein. Component forming casein consisting of calcium and phosphate, when lactic acid is formed, calcium and phosphate will bind with lactate to form calcium lactate and lactate phosphate, so clumps of casein will form curd [7]. According to [11], cheese is produced due to the deposition of proteins, especially casein in acidic conditions.

3.2.2. Water content

Water content is the amount of water contained in the product. Water is one component in food that affects the shelf life and physical properties of food. The quality of the product is determined by the water content

The results showed that the best water content of soft cheese resulted from the addition of pineapple juice 40% (67.32%) and the addition of pineapple juice 40% + *L. fabifermentans* 8%, ie 68.03% (Table 1). The standard water content of soft cottage cheese according to [3] is not more than 80%.. Both of these treatments produce low water levels because, during the manufacturing process protease enzyme derived from pineapple juice, bromelain is given. Bromelain is one of the proteolytic enzymes that can hydrolyze proteins. Protein hydrolysis by the protease enzyme will break the binding of peptides contained in the protein. This disconnection process requires water, the more active the proteolytic power, the more they need for water, so it will reduce the water content of the material.

3.2.3. Protein

Protein is an important substance needed by the body because it functions as a builder and regulator. Besides, protein also functions for the maintenance and growth of all cells in the body. The protein content is the amount of protein contained in food items expressed in percent (%).

Soft cheese treatment with the addition of pineapple juice 40% and adding pineapple juice 40% + *L. fabifermentans* 8% produced the highest protein content, namely 8.55% and 8.27%, while the lowest protein content was produced by the addition of *L. fabifermentans* 8% treatment, namely 7, 29% (Table 1). The addition of pineapple juice 40% can maintain the existing protein content. Enzymes do not reduce the protein content in food but change it into simpler forms. Pineapple juice can break down the structure of proteins contained in milk to be simpler [12]. Besides describing proteins, proteolytic enzymes can form new proteins or protein-like compounds [13]. Enzymes are also proteins so that when added to food they can maintain or even increase the protein content in these ingredients. The enzyme itself is classified as protein [14]. Also, the performance of enzymes is specific, very different from acids which can cause coagulation of proteins in various bonds in proteins. Acid can even cause changes in the secondary structure of the protein, so that protein levels are lower.

3.2.4. Fat content

Fat is an important source of energy and is needed by humans in carrying out activities. Fat in making cheese functions as clotting material that can bind to proteins so clots occur. Besides, during the process of making p-lipid cheese on the fat granules membrane will break down so that the fat coalesces and separates to the surface so that the milk clots. Soft cheese fat content of all treatments produced was in the range of 4.93% -5.46%. This value range still meets the quality requirements, namely the fat content of soft cheese ranges from 10%.

3.2.5. The pH value

The pH value is the degree of acidity used to express the acidity or the basicity of the solution. The results showed that the pH value was in the range 4.14-4.77 (Table 1). The results of the analysis, the pH value of soft cheese, found that the treatment of adding various coagulants to soft cheese gave very real effect. Soft cheese treatment with the addition of pineapple juice 40% + *L. fabifermentans* 8% produces the lowest pH value, while soft cheese produced from adding pineapple juice 40% and addition of *L. fabifermentans* 8% have similarities, which is in the pH range of 4.7. The pH value of soft cheese treatment of pineapple juice 40% + *L. fabifermentans* 8% is lowest because the bromelain enzyme in pineapple juice degrades complex proteins from milk into simpler proteins, so *L. fabifermentans* makes it easier to use these simple proteins as energy sources and produces lactic acid. Lactic acid plays a major role in reducing the acidity in cheese. Lactic acid can act as a natural compound to extend the shelf life of the resulting soft cheese. The addition of enzymes or acids aims to reduce the pH to 4.5-4.6 where the pH is the isoelectric point of casein [15].

3.2.6. Total acid

Total acid is the amount of acid contained in food. Total acid indicates the amount of organic acid content in the product. The results of the analysis of variance on the total soft cheese acid are known that the treatment of adding various coagulants to soft cheese gives very real effects. The results showed that the total acid value was positively correlated with the pH value produced. Soft cheese treatment with the addition of pineapple juice 40% + *L. fabifermentans* 8% produced the highest total acid of 1.66%, while soft cheese with the lowest total acid content was obtained from the addition of *L. fabifermentans* 8% treatment, ie 1.38%.

The acid contained, especially the lactic acid produced is needed in soft cheese products. Lactic acid is known to be one of the natural preservatives that are expected to extend the shelf life of the resulting soft cheese. *L. fabifermentans* in pineapple juice mixture treatment is more optimal in producing acids. This is due to the enzyme bromelain indirectly helping the adaptation phase of *L. fabifermentans* through the breakdown of complex protein compounds into simple compounds that are more easily utilized by these bacteria. The rapid adaptation phase causes *L. fabifermentans* to more easily carry out metabolic processes and produce lactic acid as one of its main metabolites, therefore

higher than the acid produced by the addition of pineapple. States that the more bacteria produce lactic acid, the higher the acid formed [16].

3.2.7. The organoleptic test

The hedonic soft cheese test results showed that the type of coagulant did not affect color, taste, and texture. This type of coagulant only affects the aroma of soft cheese produced. The color, taste, and texture of soft cheese produced are in the range of 2.64-3.53 (Figure 1). This value indicates that the soft cheese produced is rather preferred by panelists. The resulting soft cheese is creamy white to yellowish-white, especially the treatment that gets 40% additional pineapple juice. This color still meets the cottage soft cheese color standard according to [3], which is beige white. The yellowish-white color in soft cheese is caused by carotenoid compounds (beta carotene) contained in pineapple juice. This compound is non-polar, so it can provide a yellow color effect visually.

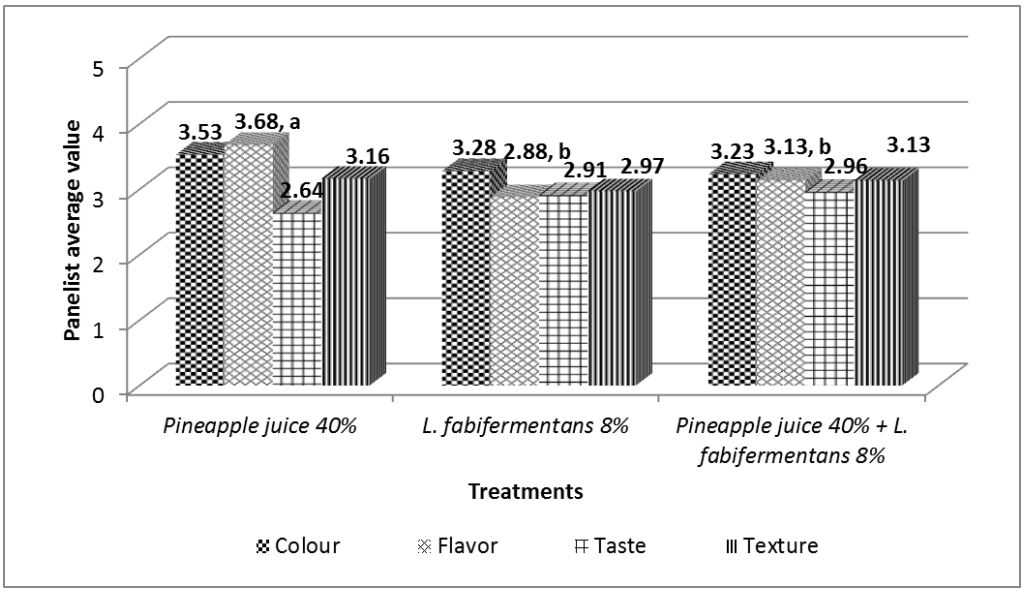

Fig. 1. Results from panelist hedonic tests on soft cheese generated

Soft cheese produced from various treatments has a distinctive taste of milk and is rather salty. The taste of soft cheese produced still meets the cottage cheese soft cheese standard. According to [3], soft cheese has a salty or slightly salty taste. Specifically for soft cheese products produced with the addition of *L. fabifermentans* 8%, the taste obtained in addition to slightly salty taste is also rather acidic. Sour taste is caused by lactic acid bacteria that produce lactic acid during the fermentation of lactose in milk [10].

The texture is a pressure that can be observed with the mouth when bitten, chewed and swallowed, or touched with fingers. The standard texture of soft cottage cheese according to [3] is smooth, not like flour, not sticky, and not runny. Bromelain enzymes contained in pineapple juice and *L. fabifermentans* cause the texture of soft cheese produced to have smooth product texture. Bromelain enzymes in pineapple and lactic acid can cut the casein bonds in milk during the process of making soft cheese. According to [12], casein protein that is overhauled will produce small lumps causing the texture of the product to feel smooth. States that the optimal addition of enzymes will produce clots that are not too large with low water content [17].

This type of coagulant only affects the aroma of soft cheese produced. The results showed that the aroma of soft cheese most favored by panelists resulted from the addition of 40% pineapple juice with a preference level of 3.68 (like) compared to the addition of *L. fabifermentans* 8% treatment and the mixture of pineapple juice 40% + *L. fabifermentans* 8%. Soft cheese which is treated only with the addition of pineapple juice 40% produces distinctive aroma of milk, while soft cheese treatment adds *L. fabifermentans* 8%, both single treatment and mixture of adding pineapple juice 40%, producing an acid

aroma due to the acid production produced by L. fabifrementans during the soft cheese fermentation process.

4. Conclusion

The type of coagulant influences the water content, protein content, pH value, total titrated acid, and the aroma of soft cheese produced. The best soft cheese is produced from adding pineapple juice 40% combined *L. fabifermentans* 8%. This soft cheese treatment resulted in lower pH value due to higher levels of titrated acid contained in the other treatments. Acid levels are quite high, namely, 1.66%, is expected to have the potential as a natural preservative compound for the soft cheese produced

References

[1] Meutia, N., Rizalsyah, T., Ridha, S, Sari, M.K. 2016. *Residu Antibotika dalam Air Susu Segar yang Berasal Dari Peternakan di Wilayah Aceh Besar.* Jurnal Ilmu Ternak. 16 (21): -.
[2] The Indonesia Central Statistics Agency. 2016. *Produksi Susu Segar menurut Provinsi,* (*online*), (https://www. bps.go.id/linkTableDinamis).
[3] United States Departement of Agriculture (USDA). 2001. (*online*), (http://www. nutritiondata. com/facts/fruits-and-fruit-juices/1936/2).
[4] Maghfiroh, K. 2010. *Pengaruh Waktu Penyimpanan Ekstrak Rennet Abomasum Domba Lokal terhadap Kualitas Keju*. Bogor: IPB.
[5] The Indonesian Center for Animal Husbandry and Agribusiness Education and Training. 2005. *Pembuatan Keju*. Departemen Pertanian Badan Pengembangan Sumber Daya Manusia Pertanian, Jl. Songgorito.
[6] Hutagalung, I. Lasroha. 2008. *Pengujian Level Enzim Rennet, Suhu dan Lama Penyimpanan Terhadap Kualitas Kimia Keju dari Susu Kerbau Murrah*. Medan: Universitas Sumatera Utara.
[7] Purwoko, Tjahjadi, Sutarno, S. A. Estikomah. 2008. *Pembuatan Keju (Unripened Cheese) dengan Starter Campuran.* Surakarta: Universitas Sebelas Maret.
[8] Sukainah, A, E. Johaness, R.P. Putra. 2016. *Identifikasi Mikroba Indegenus yang Tumbuh pada Fermentasi Spontan Jagung Bisi-18*. Makassar.
[9] Septi, N. Diana, A.D. Gavetasari. 2014. *Mikrobiologi Pengolahan Pangan* ***Keju.*** **Surabaya:** UPN 'VETERAN'.
[10] Geantaresa, Egrina, T. Supriyanti FM. 2010. *Pemanfaatan Ekstrak Kasar Papain sebagai Koagulan pada Pembuatan Keju Cottage Menggunakan Bakteri.* Jurnal Sains dan Teknologi Kimia. 1 (1): 38-43.
[11] Daulay, D. 1991. *Fermentasi keju*. Bogor: IPB.
[12] Syaikal. 2016. *Rendemen dan Kualitas Organoleptik Keju Segar dengan Penggumpal Getah Pepaya dan Sari Buah Nanas pada Berbagai Level.* Makassar: Universitas Hasanuddin.
[13] Sutrisno. 2007. *Tepung Papain Kasar, Pengempuk Daging. (online),* (E-book Pangan.com, diakses tanggal 7 November 2017).
[14] Anggraini, R. Permata, A.H.D. Rahardjo, R.S.S. Santosa. 2013. *Pengaruh Level Enzim Bromelin dari Nanas Masak dalam Pembuatan Tahu Susu Terhadap Rendemen dan Kekenyalan Tahu Susu.* Jurnal Ilmiah Peternakan 1(2): 507 – 513.
[15] Hikmat. 2016. *Bakteri Asam Lactat (BAL) dalam Fermentasi Keju. (online*), (kliksma.com/2016/09/bakteri-asam-lactat-bal-dalam-fermentasi-keju.html, diakses tanggal 10 November 2017).
[16] Legowo, A., Kusrahayu, S. Mulyani. 2009. *Ilmu dan Teknologi Susu*. Semarang: Universitas Diponegoro.
[17] Yuniwati, M. Yusran, Rahmadany. 2008. *Pemanfaatan Enzim Papain sebagai Penggumpal dalam Pembuatan Dangke.* Yogyakarta: Institut Sains & Teknologi AKPRIND.