International Journal of
Dairy Science

ISSN 1811-9743

Academic
Journals Inc.

www.academicjournals.com

OPEN ACCESS International Journal of Dairy Science

ISSN 1811-9743
DOI: 10.3923/ijds.2016.20.27

Research Article

Improvement Efforts of Sensory Quality and Preservation Cow's Milk Dangke with Addition Cow's Milk Fat and *Lactobacillus plantarum* Supernatant

Nining Arini, M.B. Sudarwanto, I. Sudirman and A. Indrawati

Department of Veterinary Public Health, Faculty of Veterinary Medicine, Jl. Agatis, Darmaga, University of Agriculture Bogor (IPB), Bogor 16680, Indonesia

Abstract

The research aimed to determine the Minimum Inhibitory Concentration (MIC) of *L. plantarum* supernatant in inhibiting the growth of *Staphylococcus aureus* ATCC 25923, determine the nutrients levels of cow's milk dangke and sensory quality after the addition of cow's milk fat 1 and 2% and determine the effect of the additional of *L. plantarum* supernatant against the growth of *S. aureus* ATCC 25923. Minimum inhibitory concentration is determined based on the lowest concentration of the supernatant that shown no growth in the media. This study used a Completely Randomized Design (CRD) with 2×2 factorial. Data of the growth of pathogenic bacteria was analyzed by ANOVA test and then continued by using Duncan test. The paired comparison test were used to determine sensory quality of cow's milk dangke and then analyzed by Wilcoxon Signed Rank test. This experiment proved that *L. plantarum* upernatant could inhibit the growth of *S. aureus* TCC 25923 at VJA medium with MIC 10% but not shown inhibiting the growth of *S. aureus* ATCC 25923 in dangke medium. The addition of cow's milk fat 1 and 2% into cow's milk dangke able to increase the fat content dangke although not equal with buffalo's milk dangke. The addition of cow's milk fat 1 and 2% into cow's milk dangke was able to improve the flavor of cow's milk dangke to be equivalent with buffalo's milk dangke. The addition of cow's milk fat 2% into dangke could improve the aroma of cow's milk dangke which equivalent to buffalo's milk dangke.

Key words: Dangke, *L. plantarum* supernatant, cow's milk fat, sensory quality

Received: October 27, 2015 **Accepted:** November 20, 2015 **Published:** December 15, 2015

Citation: Nining Arini, M.B. Sudarwanto, I. Sudirman and A. Indrawati, 2016. Improvement efforts of sensory quality and preservation cow's milk dangke with addition fat milk and *Lactobacillus plantarum* supernatant. Int. J. Dairy Sci., 11: 20-27.

Corresponding Author: Nining Arini, Department of Public Health, Institute of Health Science Indonesia Maju, Jl. Harapan N0. 50, Jakarta Selatan, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Dangke is a traditional food in Enrekang, South Sulawesi which made from buffalo's milk. Dangke is made by heating the milk, clotting and furtherly packaged using banana leaf. Hatta *et al.* (2013) reported that dangke made from buffalo's milk has more savory taste, smoother texture, softer and not sticky when ingested compared to cow's milk. This could be due to higher fat content contained in buffalo's milk. Buckle *et al.* (2007) reported that fat in buffalo's milk is twice higher than cow's milk.

Now, the market of dangke is not only in South Sulawesi but also marketed to Kalimantan, Jakarta, Papua, Malaysia and some other places where Enrekang society live in (Baba *et al.*, 2012). One of obstacles faced in marketing dangke is the shelf-life which is relatively very short. Dangke contains of pH 6.4 which generally can be stored only for two days at room temperature and 5-7 days at refrigerator temperature (Hatta *et al.*, 2013).

Contamination of dangke may occur due to the presence of pathogenic bacteria such as *Staphylococcus aureus*. Large amount of *S. aureus* is found in milk and its processing products including cheese (Nusrat *et al.*, 2015). It was reported that 10^5-10^8 CFU mL^{-1} of *S. aureus* may produce enterotoxin (Kamal *et al.*, 2013; Anunciacao *et al.*, 1995). Enterotoxin can resistance for 30 min at 110°C. Enterotoxin causes intoxication with symptoms of nausea, vomiting, abdominal cramps and diarrhoea (Nusrat *et al.*, 2015). According to Indonesian National Standard (Standar Nasional Indonesia) No. 7388 (SNI., 2009) regarding with cheese inspection, the maximum level of *S. aureus* is 1×10^2 colony per gram. Jayuska *et al.* (2014) reported that filtrate from Lactobacillus fermentation can inhibit the growth of pathogenic bacteria such as *Streptococcus* sp., *S. aureus* and *Escherichia coli.* The antibacterial capability of Lactobacillus filtrate doesn't change even it had been stored for 6 months. The addition of lactic acid in cheese manufacturing process is able to increase the coagulant activity (Carvalho *et al.*, 2007).

This research was designed as an effort to improve the sensory quality of dangke produced from cow's milk with the addition of 1 and 2% cow's milk fat so that it has flavor and texture be equivalent to buffalo's milk dangke, to determine the nutrient of dangke after addition of cow's milk fat, to determine the Minimum Inhibitory Concentration (MIC) of *L. plantarum* in inhibiting the growth of *S. aureus* ATCC 25923, and to study the influence of *L. plantarum* and cow's milk fat added into dangke in inhibiting the growth of *S. aureus* ATCC 25923.

MATERIALS AND METHODS

This research was carried out at the Laboratory of Kesmavet, Faculty of Veterinary and Laboratory of Organoleptic, Faculty of Farms (FAPET) in Bogor Agricultural University (IPB). *Staphylococcus aureus* ATCC 25923 collected by Laboratory of Kesmavet, Department IPHK, FKH-IPB and *L. plantarum* collected by Department PAU UGM were selected as the tested pathogenic bacteria. Culture media and material used in this research were Nutrient Broth/NB, Mueller-Hinton Broth/MHB, de man Rogosa and Sharpe Broth/MRSB, Vogel Johnson Agar/VJA (Oxoid, Oxoid Ltd., Basingstoke, United Kingdom) and API 50 CHL carbohydrate fermentation strips (bioMérieux, Inc., Marcy l'Etoile, France). Other materials used were: Cow's milk, buffalo's milk, papaya's latex, banana's leaf and coconut's shell as mold. Nine semi-skilled panelists were used for sensory quality test (Dzarnisa, 1999; Jinjarak *et al.*, 2006).

Lactobacillus plantarum isolate was confirmed by Gram staining, catalase test and API 50 CHL test to obtain pure culture. An identified *L. plantarum* isolate was inoculated into 100 mL MRSB and incubated at 37°C for 24 h (Usmiati and Marwati, 2007). Cell separation was performed by centrifugation at 10,000 rpm (rotation per minute) for 15 min. Supernatant was sieved using filter membrane 0.2 μm and furtherly stored at 4°C as stock.

Determination of Minimum Inhibitory Concentration (MIC): Determination of MIC was conducted by dilution method (Sari *et al.*, 2010). A total of 5 mL tested solution containing of NB, *L. plantarum* supernatant and 10^6 CFU mL^{-1} of pathogenic bacteria were placed into tube. Tested solution was made in several supernatant concentrations i.e., 0, 10, 20, 30, 40, 50, 60, 70, 80 and 90% and then incubated at 37°C for 24 h. Observation was performed in order to identify the bacteria growth which indicated by the presence of muddy condition at tested solution. About 0.1 mL was taken from each concentration of tested solution transferred into specific media for each bacteria type and incubated at 37°C for 24 h. The colony of bacteria was counted. The concentration with no growth of tested bacteria was defined as the Minimum Inhibitory Concentration (MIC) of *L. plantarum* supernatant.

Manufacturing of dangke: Cream was added into cow's milk until milk fat content was 1 and 2% (g/v) of a total milk volume. Fat content in cream was determined by Kieferle and Charlotte method (Sudarwanto, 2012). Milk was then heated with small fire until the temperature reached ±70°C. Curd

process was performed by adding papaya's latex during milk heating process. After reaching boiling stage, milk was cooled for 30 min and during this cooling process *L. plantarum* was added into solution. The next stage was to sieve the curd and inserted it into coconut shell mold and pressed used spoon to separate curd from whey. Dangke was then packed with banana's leaf.

Dangke proximate analysis: Proximate analysis was performed to determine the water content by gravimetric analysis, ash content by gravimetric analysis, fat content by hydrolysis-Soxhlet method, protein content by Kjeldahl micro (SNI., 1992; Geantaresa and Supriyanti, 2010), carbohydrate content (by difference) and pH (SNI., 1998; Rahayu *et al*., 2011).

Number of colonies of tested bacteria: Number of colonies was expressed as Colony Forming Unit (CFU) per gram or per milliliter or certain wide of sample (cm^2) (Haryadi *et al*., 2013). Counting was carried out in accordance with the Standard Plate Count (SPC) method. Counting of *S. aureus* ATCC 25923 was conducted by pour plate method using VJA medium.

Sensory analysis: Sensory analysis to evaluate dangke quality including color, texture, aroma and flavor was conducted. Dangke produced from buffalo's milk was used as comparison in this experiment. Sensory attributes were tested using paired comparison (Setyaningsih *et al*., 2010). Sensory test used 9 sensitive semi-skilled panelists (Dzarnisa, 1999; Jinjarak *et al*., 2006).

Data analysis: A Completely Randomized Design (CRD) with 2×2 factorials in time was applied in this experiment. The growth of pathogenic bacteria was analyzed by ANOVA test and followed by Duncan test if significance different occurred. Organoleptic data resulted from paired comparison test was analyzed by Wilcoxon Signed Rank.

RESULTS AND DISCUSSION

According to re-identification result on *L. plantarum* and *S. aureus* ATCC 25923, homogeny and pure colonies were found. Gram staining process against *L. plantarum* revealed that isolate was Gram-positive with a rod-shaped form, catalase-negative and could grow well at MRS agar medium. Identification using API test of 50 CHL system showed that the isolate was *L. plantarum* with validation of 99.9%. Identification against *L. plantarum* using API was also performed by Anas *et al*. (2014).

Table 1: Proximate analysis result of cow's milk dangke with the addition of *L. plantarum* and cow's milk fat 0, 1 and 2%

	Hasil uji proksimat			
Jenis uji	DSK	DSSL0	DSSL1	DSSL2
Kadar air (g/100 g)	45.65	60.65	58.39	59.10
Kadar abu (g/100 g)	1.77	1.940	1.72	1.61
Kadar lemak (g/100 g)	32.82	17.31	24.47	22.96
Kadar protein (g/100 g)	19.23	15.42	14.80	13.19
Kadar karbohidrat (g/100 g)	0.53	4.680	0.62	3.14
pH	6.65	6.510	6.08	6.11

DSK: Buffalo's milk dangke, DSSL0: Cow's milk dangke, DSSL1: Cow's milk dangke+cow's milk fat 1%, DSSL2: Cow's milk dangke+cow's milk fat 2%

Lactobacillus plantarum isolate was known having good adaptability in high acidity environment. Acid condition was caused by accumulation of lactic acid produced by bacteria during fermentation in a homo-fermentation type. This acid product is furtherly used as the active compound to preserve food (Askari *et al*., 2012). Cisarova *et al*. (2009) reported that acid which produced by *L. plantarum* is not only able to inhibit Gram-negative bacteria such as clostridium and enterobacteriaceae but also inhibit Gram-positive bacteria such as *S. aureus*.

Minimum inhibitory concentration of *L. plantarum* supernatant: During observation for 24 h, the growth of *S. aureus* ATCC 25923 was only found at tube 1 (0%) with the presence of muddy. In VJA medium, the growth of *S. aureus* ATCC 25923 was found at petri dish containing of tube 1 (0% concentration of *L. plantarum* supernatant) which indicated by black color colonies surrounded by metallic light yellow zone. All petri dish containing of tube 2-10 (*L. plantarum* supernatant with various concentration) showed no growth of *S. aureus* ATCC 25923. Thus, it can be indicated that the minimum inhibitory concentration of *S. aureus* ATCC 25923 was 10%.

Nutrient content of cow's milk dangke: The nutrient content of dangke measured in this experiment was: Water content, ash content, fat content, protein content, carbohydrate content and pH (Table 1).

Water and ash content: Water content is very important factor in determining cheese texture. The increasing water content will soften the texture. Dangke is one type of soft cheese as the water content is higher than 40% (Buckle *et al*., 2007). In this study, the water content of dangke is ±59%. The water content of dangke is influenced by the concentration of papaya's latex. Diouf *et al*. (2012) stated that increasing concentration of papaya's latex will reduce the water content

of dangke. The concentration of papaya's latex used in this research was 0.4% to avoid strong bitter taste when it is consumed (Yuniwati *et al*., 2008). Alkaloid carpaine in papaya's latex will produce bitter taste in dangke.

The water content of buffalo milk dangke was the lowest among the four types dangke (45.65%). The results reported in accordance with Murtaza *et al*. (2014) which shows that the buffalo's milk cheese has a lower water content than cow's milk cheese. The water content is influenced by the volume of solids dissolved in milk. The greater volume of dissolved solids in milk, the water content is getting smaller. Buffalo's milk dangke has the greatest of total solids followed by cow's milk dangke plus milk fat 1%, cow's milk dangke plus cow's milk fat 2% and last cow's milk dangke without adding cow's milk fat. Solids constituent materials in milk include fats, proteins, carbohydrates and minerals. Buffalo milk contains a higher fat and protein than cow's milk (Murtaza *et al*., 2014; Salman *et al*., 2014). Therefore the forming curd from buffalo milk was more when clotting protein by papain.

Fat content: The highest fat content found in buffalo's milk dangke (32.82%). This is caused by protein content of buffalo milk is higher than cow milk. Daulay (1991) stated that protein located in the outer layer of the fat globules membrane. The higher protein content in milk causes the milk fatmore bounded and retained in the curd. In addition, the size of fat globules and micellar casein buffalo milk is also greater than cow milk. Fat globule size of buffalo milk and cow milk respectively 5:05 and 3:55 μm and the casein micelles size of buffalo milk and cow's milk, respectively 190 and 180 μm (Hussain *et al*., 2012). This allows the fat out of buffalo milk curd is less than cow milk curd.

The addition of cow's milk fat was confirmed could increase fat content of dangke. This is shown by the increasing of fat content dangke after addition of 1 and 2% cow's milk fat. The lowest fat content found in cow's milk dangke without adding milk fat (17:31%). Dangke with addition of fat 2% was confirmed to have lower fat content compared with dangke with addition of cow's milk fat 1%. It is caused by fat particles out of the curd while heating. According to Abd El-Gawad and Ahmed (2011), fat content of cheese is influenced by the heating duration time and protein denaturation process. There is possibility that fat moves out from cheese during heating process at temperature above 80°C. Therefore, higher heating temperature or longer heating process will increase the possibility of fat moves out from curd and dissolved in whey.

Protein content: The highest protein content found in buffalo's milk dangke (19.23%). This is caused by protein content of buffalo milk is higher than cow milk, so curd formed was more. Cow's milk dangke with 2% cow's milk fat has the lowest protein content (13.19%), while dangke without adding milk fat has 15.42% protein content. This revealed that addition of cow's milk fat did not increase the protein content of dangke. Formed-curd is closely related with the coagulation process of milk protein to curd. This stage is the most difficult process to be controlled due to complex interaction which occurs among milk quality, heating temperature, milk volume, solid volume, pH, coagulant type, number and coagulation duration (Syah, 2012).

Carbohydrate content: The highest levels of carbohydrate found in cow's milk dangke without addition of cow's milk fat (4.68%), followed by cow's milk dangke plus cow's milk fat 2%, cow's milk dangke with cow's milk fat 1% and buffalo's milk dangke (respectively 3.14, 0.62 and 0.53%). The results showed that overall buffalo's milk dangke has a lower carbohydrate than cow's milk dangke. The results reported in accordance with Barlowska *et al*. (2011) that the lactose content of milk cow (*Bos taurus*) higher than buffalo milk (*Babalus bubalis*), respectively 4.82 and 4.79%. But it is not in accordance with the results reported Murtaza *et al*. (2014) that the lactose content in buffalo's milk cheese is higher than cow's milk cheese, (respectively 12.16 and 12.13%). Salman *et al*. (2014) and Hussain *et al*. (2012) reported that the lactose content of cow milk is only slightly higher than buffalo milk.

Lactose is a type of carbohydrate that provides a sense of sweet milk that is also called milk sugar. Most lactose left in the whey during curd formation. The lactose approximately 98% dissolved in whey and curd still contains 0.8-1.5% of lactose. Based on the results of measurements of the levels of carbohydrates in this study, it was found the addition of cow's milk fat 1% and into dangke 2% did not show elevated levels of lactose. Dangke lactose content is related directly to the water content. If the water content of dangke is high, lactose content is high too.

pH: All types of dangke the range of pH close to neutral. The highest pH found in buffalo's milk dangke (6.65). Although the processing of cow's milk dangke added with *L. plantarum* supernatant (pH was 3.8) but the milk is able to maintain the pH conditions so there is no significant decline. That is caused by natural buffer compounds (phosphate, citric and protein) dissolved in milk.

Influence of addition of *L. plantarum* supernatant and cow's milk fat (1 and 2%) on the colonies number of *S. aureus* ATCC 25923: Colonies number of *S. aureus* ATCC 25923 as resulted from counting (Table 2 and Fig. 1) was then

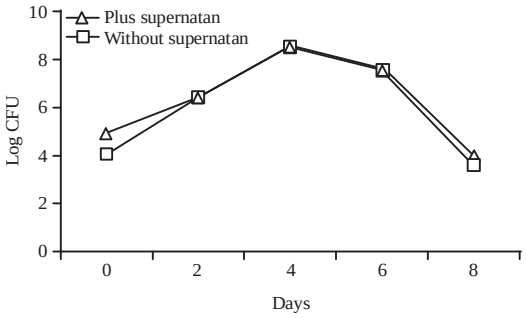

Fig. 1: Interaction between the addition of *L. plantarum* supernatant with incubation time of dangke on number colonies of *S. aureus* ATCC 25923 (Log CFU)

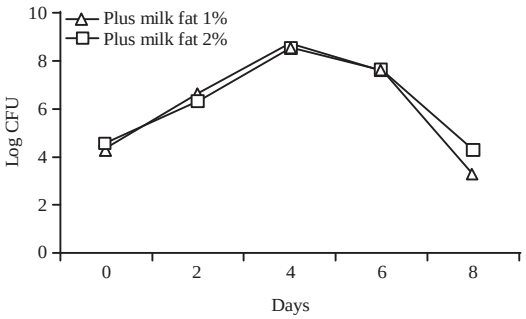

Fig. 2: Interaction between fat addition with dangke incubation time on number of colonies of *S. aureus* ATCC 25923 (Log CFU)

Table 2: Interaction between addition of *L. plantarum* supernatant with incubation time on the number of *S. aureus* ATCC 25923 colonies (Log CFU)

	Incubation time (days)				
Treatment	0	2	4	6	8
With supernatant	4.95^{D}	6.47^{C}	8.56^{A}	7.70^{B}	4.05^{C}
Without supernatant	4.05^{E}	6.40^{C}	8.53^{A}	7.55^{B}	3.60^{E}

^{A,B,C,D,E}Different superscript at the same row indicates significant different at alpha 5% (Anova test)

Table 3: Interaction between fat content with incubation time on the number of *S. aureus* ATCC 25923 colonies (Log CFU)

	Incubation time (days)				
Treatment	0	2	4	6	8
Fat 1%	4.41^{D}	6.58^{C}	8.63^{A}	7.68^{B}	3.37^{E}
Fat 2%	4.59^{D}	6.29^{C}	8.46^{A}	7.58^{B}	4.27^{E}

^{A,B,C,D,E}Different superscript at the same row indicates significant different at alpha 5% (Anova test)

analyzed with Anova test (alpha 5%). The analysis result showed that significant factors which influence the number of bacteria colonies were: Addition of *L. plantarum* supernatant, incubation time (day), interaction between addition of *L. plantarum* supernatant with the time and addition of cow's milk fat with the time. However, factors which not influence the number of bacteria colonies were: addition of cow's milk fat (1 and 2%), interaction between addition of *L. plantarum* supernatant with addition of cow's milk fat 1 and 2% and interaction between addition of *L. plantarum* supernatant and cow's milk fat with the time.

The result of Duncan test on the effect of *L. plantarum* supernatant showed that addition of *L. plantarum* supernatant produced larger number of *L. plantarum* colonies. This indicated that addition of *L. plantarum* supernatant couldn't inhibit the growth of *S. aureus* ATCC 25923 in dangke. Based on *in vitro* observation (stage 1), the addition of *L. plantarum* supernatant could inhibit the growth of *S. aureus* ATCC 25923 with concentration was 10% at NB medium. However, this observation hasn't yet provided similar effect at dangke medium. This different inhibitory capability could be due to different pH of those two mediums. At medium NB, pH solution closed to pH supernatant i.e., 3.8. This acid condition is able to break down bacteria membrane and creates acid condition at cell environment leading to H^+ ion moves from bacteria cell. The changes of pH of the bacteria cell leads to metabolic disorder and cell mortality. Immersion of dangke in *L. plantarum* supernatant caused small changes of pH from 6.5 to 6.1 (Table 1). Milk contain several compounds such as calcium, phosphate, citrate and protein are dissolved which role as natural buffer. This also had been reported by Carvalho *et al.* (2007) that soft cheese has pH 6.5 even with the addition of lactic acid during processing. Based on the observation, dangke with pH $\pm$6 allowed *S. aureus* ATCC 25923 experienced optimum growth. Radovanovic and Katic (2009) reported that at skim milk medium, growth of *L. plantarum* only changes pH from 6.63 to 6.52. That increasing pH hasn't yet inhibited the growth of *S. aureus* at skim milk. Fang and Liu (2002) also reported that antimicrobe capability of several lactic acid bacteria (*L. acidophilus*, *L. bulgaricus*, *L. casei* and *Streptococcus thermophilus*) against *S. aureus* decreases when the medium is near to neutral pH.

Based on the Duncan test, the interaction between the addition of cow's milk fat and time on the growth of tested bacteria showed that addition of 1% cow's milk fat supported higher growth of *S. aureus* ATCC 25923 at 2nd, 4th and 6th days compared to addition of fat 2% (Table 3 and Fig. 2). This indicated that dangke with fat 1% gave higher support on the growth of *S. aureus* ATCC 25923 compared to addition of cow's milk fat 2%. Proximate test resulted that dangke with cow's milk fat 1% had higher protein content than addition of cow's milk fat 2%. Harris *et al.* (2002) reported that *S. aureus* can grow well in a medium with high nitrogen as organic nutrient source.

Table 4: Paired comparison test result

Parameters	Total panelist	103	234	Buffalo milk dangke
Color	9	-1.1[a]	-0.9[a]	Greenish white
Aroma	9	-0.6[a]	0.4[a]	Milk-like flavor
Texture	9	-0.8[a]	-0.6[a]	Chewy
Flavor	9	0.2[a]	-0.1[a]	Sweet savory

alpha 5% (Wilcoxon Signed Rank test), 103: Cow's milk dangke+cow's milk fat 1%, 234: Cow's milk dangke+cow's milk fat 2%

Table 5: Sensory paired comparison test score between cow's milk dangke and buffalo's milk dangke

	Organoleptic parameters			
Score	Color	Texture	Aroma	Flavor
+3	Extremely more white	Extremely more chewy	Extremely more distinctive milk flavor	Extremely more savory
+2	More white	More chewy	More distinctive milk flavor	More savory
+1	Rather more white	Rather more chewy	Rather more distinctive milk flavor	Rather more savory
0	Not different	Not different	Not different	Not different
-1	Rather less white	Rather less chewy	Rather less distinctive milk flavor	Rather less savory
-2	Less white	Less chewy	Less distinctive milk flavor	Less savory
- 3	Extremely less white	Extremely less chewy	Extremely less distinctive milk flavor	Extremely less savory

Dangke paired comparison test result

Color: The result of Wilcoxon Signed Rank on the color of cow's milk dangke added with cow's milk fat 1% (103) and 2% (234) showed no significant different (Table 4). The average value of dangke 103 and 234 was -1.1 (-1) and -0.9 (-1), respectively which showed that cow's milk dangke was less white than buffalo milk dangke (Table 5).

White color on dangke is produced from light dispersion of fat, protein and mineral granules in milk. Milk casein evenly deflects the entire color of milk so it turns white. According to Hussain *et al*. (2012), casein content in buffalo's milk is higher than cow's milk i.e., 3.82 and 2.64%, respectively. Besides, cow's milk has higher β-carotene compared to buffalo's milk. Therefore, the color of cow's milk is more yellowish.

Aroma: The result of Wilcoxon Signed Rank on the aroma of cow's milk dangke added with cow's milk fat 1% (103) and 2% (234) showed no significant different (Table 4). The average value of dangke 103 was -0.6 (-1). That number indicated that cow's milk dangke added with cow's milk fat 1% had less distinctive milk flavor than buffalo's milk dangke. The average value of dangke 234 was -0.4 (0) (Table 5). This indicated that aroma of cow's milk dangke added with cow's milk fat 2% was not significantly different with buffalo's milk dangke.

Milk aroma is influenced by volatile compound content. According to Friedrich and Acree (2015), buffalo milk contains of indole, nonanal and 1-oktentriol compound which make the aroma is stronger than cow's milk. However, milk heating process changes the aroma profile. Volatile compound disappears after milk processed into cheese. Volatile compounds found in various types of cheese are 1-oktentrion, metional and 3-metilbutanal.

Texture: The result of Wilcoxon Signed Rank on the texture of cow's milk dangke added with cow's milk fat 1% (103) and 2% (234) showed no significant different (Table 4). The average value of dangke 103 and 234 was -0.8 (-1) and -0.6 (-1) (Table 5). This indicated that the texture of those two dangke was less chewy compared to buffalo's milk dangke. Hussain *et al*. (2012) reported that micrograph detection finds that the curd texture from buffalo's milk is thicker with denser porous compared to cow's milk. This could be due to fat and protein content of buffalo's milk is higher than cow's milk leading to higher curd. Besides, the globule size of fat and micellar casein of buffalo's milk is larger than cow's milk i.e., 5.05 and 3.55 μm; 190 and 180 μm, respectively.

Flavor: The result of Wilcoxon Signed Rank on the flavor of cow's milk dangke added with cow's milk fat 1% (103) and 2% (234) showed no significant different (Table 4). The average value of dangke 103 was 0.2 (0) (Table 5). This indicated that the flavor of cow's milk dangke was not significantly different with buffalo's milk dangke. The average value of dangke 234 was 0.1 (0). This indicated that the flavor of cow's milk dangke was not significantly different with buffalo's milk dangke. Flavor of dangke is closely related with the nutrient content. Sweet flavor of dangke is produced from lactose and salty flavor is derived from chloride, citrate and other mineral salts (Buckle *et al*., 2007). A combination between sweet and salty flavor produces savory taste on dangke.

CONCLUSION

This experiment proved that *L. plantarum* supernatant could inhibit the growth of *S. aureus* ATCC 25923 at VJA medium with MIC 10% but couldn't inhibit the growth of

S. aureus ATCC 25923 at dangke medium. The addition of cow's milk fat 1 and 2% into cow's milk dangke able to increase the fat content dangke although not equal with buffalo's milk dangke.

The addition of cow's milk fat 1 and 2% into cow's milk dangke was able to improve the flavor of cow's milk dangke to be equivalent with buffalo's milk dangke. The addition of cow's milk fat 2% into cow's milk dangke could improve the aroma of cow's milk dangke which equivalent to buffalo's milk dangke. The addition of cow's milk fat 1 and 2% into cow's milk dangke couldn't improve the quality of color and texture of cow's milk dangke.

REFERENCES

Abd El-Gawad, M.A.M. and N.S. Ahmed, 2011. Cheese yield as affected by some parameters: Review. Acta Scientiarum Polonorum. Technologia Alimentaria, 10: 131-153.

Anas, M., K. Ahmed and K. Mebrouk, 2014. Study of the antimicrobial and probiotic effect of *Lactobacillus plantarum* (P6) isolated from raw goat's milk from the region of Western Algeria. World Applied Sci. J., 32: 1304-1310.

Anunciacao, L.L.C., W.R. Linardi, L.S. do Carmo and M.S. Bergdoll, 1995. Production of staphylococcal enterotoxin A in cream-filled cake. Int. J. Food Microbiol., 26: 259-263.

Askari, G.A., A. Kahouadji, K. Khedid, R. Charof and Z. Mennane, 2012. Screenings of lactic acid bacteria isolated from dried fruits and study of their antibacterial activity. Midd-East J. Scient. Res., 11: 209-215.

Baba, S., M.I. Dagong, A. Ako, A. Sanusi and A. Muktiani, 2012. [Complete feed production of with local and cheap raw through application of participatory technology development for increase milk dangke in Enrekang District]. Pros. Ins., pp: 324-330.

Barlowska, J., M. Szwajkowska, Z. Litwinczuk and J. Krol, 2011. Nutritional value and technological suitability of milk from various animal species used for dairy production. Compr. Rev. Food Sci. Food Saf., 10: 291-302.

Buckle, K.A., R.A. Edwards, G.H. Fleet and M. Wootton, 2007. Ilmu Pangan [Food Science]. Universitas Indonesia Press, Jakarta.

Carvalho, J.D.G., W.H. Viotto and A.Y. Kuaye, 2007. The quality of Minas Frescal cheese produced by different technological processes. Food Control, 18: 262-267.

Cisarova, B., H. Koscova, J. Dubajova, D. Mlynarcik and M. Bukovsky, 2009. Probiotic characteristics of newly isolated strains of *Lactobacillus plantarum*. Tomus, 56: 54-66.

Daulay, D., 1991. Fermentasi Keju [Cheese Fermentation]. Inter-University Center for Food and Nutrition, IPB Press, Bogor.

Diouf, L., A.N. Mallaye, M. Mbengue, A. Kane and A. Diop, 2012. *Carina papaya* leaves: A substitute for animal rennet in cheese-making tradition. J. Nat. Prod. Plant Res., 2: 517-523.

Dzarnisa, 1999. Flavor dan kualitas dadih susu sapi yang dipasteurisasi dan disimpan pada suhu kamar dan lemari es [Flavor and quality of pasteurized cow's milk dadih and stored at room temperature and refrigerator]. [Dissertation]. Institut Pertanian Bogor, Bogor.

Fang, H.H.P. and H. Liu, 2002. Effect of pH on hydrogen production from glucose by a mixed culture. Bioresour. Technol., 82: 87-93.

Friedrich, J.E. and T.E. Acree, 2015. Gas chromatography olfactometry (GC/O) of diary product. Department of Food Science and Technology, Cornell University, New York, pp: 1-18.

Geantaresa, E. and F.M.T. Supriyanti, 2010. [Utilization of crude extract papain as a coagulant in the manufacture of cottage cheese using *Streptococcus thermophillus*, *Lactococcus lactis* and *Leuconostoc mesentroides*]. J. Sains Dan Tek. Kim., 1: 38-43.

Harris, L.G., S.J. Foster and R.G. Richards, 2002. An introduction to *Staphylococcus aureus* and techniques for identifying and quantifying *S. aureus* adhesins in relation to adhesion to biomaterials: Review. Eur. Cells Mater., 4: 39-60.

Haryadi, Nurliana and Sugito, 2013. [The value of pH and total of lactic acid bacteri of goat milk kefir after fermented by various concentration of sugar and different length of incubation]. J. Med. Vet., 7: 4-7.

Hatta, W., M. Sudarwanto, I. Sudirman and R. Malaka, 2013. Prevalence and sources of contamination of *Escherichia coli* and *Salmonella* spp. in cow milk dangke, Indonesian fresh soft cheese. Global Veterinaria, 11: 352-356.

Hussain, I., A.E. Bell and A.S. Grandison, 2012. Rheology and microstructure of mozzarella type curd made from buffalo and cows' milk. Ann. Trans. Nordic Rheol. Soc., 20: 133-140.

Jayuska, A., H. Khoiriyah and P. Ardiningsih, 2014. [Determination of optimum incubation time bacteriocin activity of *Lactobacillus* sp. RED4]. J. Kim. Khat., 3: 7-12.

Jinjarak, S., A. Olabi, R. Jimenez-Flores, I. Sodini and J.H. Walker, 2006. Sensory evaluation of whey and sweet cream buttermilk. J. Dairy Sci., 89: 2441-2450.

Kamal, R.M., M.A. Bayoumi and S.F.A. Abd El Aal, 2013. MRSA detection in raw milk, some dairy products and hands of dairy workers in Egypt, a mini-survey. Food Control, 33: 49-53.

Murtaza, M.A., N. Huma, A. Sameen, M. Saeed and M.S. Murtaza, 2014. Minerals and lactic acid contents in buffalo milk cheddar cheese; a comparison with cow. J. Food Nutr. Res., 2: 465-468.

Nusrat, J., T.N. Ifra and A. Mrityunjoy, 2015. Detection of methicillin-resistant *Staphylococcus aureus* within raw milk and cheese samples. Int. Food Res. J., 22: 2629-2633.

Radovanovic, R.S. and V. Katic, 2009. Influence of lactic acid bacteria isolates on *Staphylococcus aureus* growth in skimmed milk. Bulg. J. Agric. Sci., 15: 196-203.

Rahayu, W.P., F. Kusnandar and W.E. Prayitno, 2011. Stability of viable counts of lactic acid bacteria during storage of goat milk soft cheese. Microbiol. Indonesia, 5: 149-153.

SNI., 1992. Cara uji makanan dan minuman [Food and drink test method]. Standar Nasional Indonesia (ID). 01.2891. Badan Standardisasi Nasional, Jakarta.

SNI., 1998. Metode pengujian susu segar/rev [Milk test method]. Standar Nasional Indonesia (ID). 01.2782. Badan Standardisasi Nasional, Jakarta.

SNI., 2009. Batas maksimum cemaran mikroba dalam pangan [The maximum limit of microbial contamination in food]. Standar Nasional Indonesia (ID). 7388. Badan Standardisasi Nasional, Jakarta.

Salman, M., M. K haskheli, Israr-Ul-Haq, A.R. Talpur and A.P. Khuhro *et al*., 2014. Comparative studies on nutritive quality of buffalo and cow milk. Int. J. Res. Applied Nat. Social Sci., 2: 69-78.

Sari, Y.D., S.N. Djannah and L.H. Nurani, 2010. [Antibacterial activity test of the soursop leaves (*Annona muricata* L.) infuse *in vitro* against *Staphylococcus aureus* ATCC 25923 and *Escherichia coli* ATCC 35218 as well as thin layer chromatography profiles]. J. Public Health, 4: 218-232.

Setyaningsih, D., A. Apriyantono and M.P. Sari, 2010. Analisis Sensori untuk Industri Pangan dan Agro [Sensory Analysis for Food Industry and Agro]. IPB Press, Bogor, Indonesia.

Sudarwanto, M., 2012. Pemeriksaan Susu dan Produk Olahannya. PT. Penerbit IPB Press, Jakarta, Indonesia, ISBN: 978-979-493-425-8 Pages: 208.

Syah, D., 2012. Pengantar Teknologi Pangan [Food Technology Introduction]. IPB Press, Bogor.

Usmiati, S. and T. Marwati, 2007. [Selection and optimization of production processes bacteriocins from *Lactobacillus* sp.]. J. Pasc., 4: 27-37.

Yuniwati, M., Yusran and Rahmadany, 2008. [Papain enzyme utilization as a coagulant in the dangke manufacture]. Seminar Nasional Aplikasi Sains dan Teknologi. IST AKPRIND. Yogyakarta.