The comparison of fatty acid and cholesterol profile on fresh and mozarella cheese made by pampangan buffalo milk

H Rizqiati*, Nurwantoro and S Mulyani
Food Technology Department, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Indonesia

*E-mail: henirizqi@gmail.com

Abstract. This research aimed to investigate the composition of fatty acid and cholesterol profile of Fresh and Mozarella Cheese from Pampangan Buffalo Milk. Material of this research was Pampangan buffalo milk and Mozarella cheese made from buffalo milk. Fatty acids composition were analyzed by [1] method. Result showed the major saturated fatty acid found in milk and Mozzarella cheese Pampangan buffalo milk were palmitic, stearic and miristic acid while the unsaturated fatty acid was oleic acid. The total amount of fatty acid in Mozarella cheese was lower than those in Pampangan buffalo milk.

Keyword: Buffalo milk, mozarella, fatty acids, cholesterol profile

1. Introduction
Buffalo milk was consumed by Pampangan’s people, which is has a different nutrition with cow milk. [2] claimed that buffalo milk contain of 17.7% total solid, 7.3% fat, 5% protein, 4.6% lactose and 0.9% ash. [3] reported that buffalo milk has different compositions with cow’s milk, because total solid, fat, protein, fat, lactose, mineral, and ash are higher than cow’s milk. [4] explained that buffalo milk contained higher saturated fatty acids (palmitic and lauric) and lower mono-unsaturated fatty acid than cow milk in the same condition.

Milk fatty acid has been contributed in specific flavor, as a source of short chain-fatty acids (C6:0, C8:0, C10:0) which is made buffalo’s milk become easy to absorb. Buffalo milk fatty acids produced energy and activated all of endocrine gland, organ, also body tissue without forming cholesterol and adipose tissue [5]. A higher of Medium chain-fatty acid in buffalo milk has a bacteriostatic effect.

The purpose of processing is to create or increase the flavor and nutrition, give an added value, produce a new product and extended the product’s shelf-life. Buffalo’s milk is a main material in mozarella cheese making because buffalo milk has a good nutrition. The making process of mozarella cheese is complex which is start with coagulation (K-casein was broke down by renet enzyme), aglomeration (produced similar protein mass) and water-released. During the process, fat maintained the membrane integrity and protein trapped in fat membrane also formed the cheese matrix [6]. [7] reported that Mozarella cheese has a 46.0% water content, 23.0% fat, 43.0% total solid fat and 1.2% salinity. In the making process of Mozarella cheese, fat degradated into fatty acids. Fatty acid in milk
in directly contributed to the aroma of cheese, however fatty acids have a role to form volatile compound through the metabolism of fatty acids [8].

This research aim to analyze total and type of fatty acid also cholesterol profile in fresh milk and mozzarella cheese from Pampangan’s buffalo milk.

2. Metodology

2.1. Material and Method

This research use milk and Mozzarella cheese from Pampangan’s buffalo milk, obtained from Rambutan- Pampangan subdistric in Lampung. This research be held in Baranang Siang IPB Laboratory Bogor.

2.2. Experimental Procedure

This research has been analyzed the concentration and type of fatty acids, also cholestrol in milk and Mozzarella cheese from Pampangan’s buffalo milk. Fatty acid analyzing is using gas chromatography through the procedure in IPB Laboratory which is following the [1].

2.3. Data Analysis

Fatty acid was identified by descriptive analyzed and compared with the previous research.

3. Result and Discussion

Total concentration of Pampangan buffalo milk’s fatty acid and Mozzarella cheese were recorded in Table 1. Total concentration of Fatty acid in Pampangan buffalo’s milk (52.22%) is higher than Mozzarella cheese (46.53%).

| Fatty Acids         | Concentration (%) | Buffalo Milk | Mozzarella Cheese |
|---------------------|-------------------|--------------|-------------------|
| Caproic. C6:0       | 1.31              | 0.86         |
| Caprilic. C8:0      | 0.33              | 0.325        |
| Capric. C10:0       | 0.65              | 0.65         |
| Lauric. C12:0       | 0.96              | 0.95         |
| tridekanoat. C13:0  | 0.14              | 0.125        |
| miristic. C14:0     | 6.56              | 5.96         |
| pentadekanoat. C15:0| 1.81              | 1.155        |
| palmitat. C16:0     | 23.90             | 20.695       |
| heptadekanoat. C17:0| 1.03              | 0.93         |
| stearat. C18:0      | 14.37             | 14.28        |
| arakidat. C20:0     | 0.23              | 0.225        |
| heneikosanoat. C21:0| 0.09              | 0.12         |
| behenat. C22:0      | 0.52              | 0.115        |
| trikosanoat. C23:0  | 0.13              | 0.145        |
| lignoserat. C24:0   | 0.15              | 0.86         |
| Total               | 52.22             | 46.535       |
The final result shown some type of unsaturated fatty acids in fresh milk and Mozarella cheese from Pampangan’s buffalo milk, such as lauric, miristic, palmitic, stearic, caproic, caprilic, capric, tridekanoat, arakidat, heneikosanoat, behenat, trikosanoat dan lignoseratrasi in different concentration. The highest concentration of saturated fatty acid in fresh milk and Mozarella cheese are palmitic, stearic, and miristic. [4] reported that buffalo’s milk fatty acid contained of stearic and palmitic which is contributed to specific taste and aroma. [9] explained the highest concentration of fatty acid in buffalo’s milk are palmitic, miristic and stearic acid. Saturated fatty acid’s percentage in buffalo’s milk is higher than cow’s milk [10].

Miristic fatty acid (C14:0) has a role in increasing the High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL), antioxidant, prevent the oxidation of LDL and protect from microbe infection [11].

Buffalo milk’s short chain fatty acids produced energy and activated all of endocrine gland, organ, also body tissue without forming cholesterol and adipose tissue [5]. Milk’s fatty acid composition influenced by factors, such as lactation periods [12], type of buffalo [4] and feed composition [13].

In the making process of cheese involved curd forming with milk acidification and protease addition, so the process resulted the positive respond of fatty acid in milk and Mozarella cheese from buffalo milk. Milk fatty acid produced by lipolysis of fatty acid [8]. In this research, total fatty acid of Mozarella cheese is lower than Pampangan buffalo’s milk. [5] reported that lypolisis not always increase the certain fatty acid. Lypolisis is chemical reaction which is produced the flavor of milk product. Therefore, the primer total of milk’s fatty acid influenced the total fatty acid during the making process of Mozarella cheese.

| Fatty Acid                  | Buffalo Milk | Mozarella Cheese |
|-----------------------------|--------------|-----------------|
| miristoleinat. C14:1        | 0.04         | 0.355           |
| palmitoleinat. C16:1        | 1.91         | 1.615           |
| oleic. C18:1n6c             | 23.37        | 21.395          |
| linoleat. C18:2n6c          | 0.76         | 0.725           |
| linolenat. C18:3n3          | 0.33         | 0.02            |
| Cis-11-Eikosenoat. C20:1    | -            | 0.36            |
| Cis-11-14- Eikosedienoat. C20:2 | -        | 0.07            |
| Cis -8.11.14 Eicosetrinoar . C20:3n6 | -     | 0.035           |
| arakidonat. C20:4n6         | 0.04         | 0.06            |
| Cis-5.8.11.14.17 Eikosapentaenoat. C20:5n3. | 0.04 |               |
| EPA                         |              | 0.05            |
| nervonat. C24:1             | 0.05         | 0.035           |
| Total                       | 26.91        | 24.72           |

Unsaturated fatty acid which is detected in fresh milk and Mozarella cheese from Pampangan’s buffalo milk are miristoleic, palmitoleic, oleic, linoleic, linolenat, eikosanoat, arakidonat and eikosapentanoat shown in Table 2. Concentration of unsaturated fatty acid in Mozarella cheese is
lower than Pampangan’s buffalo milk. [8] explained that milk’s processing did not influence the fatty acid’s composition. Unsaturated fatty acid in food materials related to food’s spoilage. Unsaturated fatty acid not easily oxidized.

There is a tendency of decreasing in cholesterol during processing of Pampangan’s buffalo milk into Mozarella cheese. The result shown cholesterol in milk and Mozarella cheese are 1.96% and 1.04. Fat’s composition which is influenced the cholesterol is lypolisis. [6,9] explained that lauric acid (C12:0), palmitic acid (C16:0) and miristic acid (C14:0) increased the serum cholesterol. Oleic acid (C18:1), linoleic acid (C18:3), and α-linoleic acid (C18:3) decreased the serum cholesterol.

4. Conclusion
Pampangan buffalo milk has a higher fatty acid than mozarella cheese. Type of fatty acid which is identified in milk and mozarella has a similarity, however the concentration is different. There was a tendency of decreasing in cholesterol during buffalo milk processing into mozarella cheese.

Acknowledgments
Our research is funded by The Directorate of Research and Devotion to community of The Ministry of Higher Education and Culture, through the BOPTN 2014.

References
[1] AOAC 2007 Official Methods of Analysis of AOAC International 18th ed. Assoc. Off. Anal. Chem., Arlington
[2] Han XF, Lee L, Zhang L, Guo MR 2012 Chemical composition of water buffalo milk and its low-fat symbiotic yogurt development Functional Food in Health and Disease 2 (4) 86–106
[3] Paulina G, Nudda A. 2004. Milk Production Dairy Sheep Nutrition Wallingford ed Pulina G and Bencini R ((GB): CABI Publishing) pp 1-12
[4] Talpur FN, Memon N N and Bhanger M I 2007 Comparison of fatty acid and cholesterol content of Pakistani water buffalo breeds Pak. J. Analytical and Environ. Chem. 8 15
[5] Murray M 2000 Mechanisms of inhibitory and regulatory effects of methylenedioxyphenyl compounds on cytochrome P450-dependent drug oxidation Curr Drug Metab 1 67–84
[6] Pereira CI, Gomes AMP, Malcata XF 2009 Microstructure of cheese: Processing, technological and microbiological considerations Review Trends Food Sci Technol 20 213–19
[7] McMahon DJ 2007 Product Specifications : Mozzarella Cheese Specification No. 603. McMahon Food Global Marketers.
[8] Bisig W, Eberhard P, Collomb M and Rehberger B 2007 Review - Influence of processing on the fatty acid composition and the content of conjugated linoleic acid in organic and conventional dairy products – a review Lait 87 1–19
[9] Mihaylova G and Peeva T 2007 Tran’s FA and conjugated linoleic acid in the buffalo milk. Italian J. of Animal Sci. 6 1056–59
[10] Adnan M 1995 Food fat and problems. Gadjah Mada University, Yogyakarta. In Zulaikhah S R 2001 Characteristics of cheese from different starter concentration and long curing with abomasum sheep (Thesis) Master Programme Gadjah Mada University, Yogyakarta
[11] German JB and Dillar CJ 2004 Saturated fats: what dietary intake? Am. J. Clin. Nutr. 80 550–59
[12] Qureshi MS, Mushtaq A, Khan S, Habib G and Swati ZA 2007 Variation in milk fatty acids composition with body condition in dairy buffaloes (Bubalus bubalis. Asian Aust J Anim Sci 23: 340–345
[13] Patiño EM, Judis MA, Guanziroli CS, Pochon DO, Cedres JF and Doval MM 2008 Determination of milk fatty acids in buffaloes (Bubalus bubalis) from Corientes, Argentina Revista Veterinaria. 19 28–32