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CHARACTERISTICS OF PAMPANGAN BUFFALO MILK AT SOUTH SUMATERA INDONESIA

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ABSTRACT

This study was obtained to investigate the physical, chemical and microbial characteristic of Pampangan buffalo milk. As much of 20 buffalo milk samples were utilized. The samples were taken from Pampangan and Rambutan sub-district, Ogan Komering Ilir regency, South Sumatra province. Physical, chemical characteristics Total Plate Count (TPC), amino acid and fatty acid were analyzed by following the methods described in AOAC 2007 [1]. The results showed that buffalo milk has the average value of density, moisture content, fat, protein, ash, non fat dry material and TPC is 1.035 $g.ml^{-1}$, 79.01%, 9.79%, 5.73%, 0.85%, 11.19% and 5.49 log cfu. ml^{-1} respectively. Pampangan buffalo milk has typical milk flavor, white color, and sweet taste. It contains 15 amino acids which the highest amino acid concentration is glutamic acid. The highest concentration of saturated fatty acids are palmitic acid, stearic and myristic, whereas the highest concentration of unsaturated fatty acids is oleic acid.

1. INTRODUCTION

Buffalo (*Bubalusbubalis*) is a ruminant animal that has a high potential as an animal origin protein food sources. Buffalo can beutilized as farm field plower, transportation, as a source of meat and milk. Buffalos in habitant in Indonesia are generally divided into two groups: buffalo river (river buffalo) and swamp buffalo or mud buffalo (swamp buffalo). Buffalo River is widely available in North Sumatra, named Murrah buffaloes, and are reared by people of Indian descent and used as a milk producer. Swamp buffalo scattered throughout Indonesia used as working animals, then be slaughtered as meat sources [2]. Pampangan buffalo is one type of swamp buffalo whichis native species of South Sumatra. Buffalo Pampangan farming is swamp land utilization which is a business that has long hereditary done for milk and meat production.

Buffalo milk is known to contain different nutrients compare to cow's milk. Buffalo milk is believed contain high nutritional value and has great economic value. According to [3] buffalo milk has a total solid content of 17.7%, 7.3% fat, 5% protein, 4.6% lactose and 0.9% ash. Based on the chemical composition, buffalo milk is different from cow's milk because of the total solid content, fat, protein, lactose, minerals and ash higher than that of cow's milk [4].

Scientific information about Pampangan buffalo milk has not been widely published. Different farming area and environment, feeding system and management of Pampangan buffalo are expected to affect the milk quality that produced. This study was conducted to investigate the quality of Pampangan buffalo milk, including the physical, chemical, microbiological, amino acids and fatty acid.

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Data quality Pampangan buffalo milk has not been widely publicized. Pampangan buffalo are kept in several different locations, way of feeding and the different maintenance procedures are expected to affect the quality of the milk. This study was conducted to analyze the quality of buffalo milk Pampangan, including physical, chemical, microbiological, amino acids and fatty acids.

2. MATERIALS AND METHODS

2.1. Milk samples

A total of 20 Pampangan buffalo fresh milk samples were collected from the district and sub-district Rambutan Pampangan, Ogan komering Ilir regency, South Sumatra province. Research was conducted at the Laboratorium. Samples were obtained by taking a fresh Pampangan buffalo milk of 10 buffaloes each sites, taken in the morning milking time. Each buffalo milk production per cow were recorded and sampled for the milk quality testing.

2.2. Analysis procedures

The physical, chemical and Total Plate Count (TPC) analysis was performed according to standard method for the examination of milk product described in AOAC 2007 [1]. Amino acids were analyzed using HPLC, according to the procedure proposed in AOAC 2007 [1]. Amino acid was released by hydrolysing the samples with 6N HCl. Protein hydrolysates was then diluted with sodium cytrate buffer and each amino acid fractions were separated by using HPLC. Protein extraction was performed by using Kjehdahl method. Amino acid identification data result were analyzed descriptively and compared with the data from previous research.

Fatty acids were analyzed by using Gas chromatography according to the procedure described in the AOAC 2007 method [1]. The fat in the samples was extracted using soxhlet method to get the fatty acid methyl ester (FAME). After esterified into FAME, gas chromatograph was used to analyze the fatty acids that content in the samples. The identified fatty acids data were descriptively analyzed and compared with the data from previous study.

3. RESULTS AND DISCUSSION

3.1. Pampangan buffalo milk quality

Milk is not only has a complex chemical compounds, but also naturally has a very complex physical properties. The physical, chemical and Total Plate Count (TPC) characteristic is shown in Table 1. Organoleptic (color, flavor and taste) testing was performed to find abnormalities in the milk samples. White color, sweet taste and typical flavor was observed in the Pampangan buffalo milk samples. Dispersion of the reflected rays from fat globules and particles of casein and calcium phosphate compounds lead the white color of milk [5]. Distinctive flavor of Pampangan buffalo milk was resulted by some specific volatile compounds. Lactose content in milk caused the sweet taste, while saltiness that often perceived was caused by the chloride [6].

Table 1 Pampangan buffalo milk quality

Characteristic	Location (sub-district)	
	Rambutan	**Pampangan**
Specific grafity (g.ml^{-1})	1.034	1.035
Water content (%)	77.91	80.11
Fat (%)	9.94	9.64
Protein (%)	5.47	5.73
Ash (%)	0.85	0.85
Nonfat dry matter (%)	12.14	10.24
Total Plate Count (log cfu ml^{-1})	5.40	5.59

Table 1 shows the average density of buffalo milk in the sub-district Pampangan and Rambutan which is 1,034 and 1,035 g.ml^{-1}, respectively. Density of milk samples is higher than the Indonesian National Standard (SNI 01-3141-1998) [7] which is equal to 1.0280 g.ml^{-1}. The density of milk was influenced by the density of the components of milk such as proteins, lactose and minerals [8]

Water content of Pampangan buffalo milk is lower than milk produced from other dairy livestock. The average moisture content of Pampangan buffalo milk from Rambutan and Pampangan is 77.91 and 80.11%

respectively. This result is lower than reported by [9] and [3] which is 84.4 and 86.43%. The water content of milk is affected by the dry matter content, temperature and pH [5].

Fat content of Pampangan buffalo milk was higher compared to the results of previous studies. Buffalo milk fat content of Rambutan and Pampangan sub-districtwas 9.94 and 9.64%. respectively,higher than the results reported by [10], which was 7.1% and 7:52% [11]. Pampangan buffalo milk fat levels were also above Indonesian National Standard (SNI 01-3141-1998) [7] which was at least 3.0%. [12] also reported that the average fat content in buffalo milk is 8.3%, and may reach 15% under normal conditions. [13] reported that the variations in the fat content of milk was affected by the feed, genetics, environment, production levels, the period of lactation, disease and season.

The average protein content of Pampangan buffalo milk from Rambutan and Pampangan districts was 5.47 and 5.73% respectively, higher than the results (5.0%) reported by [3]. [14] which was 4.6%. Several factors that may affect the levels of protein in the milk are the nation, the feed, the age, the period of lactation, climate, season and diseases [15].

Total Plate Count (TPC) of Pampangan buffalo milk from Rambutan and Pampangan sub-district was 5:40 and 5:59 log cfu.ml-1respectively. Data on the average total microbial of Pampangan buffalo milk was still below the maximum standard for buffalo milk (6 log cfu.ml^{-1}) [16], 6 log cfu.ml^{-1}bacterial count in fresh milk [17] and the Industrial acceptance standard. The total bacterial count in milk can be reduced by good proper milk handling.

Factors that should be considered is the milk hygiene, by protecting milk from direct or indirect contact with sources that may potentially contaminate milk during the milking process, collecting and transporting. Additionally, precise handlingis needed during the milk processing and storage [18]. Results showed that the Pampangan buffalo milk quality originate from Rambutan and Pampangan was not significantly different ($P > 0.05$).

3.2. Amino Acid of Pampangan Buffalo Milk

Amino acid of Pampangan buffalo milk is presented in Table 2. Aspartic acid, glutamic acid, serine, histidine, glycine, threonine, arginine, alanine, tyrosine, methionine, valine, penilalanin, isoleucine, leucine, and lysine were consist in the product. This result in this study was agree with [19] which reported that protein in buffalo milk is consist of lysine, histidine, arginine, asparticacid, threonine, serine, glutamic acid, proline, glycine, alanine, valine, metionine, isoleucine, leucine, tyrosine, and phenilalanin.

Amino acid is categorized into two groups based on its availability, the essential amino acids and non-essential amino acids. Essential amino acids are amino acids that are needed by the body, but can not be synthesized inside the human body, therefore it must be provided (already present in the foods consumed). Included in the group of essential amino acids are: lysine, triptopan, phenylalanine, leucine, isoleucine, threonine, methionine, valine [20]. This study found that eight essential amino acids are contained in Pampangan buffalo milk .

Table 2 Profile of amino acid in Pampangan buffalo milk

Amino acid	Concentration (%)
Aspartic acid	0.425
Glutamic acid	1.265
Serine	0.295
Histidine	0.15
Glycine	0.105
Threonine	0.28
Arginine	0.18
Alanine	0.185
Tyrosine	0.28
Methionine	0.14
Valine	0.355
Phenilalanin	0.275
Isoleucine	0.335
Leucine	0.525
Lysine	0.405
Total	5.2

3.3. Fatty Acid of Pampangan Buffalo Milk

The total concentration of saturated fatty acids Pampangan buffalo milk are showed in Table 3. The total saturated fatty acids concentration of Pampangan buffalo milk was 52.22%. Several saturated fatty acid such

as caproat fatty acids, caprilat, capric, lauric, tridecanoate, myristic, palmitic, stearic, arachidate, heneicosanoate, behenic, tricosanoate and lignocerate were exist in different concentrations. Concentration of palmitic acid, stearic and myristic were the higher than other fatty acids.

Table 3 Saturated fatty acids in the Pampangan Buffalo milk

Fatty acid	Concentration (%)
Caproic acid. C6:0	1.31
Caproic acid. C8:0	0.33
Capric acid. C10:0	0.65
Lauric acid. C12:0	0.96
Tridecanoic acid. C13:0	0.14
Myristic acid. C14:0	6.56
Pentadecanoic acid. C15:0.	1.81
Palmitic acid. C16:0	23.90
Heptadecanoic acid. C17:0	1.03
Stearic acid. C18:0	14.37
Arachidic acid. C20:0	0.23
Heneicosanoic acid. C21:0	0.09
Behenic acid. C22:0	0.52
Tricosanoic acid. C23:0	0.13
Lignoceric acid. C24:0	0.15
Total	52.22

This results were in accordance with the [21] which reported that buffalo milk fatty acid was rich in stearic and palmitic fatty acids which contribute to the specific odor and taste. [22] reported that the highest concentration of fatty acids in buffalo milk is palmitic acid, myristic and stearic. The percentage of saturated fatty acids buffalo milk was higher than that of cow's milk [14]. Myristic acid (C14: 0) has a function to induce High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL), an antioxidant, preventing the oxidation of LDL particles and protects against certain microbial infections [23].

Table 4 Unsaturated fatty acids in the Pampangan Buffalo milk

Unsaturated fatty acid	Concentration (%)
Miristoilenic acid. C14:1	0.04
Palmitoleic acid. C16:1	1.91
Oleic acid. C18:1n6c	23.37
Linoleic acid. C18:2n6c	0.76
Linolenic acid. C18:3n3	0.33
Cis-11-Eicosenoic acid. C20:1	-
Cis-11-14- Eicosadienoic. C20:2	-
Cis -8.11.14 Eicosatrienoic acid. C20:3n6	-
Arachidonic acid. C20:4n6	0.04
Cis-5.8.11.14.17 Eicosapentaenoic acid. C20:5n3. EPA	0.04
Nervonic acid. C24:1	0.05
Total	26.91

Short chain fatty acids in the buffalo milk increase the nutrient absorbtion rate to produce energy as well as to enable all the functions of the endocrine glands, organs and body tissues without cholesterol and adipose tissue (fat) formation [24]. The fatty acid composition of milk was affected by several factors such as lactation period [25], breed type [21], season [26] and feed composition [27].

Unsaturated fatty acids detected in the Pampangan buffalo milk were myristoleic acid, palmitoleic, oleic, linoleic, linolenic, eicosanoate, arachidonic and eicosapentanoate (Table 4). The highest unsaturated fatty acids concentrated in the milk samples was oleic acid.

4. CONCLUSION

Pampangan buffalo milk showed good quality milk, meet the Indonesian National Standard (SNI 01-3141-1998), especially on the milk fat and protein content. Pampangan buffalo milk contains 15 type of amino acids with the highest concentration was glutamic acid. The highest concentration of saturated fatty acids

were palmitic acid, stearic and myristic, whereas the highest concentration of unsaturated fatty acids was oleic acid.

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