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Evaluation of quality of mozzarella cheese

M. A. Mijan[1], M. A Haque, M. A. Habib[2*] and M. A. Wadud
Department of Dairy Science, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

The physical and chemical qualities of mozzarella cheese prepared from cow and buffalo milk were evaluated by a panel of judges (flavour and taste, body and texture, finish and colour) and by chemical tests (acidity, pH, fat, protein, lactose and ash). The flavour and taste, finish and colour of cow cheese were not significantly different from those of buffalo cheese. Fat, protein, lactose and ash content of cow cheese were significantly higher than those of buffalo cheese. (*Bangl. vet*. 2010. Vol. 27, No. 1, 36 – 42)

Introduction

Cheese has been defined by Davis (1976) as a product made from milk by coagulating the casein with rennet or similar enzymes in the presence of lactic acid produced by added or adventitious micro-organisms, from which part of the moisture has been removed by cutting, cooking and/or pressing, which has been shaped in a mould, and then ripened at suitable temperatures and humidity.

Over several thousand years, cheese making has advanced from an art to near science. Cheese varieties have proliferated to suit varied conditions and requirements. It is estimated that more than 2000 varieties exist (Olson, 1995), and the list may still be growing. It is possible, however, to classify the cheeses as hard and soft. Some hard cheeses are ripened by moulds: Roquefort and Gorgonzola are representatives of this group. In addition, several semi hard cheeses, such as brick, are ripened by bacteria. Soft cheeses consist of un-ripened, acid curd, such as cottage cheese; Camembert, ripened by mould; and Limberger, ripened by bacteria.

Mozzarella is a prominent member of pasta filata, or stretched curd, cheeses that originated in Italy. Pasta filata cheeses are distinguished by a unique plasticizing and kneading treatment of the fresh curd in hot water, which imparts to the finished cheese its characteristic fibrous structure, and melting and stretching properties. Although mozzarella originated in Italy, the United States has become its principal producer since the technology was brought to the United States by Italian immigrants. It remained an ethnic product with a limited market until around World War II, when pizza began its meteoric rise in popularity that continues to the present. In 1989, 723,600 tons of Mozzarella was produced in the United States, representing 28% of the nation's total cheese production. The popularity of pizza is growing

[1] Catholic University of the Sacred Heart, Milan, Italy
[2] Department of Animal Breeding & Genetics, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
* Correspondence*: E-mail*:- ahsan.rony@yahoo.com

rapidly in the United Kingdom and Northern Europe, and with it Mozzarella cheese manufacturing, notably in the United Kingdom and Denmark (Kindstedt, 1993).

Buffalo milk is produced in considerable amount especially in coastal areas in Bangladesh. The quality of cheese prepared from buffalo milk in Bangladesh was described by Ahmed (2000). Few papers have been published on the quality of cheese made from cow's milk in Bangladesh, and there is no report on the quality of Mozzarella cheese manufactured from cow and buffalo milk. The present study was designed to judge the quality of Mozzarella cheese prepared from cow and buffalo milk.

Materials and Methods

Collection of milk, rennet and starter culture

Cow milk was collected from Bangladesh Agricultural University Dairy Farm, Mymensingh and buffalo milk from Senbari area of Trishal Upazila (Sub-district), Mymensingh, from April to May 2009. Rennet and starter culture were collected from Classic Dairy Foods, Beg Housing, Khagdohar, Mymensingh.

Preparation of Mozzarella cheese

The fat percentage was determined by Babcock method. Briefly, the milk was heated at 80^{o}C for 30 minutes and then cooled for about 45 minutes to 38-40^{o}C and a culture of thermophilic bacteria (5%) was added. After 30 minutes, calcium chloride ($CaCl_2$) dissolved in water was slowly added at 0.5g/2.5L of milk and after 15 minutes rennet dissolved in water was slowly added at 0.5 ml/2.5L of milk. While adding $CaCl_2$ and rennet, milk was agitated by curd rake, and ripened for about 40 to 50 minutes for curd formation. When curd formation was completed it was cut into cubes by curd cutter and the temperature was raised to 45^{o}C, while stirring gently. After 15 minutes the whey was removed from the curd using cheese cloth and put into a wooden cheese dice. The cheese was kept for 12 hours or one night in refrigerator, and taken out and dipped into 25% salt solution for 30 to 40 minutes. The cheese was wiped with soft cloth and packed tightly with transparent polyethylene. Cheese thus prepared is defined as Mozzarella cheese and was stored in deep freeze.

Sensory evaluation

The cheese was evaluated by a tasting panel using a score card. The principal objective was to evaluate whether there was any significant differences in flavour and taste, body and texture, finish and colours.

Chemical analysis

All cheese samples were analysed for moisture (g/kg), total solids (g/kg), fat (g/kg), protein (g/kg), ash (g/kg), lactose (g/kg), acidity (%) and pH.

Statistical analyses

Analysis of variance (ANOVA) was done to find out the statistical difference between treatments. Paired *T*-test was done with the help of the program MSTAT and SPSS.

Results and Discussion

Physical parameters of Mozzarella cheese

The physical parameters of the cheeses are in Table 1.

Table 1. Physical parameters of different types of Mozzarella cheese

Parameter	Score	Score of cheese made from		P-value	Level of significance
		Cow milk	Buffalo milk		
Flavour and taste	45	40.1 ± 0.7	39.6 ± 0.0	0.70	NS
Body and texture	30	26.3 ± 0.7	26.3 ± 1.0	0.91	NS
Finish	15	12.5 ± 0.4	12.5 ± 0.4	0.95	NS
Colour	10	8.2 ± 0.2	8.2 ±0.1	0.67	NS

NS = Non significant (P>0.05)

Flavour and taste

The flavour and taste score of the cheese samples prepared from cow and buffalo milk were 40.1 ± 0.7 and 39.6 ± 0.1, respectively with no statistical (P>0.05) difference. Abou-Donia (1981) found that the flavour score of Domiati cheese was 70 to 90%. Rastogi *et al.* (1989) reported that the flavour score of cows' milk cottage cheese was 80 to 90%, which was much higher than these cheeses. The reason may be that cottage cheese is made from partially skimmed milk.

Body and texture

The body and texture of Mozzarella cheese should be uniform, smooth and meaty (not too firm or too soft and pasty). Body and texture score of cheese made from cow and buffalo milk were 26.3 ± 0.7 and 26.3 ± 1.0, respectively, with no significant difference (P>0.05). The result is in agreement with the findings of Hossain (2006), where body and texture score of cheddar was 25-27.

Finish

The finish score of cheeses made from cow and buffalo milk were 12.5 ± 0.4 and 12.5 ± 0.4, respectively, with no significant difference (P>0.05), although the cheese made from cow milk had better appearance, smooth surface, free from cracks and practically free from moulds.

Colour

The cheese made from cow and buffalo milk was yellowish-white and white, respectively: the difference might be due to carotene in cows' milk. The colour scores

of cheese made from cow and buffalo milk were 8.2 ± 0.2 and 8.2 ± 0.1 (Table 1), respectively. There was no significant difference (P>0.05) in colour score of different cheeses. Rastogi *et al.* (1989) reported that colour score of cow milk cottage cheese was 11.1 to 13.3 out of 15 (74-89%), which is in accordance with this study. The result is also consistent with Dharam and Garg (1989) who reported appearance and colour score of cheese to be 7.9 ± 0.2.

Chemical parameters of Mozzarella cheese

The chemical properties (Mean ± SE) of cheeses are in Table 2.

Table 2. Chemical parameters of different types of Mozzarella cheese

Parameter	Mozzarella cheese made from		P-value	Level of significance
	Cow milk	Buffalo milk		
Moisture content (%)	47.4 ± 0.3	39.7 ± 1.1	0.02	*
Total solids content (%)	52.9 ± 0.2	60.3 ± 1.1	0.019	*
Fat content (%)	24.2 ± 0.4	28.0 ± 0.5	0.054	*
Protein content (%)	20.5 ± 0.6	23.5 ± 0.7	0.044	*
Lactose content (%)	5.45 ± 0.12	5.96±0.27	0.028	NS
Ash content (%)	2.7 ± 0.1	2.9 ± 0.1	0.055	*
Acidity content (%)	0.7 ± 0.1	0.7 ± 0.1	0.73	NS
pH content	5.0 ± 0.1	4.9 ± 0.1	0.04	*

* Significant at 5% level (P<0.05), NS = Non significant (P>0.05)

Moisture content

The moisture content of cheese made from cow milk was significantly (P<0.05) higher than cheese made from buffalo milk. The result is in line with Hine (1994) and Islam (2006), who reported moisture content of cows' milk cheese as 400-600g/kg (40-60%) and 46.8%, respectively. Ahmed (2000) and Ghosh and Singh (1996) found moisture content in cheese made from cow and buffalo milk as 506.5g/kg (50.5%), 495.9g/kg (49.5%) and 503g/kg (50.3%), 498g/kg (49.8%), respectively. These results are supported by others.

Total solids (TS) content

Total solids of cheese made from buffalo milk was higher (P<0.05) than that made from cows' milk. The result is in agreement with Ghosh and Singh (1996), who reported total solids of cows and buffalo milk cheeses to be 497.0g/kg (49.7%) and 501.9g/kg (50.2%), respectively. Ahmed (2000) found total solids of whole milk cheese to be 493.4g/kg (49.3%). Islam (2006) found 53.2% total solids in mozzarella cheese of cows' milk. Their results are in accordance with the result of this study.

Fat content

The fat content of Mozzarella cheese prepared from cow milk was significantly ($P<0.05$) lower than cheese made from buffalo milk (Table 2). The results for cow milk cheese coincide with those of Ghosh and Singh (1996), Ahmed (2000) and Islam (2006) who found 248.0g/kg (24.8%), 235.6g/kg (23.5%) and 23.5%, respectively. Ahmed (2000) reported buffalo milk contained 275.1g fat/kg (27.5%), which agrees well with this study.

Protein content

Table 2 shows significantly ($P<0.05$) higher protein in buffalo milk cheese than in cow milk cheese. Alcala *et al.* (1982) observed that the natural Mahon cheese contained 24.6% protein. Ahmed (2000) found that the protein content of cheese prepared from cow milk was 219.7g/kg (22%), whereas the cheese from buffalo milk contained 193.7g protein/kg (19.4%). Islam (2006) found that the Mozzarella cheese of cow milk contained 21.9% protein, not in agreement with the result of this study. The variation in protein content may be attributed to protein present in initial milk, processing .

Lactose content

Table 2 shows lactose content in the cheese from buffalo milk was slightly higher than that from cow milk, but not significantly. The result of this study is similar to the results of Ali *et al.* (1977); Islam (2006), who found 6.3 and 5.5% lactose, respectively.

Ash content

Table 2 shows significantly ($P<0.05$) higher ash content in buffalo milk cheese than in cow milk cheese. The result is similar to those of Ghosh and Singh (1996); Ahmed (2000). They found ash content in cheese prepared from cow and buffalo milk as 27.6g/kg (2.8%), 29.6g/kg (3.0%) and 24.6g/kg (2.5%), 27.5g/kg (2.7%), respectively. But Islam (2006) found 2.2% ash in cow milk Mozzarella cheese, which is lower than that of this study.

Acidity

Table 2 shows no significant ($P>0.05$) difference in acidity of different cheeses. This result is nearly in agreement with the result of Ghosh and Singh (1996). They found acidity of cheese made from cow and buffalo milk as 0.73 and 0.67%, respectively. But the result is slightly higher than that of Ahmed (2000) who reported the acidity of cheese prepared from cow milk and buffalo milk to be 0.8 and 0.7%, respectively.

pH

Table 2 shows higher pH in the cheese made from cow milk than cheese from buffalo milk, which might be due to higher acidity in buffalo milk. The pH of cow quark cheese, part cow milk ricotta cheese was 4.6 and 5.8, respectively as reported by Boone (2001a, 2001b); Fernandez-Albalat (2001), which were in accordance with this study. Islam (2006) reported pH to be 5.4 in cow milk Mozzarella cheese, which was closely consistent with this study.

Conclusions

The physical and taste scores of Mozzarella cheese made from cow and buffalo milk were similar. Cheese made of buffalo milk had higher fat, protein, ash and total solids than cheese made of cow milk and may be preferred by consumers.

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