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A comparative study on physical and chemical composition of swamp and water buffalo milk

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Abstract

The research was carried out to compare the physical and chemical parameters of swamp and water buffalo milk collected from Senbari village in Trishal upazila under Mymensingh district. Results revealed that average colour, flavour and taste score of swamp and water buffalo milk differed ($p<0.01$) and the mean values were 91.10 ± 0.95 vs 87.50 ± 0.83, 96.30 ± 0.64 vs 86.10 ± 0.95 and 95.00 ± 0.00 vs 90.37 ± 2.32 for swamp and water buffalo respectively. The specific gravity of swamp buffalo milk (1.032 ± 0.00) slightly differed ($p>0.05$) with water buffalo milk (1.030 ± 0.00). Texture of all milk samples was normal. From chemical analyses it was observed that average fat, total solids (TS), solids-not-fat (SNF) and protein content differed ($p<0.01$) and the mean values were 84.25 ± 0.25 vs 72.67 ± 0.58, 179.05 ± 0.35 vs 164.87 ± 0.02, 94.80 ± 0.15 vs 92.20 ± 0.1939 and 39.68 ± 0.06 vs 37.67 ± 0.26 g/kg for swamp and water buffalo respectively. However, no differences ($p>0.05$) were found among ash (7.13 ± 0.00 vs 7.07 ± 0.02), acidity (0.164 ± 0.00 vs 0.155 ± 0.00), water (826.600 ± 5.55 vs 832.967 ± 0.06) and p^H (6.52 ± 0.124 vs 6.37 ± 0.017) content of milk obtained from swamp and water buffalo. From these results it may me inferred that the quality of swamp buffalo milk is superior to water buffalo milk.

Keywords: Swamp buffalo, Water buffalo, Milk composition

Introduction

Milk contains all the essential nutrients like protein, fat, lactose, vitamins, mineral matters etc. for normal growth and perform different functions for human and animal body system. It is not only the most important food during early childhood but in one form or other it also continues to be used normal diet throughout the life. Per capita fresh milk and milk products consumption is one of the most important point of basis to measure the living standard of a nation. The more the people enjoy living standard in the world, the more they consume healthy milk and milk products (Aneja, 1990).

Buffaloes are second largest source of milk supply in the world. In India nearly half of the milk processed by the organized dairies comes from buffaloes (Aneja, 1990). Buffalo milk is richer in fat than milk from cattle; generally, it also has higher levels of proteins, lactose and ash, although these differences are not as in fat. The absence in buffalo milk of β-carotene, which is present in cow milk, is another notable characteristic (Dastur *et al.* 1971). The milk produced by Murrah buffaloes varies in composition between localities and between feeding regimes (Patel and Ray, 1948). Most of the milk enzymes and protease-peptones are found in buffalo milk at a lower concentration than in milk from cattle. Fat globules in buffalo milk are larger than in milk from cattle, and buffalo milk fat shows a higher density, a higher melting point and a lower iodine value than fat in milk from cattle.

The swamp buffalo has traditionally been regarded primarily as working animals specially in China and other rice growing countries of the Far East. It is, however, milked in many countries and yields a product rich in butter fat and similar in all respect to that of the milch river breeds. It is probable that the animal has a considerable potential for milk production if managed and bred properly. Therefore, this experiment was aimed to compare colour, taste, flavour, specific gravity as well as fat, total solids, protein, lactose and ash content of swamp and water buffalo milk.

Materials and Methods

The present experiment was carried out at dairy technology laboratory of the department of dairy science, Bangladesh agricultural university, Mymensingh, during the 3rd February to 3rd April, 2003. A total number of 6 samples of buffalo milk were collected daily from two different breeds like swamp and water buffalo from individual farmers of Kani Hari Union, Village- Senbari, Upazila-Trishal. Out of 6 samples, 3 samples are collected from swamp buffalo and the rest of 3 samples are collected from water buffalo of different individual farmers at Senbari of Trishal upazila.

Selection of area

The buffalo producers are not available all over Mymensingh district, but there are some places in this district where buffaloes are available. Trishal upazila (Senbari) is well known for buffalo milk. Two types of buffalo breed such as water and swamp buffalo are found at senbari in trishal upazila. Water buffalo milk is available at higher level than that of swamp buffalo at senbari in Trishal upazila. Not only that but also it has an excellent communication facilities from senbari to Dhaka and Mymensingh. This leads to increase marketing facilities of those milk products. It is the main cause of selection of that area.

Collection of samples

During experimental period, samples were collected from the above mentioned areas and were transferred to the Dairy Technology Laboratory, Bangladesh Agricultural University, Mymensingh. Samples were collected one time for eight days and each time samples were taken to the laboratory for analysis, approximately 250 ml of milk was taken for each sample. The following tests were performed with each milk sample; Physical test: (a) Organoleptic test; Colour, Texture, Flavour, Taste.(b)Specific gravity; Chemical test :Fat content; Solids-not-fat content; Total solids content ;Acidity content; Protein content Lactose content; Ash content; Water content.

Analytical procedure

The physical parameters like colour, flavour, texture, taste were performed according to Nelson and Traught 1964. P^H was measured with the help of a pH meter. The specific gravity test was performed using Quevenne lactometer, cylinder and floating dairy thermometer according to the method described by Aggarwala and Sharma (1961). Fat test was performed by Babcock fat test method as described by Aggarwala and Sharma (1961). Acidity test was

done by titrating milk with N/10 NaOH solution as per method described by Association of Official Agricultural Chemists (AOAC, 2003). Total solids (TS) and solids-not-fat (SNF) content of milk samples were performed according to the Eckles *et al.* (1951) and protein was estimated by formal titration method. Statistical analysis was conducted with the help of MSTAT (Microsoft statistics) statistical program using Completely Randomized Design (CRD). Analysis of variance test was done to find out the significant difference between treatments.

Results and Discussion

Milk samples collected from swamp buffalo and water buffalo at Senbari village of Trishal upazila which was analyzed to evaluate their composition. Results obtained from this experiment are presented below:

Physical parameters

The results for physical parameters of buffalo milk samples obtained from the above breeds are given in the Table 1and Table 2. There are remarkable differences among the physical parameters like colour, flavour, taste, specific gravity and pH of milk samples obtained from the above mentioned breeds. But the texture score was the same within two breeds.

Table 1. The colour, flavour, taste and texture quality of swamp and water buffalo milk

Physical parameters	Swamp buffalo	Water buffalo
Colour	Whitish	Bluish White
Flavour	Milky with slightly aromatic	Normal flavour (Milky)
Taste	Slightly sweet	Slightly watery
Texture	Free flowing fluid	Free flowing fluid

Table 2. Average score of physical parameters of milk collected from swamp and water buffalo

Physical parameters	Swamp buffalo Mean ± SD	Water buffalo Mean ± SD	Level of significance
Colour	91.10 ± 0.95	86.10 ± 0.95	**
Flavour	87.50 ± 0.83	95.00 ± 0.00	**
Taste	96.30 ± 0.64	90.37 ± 2.32	**
Texture	100 ± 0.00	100 ± 0.00	NS
Sp. gv.	1.032 ± 0.00	1.030 ± 0.00	NS

**; ($p<0.01$), *; ($p<0.05$); NS-Non significant

Colour

The color of all the milk samples collected from swamp buffalo at senbari village were whitish and milk samples collected from water buffalo were bluish white in color respectively (Table 1). The average color score of swamp and water buffalo milk are shown in Table 2. This table showed that the average color score of swamp and water buffalo milk were 91.10 ± 0.95 and 86.10 ± 0.95 respectively. From the above Tables (1&2) the statistical analysis

showed that there were highly significant differences ($p<0.01$) of color score within swamp and water buffalo milk. The differences in color may be due to the differences in nature of feed the buffaloes consumed, the breed, the fat and solids content of the milk. Their results agreed with Eckles *et al.* (1951) who reported that colour of milk depends upon the breed, the amount of fat and solids present and most of all cases it depends upon the nature of feed the buffalo consumed.

Flavour

The collected sample of swamp and water buffalo milk from Senbari of Trishal upazila showed milky flavour with slightly aroma and normal flavour (milky) respectively (Table 1). The average flavour score of swamp and water buffalo milk are shown in Table 2. This Table showed that the mean and standard deviation of flavour score of swamp and water buffalo milk were 87.50 ± 0.83 and 95.00 ± 0.00 per cent respectively. From this result, it is evident that, the flavour score within swamp and water buffalo milk differ significantly ($p< 0.01$). This might be due to the fact that farmers take hygienic measure during milking and not to allow the buffaloes with some sorts of flavoured feed prior to or during milking their buffaloes. This result agrees with the work of Islam *et al.* (1984) who showed that flavour of milk produced hygienically was normal. Demott and Ward (1956) also reported that improvement of management during milking improves the flavour of milk.

Taste

The taste of all milk samples collected from swamp buffalo and water buffalo at Senbari of Trishal upazila had normal taste (slightly sweet), slightly sweet and watery respectively (Table 1). The average taste score of swamp and water buffalo milk are shown in table 2. The mean and standard deviation of taste score of swamp and water buffalo milk were 96.30 ± 0.64 and 90.37 ± 2.32 per cent respectively. From the statistical analysis, the results showed that there were highly significant differences ($p<0.01$) of taste score within the two breeds. This result agrees with Judkins and Keener (1960) who reported that milk produced under proper hygienic condition, had slightly sweet taste. Abnormal taste (watery) of milk collected from vendors might be due to the fact that the samples had been stored in poorly ventilated house prior to sell in the markets (Foley *et al.* 1972).

Texture

The texture of collected milk samples were observed before starting the experiment. All the milk samples collected from swamp and water buffalo at Senbari of Trishal upazila showed normal texture (free flowing liquid) (Table 1). The texture score was 100 ± 0.00 of both swamp and water buffalo (Table 2).

Specific Gravity

The average mean and standard deviations of specific gravity of swamp and water buffalo milk samples were 1.032 ± 0.00 and 1.030 ± 0.00 respectively (Table 1) . Statistical analysis showed that the differences among specific gravity of swamp and water buffalo milk were non-significant ($P>0.05$). The result is in agreement with Warner (1953). He observed that the specific gravity of murrah buffalo milk was 1.031 which is similar with the specific gravity of milk samples of this present study.

Chemical parameters

The chemical tests were carried out in the Dairy Technology Laboratory of the Department Of Dairy Science, Bangladesh Agricultural University, Mymensingh to detect the content of acidity, fat, total solids, solids-not-fat, protein, ash, lactose, water and p^H. The results for chemical parameters of milk samples are shown in the Table 3 and the results obtained are discussed in this section.

Table 3. Average chemical parameters of milk collected from swamp and water buffalo during experimental period

Chemical parameter	Swamp buffalo Mean ± SD	Water buffalo Mean ± SD	Average Mean ± SD	Level of significance
Fat (g/kg)	84.25 ± 0.25	72.67 ± 0.58	78.46 ± 6.36	**
TS (g/kg)	179.05 ± 0.35	164.87 ± 0.02	171.96 ± 5.19	**
SNF (g/kg)	94.80 ± 0.15	92.20 ± 0.19	93.50 ± 1.42	**
Protein (g/kg)	39.68 ± 0.06	37.67 ± 0.26	38.673 ±1.11	**
Lactose (g/kg)	48.00 ± 0.1	47.55 ± 0.18	47.77 ± 0.28	*
Ash (g/kg)	7.13 ± 0.00	7.07 ± 0.02	7.1 ± 0.04	NS
Acidity %	0.164 ± 0.00	0.155 ± 0.00	0.160 ± 0.00	NS
Water (g/kg)	826.600 ± 5.55	832.967 ± 0.06	829.783 ± 4.95	NS
pH	6.37 ± 0.017	6.52 ± 0.124	6.450 ± 0.11	NS

**; ($p<0.01$), *; ($p<0.05$); NS-Non significant

Fat content

The mean fat content and standard deviation in milk collected from swamp and water buffalo at Senbari of trishal upazila were 84.25 ± 0.25 and 72.67 ± 0.58 (g/kg) respectively Table 3. Statistical analysis showed that the differences between the fat percentage of milk obtained from the above two breeds were highly significant ($p<0.01$). Normally butter fat of buffalo milk varies from 4.4 to 8.9 (Faruque, 1996). In another experiment El-Salam and El-Shibini (1963) reported that the mean fat percentages of buffalo milk sample and found that the values were 5.4-7.80 %. The result of present study agrees the findings of above authors.

Solids-not-fat (SNF) content

The mean and standard deviation of SNF content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 94.80 ± 0.15 and 92.20 ± 0.19 (g/kg) respectively Table 3 . Statistical analysis showed that the differences between the solids-not-fat content of above two breeds were highly significant ($p<0.01$). The results of the chemical analysis of SNF content of the collected samples are in agreement with a number of authors. Mean SNF content of milk collected from swamp and water buffalo were normal. On the other hand, the average solids-not-fat content of buffalo milk in our experiment was 93.50±1.42 which was nearly similar with the result of Sharma *et al.* (1980).

Total Solids (TS) content

The mean and standard deviation of total solids content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 179.05 ± 0.35 and 164.87 ± 0.02 (g/kg) respectively Table 3. Statistical analysis showed that the differences between the total solids content of above two breeds were highly significant ($p<0.01$). On the other hand the average total solids content of buffalo milk in our experiment was 171.96 ± 5.19 (g/kg) which was similar with the results of El-Salam and El-Shibini (1966).

Protein content

The mean and standard deviation of protein content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 39.68 ± 0.06 and 37.67 ± 0.26 (g/kg) respectively Table 3 . Statistical analysis showed that the differences between protein content of above two breeds were non significant ($p>0.05$). In our experiment the average protein content of milk from two types of breed was 38.673 ± 1.11 (g/kg). The results agree with the works of Sharma *et al.* (1980).

Ash content

The mean and standard deviation of ash content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 7.13 ± 0.00 and 7.07 ± 0.02 (g/kg) respectively Table 3 . Statistical analysis showed that the differences between ash content of above two breeds were non significant ($p>0.05$). In our experiment the average ash content of milk from two types of breed was 7.1 ± 0.04 (g/kg). The ash content for swamp and water buffalo milk at Senbari of trishal upazila were also about similar. This result agrees with Sharma *et al.* (1980) who reported that the percentage of ash in buffalo milk collected from non-described breed was 0.72 %, which is similar with the ash content of milk samples of this experiment.

Lactose content

The mean and standard deviation of lactose content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 48.00 ± 0.1 and 47.55 ± 0.18 (g/kg) respectively Table 3 . Statistical analysis showed that the differences between lactose content of above two breeds were significant ($p<0.05$). In our experiment the average lactose content of milk from two types of breed was 47.77 ± 0.28 (g/kg). Generally milk contains 4.11 ± 5.55 % lactose. The lactose content for swamp and water buffalo milk at Senbari of Trishal upazila were within the normal range.

Acidity percentage

The mean and standard deviation of acidity percentage of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 0.164 ± 0.00 and 0.155 ± 0.001 respectively Table 3 . From the results it is evident that the acidity percentages of milk from swamp buffalo were higher than the acidity of milk colleted from water buffalo. Statistical analysis showed that the differences between acidity percentage of above two breeds were non significant ($p>0.05$). In our experiment the average acidity percentage of milk from two types of breed was 0.160 ± 0.00. El-Salam and El-Shibini (1966) reported from an experiment that the acidity percentage of buffalo cows milk was 0.148 ± 0.0084, which is lower with the acidity percentage of milk samples collected from the two different breeds. However, in our experiment the acidity percentage of all milk samples from the above breeds were within the normal.

Water content

The average mean and standard deviation of water content of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 826.60 ± 5.55 and 832.97 ± 0.06 (g/kg) respectively Table 3. Statistical analysis showed that the differences among water content of milk from the above breeds were non-significant ($p>0.05$). From the results it is evident that the average water content of swamp buffalo milk was slightly higher than that of water buffalo milk. In our experiment the average water content of milk from two types of breed was 829.78 (g/kg) which was slightly lower than the result of El-Salam and El-Shibini (1966).

P^H

The average mean and standard deviation of pH of milk samples collected from swamp and water buffalo at Senbari of Trishal upazila were 6.37 ± 0.017 and 6.52 ± 0.124 respectively Table 3 . Statistical analysis showed that the differences among pH of milk from the above breeds were non-significant ($p>0.05$). The pH of murrah buffalo milk was found 6.74 with an acidity of 0.12 per cent (Rao and Dastur, 1955).

Conclusion

Milk samples collected from swamp buffalo at Senbari of Trishal Thana were whitish in colour and bluish white in case of water buffalo. Flavour of milk samples of swamp and water buffalo were milky with slightly aroma and only milky, respectively. Taste of milk of swamp and water buffalo were slightly sweet and slightly watery, respectively. The specific gravity of milk collected from swamp buffalo was slightly higher than that of milk collected from water buffalo.

The average fat, total solids, solids-not-fat, protein, ash, lactose, acidity and water content of milk samples obtained from swamp was higher than water buffalo. The pH of milk collected from water buffalo was higher than that of milk collected from swamp buffalo. The results of physical parameters showed that the colour, flavour and taste of milk samples may vary from breed to breed. It was concluded that milk samples collected from swamp buffalo. at Senbari of Trishal Thana was superior to milk samples collected from water buffalo.

References

Aggarwala, A.C, Sharma, R.M. 1961. A laboratory manual of milk inspection. 4th edn. Asian Publishing House, Bombay.

Aneja, R.P. 1990. Processing and distribution of buffalo milk. Proc. XXIII Int. Dairy Cong., Montreal, (April 03-07, 1990), 1: 383-396.

AOAC. 2003. Official Methods of Analysis. Association of Official Analytical Chemists. 10th edn. Washington, DC.

Dastur, N.N., Ganguli, N.C., Laxminarayan, H. and Patel, I.M. 1971. Recent trends in research work on buffaloes' milk and milk products. In: I. D. F. Seminar on "Milk other than Cows' milk". Int. Dairy Fed., Madrid, Spain (December 14-16, 1971).

Demott, B.J. and Ward, G.M. 1956. Some observations of the effect of management practices upon the flavour milk. Dairy Sci. Abstr., 19: 348.

Eckles, C.H. Combs, W.B. and Macy, H. 1951. Milk and milk products. 4th edn. McGraw-Hill Book Company, New York, Toronto, London. pp. 69.

El-Salam and El-Shibini. 1966. Chemical composition of buffalo milk. In: The Asiatic water buffalo. (Ed. N. R. De Guzaman). Taipei, Taiwan, China. pp. 43.

Faruque, M.O. 1996. Indigenous buffaloes in the coastal areas of Bangladesh. Dairy Sci. Abstr., 16 : 583.

Foley, R.C., Bath, D.D, Diekinson, E.M. and Tucker, H.A. 1972. Dairy cattle: Principles practices, problem and profit. Lea and Febiger, Philadelphia, USA.

Ganguli, N.C. 1974a. Physico-chemical make-up of buffalo milk in the standardization of techniques of handling processing and manufacture of products. XIX Int. Dairy Confer (September 11-15, 1974)., B5 : 358-377.

Islam, M.N, Hussain, S.M.I. and Mannan, A.K.M. 1984. Studies on the physical parameters and chemical qualities of market milk in Mymensingh town. Bang. J. Anim. Sci., 13 (1 & 2) : 52.

Judkins, H.F. and Keener, H.A. 1960. Milk production and processing. John Wiley & Sons Inc., New York.

Nelson, J.A. and Traught, G.M. 1964. Judging Dairy Products. 4th edn. The Olsen Publishing Company, Michiigan.

Patel, B.N. and Ray, S.C. 1948. Studies on cotton seed feeding to milch animals. Part 1. Effect on the production of milk and butter fat in buffalo on (a) equivalent replacement of dairy mixture by cotton seed and (b) exclusion of green fodder in a cotton seed dietary. Ind. J. Dairy Sci., 1: 1-10.

Rao, B. and Dastur, N.N. 1955. Buffer value of milk and colostrums. Ind. J. Dairy Sci., 8: 158.

Sharma, U. P., Rao, S.K. and Zariwala, I.T. (1980). Composition of milk of different breeds of buffalo. Ind. J. Dairy Sci., 33 : 7-10.

Wahid, A. 1973. Pakistani buffaloes. FAO, World Animal Review, No. 7.

Warner, J.N. 1953. Dairying in India. Memillian and Co. Ltd., Calcatta, Bombay, Madras and London.