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Physico-chemical properties of paneer prepared from buffalo milk blended with cow colostrum

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Abstract

In the present investigation the attempt was made to study the physico-chemical properties of paneer prepared from buffalo milk blended with cow colostrum. The paneer was prepared by considering treatment combination of buffalo milk and cow colostrum as 95%, 90% and 85% of buffalo milk and 5%, 10% and 15% of cow colostrum in treatments T₂, T₃ and T₄ and treatment T₁ taken as a control prepared from buffalo milk only. The physico-chemical properties (pH, acidity, fat, protein, ash, moisture and total solid) for the paneer prepared from buffalo milk blended with cow colostrum. The treatment T₁, T₂, T₃ and T₄ contained score for pH 5.85, 5.87, 5.77 and 5.74, acidity 0.43, 0.47, 0.51 and 0.55 percent, fat 26.01, 25.08, 25.06, and 25.01 percent, protein 18.20, 18.26, 18.31 and 18.37 percent, moisture 52.45, 52.32, 52.24 and 52.16 percent, ash 1.57, 1.61, 1.65 and 1.68 percent, total solid 47.12, 47.19, 47.25 and 47.31 percent, respectively. On the basis of result it was revealed that as the concentration of colostrum in paneer increased there was increased in acidity, protein, ash, total solid, while pH, fat, and moisture percentage decreased.

Keywords: Buffalo milk, cow colostrum, paneer

Introduction

India rank first in milk production contributing 23 percent of global milk production. Milk production during 2020-21 and 2021-22 is 209.96 million tonnes and 221.06 million tonnes respectively showing an annual growth of 5.29 percent. (Anonymous 2022-23) [1]. According to Prevention of Food Adulteration Rules (PFA 2010) [17], Paneer means the product obtained from cow or buffalo milk or a combination thereof by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70 percent moisture and the milk fat content shall not be less than 50% of the dry matter. Colostrum is the first secretion of the mammary gland following parturition which is designed by nature to give young a good start in life. Colostrum is richer than normal milk in most nutrients (including vitamin), apart from lactose and fat. Its major effect is to confer passive resistance on the newborn against pathogenic microorganisms. Cow colostrum contains the water 77.5 percent, fat 3.6 percent, lactose 3.1 percent, protein 14.3 percent, ash 1.5 percent (Banerjee, 2010) [10]. The present investigation was carried out to study the physico-chemical and textural properties of paneer prepared from buffalo milk blended with cow colostrum.

Material and Methods

Buffalo Milk and Cow colostrum

The fresh Buffalo milk was purchased from local market of Latur city, having 6.0 percent fat and 9 percent SNF. The Cow colostrum was purchased from farmer of Sonvati village of Latur.

Chemicals

Analytical reagents (AR), or Guaranteed reagents (GR), were used in chemical analysis.

Packaging material

A polythene bag of 200 gauge were used for packing of paneer.

Equipment and accessories

The equipment includes stainless steel vessels of requisite capacity, knives, mixture, milometer (fat, lactose, solid not fat and protein of milk), standard weight balance,

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thermometer, gas shegadi, muslin cloth, paneer press machine, etc. used for the preparation of paneer. All the equipment was properly cleaned and washed with the detergent solution before using and all the precautionary measures were considered during the conduction of trials to avoid contamination.

Preparation of paneer from buffalo milk blended with cow colostrum

The milk selected for preparation of paneer of 6% fat and 9% SNF was boiled in a vessel. Before using milk was filtered then heated up to 90 °C for 5 min. Then stopped heating to fall temp at 76 °C and later on cow colostrum added slowly with continuous stirring for uniform mixing then 1% citric acid solution added at 70 °C with slow stirring till coagulation occurred. Formation of clear whey was indicative of complete coagulation. Stirring was stopped, as the coagulum tends to coalesce. Now leave it for 5 min to settle down the coagulated mass and complete separation of whey. Then coagulated mass strained through a muslin cloth. The coagulum so obtained was lightly pressed to facilitate formation of paneer blocks of suitable size, followed by their immersion in chilled water to impart them a distinctive texture.

Treatment combinations

The paneer was prepared from buffalo milk blended with cow colostrum as per the following treatments.

T₁= Paneer from Buffalo milk (control)

T₂= Paneer with 5 percent of cow colostrum (On a wt. basis of milk)

T₃= Paneer with 10 percent of cow colostrum (On a wt. basis of milk)

T₄= Paneer with 15 percent of cow colostrum (On a wt. basis of milk)

Evaluation of physico-chemical properties of Paneer

Paneer samples of different treatments were subjected for analysis for pH {digital pH meter}, titrable acidity {IS: 1479 (1960) [13] Part-I}, fat {IS: 1224 (part II) (1977)} [12], protein {Lowry’s method (1951)} [15], moisture/total solid/ash {IS: SP (Part XI) 1981} [14]. The data were analyzed statistically by using Completely Randomized Design (CRD) as per Panse and Sukhatme (1985) [16].

Result and Discussion

Physico-chemical analysis of paneer

The requisite paneer samples prepared from buffalo milk blended with cow colostrum were subjected for the proximate analysis of physico-chemical properties such as pH, acidity, fat, protein, moisture, ash and total solids.

pH of paneer prepared from buffalo milk blended with cow colostrum: The pH content in the finished product was measured using digital pH meter at room temperature. The results obtained were presented in table no. 1.

Table 1: pH of paneer prepared from buffalo milk blended with cow colostrum

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	5.83	5.84	5.85	5.87	5.85 ^a
T ₂	5.80	5.81	5.79	5.83	5.81 ^b
T ₃	5.76	5.77	5.76	5.78	5.77 ^c
T ₄	5.73	5.75	5.72	5.74	5.74 ^d
SE ± 0.007	CD at 5% 0.022				

The values with different superscripts differ significantly at 5 percent level of significance

From table no.1, it was revealed that, the average pH scores of the developed paneer decreased with increased the level of cow colostrum. The mean pH of paneer from buffalo milk blended with cow colostrum were T₁(5.85), T₂(5.87), T₃(5.77), T₄(5.74). The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The highest pH value was shown in the treatment T₁, i.e. 5.85, and the lowest was shown in the treatment T₄ i.e. 5.74 in all the treatment studies. The reducing pH of paneer might be due to the cow colostrum and their composition.

The pH of colostrum used milk product i.e. khees prepared by Amrita and Dabur (2012) [3] was for cow milk colostrum khees 6.23 and for buffalo colostrum khees 6.15 were found higher than present findings.

Ayar *et al.* (2016) [8] found pH values of yogurt increased as the colostrum percent increased 4.67, 4.68, 4.69, respectively and in kefir colostrum percent increased the pH value decreased 4.73, 4.72, 4.71, respectively.

The product prepared by using colostrum was mostly associated with present findings.

Acidity of paneer prepared from buffalo milk blended with cow colostrum

The acidity of the paneer prepared from buffalo milk blended with cow colostrum formulated under the different treatment combination was evaluated. The results obtained were presented in table no 2.

Table 2: Acidity of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R ₁	R ₂	R ₃	R ₄	Mean
T ₁	0.44	0.43	0.45	0.41	0.43 ^d
T ₂	0.48	0.46	0.48	0.47	0.47 ^c
T ₃	0.51	0.50	0.52	0.49	0.51 ^b
T ₄	0.55	0.53	0.56	0.54	0.55 ^a
S. E. ± 0.006	CD at 5% 0.0206				

The values with different superscripts differ significantly at 5 percent level of significance

From table no. 2, it show that the mean average scores for acidity of paneer were 0.43, 0.47, 0.51 and 0.55 percent for treatment T₁, T₂, T₃ and T₄, respectively. It was revealed that the average acidity scores of the developed paneer continued to increase with increased in level of cow colostrum. The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The acidity of the paneer increased as the amount of colostrum in the paneer increased. The acidity and pH was inversely proportionate to each other and that’s why as the colostrum increased in the paneer preparation the acidity increased and pH decreased.

The data of present investigation of acidity were in line with the David (2014) [11] reported that the preparation of steam *sandesh* in the ratios of control (T₀), 50:50 (T₁), 60:40 (T₂) and 70:30 (T₃) of colostrum and cow milk. The acidity percent 0.14, 0.19, 0.18, 0.16 for treatment (T₀), (T₁), (T₂) and (T₃), respectively.

Saleh *et al.* (2020) [18] prepared the ice cream with control (Tc) and four level of buffalo colostrum as T₁(10%), T₂(20%), T₃(30%), T₄(40%). As the proportion of buffalo colostrum increased in ice cream the acidity of product increased 0.22, 0.24, 0.28, 0.31, 0.36, respectively.

Fat of paneer prepared from buffalo milk blended with cow colostrum

The fat content of the paneer from buffalo milk blended with cow colostrum formulated under the different treatment combination was determined by Gerber's fat determination device. The results obtained are presented in table no. 3.

Table 3: Fat content of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R1	R2	R3	R4	Mean
T1	26.00	26.02	26.00	26.03	26.01 ^a
T2	25.08	25.09	25.07	25.09	25.08 ^b
T3	25.06	25.07	25.05	25.03	25.06 ^c
T4	25.02	25.04	25.00	25.01	25.02 ^d
S. E. ± 0.006		CD at 5% 0.020			

The values with different superscripts differ significantly at 5 percent level of significance

From table no. 3, it exhibits that the mean average scores for fat content of paneer were 26.01, 25.08, 25.06, and 25.02 percent for treatment T₁, T₂, T₃ and T₄, respectively. It was show that the average fat scores of the developed paneer continued to decrease with increased in level of cow colostrum. The treatment T₁ T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The fat content of the paneer decreased as the amount of cow colostrum in the paneer increased.

The values recorded in fat content in the present investigation were decreased whereas, fat content were found increased in the research of Amrita and Dabur (2015) [2], reported that fat content of control and buffalo colostrum paneer i.e. 24 ± 1.10 and 25.5 ± 1.23 , respectively, might be due to the buffalo colostrum having more fat than cow colostrum.

Alshymaa *et al.* (2022) [1] reported functional stirred yoghurt fortified with buffalo milk and bovine milk. The yoghurt was fortified with control, buffalo colostrum (15%), bovine colostrum (15%), mix colostrum (1 buffalo: 1 bovine) and lactoferrin (5mg/mL) observed the fat scores as 6.52, 6.75, 6.42, 6.58, 6.51, respectively.

Protein content of paneer prepared from buffalo milk blended with cow colostrum

The protein content of the paneer from buffalo milk blended with cow colostrum formulated under the different treatment combination was determined by Lowry's method. The results obtained are presented in table no. 4.

Table 4: Protein content of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R1	R2	R3	R4	Mean
T1	18.20	18.22	18.16	18.23	18.20 ^d
T2	18.25	18.28	18.24	18.27	18.26 ^c
T3	18.32	18.34	18.30	18.31	18.31 ^b
T4	18.35	18.40	18.37	18.39	18.37 ^a
S. E. ± 0.011		CD at 5% 0.035			

The values with different superscripts differ significantly at 5 percent level of significance

From table no. 4, it could be seen that the mean average scores for protein content of paneer were 18.20, 18.26, 18.31 and 18.37 percent for treatment T₁, T₂, T₃ and T₄, respectively. It was show that, the average protein scores of the developed paneer continued to increased with increased in level of cow colostrum. The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The treatment

T₁ (18.20) show that lowest value of protein content and highest value shown by the T₄ (18.37). The protein content increased in each treatment was due to the higher protein in cow milk colostrum.

The scores recorded in protein content in the present investigation were comparable with another research Anamika and Seth (2017) [4] reported that the colostrum whey powder fortified curd. The data reported that the values of control and colostrum whey powder fortified curd for protein 3.75 and 4.83 percent, respectively.

Azza *et al.* (2018) [9] reported that functional yoghurt was prepared by using control (T_c) and bovine colostrum was added at different ratios 5% (T₂), 10% (T₃) and 15% (T₄). The protein content of the yoghurt increased as the bovine colostrum promotion increased 3.91(T_c), 4.77(T₁), 4.89(T₂), 6.09(T₃), 6.70, (T₄), respectively.

Moisture of content paneer prepared from buffalo milk blended with cow colostrum

The moisture content of the paneer from buffalo milk blended with cow colostrum formulated under the different treatment combination. The results obtained were presented in table no. 5.

Table 5: Moisture content of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R1	R2	R3	R4	Mean
T1	52.40	52.47	52.51	52.45	52.45 ^a
T2	52.32	52.34	52.33	52.31	52.32 ^b
T3	52.24	52.22	52.26	52.25	52.24 ^c
T4	52.20	52.18	52.15	52.14	52.16 ^d
S. E. ± 0.014		CD at 5% 0.044			

The values with different superscripts differ significantly at 5 percent level of significance

From the table no. 5, it was show that the moisture content of the paneer decreased as the amount of cow colostrum in the paneer increased. The mean average scores for moisture content of paneer were 52.45, 52.32, 52.24 and 52.16 percent for treatment T₁, T₂, T₃ and T₄, respectively. The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The treatment T₁ (52.45) showed the highest value for the moisture percentage and treatment T₄ (52.16) showed the lowest moisture percentage.

The values recorded in moisture content in the present investigation were comparable with research of Amrita and Dabur (2012) [3] evaluated the properties of *khees* obtained from buffalo and cow colostrum. The moisture percentage of buffalo and cow colostrum was 47 and 40.62 percent, respectively reduced in cow colostrum used *khees*.

Shelke *et al.* (2022) [19] reported that the properties of *kharwas* delicacy blend with sterile milk. The treatments combination in which colostrum used in different proportion of 88% (T₀), 83% (T₁), 78% (T₃), 68% (T₄). The moisture content of control and T₃ sample was 44.42 and 47.22, respectively

Ash of paneer prepared from buffalo milk blended with cow colostrum

The ash content of the paneer from buffalo milk blended with cow colostrum formulated under the different treatment combination was evaluated by using muffle furnace. The results obtained are presented in table no. 6.

Table 6: Ash content of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R1	R2	R3	R4	Mean
T1	1.56	1.57	1.59	1.58	1.57 ^d
T2	1.60	1.61	1.63	1.62	1.61 ^c
T3	1.64	1.66	1.65	1.65	1.65 ^b
T4	1.67	1.68	1.70	1.69	1.68 ^a
S. E. ± 0.005		CD at 5% 0.018			

The values with different superscripts differ significantly at 5 percent level of significance

From table no. 6, it exhibits that the mean average scores for ash content of paneer were 1.57, 1.61, 1.65 and 1.68 percent for treatment T₁, T₂, T₃ and T₄, respectively. It was show that, the average ash scores of the developed paneer continued to increased with increased in level of cow colostrum. The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The ash content of the paneer increased as the amount of cow colostrum in the paneer increased.

The values recorded in moisture content in the present investigation were comparable with research of Anamika and Seth (2017) [4] studied that the quality attribute of skimmed colostrum powder. The ash content of raw bovine colostrum and bovine skimmed colostrum powder observed that 2.3-1.1 and 7.3-6.7, respectively.

Saleh *et al.* (2020) [18] prepared the ice cream with control (T_c) and four level of buffalo colostrum as T₁ (10%), T₂ (20%), T₃ (30%), T₄ (40%). The ash content of product increased as the concentration of colostrum increased 0.88, 0.90, 1.07, 1.08, 1.09, respectively.

Total solid of paneer prepared from buffalo milk blended with cow colostrum

The total solid content of the paneer from buffalo milk

blended with cow colostrum formulated under the different treatment combination. The results obtained are presented in table no. 7.

Table 7: Total solid content of paneer prepared from buffalo milk blended with cow colostrum (percent)

Replication Treatment	R1	R2	R3	R4	Mean
T1	47.10	47.12	47.16	47.13	47.12 ^d
T2	47.18	47.20	47.21	47.17	47.19 ^c
T3	47.22	47.24	47.28	47.26	47.25 ^b
T4	47.29	47.30	47.33	47.32	47.31 ^a
S. E. ± 0.011		CD at 5% 0.034			

The values with different superscripts differ significantly at 5 percent level of significance

From table no. 7, it was concluded that the mean average scores for total solid content of paneer were 47.12, 47.19, 47.25 and 47.31 percent for treatment T₁, T₂, T₃ and T₄, respectively. It was show that, the average total solid scores of the developed paneer continued to increased with increased in level of cow colostrum. The treatment T₁, T₂, T₃, T₄ were significantly ($p < 0.05$) differ from each other. The total solid content of the paneer increased as the amount of cow colostrum in the paneer increased.

The values recorded in total solid content in the present study were similar with research of Anamika *et al.* (2013) [6] studied physiochemical values of control and colostrum fortified dahi contains total solid 14.12 and 14.10 percent respectively.

Azza *et al.* (2018) [9] reported that functional yoghurt was prepared by using buffalo with control and bovine colostrum was added at different ratios 5% (T₂), 10% (T₃) and 15% (T₄). The proportion of colostrum increased total solid content increases 14.67 (T_c), 17.84 (T₁) 18.11 (T₂), 18.34 (T₃), 18.80 (T₄), respectively.

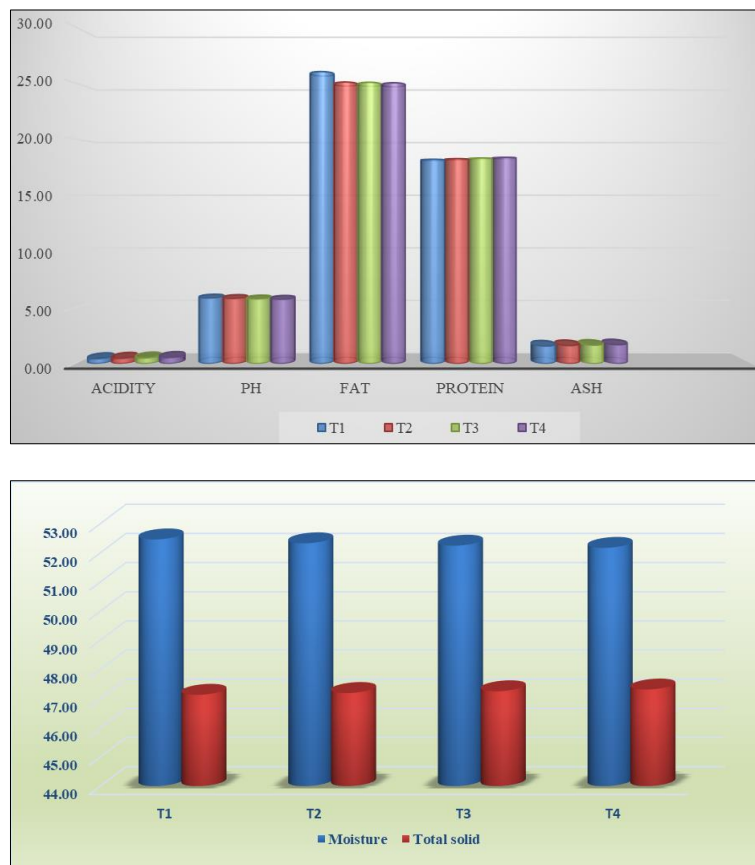


Fig 2: Physico-chemical analysis of paneer prepared from buffalo milk blended with cow colostrum

Conclusion

From present investigation it can be concluded that the cow colostrum can be very well utilized for preparation of medicinal and nutritional paneer. All the physico-chemical properties i.e., pH, acidity, fat, protein, ash, moisture and total solid these values were found to be significantly differed over control and between each other. There was increase in acidity, protein, ash and total solid content whereas, decrease in pH, moisture content of paneer.

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