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Sensory properties of *paneer* developed from cow milk blended by buffalo colostrum

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Abstract
In the present investigation the attempt was made to study the sensory properties of *paneer* prepared from cow milk blended with buffalo colostrum. The *paneer* was set by seeing treatment combination of cow milk and buffalo colostrum as 95%, 90% and 85% of cow milk and 5%, 10% and 15% of buffalo colostrum in treatments T_2, T_3 and T_4 whereas treatment T_1 was taken as control. The product obtained was subjected for organoleptic evaluation by panel of semi expert judges using 9 point Hedonic Scale and observed score for colour and appearance (7.88, 8.28, 8.66, 7.53), flavour (8.25, 8.50,9.13, 7.83), body and texture (7.83,8.23,8.54,8.37), mouthfeel (7.81,7.87, 8.74,7.87). It was also observed that overall acceptability score for control T_1 and treated samples T_2, T_3 and T_4 were 7.89, 8.16, 8.75 and 7.66 individually and sample T_3 was found superior among all buffalo colostrum blended cow milk *paneer* samples.

Keywords: *Paneer*, Cow milk, buffalo colostrum

1. Introduction
India is leading as a global milk producer. India's fluid milk production in market year 2023 is 207 million metric tons, up to 2 per cent from the earlier revised MY 2022 estimates of 202.5 MMT and milk consumption in MY 2023 at 86.5 MMT up somewhat compared to the MY 2022 [9] consumption of 85 MMT. (Anonymous 2022-23) [2]. According to Prevention of Food Adulteration Rules (PFA 2010) *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 per cent moisture and the milk fat content shall not be less than 50% of the dry matter. Cow milk *paneer* has sensory attributes of creamy yellowish white colour, closed and compact body and texture, and nutty flavour with a bland note. Increased yield of *paneer* as well as whiter *paneer* using cow milk seems to be the primary requirement of *paneer* makers in dairy industry (Kumar and Rashmi 2019) [8].
Colostrum contains major nutrients (fatty acids, proteins, carbohydrates, vitamins (A, B_6, B_{12}, C etc), minerals (Ca, Na, Mg, P, CI, K etc), immunological compounds (Immunoglobulines - IgG and IgM, hormones and enzymes. Besides providing immune support colostrum has remarkable musculoskeletal repair and growth capabilities. In addition, it seems that colostrum is the only natural source of four major growth factors namely transforming growth factors alpha (TGF- a) and beta (TGF-B), and insulin-like growth factors 1 (IGF-1) and 2 (IGF-2). Colostrum in addition is also a protecting agent in contradiction of various disease (Coroian *et al.* 2013) [3]. The present investigation was carried out to study the sensory properties of *paneer* prepared from cow milk blended with buffalo colostrum.

Materials and Methods
Cow milk and Buffalo colostrum
The fresh Cow milk was purchased from local market of Latur city, having 3.5 per cent fat and 8.5 per cent SNF. The Buffalo 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, milkometer (fat, lactose, solid not fat and protein of milk), standard weight balance, thermometer, gas shegadi, muslin cloth, *paneer* press machine, etc used for the research of *paneer*. All the equipment was correctly cleaned and washed with the detergent solution before using and all the precautionary measures were measured during the conduction of trials to evade contamination.

Preparation of *paneer* from cow milk blended with buffalo colostrum
The cow milk with 3.5 per cent fat and 8.5 per cent SNF was heated to 90 °C and chilled up to temperature 78 °C. After cooling buffalo colostrum was added than citric acid was added @ 1 per cent at 76 °C with stiring. After complete coagulation the stirring was stopped and allow the curd to sink to the bottom. The whey was then drained through a stainless steel container. The curd was collected and filled in stainless steel *paneer* hoop. The hoop used was of circular blocks with holes on its side to facilitate the expulsion of whey. *Paneer* was pressed 10-15 minutes @ 3 kg/sq cm. The pressed block of curd was detached from the hoop, cut into pieces and occupied in chilled water (4 °C) for 2 to 3 hours. The chilled *paneer* was then removed from water to drain out and filled in polythene bag and finally was stored in refrigerator (5 °C).

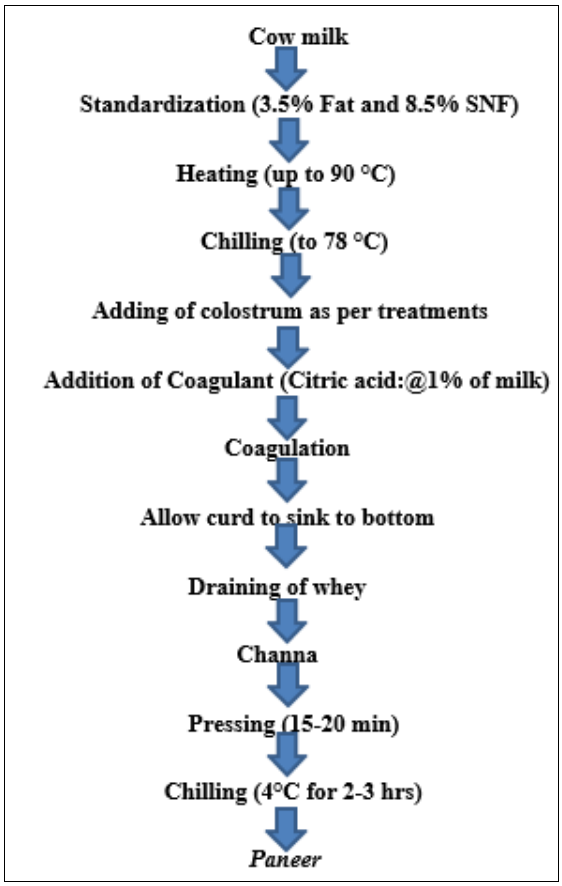

Fig 1: Flow chart for prepration of *panner* from cow milk blended with buffalo colostrum (Aneja 2002) [1]

Treatment combinations
The *paneer* was prepared from cow milk blended with buffalo colostrum as per the following treatments.
T_1= *Paneer* from Cow milk (control)
T_2= *Paneer* with 5 per cent of Buffalo colostrum (On a wt. basis of milk)
T_3= *Paneer* with 10 per cent of Buffalo colostrum (On a wt. basis of milk)
T_4= *Paneer* with 15 per cent of Buffalo colostrum (On a wt. basis of milk)

Sensory evaluation
Paneer samples of different treatments were evaluated for its colour and appearance, flavor, body and texture, mouthfeel/smoothness and overall acceptability. The scoring was done on "9 point Hedonic scale" developed by Quarter Master, Food and Container Institute, USA (Gupta, 1976) [5].

Results and Discussions
Sensory evaluation of buffalo colostrum blended cow milk *paneer*
Buffalo colostrum blended cow milk *paneer* was evaluated for its colour and appearance, flavour, body and texture, mouth fill/smoothness by a panel of five judges using a nine-point hedonic scale. The numerical score given by judges for individual quality attributes were computed to get the mean and these mean were then subjected to the statistical analysis. The results obtained for sensory evaluation of buffalo colostrum blended cow milk *paneer* are discussed as under.

Colour and appearance
The colour and appearance score as influenced by the proportion of cow milk and buffalo colostrum per cent have been noted in Table 1.

Table 1: Effect of buffalo colostrum blending on colour and appearance score of cow milk *paneer*

Replication / Treatment	R1	R2	R3	R4	Mean
T_1	8.00	7.00	8.00	8.50	7.88bc
T_2	8.20	8.50	8.15	8.25	8.28ab
T_3	8.48	9.00	8.59	8.56	8.66^a
T_4	7.50	7.90	7.20	7.50	7.53^c
SE ± 0.1865	CD at 5% 0.5748				

The values with various small letters superscripts differ considerably from one another row by row at the 5per cent level of significance.

Table 1 shows that as the percentage of buffalo colostrum increases, the colour and appearance of the *paneer* improve and become more appealing, but the extent level reduces the colour and appearance of buffalo colostrum blended cow milk *paneer*. In this study, the alternate treatment shown significant variation whereas successive treatment were at par each other at 5 per cent level of significant. T_1, T_2 and T_3 were found at par to each other. As well as T_1 and T_4 were at par with each other. It specifies that the colour and appearance score is improved by up to 5 and 10 per cent of buffalo colostrum, similarly and decreased by 15 per cent of buffalo colostrum, which is an excessive quantity. This indicates that the increased in proportion of buffalo colostrum in *paneer* increased the white colour and appearance of *paneer*. It is practical that more percent of buffalo colostrum dropped the score of developed *paneer* for colour and appearance secured the score for all treatments additional than 7.53 means it was in between like moderately to like extremely on 9 point hedonic scale. To conclude, colour and appearance of food products is the stuff of practice and are the most crucial sensory attributes, mainly when they are closely related to indicators of food quality.

Rasika (2018) [10] recorded the maximum score for colour and appearance for T_3 (8.07) i.e. artificial colostrum cake with 15 per cent mango pulp trailed by treatment T_2 (7.83) i.e. artificial colostrum cake with 10 per cent mango pulp. The lowest score was noted by T_4 (7.57) i.e. artificial colostrum cake with 20 per cent mango pulp.

Shamika *et al.* (2022) [11] studied that colour and appearance score increased with the addition of coconut milk per cent from 7.24, 7.49, 7.25, 7.37, and 7.24 from T_1 to T_5. The sample with the highest score, T_2, had 20 per cent coconut milk.

Values and explanations noted in the presence study are friendly with above conclusions.

Flavour score for buffalo colostrum blended cow milk *paneer*

The flavour is the important sensory parameter of any food material and sensitive for consumer point of view. Table 2 displays the typical flavour rankings for developed buffalo colostrum blended cow milk *paneer.*

Table 2: Flavour score for buffalo colostrum blended cow milk *paneer*

Replication / Treatment	R1	R2	R3	R4	Mean
T_1	8.00	9.00	8.00	8.00	8.25^b
T_2	9.00	8.00	8.00	9.00	8.50ab
T_3	9.00	9.00	9.50	9.00	9.13^a
T_4	8.00	7.00	8.50	7.80	7.83^b
SE ± 0.2543	CD at 5% 0.7836				

The values with various small letters superscripts differ considerably from one another row by row at the 5per cent level of significanc.

From Table 2 it was clear that the cow milk *paneer* blended with buffalo colostrum had a significantly unlike mean flavour score. The flavour rating of the different treatments under consideration reached from 8.25 to 9.13. In this present study it was originated that T_1, T_2 and T_4 were at par with each other and treatment T_2 was also at par with treatment T_3 having highest score as 9.13 at 5 per cent level of significant. Obtained flavour scores indicated that buffalo colostrum blended cow milk *paneer* had grade distribution as 'Like extremely.'

The present study's values were comparable to those from the next study, which contained.

Rasika (2018) [10] reported that artificial colostrum cake with 15 per cent mango pulp (T_3) recorded highest score of (8.10) for flavour followed by treatment T_2 (7.89) i.e. artificial colostrum cake with 10 per cent mango pulp. The artificial colostrum cake with 20 per cent mango pulp (T_4) had significantly lowest score (7.51).

Joseph and Rao (2019) [6] considered that as the percentage of lemongrass extract had more flavour rating of the *paneer* with lemongrass in it persistent to fall down from 8.04 (0 per cent), 8.03 (2 per cent), 7.92 (4 per cent), 7.48 (6 per cent).

Body and texture score for buffalo colostrum blended cow milk *paneer*

The body and texture of buffalo colostrum *paneer* as influenced by the unlike levels of buffalo colostrum per cent and score verified on account of this is presented in Table 3.

Table 3: Body and texture score for buffalo colostrum blended cow milk *paneer*

Replication /Treatment	R1	R2	R3	R4	Mean
T_1	8.00	7.50	8.00	7.80	7.83^b
T_2	8.30	8.50	8.10	8.00	8.23^a
T_3	8.40	8.45	8.80	8.50	8.54^a
T_4	8.80	8.15	8.29	8.25	8.37^a
SE ± 0.1177	CD at 5% 0.3629				

The values with various small letters superscripts differ considerably from one another row by row at the 5 per cent level of significance.

From Table 3 it was revealed that the steady body and texture ratings of the developed *paneer* endless to rise. The mean body and texture ratings of cooked *paneer* for various treatments varied from 7.83 to 8.54. T_3 (8.54) had the greatest score, while T_1 (7.83) had the lowest body and texture score of all treatments. In the present study, it was clear that T_2, T_3, and T_4 were at par with each other but significantly different from T_1. In this study, the alternate treatment shown significant variation whereas successive treatment were at par each other at 5 per cent near of significant. This study showed that buffalo colostrum blended cow milk *paneer* had a grade dispersal as 'Like very much.

Kirti (2015) [7] found variation in the body & texture could be attributed to the possible variation in the proportion of milk: colostrum which had firm body & closed texture with smooth surface of the product.

Shelke *et al.* (2022) [12] reported the score for texture from 6.8 to 8.5. T_I noted very less score of texture because it made up of whole colostrum and which were high in protein content and give rigid texture to *kharwas.* The acceptable texture were obtain for sample T_3 and it scored higher than other sample and was 8.5.

The marks noted in the present study are pleasant with the above findings.

Mouthfeel /smoothness of buffalo colostrum blended cow milk *paneer*

The sensory scores for mouthfeel/smoothness of buffalo colostrum blended cow milk *paneer* as partial by different per cents of buffalo colostrum is noted in Table 4.

Table 4: Mouthfeel/ smoothness of buffalo colostrum blended cow milk *paneer*

Replication / Treatment	R1	R2	R3	R4	Mean
T1	8.00	7.55	8.20	7.50	7.81 b
T2	8.10	7.60	8.25	7.52	7.87b
T3	8.50	8.62	8.85	9.00	8.74
T4	8.12	7.66	8.10	7.60	7.87b
SE ± 0.1533	CD at 5% 0.4724				

The values with various small letters superscripts differ considerably from one another row row at the 5per cent level of significance.

Table no. 4 concluded that in this present scenario the normal mouthfeel scores, i.e. the smoothness of buffalo colostrum blended cow milk *paneer* of treatments T_1, T_2 and T_4 were at par from each other but significantly different from T_3 having highest score of 8.74 at 5 per cent level of significant. This study concluded that buffalo colostrum blended cow milk *paneer* with mouth feel score lies between sensory score 7 to 8 i.e. with grade distribution as 'Like moderately' to 'Like very much.

A similar observation for the mouthfeel or smoothness of buffalo colostrum blended cow milk *paneer* was demonstrated.

David (2012) [4] made functional *paneer* from buffalo milk blended with coconut milk. The treatment combination was (95:05, 90:10 and 85:15) of buffalo milk and coconut milk. The flavour and test score of *paneer* was 8.36 (T_1) 7.78 (T_2), 7.92 (T_3) and 7.86 (T_4).

Shelke *et al.* (2022) [12] found that the score for mouthfeel given for sample T_0,T_1,T_2,T_3 and T_4 were 7.1, 7.3, 7.8, 8.1 and 8. The maximum score were seen in sample T_3 wherin 73 per cent colostrum and 15 per cent sterile milk was added.

Overall acceptability of buffalo colostrum blended cow milk *paneer*

The overall acceptability score is the average score worked out from the score given by the judges for the dissimilar characteristics of the product i.e. colour and appearance, flavour, body and texture and mouthfeel/smoothness. Thus the regular score ran out as overall acceptability score is presented in Table 5.

From Table no. 5 it was stated that the average overall acceptability score for buffalo colostrum blended cow milk *paneer* gradually rises and after treatment T_3 it declined. Treatment T_1, and T_2. As well as treatment T_1 also at par with treatment T_3. In this study, the alternate treatment shown significant variation whereas successive treatment were at par each other at 5 per cent level of significant. From the above result, we can conclude that buffalo colostrum blended cow milk *paneer* had an overall acceptance score of 8 which indicates that it had a grade distribution as 'like very much.

Table 5: Overall acceptability of buffalo colostrum blended cow milk *paneer*

Replication / Treatment	R1	R2	R3	R4	Mean
T1	7.95	7.89	7.80	7.92	**7.89bc**
T2	8.20	8.18	8.10	8.15	**8.16^{b}**
T3	9.00	8.50	8.29	9.20	**8.75^{a}**
T4	7.50	7.59	7.65	7.90	**7.66^{c}**
SE ± 0.1159	CD at 5% 0.3573				

The values with various small letters superscripts differ considerably from one another row by row at the 5per cent level of significance.

The results of the overall acceptance score for buffalo colostrum blended cow milk *paneer* presented above were equivalent to the findings presented below.

Kirti (2015) [7] stated that the overall acceptability scores of different samples of *kharvas* made from milk and colostrum ranged from 7.00±0.23 to 8.13±0.44 which is a reflection of the overall quality perception of any product.

Shamika *et al.* (2022) [11] found that the most adequate level of coconut milk was observed in T_2 (7.55), followed by T_3 i.e. designed colostrum cake with 15 per cent coconut milk (7.46), while lowest score was obtained by T_4 i.e. Designed colostrum cake with 10 per cent coconut milk with overall acceptability score of 7.28.

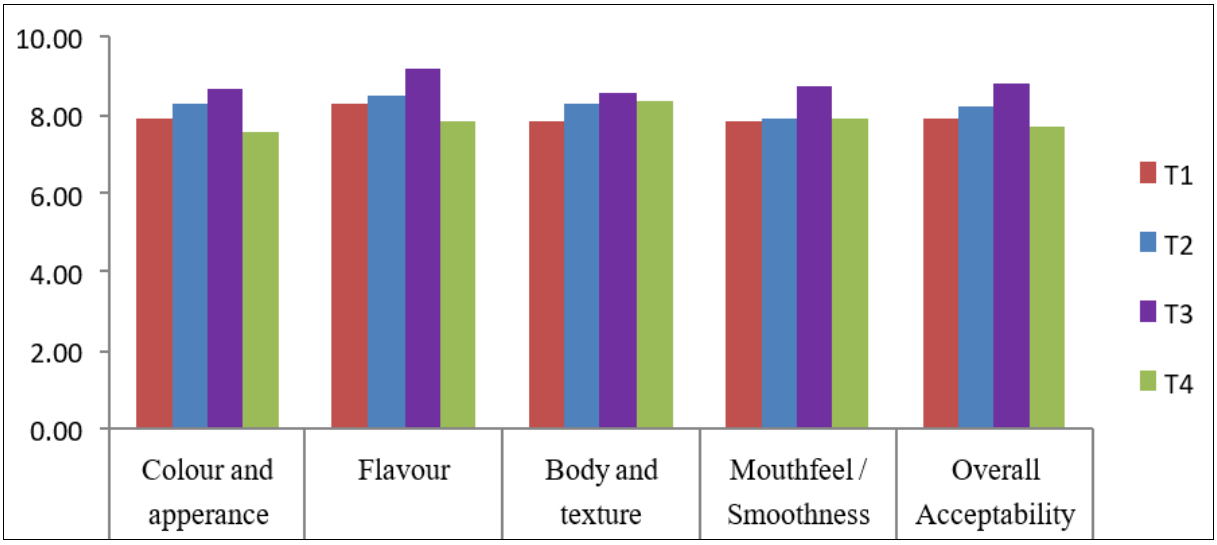

Fig 2: Sensory analysis of *paneer* prepared from cow milk blended with buffalo colostrum.

Conclusion

From present examination it can be concluded that the buffalo colostrum can be very well utilized for research of medicinal and nutritional *paneer*. All the sensory parameters were differed significantly between each treatments but they secured acceptable sensory score for all sensory parameters

on 9 point hedonic scale, it means all treatments were acceptable on sensory basis and sample T_3 was found superior among all buffalo colostrum blended cow milk *paneer* samples.

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