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An investigation of varying composition and processing conditions on the organoleptic quality of *Chhana* based cheese spread

Praveen Sahu, MPS Yadav, Rahul Tiwari and Pooja Yadav

Abstract
The present investigation entitled was conducted in the laboratory of Department of A.H. & Dairying (Dairy Technology), C.S.A University of Agriculture and Technology Kanpur. In the experiment mixed milk of Cow and Buffalo are taken and five level of cheese (5%, 10%, 15%, 20% & 25%), salt level 1.5 & 2.0 per cent, coagulant citric acid 1%, and preservative Potassium Meta bi sulphite (0.1%) & Sorbic Acid (0.03%) were taken for Preparation of *Chhana* based cheese spread. Sensory quality of *Chhana* based cheese spread depends on flavour, body & texture, colour & appearance, spreadibility and overall acceptability. The highest flavour score (8.0), body & texture score (7.9), colour & appearance score (8.1), spreadibility score (8.2) and overall acceptability score (7.8) was found in the treatment combination of $A_1B_1C_5D_1$ among all the physical attributes of *Chhana* based cheese spread.

Keywords: Citric acid, potassium Meta bi sulphite, Sorbic acid, *Chhana*, cheese, Spreadability

Introduction
India is the highest milk producer i.e., rank first position in the world contributing twenty-four percent of global milk production in the year 2021-22. The milk production of Indian has registered fifty –one percentage increases in last eight years i.e. during the year 2014-2015 and 2021-2022 and increase to twenty–two crore tonne in the year 2021-2022. (According to Ministry of Fisheries, Animal Husbandry & Dairying). Total milk production in the country during 2021-22 is 221.06 million tonnes. In the current year 2021-22, the milk production has registered an annual growth rate of 5.29%. Top five milk producing States are Rajasthan (15.05%), Uttar Pradesh (14.93%), Madhya Pradesh (8.06%), Gujarat (7.56%) and Andhra Pradesh (6.97%). The per-capita availability of milk is 444 gram/day during 2021-2022 increased by 17 gram per day over previous year. According to economic survey of India.

Cheese is the ripened or unripe Ned soft, semi-hard, hard, or extra-hard product, which may be coated with food grade waxes or polyfilm, and in which the whey protein/ casein ratio does not exceed that of milk. Cheese is obtained by coagulating wholly or partly the protein of milk, skimmed milk, partly skimmed milk, cream, whey cream or buttermilk, or any combination of these materials, through the action of suitable enzymes of non-animal origin or other suitable coagulating agents, with or without use of harmless lactic acid bacteria and flavour producing bacteria, and by partially draining the whey resulting from the coagulation, while respecting the principle that cheese-making results in a concentration of milk protein (in particular, the casein portion), and that consequently the protein content of the cheese will be distinctly higher than the protein level of the blend of the above milk materials from which cheese was made. The processing techniques involving coagulation of the protein of milk or products obtained from milk, or both, which give an end-product with similar physical, chemical and organoleptic characteristics as the product specified. All cheese shall be made from milk which is subject to heat treatment at least equivalent to that of pasteurization.

It differs from Paneer as no pressure is applied to drain the whey and its pH is slightly higher. Scanning electron microscopy of defatted sample of *Chhana* revealed a conglomerated compact protein matrix with numerous small uniformly distributed pores. The coalesced, smooth protein bodies are joined with thick bridge in which fat globules embodied in coalesced casein micelles with some whey filled space at edge. The agglomerated large casein particles formed continuous thick strands joined together with numerous spaces in between (Adhikari *et al.* 1992) [19].

Presently, there are mainly two types of spread available in the domestic market butter and cheese spreads. In present scenario most consumers are fat conscious and hesitant to consume butter fat because of the possibility of coronary heart disease and obesity. The Indian Dairy sector is constantly looking for alternative product to create a new category of *Chhana* spread. *Chhana* based cheese spread which is rich in protein and low in cholesterol. This is usually used with bread in the breakfast and currently, gym doing person mostly used as a protein supplement. Use of cheese spread is confined only a small section of society because it's unique flavour. *Chhana* based cheese spread is good source of essential amino acid and fat soluble vitamin A, D, E and K and protein. It contains low sugar and low animal fat as compare to other spread, so that it is highly recommended to the diabetic patient, heart patient and obese person. It has pleasant and rich flavour with slightly sour and sweet flavour which makes it palatable to Indian society and it cheaper than other spread.

Material and Methods
Materials
(1) Mixed milk of Cow and Buffalo: Mixed milk was obtained from university Dairy for the manufacturing of *Chhana* and subsequently *Chhana* spread.
(2) Coagulant: Analytical grade citric acid was used as coagulant for the preparation of *Chhana* spread.
(3) Preservative: Potassium Meta bi sulphite & Sorbic acid.
(4) Salt: Refined commercial grade Tata brand salt was used.
(5) Cheese: Amul brand company Processed Cheese was used.
(6) Equipment: The following equipment's were used for the preparation of *Chhana* based cheese spread.
1. Gas Stove
2. Stainless Steel Pan
3. Stainless Steel Laddle
4. Muslin Cloth
5. Stainless Steel Plate
6. Domestic Blender
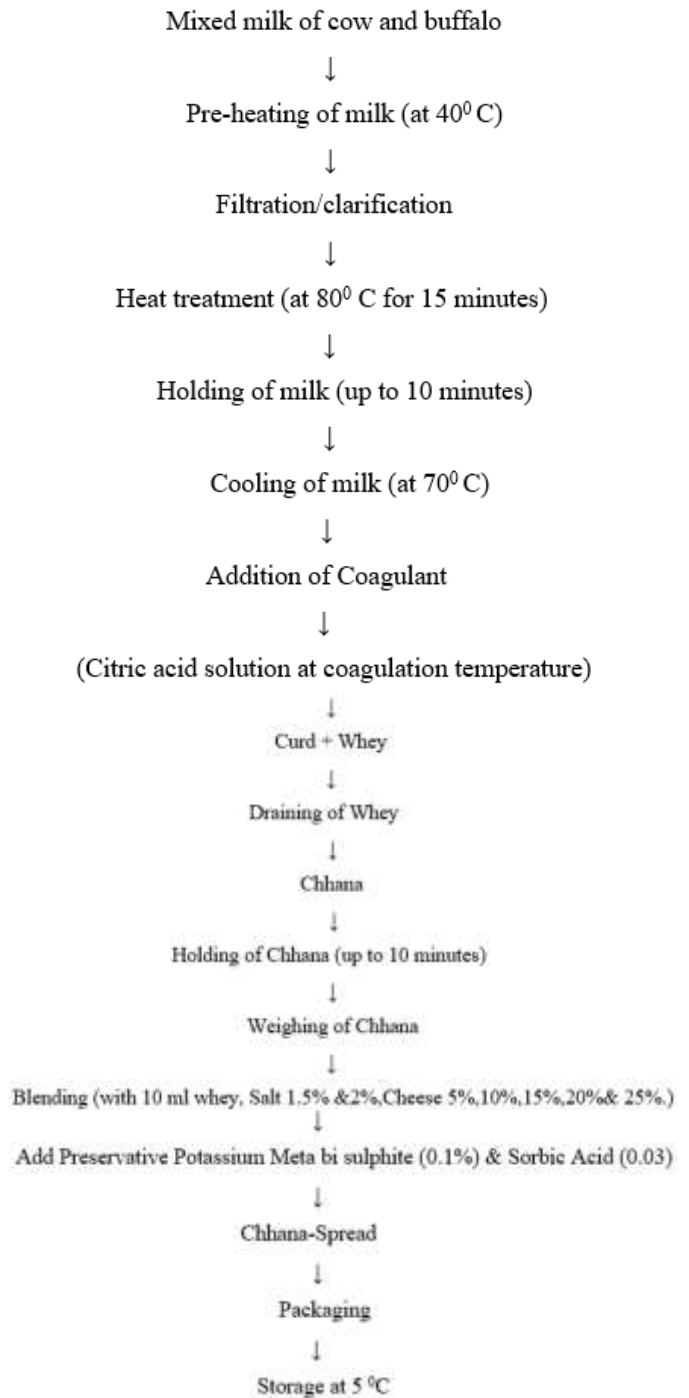7. Plastic Cups
8. Aluminum foil paper

Methods
The cow and buffalo milk was heated subsequently in karahi; over an open fire to 70 °C. The milk was slowly stirred by a ladle during heating to avoid burning. When temperature of milk reached 80 °C then coagulation of 1% solution of citric acid with 100 ml of distilled water was added to the milk slowly with stirring till the complete coagulation take place. After coagulation the stirring was stopped and contents were poured over a piece of clean muslin cloth for straining of whey. After the draining of whey *Chhana* was collected then after 10 minutes hanging of *Chhana* for re moval of water from *Chhana* and weighed.

After weighting, the common salt at 1.5% & 2.0% and level of Cheese 5%, 10%, 15%, 20%, 25% with 0% control was mixed with the help of mixer and add preservative Potassium Meta bi sulphate 0.1% and Sorbic acid 0.03% for improve keeping quality of product. Finally, *Chhana* spread was collected and packed in plastic cups.

The samples were stored at refrigeration temperature (5 °C) for testing the physico-chemical, microbiological and its shelf life quality.

Flow Diagram

Manufacturing procedure of Chhana based cheese spread

Mixed milk of cow and buffalo
↓
Pre-heating of milk (at 40⁰ C)
↓
Filtration/clarification
↓
Heat treatment (at 80⁰ C for 15 minutes)
↓
Holding of milk (up to 10 minutes)
↓
Cooling of milk (at 70⁰ C)
↓
Addition of Coagulant
↓
(Citric acid solution at coagulation temperature)
↓
Curd + Whey
↓
Draining of Whey
↓
Chhana
↓
Holding of Chhana (up to 10 minutes)
↓
Weighing of Chhana
↓
Blending (with 10 ml whey, Salt 1.5% &2%,Cheese 5%,10%,15%,20%& 25%.)
↓
Add Preservative Potassium Meta bi sulphite (0.1%) & Sorbic Acid (0.03)
↓
Chhana-Spread
↓
Packaging
↓
Storage at 5 ⁰C

Organoleptic evaluation of *Chhana* based cheese spread
Sensory evaluation
Sensory evaluation of *Chhana* based cheese spread was done on the basis of organoleptic tests by panel of five judges of department of animal husbandry and dairying, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Samples were given code nos. to avoid bias opinion and individuality. The judges evaluated the sample taking in the consideration of flavour, body and texture, colour and appearance, spreadibility, and over all acceptability of *Chhana* spread.

The point hedonic scale was used for evaluation of product for sensory characteristics.

Test the sample and check how much you like or dislike each one. Use appropriate scale to show your attitude by checking at the point that best describe yours feeling about the sample.

Hedonic Scale

Hedonic Scale	Score
Excellent	9
Very Good	8
Good	7
Fair	6
Neither good nor bad	5
Slightly undesirable	4
Poor	3
Very Poor	2
Unacceptable	1

Results and Discussion

The combination level samples of spread using cheese from mixed milk of cow and buffalo in which *Chhana* and cheese mixed at different ratios are -

C_1 = *Chhana*: Cheese combination level at 95:05 in spread using cheese from mixed milk of cow and buffalo.

C_2 = *Chhana*: Cheese combination level at 90:10 in spread using cheese from mixed milk of cow and buffalo.

C_3 = *Chhana*: Cheese combination level at 85:15 in spread using cheese from mixed milk of cow and buffalo.

C_4 = *Chhana*: Cheese combination level at 80:20 in spread using cheese from mixed milk of cow and buffalo.

C_5 = *Chhana*: Cheese combination level at 75:25 in spread using cheese from mixed milk of cow and buffalo.

All the samples were made in laboratory. The data thus obtained were analyzed in Factorial Complete Randomized Design. The results drawn and their interpretation were presented systematically in the following tables.

A. Sensory Evaluation of *Chhana* based cheese spread

1. Flavour: Flavour of *Chhana* spread is considered to be the main attribute to determine its acceptability.

The comparison of mixed milk of cow and buffalo, two level of salt, two preservative (Sorbic acid and Potassium meta bi-sulphite) at different cheese level and storage periods on flavour of *Chhana* based cheese spread has been given in Table 1, which revealed the following facts:-

Table 1: An average flavour Score of *Chhana* based Cheese spread using mixed milk of cow and buffalo as affected by the Salt level (A), Preservative (B), Cheese level (C) & Storage periods (D).

Treatment	B1	B2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	Mean
A1	6.33	6.30	5.30	5.33	5.38	6.21	6.27	7.75	7.14	6.45	5.53	4.70	6.05
A2	5.83	5.77	5.65	5.72	5.78	5.82	6.03	7.35	6.69	5.71	5.00	4.25	5.80
B1			5.23	5.91	6.04	6.10	6.12	7.60	6.94	6.13	5.23	4.50	5.98
B2			5.87	5.93	5.95	6.10	6.26	7.50	6.89	6.03	5.30	4.45	6.01
C1								7.35	6.85	6.20	5.40	4.70	6.10
C2								7.45	6.80	6.08	5.25	4.55	6.03
C3								7.55	6.95	6.18	5.28	4.45	6.08
C4								7.65	6.88	5.73	5.03	4.38	5.93
C5								7.75	7.10	6.23	5.38	4.30	6.15
Mean	6.08	6.03	5.51	5.72	5.78	6.09	6.17	7.55	6.92	6.08	5.27	4.48	

From Table 1 the main effect of different levels of all the factors for Flavour Score of *Chhana* based Cheese spread, the following facts were observed. The Highest significant flavour score (7.75) was found to be in A_1 samples and lowest flavour score (4.25) was noticed in A_2 samples both salt levels shows significant difference at 5%. The present finding supported to the finding of Yadav *et al.* (2019) [17].

The main effect of Preservative (B) on Flavour Score of *Chhana* based Cheese spread, it was observed that highest flavour score (7.60) was noticed in B_1 samples, while lowest flavour score (4.45) was recorded in B_2 samples both preservative shows significant difference at 5%. The finding closely agreed with the finding of Misra *et al.* (2019) [20].

As the main effect of cheese level (C) on Flavour Score of *Chhana* based Cheese spread, it was observed that highest flavour score (6.27) was noticed in C_5 samples, while lowest flavour score (5.23) was recorded in C_1 samples. It shows significant difference at 5% in cheese level. The present finding corroborated with the finding of Tiwari *et al.* (2008) [21]. In case of storage periods (D), the highest significant flavour score (7.75) in *Chhana* based cheese spread was observed in D_1 samples and lowest flavour score (4.25) in D_5 samples. It shows significant difference at 5% in storage periods. The finding closely agreed with the finding of Misra *et al.* (2019) [20]. From the first order of interaction effect of A×B, the maximum flavour score (6.33) was found to be in

A_1B_1 combination while minimum flavour score (5.77) was noticed in A_2B_2 samples non- significant. From the first order of interaction effect, In case of A×C, the maximum flavour score (6.27) was observed in A_1C_5 samples and minimum flavour score (5.30) was noticed in A_1C_1 samples at 5% significant level. From the first order of interaction effect, In case of A×D, the maximum flavour score (7.75) was observed in A_1D_1 samples and minimum flavour (4.25) was noticed in A_2D_5 samples at 5% significant level. From the first order of interaction effect of B×C, the maximum flavour score (6.26) was noticed in B_2C_5 samples, and minimum flavour (5.23) was noticed in B_1C_1 samples it was significant at 5% level. From the first order of interaction effect of B×D, the maximum flavour score (7.60) was noticed in B_1D_1 samples, and minimum flavour score (4.45) was noticed in B_2D_5 samples it was significant at 5% level. From the first order of interaction effect of C×D, the maximum flavour score (7.75) was recorded in C_5D_1 samples, while minimum flavour score (4.30) was noticed in C_5D_5 samples at 5% significant level.

2. Body and Texture

The comparison effects of mixed milk of cow and buffalo, two level of salt, two preservative (Sorbic acid and Potassium meta bi-sulphite) at different cheese level and storage periods on body and texture of *Chhana* based cheese spread has been given in Table no. 2, which revealed the following facts:-
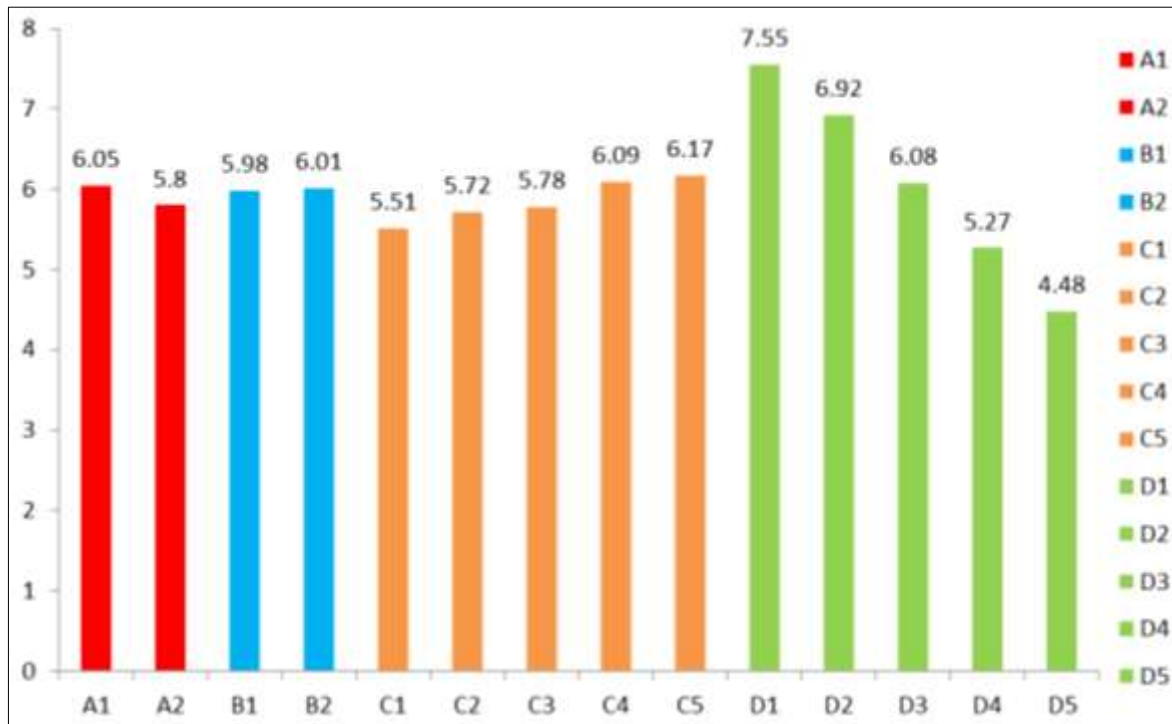
Fig 1: Average body and texture score of *Chhana* based cheese spread

Table 2: An average body and texture score of *Chhana* based Cheese spread using mixed milk of cow and buffalo as affected by the Salt level (A), Preservative (B), Cheese level (C) & Storage periods (D)

Treatment	B1	B2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	Mean
A1	6.24	6.20	6.11	6.17	6.25	6.28	6.30	7.65	7.04	6.35	5.45	4.60	6.22
A2	5.73	5.68	5.56	5.62	5.68	5.70	5.93	7.25	6.59	5.61	4.91	4.15	5.70
B1			5.81	5.94	6.02	6.04	6.13	7.50	6.84	6.03	5.15	4.40	5.98
B2			5.85	5.86	5.87	5.94	6.16	7.40	6.79	5.93	5.31	4.35	5.94
C1								7.25	6.75	6.10	5.30	4.60	6.00
C2								7.35	6.70	5.98	5.20	4.45	5.94
C3								7.45	6.85	6.08	5.18	4.35	5.98
C4								7.55	6.78	5.63	4.95	4.28	5.84
C5								7.65	7.00	6.13	5.28	4.20	6.05
Mean	5.98	5.94	5.83	5.89	5.95	5.99	6.13	7.45	6.82	5.98	5.18	4.38	

From Table 1 the main effect of different levels of all the factors for body and texture score of *Chhana* based Cheese spread, the following facts were observed. The Highest significant body and texture score (7.65) was found to be in A_1 samples and lowest body and texture score (4.15) was noticed in A_2 samples both salt levels shows significant difference at 5%. The present finding supported to the finding of Yadav *et al.* (2019) [16].

The main effect of Preservative (B) on body and texture Score of *Chhana* based Cheese spread, it was observed that highest body and texture score (7.50) was noticed in B_1 samples, while lowest body and texture score (4.35) was recorded in B_2 samples both preservative shows significant difference at 5%. The finding closely agreed with the finding of Misra *et al.* (2019) [20].

As the main effect of cheese level (C) on body and texture Score of *Chhana* based Cheese spread, it was observed that highest body and texture score (6.30) was noticed in C_5 samples, while lowest body and texture score (5.56) was recorded in C_1 samples. It shows significant difference at 5% in cheese level. The present finding corroborated with the finding of Chappalwar *et al.* (2010) [2]. In case of storage periods (D), the highest significant body and texture score (7.65) in *Chhana* based cheese spread was observed in D_1 samples and lowest body and texture score (4.15) in D_5

samples. It shows significant difference at 5% in storage periods. The finding closely agreed with the finding of Misra *et al.* (2019) [20]. From the first order of interaction effect of A×B, the maximum body and texture score (6.24) was found to be in A_1B_1 combination while minimum body and texture score (5.68) was noticed in A_2B_2 samples non- significant.

From the first order of interaction effect, In case of A×C, the maximum body and texture score (6.30) was observed in A_1C_5 samples and minimum body and texture score (5.56) was noticed in A_2C_1 samples at 5% significant level. From the first order of interaction effect, In case of A×D, the maximum body and texture score (7.65) was observed in A_1D_1 samples and minimum body and texture score (4.15) was noticed in A_2D_5 samples at 5% significant level. From the first order of interaction effect of B×C, the maximum body and texture score (6.16) was noticed in B_2C_5 samples, and minimum body and texture score (5.81) was noticed in B_1C_1 samples it was significant at 5% level. From the first order of interaction effect of B×D, the maximum body and texture score (7.50) was noticed in B_1D_1 samples, and minimum body and texture score (4.35) was noticed in B_2D_5 samples it was significant at 5% level. From the first order of interaction effect of C×D, the maximum body and texture score (7.65) was recorded in C_5D_1 samples, while minimum body and texture score (4.20) was noticed in C_5D_5 samples at 5% significant level.
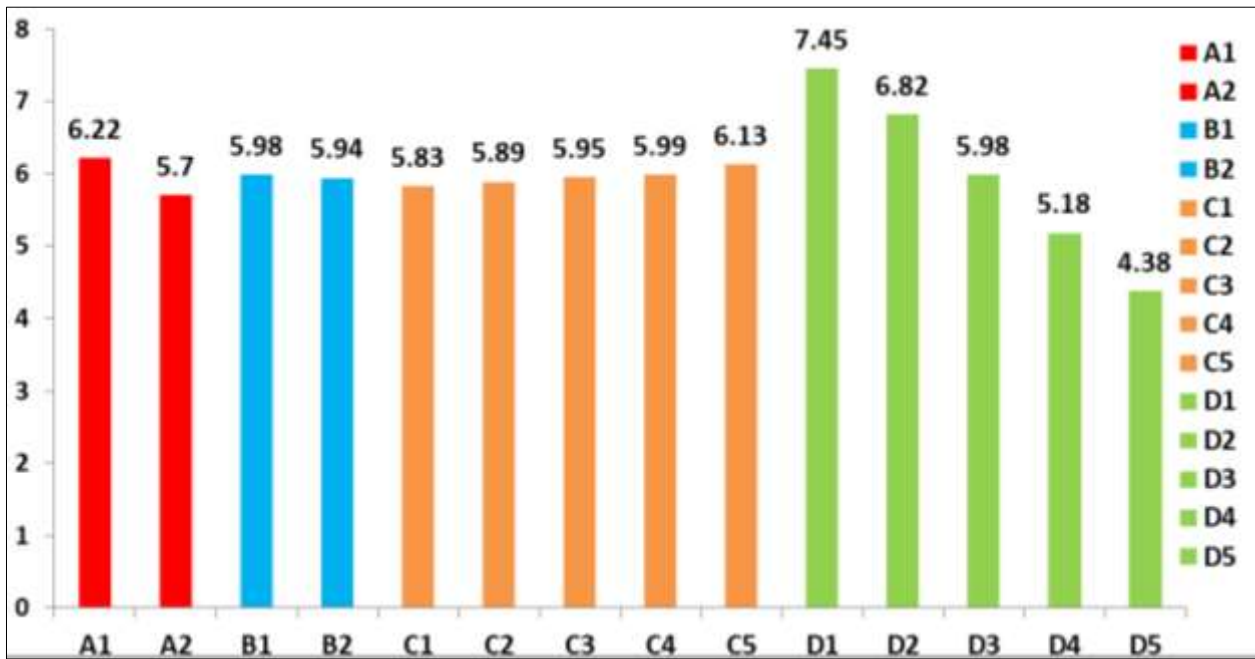
Fig 2: Average body and texture score of *Chhana* based Cheese spread

3. Colour and Appearance

Chhana based cheese spread should have a light yellow colour, mild acidic aroma and soft elastic texture. The comparison effects of mixed milk of cow and buffalo, two level of salt, two preservative (Sorbic acid and Potassium meta bi-sulphite) at different cheese level and storage periods on colour and appearance of *Chhana* based cheese spread has been given in Table no. 3, which revealed the following facts:-

Table 3: An average colour and appearance score of *Chhana* based Cheese spread using mixed milk of cow and buffalo as affected by the Salt level (A), Preservative (B), Cheese level (C) & Storage periods (D)

Treatment	B1	B2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	Mean
A1	6.43	6.39	6.31	6.33	6.44	6.47	6.48	7.85	7.24	6.55	5.64	4.79	6.41
A2	5.93	5.87	5.75	5.82	5.88	5.92	6.13	7.45	6.79	5.81	5.10	4.35	5.90
B1			6.01	6.14	6.21	6.28	6.33	7.70	7.04	6.23	5.34	4.59	6.18
B2			6.05	6.15	6.24	6.28	6.36	7.60	6.99	6.13	5.40	4.54	6.17
C1								7.45	6.95	6.30	5.50	4.78	6.20
C2								7.55	6.90	6.18	5.38	4.65	6.13
C3								7.65	7.05	6.28	5.38	4.53	6.18
C4								7.75	6.98	5.83	5.13	4.48	6.03
C5								7.85	7.20	6.33	5.48	4.40	6.25
Mean	6.18	6.13	6.03	6.11	6.19	6.23	6.32	7.65	7.02	6.18	5.37	4.57	

From Table 3 the main effect of different levels of all the factors for colour and appearance Score of *Chhana* based Cheese spread, the following facts were observed. The Highest significant colour and appearance score (7.85) was found to be in A_1 samples and lowest colour and appearance score (4.35) was noticed in A_2 samples both salt levels shows significant difference at 5%. The present finding supported to the finding of Yadav *et al.* (2019) [16]. The main effect of Preservative (B) on colour and appearance Score of *Chhana* based Cheese spread, it was observed that highest colour and appearance score (7.70) was noticed in B_1 samples, while lowest colour and appearance score (4.54) was recorded in B_2 samples both preservative shows significant difference at 5%. The finding closely agreed with the finding of Misra *et al.* (2019) [20].

As the main effect of cheese level (C) on colour and appearance Score of *Chhana* based Cheese spread, it was observed that highest colour and appearance score (6.48) was noticed in C_5 samples, while lowest colour and appearance score (5.75) was recorded in C_1 samples. It shows significant difference at 5% in cheese level. The present finding

corroborated with the finding of Chappalwar *et al.* (2010) [2]. In case of storage periods (D), the highest significant colour and appearance score (7.85) in *Chhana* based cheese spread was observed in D_1 samples and lowest colour and appearance score (4.35) in D_5 samples. It shows significant difference at 5% in storage periods. The finding closely agreed with the finding of Tiwari *et al.* (2008) [21]. From the first order of interaction effect of A×B, the maximum colour and appearance score (6.43) was found to be in A_1B_1 combination while minimum colour and appearance score (5.87) was noticed in A_2B_2 samples non- significant. From the first order of interaction effect, In case of A×C, the maximum colour and appearance score (6.48) was observed in A_1C_5 samples and minimum colour and appearance score (5.75) was noticed in A_2C_1 samples at 5% significant level. From the first order of interaction effect, In case of A×D, the maximum colour and appearance score (7.85) was observed in A_1D_1 samples and minimum colour and appearance score (4.35) was noticed in A_2D_5 samples at 5% significant level. From the first order of interaction effect of B×C, the maximum colour and appearance score (6.36) was noticed in B_2C_5 samples, and

minimum colour and appearance (6.01) was noticed in B_1C_1 samples it was significant at 5% level. From the first order of interaction effect of B×D, the maximum colour and appearance score (7.70) was noticed in B_1D_1 samples, and minimum colour and appearance score (4.54) was noticed in B_2D_5 samples it was significant at 5% level. From the first order of interaction effect of C×D, the maximum colour and appearance score (7.85) was recorded in C_5D_1 samples, while minimum colour and appearance score (4.40) was noticed in C_5D_5 samples at 5% significant level.

Fig 3: Average colour and appearance score of *Chhana* based Cheese spread

4. Spread ability

The comparison effects of mixed milk of cow and buffalo, two level of salt, two preservative (Sorbic acid and Potassium meta bi-sulphite) at different cheese level and storage periods on spread ability of *Chhana* based cheese spread has been given in Table No. 4, which revealed the following facts:-

Table 4: An average spread ability score of *Chhana* based Cheese spread using mixed milk of cow and buffalo as affected by the Salt level (A), Preservative (B), Cheese level (C) & Storage periods (D).

Treatment	B1	B2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	Mean
A1	6.53	6.49	6.41	6.47	6.54	6.56	6.57	7.95	7.33	6.65	5.74	4.87	6.51
A2	6.03	5.97	5.81	5.92	5.98	6.02	6.23	7.55	6.89	5.91	5.20	4.45	6.00
B1			6.11	6.24	6.30	6.31	6.43	7.80	7.13	6.33	5.44	4.69	6.28
B2			6.14	6.15	6.16	6.24	6.46	7.70	7.09	6.23	550	4.64	6.23
C1								7.55	7.05	6.40	5.60	4.87	6.29
C2								7.65	7.00	6.28	5.48	4.75	6.23
C3								7.75	7.13	6.38	5.48	4.62	6.27
C4								7.85	7.08	5.93	5.23	4.58	6.13
C5								7.95	7.30	6.43	5.58	4.50	6.35
Mean	6.28	6.23	6.11	6.19	6.24	6.28	6.42	7.75	7.11	6.28	5.47	4.66	

From Table 4 the main effect of different levels of all the factors for spread ability Score of *Chhana* based Cheese spread, the following facts were observed. The Highest significant spread ability score (7.95) was found to be in A_1 samples and lowest spread ability score (4.45) was noticed in A_2 samples both salt levels shows significant difference at 5%. The present finding supported to the finding of Yadav *et al.* (2019) [16]. The main effect of Preservative (B) on spread ability Score of *Chhana* based Cheese spread, it was observed that highest spread ability score (7.80) was noticed in B_1 samples, while lowest spread ability score (4.64) was recorded in B_2 samples both preservative shows significant difference at 5%. The finding closely agreed with the finding of Misra *et al.* (2019) [20]. As the main effect of cheese level (C) on spread ability Score of *Chhana* based Cheese spread, it was observed that highest spread ability score (6.57) was noticed in C_5 samples, while lowest spread ability score (5.81)

was recorded in C_1 samples. It shows significant difference at 5% in cheese level. The present finding corroborated with the finding of Gupta *et al.* (2022) [6]. In case of storage periods (D), the highest significant spread ability score (7.95) in *Chhana* based cheese spread was observed in fresh D_1 samples and lowest spread ability score (4.45) in D_5 samples. It shows significant difference at 5% in storage periods. The finding closely agreed with the finding of Tiwari *et al.* (2008) [21]. From the first order of interaction effect of A×B, the maximum spread ability score (6.53) was found to be in A_1B_1 combination while minimum spread ability score (5.97) was noticed in A_2B_2 samples non- significant. From the first order of interaction effect, In case of A×C, the maximum spread ability score (6.57) was observed in A_1C_5 samples and minimum spread ability score (5.81) was noticed in A_2C_1 samples at 5% significant level. From the first order of interaction effect, In case of A×D, the maximum spread

ability score (7.95) was observed in A_1D_1 samples and minimum spread ability (4.45) was noticed in A_2D_5 samples at 5% significant level. From the first order of interaction effect of B×C, the maximum spread ability score (6.46) was noticed in B_2C_5 samples, and minimum spread ability score (6.11) was noticed in B_1C_1 samples it was significant at 5% level. From the first order of interaction effect of B×D, the

maximum spread ability score (7.80) was noticed in B_1D_1 samples, and minimum spread ability score (4.64) was noticed in B_2D_5 samples it was significant at 5% level. From the first order of interaction effect of C×D, the maximum spread ability score (7.95) was recorded in C_5D_1 samples, while minimum spread ability score (4.50) was noticed in C_5D_5 samples at 5% significant level.
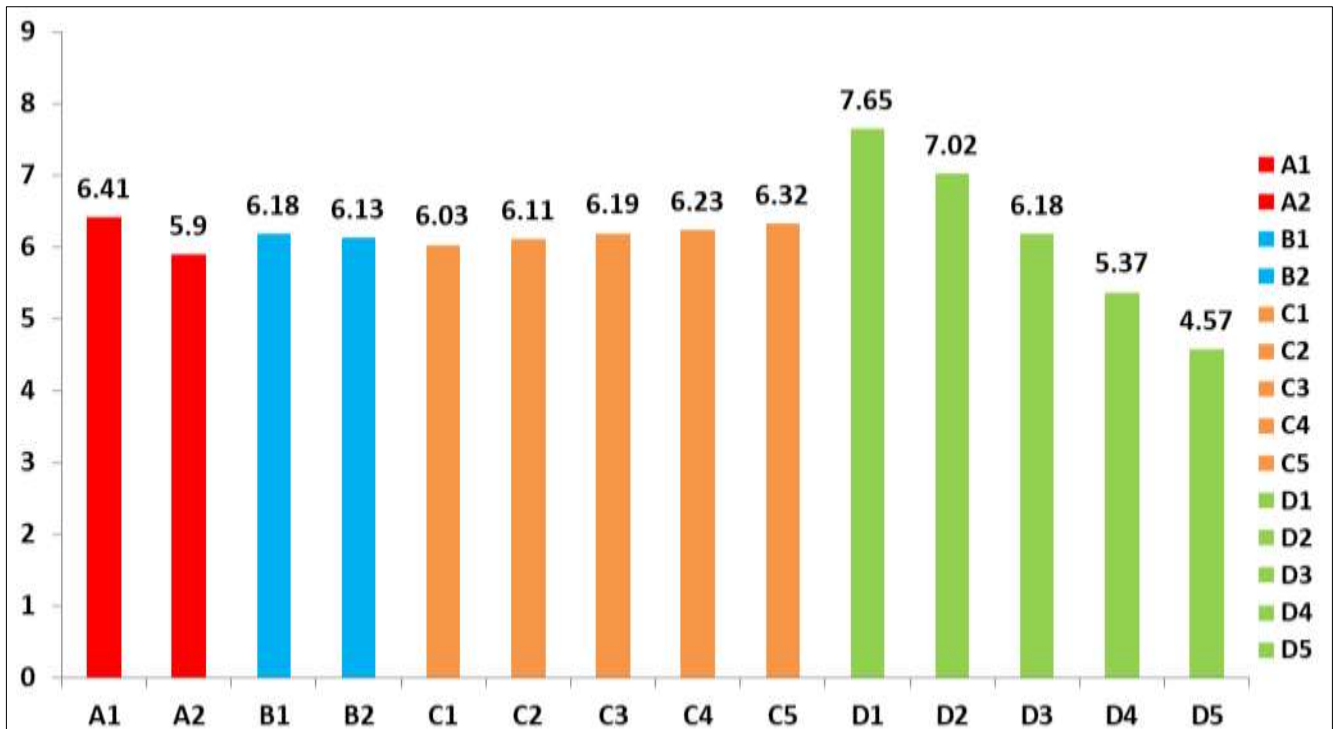

Fig 4: Average colour and appearance score of *Chhana* based Cheese spread

5. over all acceptability

The comparison effect of mixed milk of cow and buffalo, two level of salt, two preservative (Sorbic acid and Potassium meta bi-sulphite) at different cheese level and storage periods

on overall acceptability of *Chhana* based cheese spread has been given in Table No. 5, which revealed the following facts:-

Table 5.1: An average overall acceptability score of *Chhana* based Cheese spread using mixed milk of cow and buffalo as affected by the Salt level (A), Preservative (B), Cheese level (C) & Storage periods (D).

Treatment	B1	B2	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5	Mean
A1	6.15	6.10	6.01	6.07	6.17	6.18	6.20	7.55	6.94	6.25	5.37	4.50	6.12
A2	5.63	5.58	5.46	5.52	5.58	5.62	5.84	7.15	6.49	5.52	4.81	4.05	5.60
B1			5.71	5.84	5.92	5.94	6.03	7.40	6.74	5.93	5.07	4.30	5.89
B2			5.75	5.76	5.77	5.84	6.07	7.30	6.69	5.84	5.11	4.25	5.84
C1								7.15	6.65	6.00	5.20	4.50	5.90
C2								7.25	6.60	5.88	5.15	4.35	5.85
C3								7.35	6.75	5.98	5.08	4.25	5.88
C4								7.45	6.68	5.53	4.85	4.18	5.74
C5								7.55	6.90	6.05	5.18	4.10	5.96
Mean	5.89	5.84	5.73	5.79	5.86	5.89	6.03	7.35	6.72	5.89	5.09	4.28	

From Table No. 5 the main effect of different levels of all the factors for overall acceptability overall acceptability Score of *Chhana* based Cheese spread, the following facts were observed. The Highest significant overall acceptability score (7.55) was found to be in fresh A_1 samples and lowest overall acceptability score (4.05) was noticed in A_2 samples both salt levels shows significant difference at 5%. The present finding supported to the finding of Yadav *et al.* (2019) [16]. The main effect of Preservative (B) on overall acceptability Score of *Chhana* based Cheese spread, it was observed that highest overall acceptability score (7.40) was noticed in B_1 samples,

while lowest overall acceptability score (4.25) was recorded in B_2 samples both preservative shows significant difference at 5%. The finding closely agreed with the finding of Chappalwar *et al.* (2010) [2]. As the main effect of cheese level (C) on overall acceptability Score of *Chhana* based Cheese spread, it was observed that highest overall acceptability score (6.20) was noticed in C_5 samples, while lowest overall acceptability score (5.46) was recorded in C_1 samples. It shows significant difference at 5% in cheese level. The present finding corroborated with the finding of Gupta *et al.* (2022) [6]. In case of storage periods (D), the highest

significant overall acceptability score (7.55) in *Chhana* based cheese spread was observed in fresh D_1 samples and lowest overall acceptability (4.05) in D_5 samples. It shows significant difference at 5% in storage periods. The finding closely agreed with the finding of Misra *et al.* (2019) [20]. From the first order of interaction effect of A×B, the maximum overall acceptability score (6.15) was found to be in A_1B_1 combination while minimum overall acceptability score (5.58) was noticed in A_2B_2 samples non- significant. From the first order of interaction effect, In case of A×C, the maximum overall acceptability score (6.20) was observed in A_1C_5 samples and minimum overall acceptability score (5.46) was noticed in A_2C_1 samples at 5% significant level. From the first order of interaction effect, In case of A×D, the maximum overall acceptability score (7.55) was observed in A_1D_1

samples and minimum overall acceptability score (4.05) was noticed in A_2D_5 samples at 5% significant level. From the first order of interaction effect of B×C, the maximum overall acceptability score (6.07) was noticed in B_2C_5 samples, and minimum overall acceptability score (5.71) was noticed in B_1C_1 samples it was significant at 5% level. From the first order of interaction effect of B×D, the maximum overall acceptability score (7.40) was noticed in B_1D_1 samples, and minimum score (4.25) was noticed in B_2D_5 samples it was significant at 5% level. From the first order of interaction effect of C×D, the maximum overall acceptability score (7.55) was recorded in C_5D_1 samples, while minimum overall acceptability score (4.10) was noticed in C_5D_5 samples at 5% significant level.
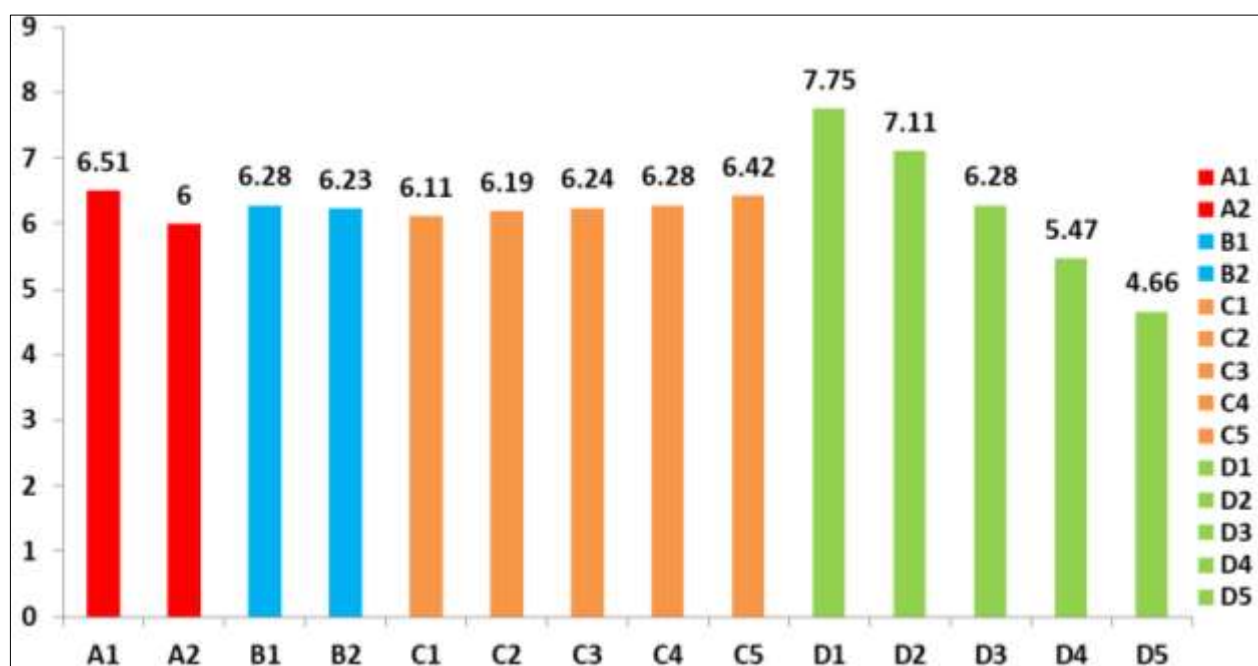

Fig 5: Average Spreadability score of *Chhana* based Cheese spread

Conclusion
On the basis of sensory quality examination of *Chhana* based cheese spread samples prepared from mixed milk of cow and buffalo by using salt level, preservative and cheese level, it is concluded that an excellent quality *Chhana* based cheese spread could be prepared from mixed milk of cow and buffalo using 1% citric acid, 1.5% salt (A_1), preservative Potassium meta bi sulphite (B_1), Cheese Level (C_5) and storage periods (D_1). The highest flavour score (8.0), body & texture score (7.9), colour & appearance score (8.1), spreadibility score (8.2) and overall acceptability score (7.8) was found in the treatment combination of $A_1B_1C_5D_1$ among all the physical attributes of *Chhana* based cheese spread.

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