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Physical quality of moringa paneer prepared from buffalo milk

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Abstract

The current study, "Technology of preparation of moringa paneer from buffalo milk," was conducted at Chandra Shekhar Azad University of Agricultural and Technology in Kanpur at the Department of Animal Husbandry and Dairying. Using buffalo milk, two types of coagulant, three types of temperature, and extracts of 0%, 5%, 10%, 15%, and 20% moringa leaves, moringa paneer was made. The sensory and chemical properties of the fresh samples were examined. When samples were made with 10% moringa leaf extract, 2% citric acid, and 80 °C temperature, the higher sensory quality of moringa paneer was attained. The cost of manufacturing was also determined; for moringa paneer, the maximum average cost of production was Rs. 232 per kg. The highest production cost per kilogram for a sample made with 20% extract from moringa leaves was Rs. 236.00. For sample (A3 B1 C2), the production cost was determined to be Rs. 232 per kg. It is also recommended that the study be used to help the dairy industry and regional confectioners produce paneer of the highest caliber using extract from moringa leaves.

Keywords: Moringa, paneer, technology, physical quality and chemical quality

Introduction

One popular product made from heat- and acid-coagulated milk is paneer, which tastes like soft cheese. In addition to the Indian subcontinent, it has made appearances in the Middle Eastern and Western markets. When kept refrigerated, paneer has a very short shelf life and loses freshness after two to three days. Researchers have suggested a number of preservation methods to increase its shelf life, including as chemical additions, packaging, thermal processing, and low temperature storage. Because of the potential for toxicity, the use of antibacterial agents is not advised. One of the greatest methods for extending the shelf life of paneer is modified atmosphere packaging, or MAP. With the exception of minerals and vitamins, paneer has a pretty high food and nutritional value because it contains nearly all of the proteins found in milk. Its slightly sour and sweet taste along with its nutty flavor appeals to Indian palates. It is the perfect diet for babies, expecting and nursing moms, developing kids, teens, and adults. It is an excellent source of all the essential amino acids for vegetarians due to its high content of animal protein. Because of its fat content, it provides energy, linoleic, linolenic, and arachidonic acid, as well as the fat-soluble vitamins A and D. Patients with diabetes should definitely try it because of its high protein and low sugar content. It also offers special nutritional value for people with milk sensitivity issues. Cow chhana has an energy content of 250–280 calories per 100 grams. Additionally, chhana maintain a significant amount of fat-soluble vitamins, such as A and D.

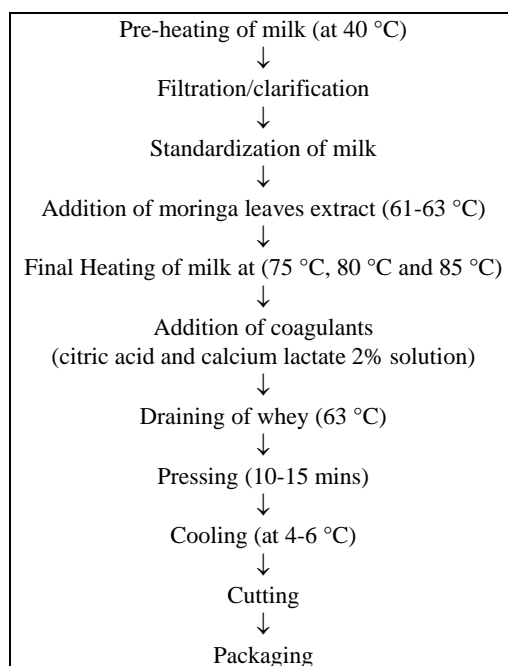
Moringa oleifera belongs to the Moringaceae family is a useful treatment for malnutrition. Because its leaves, pods, and seeds contain a range of vital compounds, moringa is high in nutrients. Moringa is believed to have seven times the amount of vitamin C as oranges, ten times the amount of vitamin A as carrots, seventeen times the amount of calcium as milk, nine times the amount of protein as yoghurt, fifteen times the amount of potassium as bananas, and twenty-five times the amount of iron as spinach. Moringa is a sustainable treatment for malnutrition since it is simple to grow. Moringa is used to cure youngsters in nations like Senegal and Benin. Youngsters who aren't given enough breast milk frequently exhibit signs of malnutrition.

In order to increase milk production, breastfeeding moms are typically prescribed lactagogues. The phytosterol-based lactagogue functions as a precursor to the hormones needed for the development of reproductive organs. Hormone precursors, such as stigmasterol, sitosterol, and kampesterol, are abundant in moringa phytosterols. These substances raise the synthesis of estrogen, which in turn promotes the growth of the mammary gland ducts, resulting in the secretion of milk. It is used to children under three years old to address malnutrition. During pregnancy, a woman can consume around six spoonfuls of leaf powder to meet her daily needs for calcium and iron. An overview of the pharmacological characteristics, nutritional benefits, and commercially useful therapeutic qualities of moringa are

given in this paper. There are no in-depth studies on the use of moringa to treat cancer and diabetes.

Materials and Methods

The Chandra Shekhar Azad University of Agricultural and Technology in Kanpur's Dairy Technology Laboratory was the site of the current study, "Technology of preparation of Moringa paneer from buffalo milk." The manufacturing process for moringa paneer was standardized based on a number of criteria that were being studied, and the finished product was evaluated for its sensory and chemical attributes. This chapter describes the materials used in the experiment, the methods used to process milk in order to prepare paneer, and other tests.



Flow diagram of manufacture of moringa paneer prepared with Moringa Leaf Extract:

Manufacturing Technology

According to Ray and De's recommended approach, the required amount of buffalo milk was standardized at 6.0% fat and 9.0% SNF (1953). Adding varying amounts of extract from moringa leaves (e.g., 0%, 5%, 10%, 15%, and 20%), buffalo milk was heated to a temperature of 64–66 degrees Celsius. The milk was heated to a final temperature of 75°, 80°, and 85°. A stainless steel ladle was used to ensure enough churning during heating in order to prevent burning and the formation of skin. Milk was mixed with a 2 percent solution of calcium lactate and a 2 percent solution of citric acid. The coagulated curd clear whey was obtained by gently stirring the milk. The curd was not stirred and was allowed to settle for five to ten minutes. A muslin cloth was used to drain the whey, and the temperature was never permitted to drop below 63 °C while the draining was happening. Once the whey was drained, the curd that had collected in the muslin fabric was rolled up and compressed for ten to fifteen minutes, using enough force to extract any remaining whey.

To obtain a hard curd, the strained curd was lastly submerged in cooled water (4-6 °C) for two hours. It was

then taken out of the water to be processed further.

Next, a plastic pouch was used to package the moringa paneer blocks.

Results and Discussion

The present investigation entitled, "Technology of preparation of moringa paneer from buffalo milk" was carried out in the department of Animal Husbandry and Dairying, C.S. Azad University of Agriculture and Technology, Kanpur. In order to study the effect of different factors like different types of moringa leaves extract (A), two type of coagulants (B), and three type of temperature (C), on moringa paneer with respect to (1) Sensory evaluation, (2) Chemical characteristics. The laboratory experiment on variance of these data was worked out on the basis of factorial experiment in completely randomized design. The results drawn and their interpretations for different characters have been discussed systematically. 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.

Flavour

Table 1: (A) The effect of moringa leaves extract (A), Coagulants (B), Temperature (C), on flavour score of moringa paneer.

Treatment	B ₁	B ₂	C ₁	C ₂	C ₃	Mean
A ₁	7.95	7.86	7.92	7.90	7.90	7.90
A ₂	8.10	8.01	8.05	8.17	7.95	8.05
A ₃	8.40	8.29	8.35	8.43	8.25	8.34
A ₄	8.30	8.20	8.25	8.35	8.15	8.25
A ₅	8.06	7.97	8.01	8.10	7.95	8.01
C ₁	8.16	8.07				8.11
C ₂	8.25	8.13				8.19
C ₃	8.08	8.00				8.04
Mean	8.16	8.06	8.11	8.19	8.04	

	A	B	C	A×B	A×C	B×C	A×B×C
SE (M)	0.0087	0.0055	0.0067	0.0122	0.0150	0.0095	0.0212
SE (D)	0.0122	0.0077	0.0095	0.0173	0.0212	0.0134	0.0299
CD	0.0145	0.0155	0.0190	N.S.	0.0424	N.S.	0.0599

Table 1: (B) The mean effect of ABC on flavour score of moringa paneer.

Treatment	C ₁	C ₂	C ₃	Mean
A ₁ B ₁	7.950	8.000	7.900	7.95
A ₁ B ₂	7.900	7.800	7.900	7.86
A ₂ B ₁	8.100	8.200	8.000	8.10
A ₂ B ₂	8.000	8.150	7.900	8.01
A ₃ B ₁	8.400	8.500	8.300	8.40
A ₃ B ₂	8.300	8.370	8.200	8.29
A ₄ B ₁	8.300	8.400	8.200	8.30
A ₄ B ₂	8.200	8.300	8.100	8.20
A ₅ B ₁	8.050	8.150	8.000	8.06
A ₅ B ₂	7.970	8.050	7.900	7.97
Mean	8.117	8.192	8.04	

Table 1: (C) Analysis of variance for Flavour score of moringa paneer.

Source	D.F.	S.S.	M.S.S.	F- cal	Significance
A	4	2.271	0.568	420.271	0.0000
B	1	0.202	0.202	149.277	0.0000
A × B	4	0.000	0.000	0.090	0.9851
C	2	0.350	0.175	129.398	0.0000
A × C	8	0.098	0.012	9.036	0.0000
B × C	2	0.002	0.001	0.904	0.4105
A × B × C	8	0.033	0.004	3.072	0.0057
Error	60	0.081	0.001		
Total	89	3.037			

The highest (8.34) flavour score was found in milk sample of A₃ (10% moringa leaves extract) followed by A₄ (15% moringa leaves extract) score (8.25). The flavour score

showed an increasing trend as a content of moringa leaves increased up to 10% in moringa paneer. The mean difference

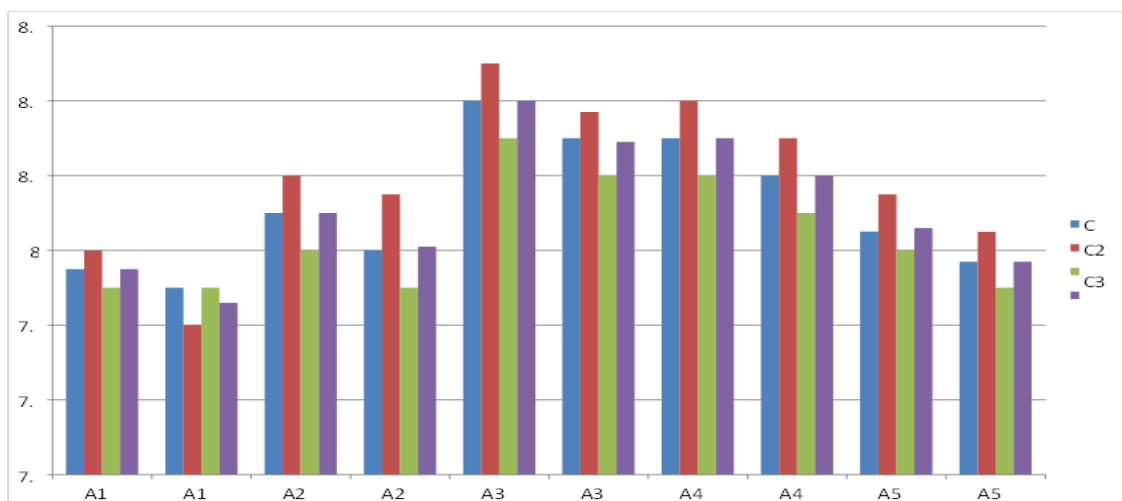


Fig 1: Effect of various moringa leaf extract, coagulants and temperature levels on flavour score of moringa paneer.

Body and Texture

The body and texture of moringa paneer should be moderately soft and uniform texture without showing any

sign of visible foreign matter. Moringa paneer should have smooth and glossy surface.

Table 2: (A) The effect of moringa leaves extract (A), Coagulants (B), Temperature (C), on Body and texture score of moringa paneer.

Treatment	B ₁	B ₂	C ₁	C ₂	C ₃	Mean
A ₁	8.00	7.91	7.97	7.95	7.94	7.95
A ₂	8.15	8.06	8.10	8.22	8.00	8.10
A ₃	8.45	8.34	8.40	8.48	8.30	8.39
A ₄	8.35	8.25	8.30	8.40	8.20	8.30
A ₅	8.11	8.02	8.06	8.15	8.00	8.06
B ₁						
B ₂						
C ₁	8.21	8.12				8.16
C ₂	8.30	8.18				8.24
C ₃	8.13	8.04				8.08
Mean	8.21	8.11	8.16	8.24	8.08	

Factors	A	B	C	A×B	A×C	B×C	A×B×C
SE (M)	0.0145	0.0092	0.0113	0.0205	0.0252	0.0159	0.0356
SE (D)	0.0205	0.0130	0.0159	0.0291	0.0356	0.0225	0.0503
CD	0.0411	0.0259	0.0318	N.S.	0.0712	N.S.	N.S.

Table 2: (B) The mean effect of ABC on Body and Texture of moringa paneer.

Treatment	C ₁	C ₂	C ₃	Mean
A ₁ B ₁	8.00	8.06	7.95	8.00
A ₁ B ₂	7.95	7.85	7.93	7.91
A ₂ B ₁	8.15	8.25	8.05	8.15
A ₂ B ₂	8.05	8.20	7.95	8.06
A ₃ B ₁	8.45	8.55	8.35	8.45
A ₃ B ₂	8.35	8.42	8.25	8.34
A ₄ B ₁	8.35	8.45	8.25	8.35
A ₄ B ₂	8.25	8.35	8.15	8.25
A ₅ B ₁	8.10	8.20	8.05	8.11
A ₅ B ₂	8.03	8.10	7.95	8.02
Mean	8.168	8.243	8.088	

Table 2: (C) Analysis of variance for Body and Texture score of moringa paneer.

Source	D.F.	S.S.	M.S.S.	F- cal	Significance
A	4	2.276	0.569	148.125	0.0000
B	1	0.204	0.204	53.136	0.0000
A × B	4	0.002	0.000	0.127	0.9721
C	2	0.361	0.180	46.970	0.0000
A × C	8	0.086	0.011	2.812	0.0102
B × C	2	0.006	0.003	0.826	0.4426
A × B × C	8	0.030	0.004	0.985	0.4566
Error	60	0.230	0.004		
Total	89	3.196			

The body and texture of moringa paneer as affected by different factors have been presented in Table 3 (A&B) and its analysis of variance. The highest (8.39) body and texture score was found in milk sample of A₃ (10% moringa leaves extract) followed by A₄ (15% moringa leaves extract) score (8.30), while minimum score noted in A₁ sample. The body

and texture score showed an increasing trend as a content of moringa leaves. Increased up to 10% in moringa paneer. The mean difference in scores between A₁ and A₂, A₂ and A₃, A₃ and A₄, A₄ and A₅ when compared the flavour scores varied significantly from one another's.

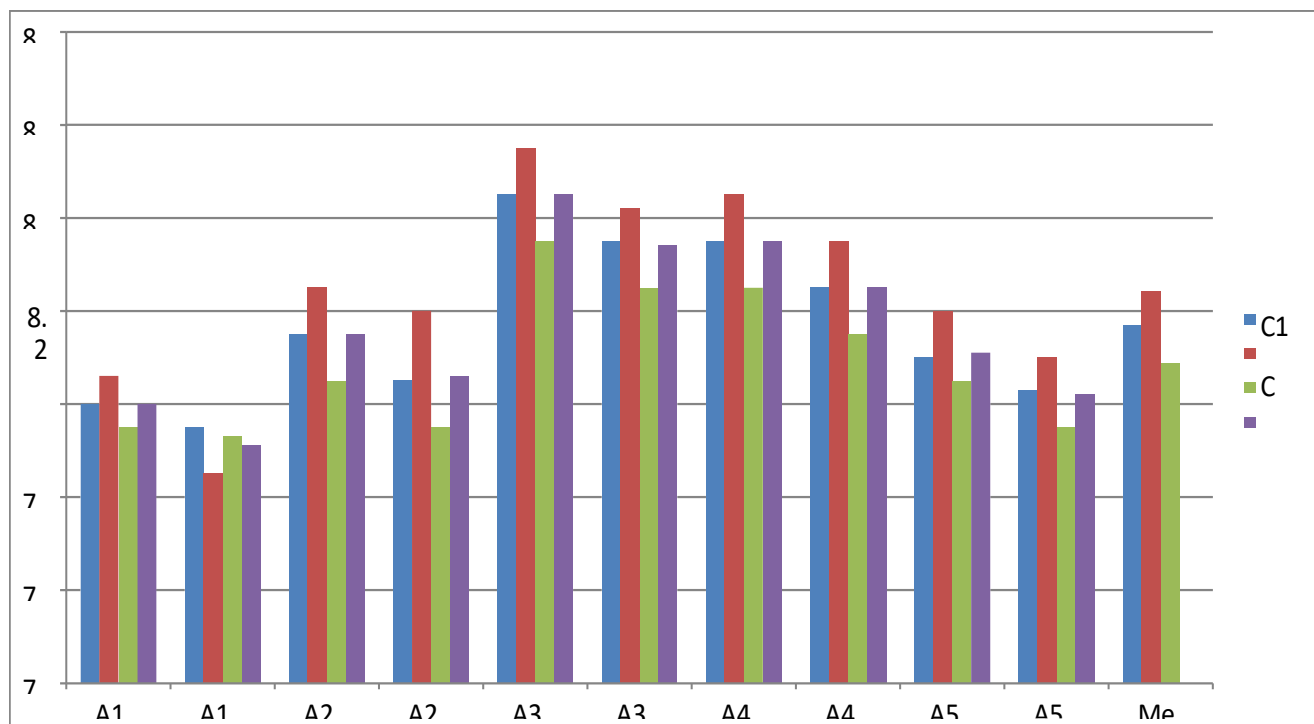


Fig 2: Effect of various moringa leaf extract, coagulants and temperature levels on body and texture score of moringa paneer.

Colour and Appearance

The colour of moringa paneer should be pleasing, attracting and uniform without showing any sign of visible foreign

matter. The colour of moringa paneer ranges from light yellow to creamy for cow and creamy white for buffalo milk. It should be free from browning.

Table 3: (A). The effect of moringa leaves extract (A), Coagulants (B), Temperature (C), on Colour and appearance score of moringa paneer.

Treatment	B ₁	B ₂	C ₁	C ₂	C ₃	Mean
A ₁	8.12	7.97	8.08	8.06	8.00	8.04
A ₂	8.19	8.12	8.13	8.28	8.06	8.15
A ₃	8.51	8.40	8.46	8.54	8.36	8.45
A ₄	8.41	8.31	8.36	8.46	8.26	8.36
A ₅	8.17	8.17	8.26	8.21	8.06	8.17
B ₁						
B ₂						
C ₁	8.27	8.24				8.25
C ₂	8.38	8.24				8.31
C ₃	8.19	8.10				8.14
Mean	8.28	8.19	8.25	8.31	8.14	

Factors	A	B	C	A×B	A×C	B×C	A×B×C
SE (M)	0.0269	0.0170	0.0208	0.0380	0.0465	0.0294	0.0658
SE (D)	0.0380	0.0240	0.0294	0.0537	0.0658	0.0416	0.0931
CD	0.0760	0.0481	0.0588	N.S.	N.S.	N.S.	N.S.

Table 3: (B) The mean effect of ABC on Colour and appearance of moringa paneer.

Treatment	C ₁	C ₂	C ₃	Mean
A ₁ B ₁	8.15	8.21	8.01	8.12
A ₁ B ₂	8.01	7.91	7.99	7.97
A ₂ B ₁	8.16	8.31	8.11	8.19
A ₂ B ₂	8.11	8.26	8.01	8.12
A ₃ B ₁	8.51	7.61	8.41	8.17
A ₃ B ₂	8.41	8.48	8.31	8.40
A ₄ B ₁	8.41	8.51	8.31	8.41
A ₄ B ₂	8.31	8.41	8.21	8.31
A ₅ B ₁	8.16	8.26	8.11	8.17
A ₅ B ₂	7.36	8.16	8.01	7.84
Mean	8.159	8.212	8.148	

Table 3: (C) Analysis of variance for Colour and appearance score of moringa paneer.

Source	D.F.	S.S.	M.S.S.	F- cal	Significance
A	4	1.951	0.488	37.323	0.0000
B	1	0.166	0.166	12.665	0.0007
A × B	4	0.059	0.015	1.121	0.3552
C	2	0.419	0.210	16.046	0.0000
A × C	8	0.112	0.014	1.069	0.3965
B × C	2	0.036	0.018	1.382	0.2589
A × B × C	8	0.117	0.015	1.121	0.3626
Error	60	0.784	0.013		
Total	89	3.644			

The highest (8.45) Colour and appearance score was found in milk sample of A3 (10% moringa leaves extract) followed by A4 (15% moringa leaves extract) score (8.36),

while minimum score noted in A1 sample. The Colour and appearance score showed an increased trend as a content of moringa leaves increased in moringa paneer.

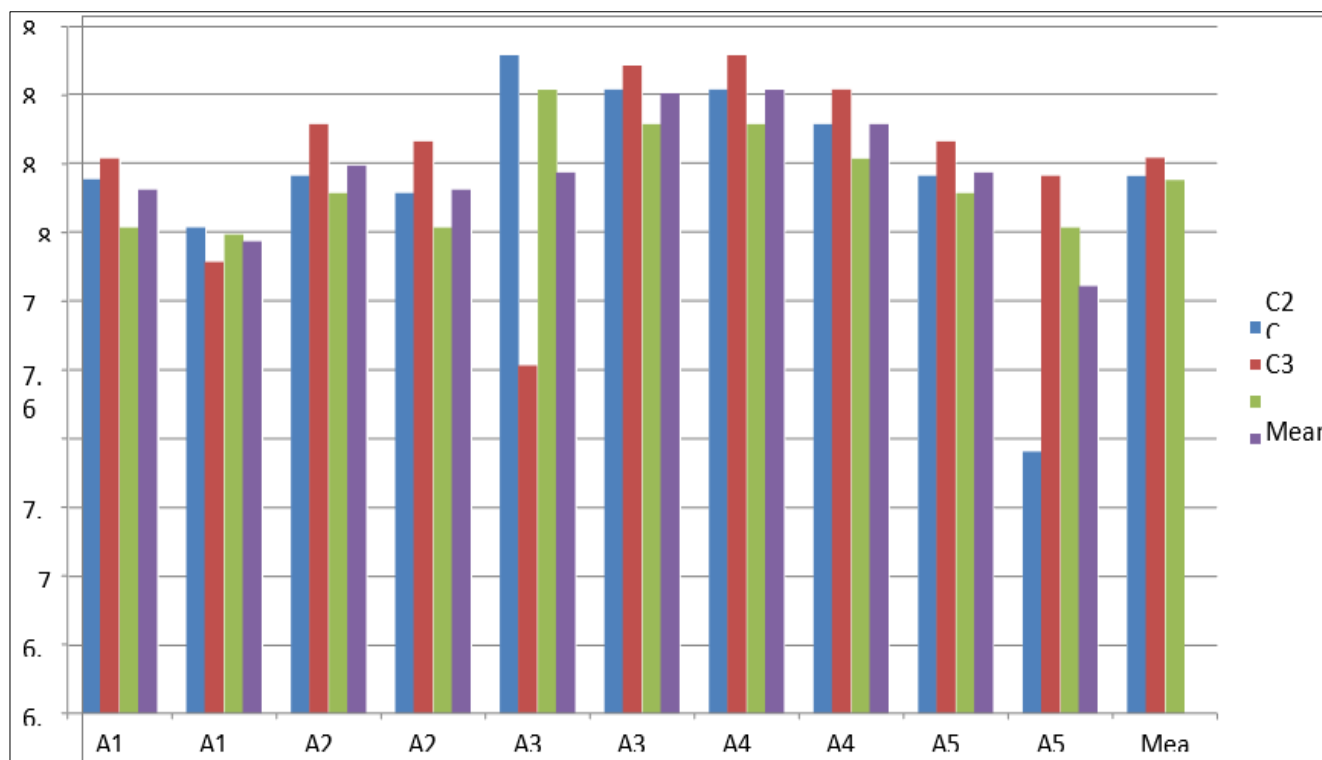


Fig 3: Effect of various moringa leaf extract, coagulants and temperature levels on colour and appearance score of moringa paneer.

4-Overall acceptability

Table 4: (A) The effect of moringa leaves extract (A), Coagulants (B), Temperature (C), on overall acceptability score of moringa paneer.

Treatment	B ₁	B ₂	C ₁	C ₂	C ₃	Mean
A ₁	8.02	7.91	7.99	7.97	7.94	7.96
A ₂	8.14	8.07	8.09	8.22	8.00	8.10
A ₃	8.45	8.34	8.40	8.48	8.30	8.39
A ₄	8.35	8.25	8.30	8.40	8.20	8.30
A ₅	8.12	8.02	8.06	8.15	8.00	8.07
B ₁						
B ₂						
C ₁	8.21	8.12				8.16
C ₂	8.31	8.18				8.24
C ₃	8.13	8.05				8.09
Mean	8.21	8.11	8.16	8.24	8.08	

Factors	A	B	C	A×B	A×C	B×C	A×B×C
SE (M)	0.0183	0.0115	0.0141	0.0258	0.0316	0.0200	0.0447
SE (D)	0.0258	0.0163	0.0199	0.0365	0.0447	0.0283	0.0632
CD	0.0516	0.0326	0.0400	N.S.	N.S.	N.S.	N.S.

Table 4: (B) The mean effect of ABC on overall acceptability score of moringa paneer.

Treatment	C ₁	C ₂	C ₃	Mean
A ₁ B ₁	8.03	8.09	7.95	8.02
A ₁ B ₂	7.95	7.85	7.94	7.91
A ₂ B ₁	8.13	8.25	8.05	8.14
A ₂ B ₂	8.05	8.20	7.95	8.06
A ₃ B ₁	8.45	8.55	8.35	8.45
A ₃ B ₂	8.35	8.42	8.25	8.34
A ₄ B ₁	8.35	8.45	8.25	8.35
A ₄ B ₂	8.25	8.35	8.15	8.25
A ₅ B ₁	8.10	8.20	8.05	8.11
A ₅ B ₂	8.03	8.10	7.95	8.02
Mean	8.169	8.246	8.089	

Table 4: (C) Analysis of variance for overall acceptability score of moringa paneer.

Source	D.F.	S.S.	M.S.S.	F- cal	Significance
A	4	2.201	0.550	91.378	0.0000
B	1	2.211	0.211	35.027	0.0000
A × B	4	0.007	0.002	0.304	0.8741
C	2	0.367	0.183	30.446	0.0000
A × C	8	0.084	0.011	1.753	0.1046
B × C	2	0.011	0.006	0.932	0.3992
A × B × C	8	0.031	0.004	0.649	0.7337
Error	60	0.361	0.006		
Total	89	3.274			

The acceptability score showed an increasing trend as a content of moringa leaves increased up to 10% in paneer Spread. The mean difference in scores between A₁ and A₂, A₂ and A₃, A₃ and A₄, A₄ and A₅ when compared the overall acceptability scores varied significantly from one another's. The effect type of temperature (C) on overall acceptability score of moringa paneer. It was observed that the highest average score (8.24) was in C₂ (80 °C temperature) sample

followed by C₁ (75 °C temperature), while minimum score was noted in C₃ Sample. Among the treatment combinations of levels of moringa leaves extract (A) and type of temperature (C), the maximum colour and appearance score(8.48) observed when samples prepared with 10% moringa leaves extract and 80 °C temperature (A₃C₂) followed by A₄C₂ score of (8.40), while minimum overall acceptability (7.94) was noted in A₁C₃ sample.

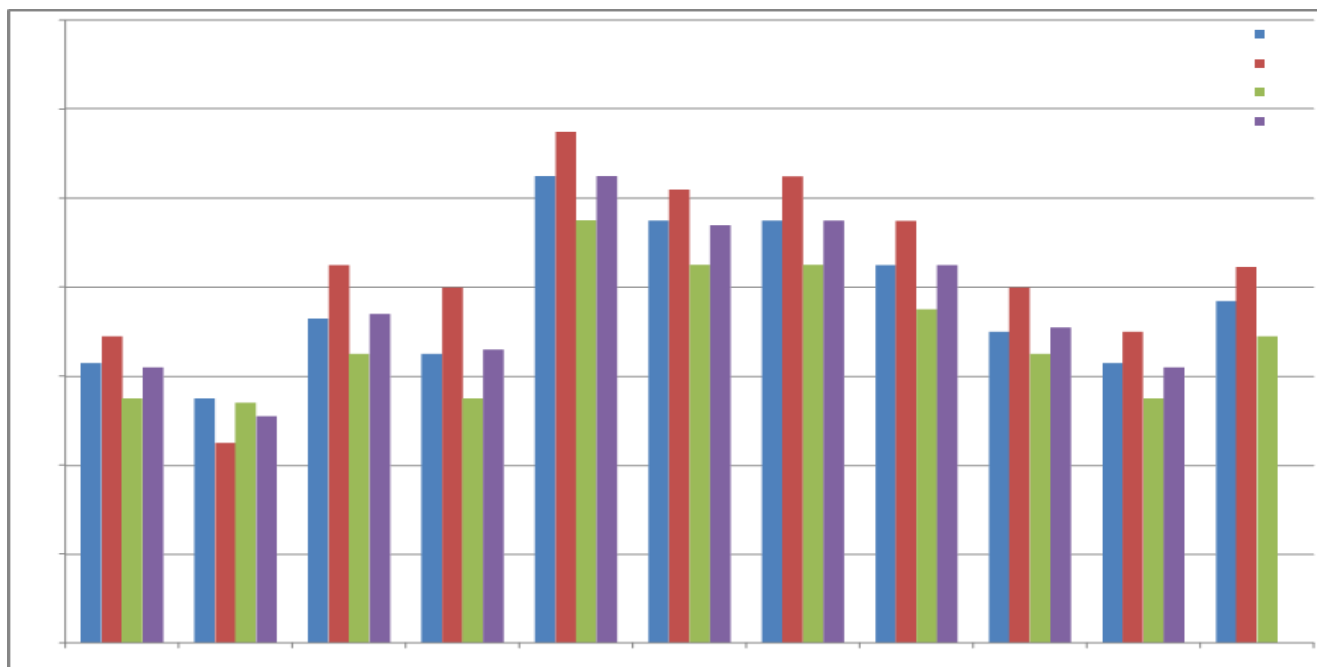


Fig 4: Effect of various moringa leaf extract, coagulants and temperature levels on overall acceptability score of moringa paneer.

Conclusion

The data obtained on the basis of sensory, physical qualities of moringa paneer prepared from different levels of moringa leaves extract, coagulants and temperature. The overall suitability of moringa paneer was found in samples prepared from 10% moringa leaves extract, citric acid (2% solution)

at 80 °C temperature, which is the best as compared to other treatment combination. It is therefore, concluded that 10% moringa leaves extract can be easily mixed in milk to produce good quality moringa paneer, it is suitable for nutritional importance.

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