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Development of milkshake blended with finger millet (*Eleusine coracana*)

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Abstract
Milkshake was prepared by using cow milk with optimized levels of finger millet flour and suger. The sensory evalution of milkshake was done by semi trained judges. The investigation was undertaken to explore the possibilities of utilization finger millet flour in milkshake manufacture to improve health benefits. The product obtained was subjected for chemical analysis. The milkshake sample (T_3) prepared with 2.5 per cent finger millet and 9 per cent sugar level received the highest overall acceptability score i.e., 8.29.The sensorily most acceptable treatment combination (T_4) has an average chemical composition of 3.84% fat, 3.21% protein, 1.02% crude fiber, 0.96% ash,20.56% total solid,0.13% acidity, 6.37 pH.

Keywords: Finger millet, cow milk, sugar, milkshake

Introduction
Milk, recognized as a nearly complete food, is rich in protein, fat, and vital minerals. It plays important role in daily diet, particularly for infants, school-going children, and the elderly (Davies *et al.*, 1986) [1]. In terms of production, India led the world in 2023, producing 230 million tonnes of milk.

Milk is one of the most important animal-based commodities due to its high nutritional value. It provides body-building proteins, bone-strengthening minerals, health-promoting lactose, and milk fat. Its ideal composition makes it suitable not only for growing children but also for meeting the energy requirements of adults. Considered nature's most blessed food, milk contains nearly every nutrient essential for human survival and growth. From time immemorial, an individual's life begins with milk, and this association often continues throughout their lifetime.

A milkshake is a sweet, cold beverage which is usually made from milk, ice cream or iced milk, and flavourings or sweeteners such as fruit syrup or chocolate sauce. Milkshakes, like soft-frozen products, are usually prepared for consumption at the retail outlet directly from milkshake mixes that have been processed at a dairy processing facility and packaged and shipped in bulk containers (Karki *et al*., 2015) [3].

Milkshakes is typically made by blending milk, ice cream, and sugar, milkshakes are delicious cold beverages based on milk, with the mixture quickly processed in a blender to achieve a pourable consistency (Patil *et al*., 2019) [7].

Finger millet (*Eleusine coracana* L.), commonly known as Ragi or mandua, is widely cultivated across various regions of India and throughout the world. India is the leading producer of finger millet, accounting for nearly 60% of the global output (S Kamini *et al*., 2011) [9].

The health benefits associated with finger millet include delayed nutrient absorption, increased fecal bulk, lowered blood lipid levels, prevention of colon cancer, resistance to digestion, enhanced mobility of intestinal contents, prolonged fecal transit time, and notable fermentability characteristics (Tharanathan and Mahadevamma, 2003) [8].

Materials and Methods
The fresh, clean milk of cows was procured from Research Cum Development Project (RCDP) on cattle, Department of Animal Husbandry and Dairy Science, MPKV, Rahuri

Ragi, good quality, clean, crystalline, white cane sugar and efficient stabilizer (CMC) were purchased from local market in single lot. Analytical (AR) or guaranteed grade (GR) reagents were used in the chemical analysis.

Methods Phase-I

Preliminary Trials

Preliminary trials were conducted to optimize finger millet flour and sugar levels.

Phase-II Experimental Trails

On the basis of results of sensory evaluation of preliminary trials 2, 2.5 and 3% finger millet flour and 9 and 10% sugar were used to prepare the milkshake samples.

Preparation of finger millet milkshake

The finger millet milkshake was prepared by using procedure described by Shinde *et al*., (2018) [10] for date palm milkshake with slight modification.

Cow Milk
↓
Pre-heating (38-40 °C)
↓
Filtration of milk
↓
Standardization of milk (4.5% fat)
↓
Heating of milk (71 °C/30min)
↓
Addition of stabilizer (0.2% CMC)
↓
Addition of sugar (9% sugar)
↓
Addition of finger millet flour (2.5% roasted finger millet flour)
↓
Mixing/Blending
↓
Ageing of Mix (6-10 °C for 2-3 hrs.)
↓
Milkshake
↓
Storage (5±1 °C)

Treatment combinations

- **T_0:** Controlled treatment of milk shake without addition of finger millet flour
- **T_1 (P_1S_1):** Milk (4.5% fat) + 2% finger millet flour + 9% Sugar
- **T_2 (P_1S_2):** Milk (4.5% fat) + 2% finger millet flour + 10% Sugar
- **T_3 (P_2S_1):** Milk (4.5% fat) + 2.5% finger millet flour + 9% Sugar
- **T_4 (P_2S_2):** Milk (4.5% fat) + 2.5% finger millet flour + 10% Sugar
- **T_5 (P_3S_1):** Milk (4.5% fat) + 3% finger millet flour + 9% Sugar
- **T_6 (P_3S_2):** Milk (4.5% fat) + 3% finger millet flour + 10% Sugar

On the basis of sensory evaluation, one best treatment combination was selected for further study.

Table 1: Effect of levels of finger millet flour and sugar on sensory score of milkshake

Treatments	Sensory Attributes			
	Colour and Appearance	Flavour	Body and texture	Overall Acceptability
T_0	7.13^{f}	7.21^{g}	7.18^{f}	7.17^{f}
T_1	7.80^{d}	7.71^{f}	7.92^{d}	7.81^{e}
T_2	7.76^{e}	7.81^{e}	7.80^{e}	7.79^{e}
T_3	8.31^{a}	8.28^{a}	8.29^{a}	8.29^{a}
T_4	8.14^{b}	8.11^{b}	8.16^{b}	8.13^{b}
T_5	8.05^{b}	8.01^{c}	8.04^{c}	8.03^{c}
T_6	7.93^{c}	7.91^{d}	7.93^{d}	7.92^{d}
S.E.	0.04	0.02	0.02	0.02
CD at 5%	0.12	0.08	0.07	0.09

Colour and Appearance

The scores of the finger millet milkshake in terms of colour and appearances for treatment T_0, T_1, T_2, T_3, T_4, T_5, and T_6 were 7.13, 7.80, 7.76, 8.31, 8.14, 8.05 and 7.93, respectively. The score of treatment T_3 was recorded significantly (p<0.05) highest among all treatments. The treatments T_4 and T_5 were found at par with each other. The effect of levels of finger millet flour and sugar on colour quality of finger millet milkshake was noticed as colour changes from off white to brownish tinge. It was seen that with addition of finger millet flour and sugar the colour of milkshake increased in brownish tinge.

Similar trend was noticed by Palave ST (2021) [5] Shrikhand prepared by blending buffalo milk chakka with finger millet

flour (2, 4 and 6 per cent). There was slight decrease in cost of shrikhand at higher level of addition of finger millet flour in shrikhand as compared to control.

Flavour

Mean flavour score of milkshake for treatments T_0, T_1, T_2, T_3, T_4, T_5, and T_6, were 7.21, 7.71, 7.81, 8.28, 8.11, 8.01 and 7.91, respectively. The flavour score was significantly (p<0.05) affected by both ingredients. Further, level of 3 per cent finger millet flour in milkshake was not as much liked by the judges and commented that milkshake had slightly unpleasant flavour due to increasing finger millet flour level.

Our results are similar with Solanki *et al.* (2018) [12], who reported that addition of finger millet powder in kheer at 2, 4 and 6 per cent resulted in reduction in flavour score from 8.75 (control) to 8.25, 7.00 and 6.25 in treated finished product (2, 4 and 6 per cent).

Body and Texture

The mean scores for body and texture of milkshake varied from 7.18 to 8.29 for different treatment combinations. The maximum score obtained for formulation containing of 2.5% per cent of finger millet flour and 9 per cent sugar level and minimum score obtained for control sample without addition of finger millet flour. Treatment T_3 found to be significantly (p<0.05) superior over all other treatments in terms of better body and texture.

From the data it is clear that the all the levels of finger millet flour were accepted. The overall acceptability score of all samples were under the category "like moderately to like very much" on 9 point hedonic scale.

Overall Acceptability

Overall acceptability is sum of combinations of colour and appearance, flavour and body and texture of products. There seemed to have significant improvement in all characters which might have enhanced judges preference for overall acceptability of all the treatment combinations of milkshake. Moreover, it is stressed that treatment T_3 had me*et al*l sensory attribute to desired level. Hence, it could be inferred that addition of 2.5 per cent finger millet flour and 9 per cent sugar to milk shake were most optimum to prepare finger millet milkshake. The result indicated that addition of finger millet flour in milkshake reduced overall acceptability score significantly towards increased level (2, 2.5 and 3 per cent) of addition of finger millet flour in milkshake. Our results are similar with Solanki *et al*. (2018) [12], who reported that addition of finger millet powder in kheer at 2, 4 and 6 per cent resulted in reduction in overall acceptability score from 8.50 (control) to 8.25, 7.41 and 6.46 in treated finished product (2, 4 and 6 per cent).

Table 2: Effect of levels of roasted finger millet flour and sugar on physico-chemical composition of milkshake

Treatments	Physico-chemical Constituents							
	Fat (%)	Protein (%)	Carbohy-drates (%)	Crude Fiber (%)	Ash (%)	Total Solid (%)	Acidity (% LA)	pH
T_0	4.12^a	3.01^f	9.66^g	ND	0.76^d	17.55^f	0.15	6.25^f
T_1	4.01^b	3.09^d	11.37^f	0.64^c	0.86^c	19.33^e	0.14	6.29^e
T_2	3.95^b	3.05^e	11.52^e	0.63^c	0.88^c	19.40^d	0.14	6.32^e
T_3	3.84^c	3.21^b	12.55^d	1.02^b	0.96^b	20.56^c	0.13	6.37^d
T_4	3.75^d	3.08^d	12.82^c	0.99^b	0.98^b	20.63^b	0.13	6.42^c
T_5	3.68^e	3.28^a	13.40^b	1.46^a	1.06^a	21.42^a	0.12	6.49^b
T_6	3.65^f	3.15^c	13.57^a	1.47^a	1.08^a	21.45^a	0.12	6.54^a
S.E.	0.02	0.01	0.015	0.007	0.017	0.016	0.007	0.008
CD at 5%	0.06	0.03	0.045	0.023	0.054	0.051	NS	0.026

Mean of 4 replications

Fat

The fat content in milkshake were significantly (p<0.05) differed by addition of roasted finger millet flour at different per cent level. The fat content is ranged from 4.01 to 3.65.

These observations indicated that as finger millet flour increased, the fat content in final product was decreased because less amount of fat in the finger millet but then as sugar content increased, the fat content in final product decreased.

These findings are in accordance with Pardhi *et al.* (2014) [6], who reported that addition of finger millet flour in lassi resulted in reduction in fat content from 2.7 (control) to 2.34, 2.18 and 1.82 in treated finished product (2, 3 and 4 per cent).

Protein

Protein values of milkshake ranged from 3.01 to 3.28 per cent for treatment T_0 to T_6, respectively. The protein content of milkshake increased due to increase in finger millet flour which is good source of protein and decreased with increase in sugar level might be due to increased volume of the final product.

These findings are in accordance with Surve (2017) [13], who found that protein content increased with higher levels of date pulp and decreased with higher levels of jiggery.

Carbohydrates

From the table 2 it is clear that there was increase in carbohydrate content of finger milllet milkshake from T_0 to T_6. This was due to increase proportion of roasted finger millet flour and sugar in different treatment combinations.

Crude Fiber

The crude fiber content of milkshake was significantly (p<0.05) highest in T_6. Crude Fiber content was not detected in the controlled sample. It is cleared that increase in roasted finger millet flour level resulted in increased crude fiber content.

Hemanth (2021) reported high percentage of (2.25 per cent) crude fiber in milkshake prepared using psyllium husk.

Ash

The ash values for treatments T_0 toT_6 ranged from 0.76 to 1.08 per cent and significantly (p<0.05) inclined by addition of finger millet flour.

It indicated that there was increasing trend in the ash content of finished product, this might be due to increasing proportion of finger millet flour. These findings are in accordance with Pardhi *et al.* (2014) [6], who reported that addition of finger millet flour in lassi at 2, 3 and 4 per cent resulted in increase in ash content from 0.73 (control) to 0.75, 0.82 and 0.85 in treated finished product.

Total Solid

From Table 2 it can be observed that total solids in finger millet flour milkshake ranged between 17.55 to 21.45 per cent. The lowest value recorded for T_0 (17.55) and that of highest value for T_6 (P_3S_2) was observed as 21.45 per cent. T_5 and T_6 were at par with each other.

It was noticed that as percentage of finger millet flour and sugar increased the total solid content of product was also increased.

Shivakumar *et al.* (2014) [11] found that the addition of finger millet flour inpaneerkheerata1per cent levelled to an increase in total solid content from 35.86 percent (control) to 35.95 per cent in the treated finished product

Acidity

The acidity of finger millet milk shake are illustrated in Table 2.The values of acidity for treatment T_0, T_1, T_2, T_3, T_4, T_5 and T_6 were 0.15, 0.14, 0.14, 0.13, 0.13, 0.12, 0.12 per cent, respectively. This obtained result indicated that titrable acidity of milkshake decreases slightly as the per cent level of finger millet flour increases might be due to alkaline nature of finger millet.

These findings are in accordance with Kashid (2007) [4] who evaluated that acidity of milkshake decreased along with addition of safflower in golden milkshake.

pH of milkshake prepared with addition of roasted finger millet flour are presented in Table 2. e The pH values for the treatment T_0, T_1, T_2, T_3, T_4, T_5 and T_6 were 6.25, 6.29, 6.32, 6.37, 6.42, 6.49 and 6.54, respectively.

The maximum incline in pH value (6.54) was observed in milkshake prepared using 3 per cent roasted finger millet flour due to decrease in acidity. Kashid *et al.* (2007) [4] evaluated that pH of milkshake increased along with addition of safflower in golden milkshake which resembles with above finding.

Conclusion

The better quality milkshake can be prepared by incorporating 2.5 per cent finger millet flour and 9 per cent sugar (overall acceptability score 8.29). The sensorily superior fresh milkshake sample had average chemical composition 3.84 per cent fat, 3.21 per cent protein, 12.55 per cent carbohydrate, 1.02 per cent crude fiber, 0.96 per cent ash, 0.13 per cent acidity and 6.37 pH.

Reference

1. Davies JE, Freed V, Whittemore FW. An agromedical approach to pesticide management. Coral Gables (USA): University of Miami School of Medicine; 1986.
2. Hemanth M, Deshpande HW, Katke SD, Machewad GM, Gangakhedkar PS. Studies on process standardization of milkshake by using acid modified psyllium husk. Pharma Innov J. 2021;10(7):1215-1218.
3. Karki A, Yadav RS, Banerjee J. Development of fibre-enriched milkshakes and its quality evaluation. Int J Adv Eng Technol Innov Sci. 2015;1(2):14-20.
4. Kashid UB, Sontakke AT, Shinde DB. Manufacture of golden milk shake from cow milk blended with safflower milk. J Dairying Foods Home Sci. 2007;26(3-4):159-163.
5. Palave ST. Preparation of shrikhand blended with finger millet (*Eleusine coracana*) flour [MSc thesis]. 2021.
6. Pardhi PS, Desale RJ, Mule PR, Ghule BK, Tambe DR, Gavhane MS. Studies on finger millet lassi. Asian J Dairy Food Res. 2014;33(4):255-8.
7. Patil SR, Patil NJ, Sahoo AK. Process optimization, sensory evaluation and physico-chemical analysis of carrot milkshake. J Emerg Technol Innov Res. 2019;6(6):248-255.
8. Tharanathan RN, Mahadevamma S. Grain legumes: a boon to human nutrition. Trends Food Sci Technol. 2013;14:507-518.
9. Kamini S, Sarita S. Quality characteristics of finger millet-based baby food preparation as affected by its varieties and processing techniques. J Funct Environ Bot. 2011;1:77-84.
10. Shinde DV, Gawali AS, Manohar AB, Inamke ND, Kedare VS. Physico-chemical analysis of milkshake blending with date pulp. Pharma Innov J. 2018;7(5):673-674.
11. Shivakumar A, Arunkumar H, Venkatesh MV. Process optimization for the production of paneer (soft cheese) kheer blended with foxtail millet and finger millet flour. J Res Agric Anim Sci. 2014;2(6):6-9.
12. Solanki KG, SG, Kamble NS. Preparation of finger millet kheer. Int J Curr Microbiol App Sci. 2018;6:2326-31.
13. Surve SV. Process standardization for preparation of milkshake incorporating date (*Phoenix dactylifera* L.) and jaggery [MSc (Agri) thesis]. Dapoli: Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2017.