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Studies on sensory qualities of kulfi incorporated with different levels of Finger millet powder (*Eleusine coracana*)

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Abstract
The present investigation entitled "Studies on sensory qualities of kulfi incorporated with different levels of Finger millet powder (*Eleusine coracana*)" was undertaken in the Department of Animal Husbandry and Dairy Science, Dr. P.D.K.V., Akola, Maharashtra. In the present investigation the attempt was made to study the sensory properties of Kulfi prepared by using different levels of finger millet powder by using 9 point hedonic scale by panel of semi trained judges. 50% concentrated cow milk was incorporated with different level of finger millet powder (control, 0.4%, 0.8%, 1.2%, and 1.6%) for treatments T_1, T_2, T_3, T_4, and T_5 treatment. The average mean score of flavour were 8.20 (T_1), 7.83 (T_2), 8.62 (T_3), 7.65 (T_4) and 7.47 (T_5) respectively. The average mean score of colour and appearance were 7.98 (T_1), 7.87 (T_2), 8.72 (T_3), 7.76 (T_4) and 7.44 (T_5) respectively. The average mean score of body and texture were 8.30 (T_1), 7.74 (T_2), 8.55 (T_3), 7.71 (T_4) and 7.59 (T_5) respectively. The average mean score of overall acceptability were 8.17 (T_1), 7.86 (T_2), 8.70 (T_3), 7.74 (T_4) and 7.55 (T_5) respectively.

Keywords: Cow milk, kulfi, finger millet powder, sensory evaluation

Introduction
Kulfi is a popular frozen dessert in South Asia and is popular throughout adjacent countries in the Middle East.
The Indian food industry's current growing trend and new possibilities for the production of healthy meals through the judicious blending of millet with milk or milk products. Millets are combined with milk or milk derivatives to make a range of traditional meals. It improves not just the palatability of these products, but also their nutritional value. Malted milk foods are an example of 'Composite Dairy Foods' based on milk and grains that are popular among people of all ages, particularly children. Milk-millet-based composite dairy foods have the potential to be produced at a cheaper cost. Finger millet is a member of the millet group and is also known as Ragi or Tamba.
The interest in finger millet due to its health benefits namely, hypoglycemic characteristics (Lakshmi and Sumathi, 2002) [3] and also the antimicrobial and antioxidant activities of its polyphenols (Chethan and Malleshi, 2007) [1] has been growing. Evidence has shown that patients with diabetes tolerate finger millet better than rice and that their blood sugar levels are lower (Rachie and Peters, 2002) [7]. It has revitalized the interests not only of consumers but also among researchers to develop formulated products, which are "natural, functional and nutritional" as well.
Therefore, it is hypothesized that the incorporation of finger millet in kulfi as a functional ingredient can reduce the amount of stabilizer used and effectively function as a fat replacer in kulfi. Finger millet in combination with kulfi helps in increasing the level of calcium, iron, B vitamins and fibre. When milk is supplemented with such beneficial cereals it provides more nutrition and marketing opportunities

Materials and Methods
Whole, Fresh and clean cow milk was procured from the herd maintained at Livestock

Instructional Farm, Department of Animal Husbandry and Dairy Science, Dr P.D.K.V., Akola and utilized for the preparation of kulfi. Good quality organically produced dehulled Finger millet of variety phule nachani was procured from the Center for Organic Agriculture Research and Training Department of Agronomy Dr P.D.K.V., Akola. Clean crystalline commercial-grade cane sugar was purchased from the local market of Akola city, and used as per requirement. Sodium alginate was used @ 0.3 percent as a stabilizer for preparation of kulfi. For cooling and ageing of the Kulfi mix Godrej refrigerator was used. The temperature was 0 °C to -5 °C. Kulfi prepared in a kulfi machine was transferred into a deep freezer for hardening at temperature -20 °C for 4 to 6 hrs.

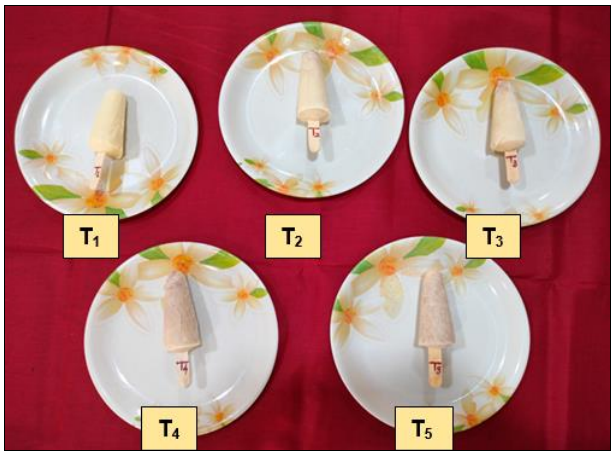

Fig 1: Different treatment combination of finger millet powder added kulfi

Fig 2: Sensory evaluation of kulfi blended with finger millet powder was done at Department of Animal Husbandry and Dairy science Dr. P. D. K. V., Akola.

Methods

The kulfi was prepared as per the procedure given by Siva *et al*. (2019) [8]. with slight modification.

Treatment combinations

T_1 - control (Kulfi mix as per standard)
T_2- Kulfi mix added with 0.4% Finger millet powder
T_3- Kulfi mix added with 0.8% Finger millet powder
T_4- Kulfi mix added with 1.2% Finger millet powder
T_5- Kulfi mix added with 1.6% Finger millet powder

Sensory evaluation

The product was subjected to organoleptic evaluation by the semi expert panel of judges. It was evaluated for colour and appearance, flavour, taste, body and texture and overall acceptability. Score card was provided to all judges comprising "9-points Hedonic Scale" as prescribed by Nelson and Trout (1964) [4].

Statistical analysis

The data obtained in the present investigation was tabulated. The data were analyzed statistically by using Completely Randomized Design (CRD).

Results and Discussion

The acceptability of the control and experimental kulfi was measured in terms of sensory attributes such as flavor, colour and appearance, body and texture and overall acceptability by using 9 point hedonic scale by a panel of semi trained judges. The results obtained on account of this parameter were tabulated, statistically analyzed and presented in Table 1.

Flavour acceptability

The average mean score for flavour scores were 8.20, 7.83, 8.62, 7.65 and 7.47 for kulfi prepared under T_1, T_2, T_3, T_4 and T_5 treatments respectively. The highest score obtained for the flavour was treatment T_3 (8.62) containing 0.8% finger millet powder over all treatments while the lowest score was obtained for treatment T_5 (7.47) containing 1.6% finger millet powder this might be due to the floury flavour of finger millet powder which is added in kulfi. These results are in agreement with results showed by Thomas *et al*. (2019) [9] observed that the flavour score for oat kulfi showed in decreasing trend as the addition of oat flour increased. Patel *et al*. (2020) [5] prepared kulfi incorporated with Amaranthus (Rajgira) and reported that the flavour score for experimental kulfi decreased with an increase in the level of Amaranthus.

Colour and appearance acceptability

The average score of colour and appearance attributes ranges between 7.98 to 7.48. The means of all treatments were acceptable and secured a score for the point of like slightly to like very much on a 9-point hedonic scale for colour and appearance. The highest score for colour and appearance was recorded for treatment T_3 (8.72) prepared by using 0.8% finger millet powder as per treatment whereas, treatment T_5 showed the lowest score i.e. (7.44). This might have been owing to the presence of finger millet powder particles, which were visible on the product body because finger millet powder is insoluble. Hence, it is indicated that an increase in the level of finger millet powder resulted in better colour and appearance of kulfi up to a certain limit and thereafter it decreased proportionately. These results are in agreement with results showed by Pranjali Mohod *et al*. (2020) [6] prepared burfi incorporated with finger millet powder and reported that the increase in the level of finger millet flour resulted in better colour and appearance of burfi up to certain limit and thereafter it decreased proportionately.

Body and Texture acceptability

The body and texture scores were 8.30, 7.74, 8.55, 7.71 and 7.59 for kulfi prepared under T_1, T_2, T_3, T_4 and T_5 treatments respectively. It was observed that the score for body and texture for all treatments were acceptable on 9-point hedonic scale securing more than 6 points. The highest score for body and texture was recorded for treatment T_3 (8.55) whereas the lowest score was recorded for treatment T_5 (7.59). Treatment T_3 was significantly superior to all treatments. It was indicated from the below table that as the increased in proportion of finger millet powder as per treatment, the score

of body and texture decreased which might be due to Kulfi possessed a heavy and chewy body due to the greater water holding property of finger millet powder. These results are in agreement with results showed by Patel *et al*. (2020) [5] prepared kulfi incorporated with Amaranthus (Rajgira) and reported that the body and texture scores also showed a decreasing trend as the level of Amaranthus flour increased in Kulfi.

Overall acceptability

The overall acceptability score was 8.17, 7.86, 8.70, 7.74 and 7.55 for kulfi prepared under T_1, T_2, T_3, T_4 and T_5 treatments respectively. The highest score for overall acceptability was recorded for treatment T_3 (8.70) because in all parameters *viz*., flavour, colour and appearance and body and texture T_3 got a maximum score from a panel of judges that's why T_3 got maximum marks for overall acceptability whereas lowest score was recorded for treatment T_5 (7.55). It is observed that the overall acceptability score was found to be in decreasing order. As the proportion of finger millet flour in the kulfi mix increased there was a decrease in the overall acceptability score of the finished product.

These results are in agreement with results showed by Kedaree *et al*. (2021) [2] analyzed the kulfi blended with guava powder and reported overall acceptability scores of guava powder kulfi with 0%, 5%, 10% and 15% ranging from 6.92, 8.52,7.20 and 6.84.

Table 1: Overall average Sensory evaluation of kulfi blended with Finger millet powder

Treatments	Flavour	Colour and appearance	Body and Texture	Overall acceptability
T_1 Control	8.20^b	7.98^b	8.30^b	8.17^b
T_2 (0.4% FM)	7.83^c	7.87^c	7.74^c	7.86^c
T_3 (0.8% FM)	8.62^a	8.72^a	8.55^a	8.70^a
T_4 (1.2% FM)	7.65^d	7.76^d	7.71^d	7.74^d
T_5 (1.6% FM)	7.47^e	7.44^e	7.59^e	7.55^e
S.E.(m) ±	0.011	0.009	0.011	0.011
C. D. at 5%	0.035	0.029	0.035	0.036
F-test	sig	sig	sig	sig

Conclusion

It is concluded from the present investigation that the kulfi prepared with the incorporation of 0.8% (T_3) Finger millet powder was found to be superior over the rest of the treatments. As the level of finger millet powder in kulfi increases change in sensory properties of kulfi was observed.

Conflict of Interest

Not available

Financial Support

Not available

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