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Utilization of ginger (*Zingiber officinale*) juice for preparation of flavoured milk

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Abstract

The present investigation entitled "Utilization of ginger (*Zingiber officinale*) juice for preparation of flavoured milk" was undertaken during the year 2018-2019. Cow milk was standardized to 3 per cent fat and the flavoured milk was prepared with different combinations of milk and ginger juice viz. 98:2 (T₁), 96:4 (T₂), 94:6 (T₃) and 92:8 (T₄) with four treatments and five replications in completely randomized design (CRD). The data observed that total solids, SNF, ash and acidity percentage of flavoured milk were increased with increase in level of ginger juice, while fat, protein, pH and moisture percentage were decreased with the increase in level of ginger juice. Flavoured milk prepared by blending with 4 parts of ginger juice (T₂) contained fat, T.S., SNF, acidity, protein, ash, pH and moisture as 2.90, 11.50, 8.59, 0.15, 3.31, 0.78, 6.71, and 88.50% respectively. Sensory evaluation carried out by the five judges, showed the different levels of ginger juice had a significant effect on sensory attributes such as flavour and taste, consistency, mouth feel, colour and appearance and overall acceptability of ginger flavoured milk. Flavoured milk prepared by blending with 4 parts of ginger juice (T₂) had secured the highest score (95.39) and costing Rs 72.82 per lit which was superiorly accepted by the panel of judges. Hence, it may be concluded that best quality flavoured milk can be prepared by using 4 parts of ginger juice and 96 parts of milk with 5% sugar.

Keywords: Milk, flavoured milk, ginger juice, sensory attributes, cost structure

Introduction

Milk is regarded as the complete food in the human diet. Milk provides all the nutrient elements, essential for the nourishments of human body. From the time immemorial, milk and milk products have been in the part of the heritage of Indians. According to FSSAI (2006), "Flavoured Milk, by whatever name called may contain nuts (Whole, fragmented or ground) chocolate, coffee or any other edible flavour, edible food colours and cane sugar. Flavoured milk shall be pasteurized, sterilized or boiled. The type of milk shall be mentioned on the label" (Tiwari and Asgar, 2017) [20]. Flavoured milk provides energy, water to digest food, regulates body temperature and prevents dehydration. From economic point of view flavoured milks are important because it makes milk more palatable to those who don't relish it as such (Sonwalkar, 2017) [18].

Ginger (*Zingiber officinale*) is one of the world's best-known spices and ancient Indian medicine used throughout history for its health benefits. The main antioxidant principles in ginger are the gingerols, shagaols and some related phenolic ketone derivatives. It is found effective internally, when used in food preparation and herbal extracts and externally as a ginger compress or mixed with oil to massage around the joints. The fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and 12.3% carbohydrates (Palthur 2014) [13]. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C (Adel, 2010) [1].

Materials and Methods

The preparation of flavoured milk by incorporation different levels of ginger juice was undertaken in the section of Animal Husbandry and Dairy science, College of Agriculture Nagpur, during 2018-19. Flavoured milk prepared from cow milk was standardized at 3% fat and 8.5% SNF. Ginger juice was added in flavoured milk at different levels, *i. e.* 2 (T₁), 4 (T₂), 6 (T₃) and 8 (T₄) parts of milk with five replications and sugar was added @ 5% of milk. The fat, total solids, acidity, protein, ash, pH and moisture of ginger juice were determined. The process flow chart for preparation of ginger juice flavoured milk is given in flow chart 1.

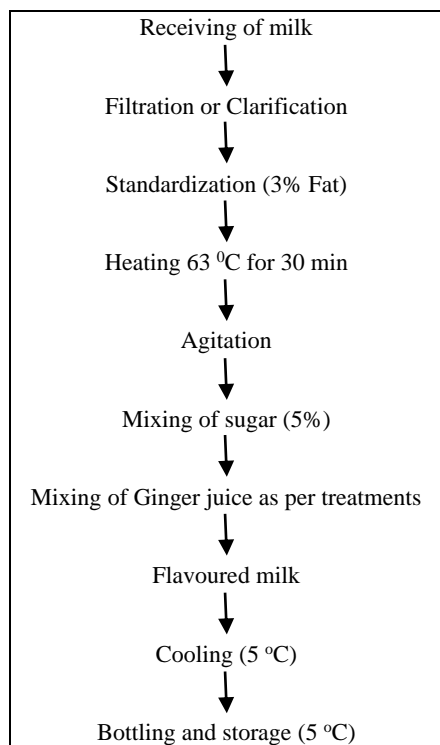


Fig 1: Flow chart for preparation of ginger juice based flavoured milk.

The product was subjected to chemical analysis the fat (by Gerber's method, IS: 1224, Part 1, 1977), total solids (by gravimetric, SP-18 part XI, 1981), Solids not fat (IS: 1183, 1965), acidity (SP-18, Part XI, 1981), protein (by macrokjeldahl method, IS: 1479, part II, 1961), ash (IS: 1167, 1967), pH (by digital pH meter) and moisture was determined by subtracting the total solid content from 100 in the sample. The quality of flavoured milk was judged by offering the sample to the panel of 5 judges in each trial separately by score card method for sensory evaluation by using 100 point score card prescribed by BIS.

The experiment was laid out in completely randomized design (CRD) with 4 treatments and 5 replications. The data obtained were analyzed statistically according to method described by Snedecor and Cochran (1994).

Results and Discussion

The finished product of ginger flavoured milk were subjected for the proximate analysis viz., fat, total solids, SNF, acidity, protein, ash, pH and moisture. The results obtained on account of these parameter are presented in Table 1.

Fat content

The fat percentage was significantly highest in treatment T₁ (2.94%) prepared with 2 parts ginger juice and lowest fat content was noticed in T₄ (2.83%) prepared with 8 parts of ginger juice. It indicated that fat content in flavoured milk decreased with the increased ginger juice level. Similar results were reported by Deore (2013) [4] in pineapple flavoured milk.

Total solids content

The maximum total solids content (11.53%) was noticed in

flavoured milk with 8 parts ginger juice i.e. T₄, whereas the lowest (11.47%) was recorded in flavoured milk with 2 parts ginger juice i.e. T₁. Total solid content of flavoured milk increased with the level of ginger juice. The finding is in agreement with Mane (2017) [12] in carrot juice flavoured milk.

SNF content

The highest SNF content in flavoured milk (8.70%) was observed in treatment T₄ i.e. with 8 parts ginger juice and lowest (8.53%) in treatment T₁ i.e. 2 parts level of ginger juice. Solids not fat content of flavoured milk was gradually increased due to the addition of different levels ginger juice. The finding is in agreement with Tayde *et al.* (2018) [19] in black carrot juice flavoured milk.

Acidity content

The acidity percentage was significantly highest T₄ (0.20%) prepared with 8 parts of ginger juice and lowest acidity content was noticed in T₁ (0.14%) prepared with 2 parts of ginger juice. It indicated that acidity content in flavoured milk increased with the increased ginger juice level. Similar result was reported by Tayde *et al.* (2018) [19] in flavoured milk prepared with black carrot juice (6%).

Protein content

The highest protein content in flavoured milk (3.36%) was observed in treatment T₁ i.e. with 2 parts ginger juice and lowest (3.19%) in treatment T₄ i.e. 8 parts level of ginger juice. Addition of ginger juice decreased the protein content of flavoured milk. Similar result was reported by Shirke *et al.* (2015) in carrot juice (2%) flavoured milk.

Ash content

Ash content of flavoured milk was increased due to the addition of different levels ginger juice. The highest ash content in flavoured milk (0.85%) was observed in treatment T₄ i.e. with 8 parts ginger juice and lowest (0.74%) in treatment T₁ i.e. 2 parts level of ginger juice. This result in agreement with Sonwalkar *et al.* (2017) [18] in flavoured milk prepared with jackfruit pulp (0.84 to 0.96%).

pH value

The pH value was significantly highest T₁ (6.75%) prepared with 2 parts of ginger juice and lowest ash value was noticed in T₄ (6.54%) prepared with 8 parts of ginger juice. It indicated that pH values in flavoured milk decreased with the increased ginger juice level. Samaddar *et al.* (2015) [15] reported that the pH in the flavoured milk decreased with the increase in 7 days storage interval. However, magnitude of decreased in pH of essential oils enriched flavoured milk.

Moisture content

The maximum moisture content (88.52 per cent) was noticed in flavoured milk prepared with 2 parts ginger juice (T₁), whereas the lowest (88.46 per cent) was recorded in flavoured milk with 8 parts ginger juice (T₄). Similar results were also reported by Ramirez-Sucre *et al.* (2011) [14] in caramel jam drink.

Table 1: Overall average of physico-chemical attributes of flavoured milk as affected by different levels of ginger juice (pe cent).

Treatments	Fat	Total solids	Solids not fat	Moisture	Acidity	Protein	Ash	pH
T ₁	2.94 ^a	11.47 ^d	8.53 ^d	88.52 ^a	0.14 ^d	3.36 ^a	0.74 ^d	6.75 ^a
T ₂	2.90 ^b	11.50 ^c	8.59 ^c	88.50 ^b	0.15 ^c	3.31 ^b	0.77 ^c	6.71 ^b
T ₃	2.87 ^c	11.51 ^b	8.64 ^b	88.48 ^c	0.18 ^b	3.25 ^c	0.82 ^b	6.55 ^c
T ₄	2.83 ^d	11.53 ^a	8.70 ^a	88.46 ^d	0.20 ^a	3.19 ^d	0.85 ^a	6.54 ^d
S.E.(m) ±	0.005	0.009	0.007	0.009	0.004	0.010	0.005	0.021
C.D.	0.015	0.028	0.022	0.027	0.014	0.031	0.016	0.063
Result	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig

Sensory evaluation of flavoured milk

The data with respect to sensory evaluation of ginger flavoured milk are presented in Table 2.

Flavour & taste

The score for flavour and taste was increased upto T₂ i.e. 4 per cent addition of ginger juice, thereafter score was declined simultaneously. The highest score (38.58) was obtained by the treatment T₂ i.e. at 4 per cent level of ginger juice and the lowest score (32.26) was obtained by treatment (T₁) i.e. flavoured milk with 2 per cent addition of ginger juice. This finding is in tune with Mane (2017) [12] in carrot juice (6%) flavoured milk.

Consistency

The highest score (28.51) was obtained by the treatment T₂ i.e. at 4 per cent level of ginger juice and the lowest score (24.72) was secured by in treatment (T₁) i.e. flavoured milk with 2 per cent addition of ginger juice. Similar results were reported by Ramirez-Sucre *et al.* (2011) [14] in caramel jam flavoured milk (6%).

Mouth feel

The mouth feel of flavoured milk was significantly highest score (19.12) received by flavoured milk prepared with 4 parts of ginger juice i.e. under T₂ treatment which was superior treatment in respect of mouth feel of flavoured milk, while lowest score (14.83) was received by flavoured milk prepared with addition of 2 parts ginger juice i.e. T₁. The mouth feel of flavoured milk in treatment T₂ was superior over rest of the treatments. This finding is in agreement with Samaddar *et al.* (2015) [15] in essential oils enriched flavoured milk.

Colour and appearance

The colour and appearance scores of flavoured milk was significantly highest score (9.18) received by flavoured milk prepared with 4 parts of ginger juice i.e. T₂ treatment which is superior treatment in respect of colour and appearance of flavoured milk, while the lowest score (7.17) was received by flavoured milk prepared with addition of 8 parts of ginger juice i.e. T₄. Similar results were reported by Kubde (2004) [11] in cardamom flavoured milk.

Table 2: Overall sensory scores for different sensory attributes of flavoured milk as affected by different levels of ginger juice.

Treatments	Flavour and taste (40)	Consistency (30)	Mouth feel (20)	Colour and appearance (10)	Total (100)
T ₁	32.82 ^d	24.72 ^d	14.83 ^d	7.20 ^c	79.57
T ₂	38.58 ^a	28.51 ^a	19.12 ^a	9.18 ^a	95.39
T ₃	34.53 ^b	25.90 ^b	16.84 ^b	7.49 ^b	84.76
T ₄	33.02 ^c	25.11 ^c	16.22 ^c	7.17 ^d	81.52
S.E.(m)	0.27	0.19	0.35	0.15	
C.D.	0.81	0.58	1.05	0.48	
Result	Sig	Sig	Sig	Sig	

Cost of production

The cost of production of 1 lit ginger juice flavoured milk prepared with milk and ginger juice in proportion of 98:2 (T₁), 96:4 (T₂), 94:6 (T₃), and 92:8 (T₄) treatments were Rs 72.33, Rs 72.82, Rs 73.30 and Rs 73.77, respectively. Lowest cost of production Rs.72.33 per liter was calculated in case of flavoured milk prepared with addition of 2.0% ginger juice (T₁) treatment. The highest cost of production Rs 73.77 per liter in case of flavoured milk prepared with addition of 8.0% ginger juice (T₄) treatment was due to increase in level of ginger juice. However, the cost of production of flavoured milk prepared with 4.0% ginger juice (T₂) was found to be Rs.72.82 per liter which is best treatment selected by judges for sensory evaluation. This result is agreement with Tayde *et al.* (2018) [19] who reported the cost of carrot (6%) flavoured milk was Rs. 69.64/lit.

Conclusion

Hence, it may be concluded that best quality flavoured milk can be prepared by addition of 4 parts of ginger juice and 96 parts of milk with 5.0% sugar.

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