

DEVELOPMENT OF GUAVA PULP ENRICHED MISTHI DAHI FROM TONED MILK

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ABSTRACT

The present study was undertaken to develop low fat guava pulp enriched misthi dahi from toned milk. The developed product i.e. guava pulp enriched misthi dahi prepared from toned milk (G1) contained per cent total solids, fat, protein, crude fiber and titratable acidity as 18.54, 2.89, 3.36, 0.24, and 0.80, respectively. On storage at $4\pm 1^{\circ}\text{C}$, the product G1 was highly acceptable up to 3 days as per sensory scores and microbiological qualities. The titratable acidity (%) in G1 was 0.81 and 0.85 on 0 and 3rd day of storage, respectively. The cost of production for preparing 100 kg misthi dahi per day for all the products i.e. control and guava pulp enriched misthi dahi was calculated as Rs. 11.3 and 11.9 per 200 ml cup, respectively.

Key words: Guava pulp, misthi dahi, toned milk

Milk is very nutritious and perhaps an indispensable food for human being. Milk is also converted to various milk products including dahi or yoghurt. Consumption of fermented milk product is associated with several types of human health benefits. Fermented foods are of great significance since they provide and preserve vast quantities of nutritious foods in a wide diversity of flavor, aroma and texture, which enrich the human diet (Sarkar and Misra, 2002).

Dahi is the product obtained from pasteurized or boiled milk by souring, natural or otherwise, by a harmless lactic acid or other bacterial culture (FSSAI, 2011). Starter cultures such as *Streptococcus lactis*, *S. diacetylactis*, *S. cremoris* alone or in combination with or without *Leuconostoc* species and *Lactobacillus acidophilus*, *L. bulgaricus*, and *S. thermophilus* may be used for dahi preparation (IS: 9617, 1980). Dahi may contain additional cane sugar. It should have the same percentage of fat and solid-not-fat as the milk from which it is prepared. Being a widely consumed dairy product, dahi was chosen as a vehicle by some workers to incorporate different nutraceuticals and combat chronic and non-communicable diseases in India. Fortification with minerals (Singh *et al.*, 2005; Ranjan *et al.*, 2006), incorporation of dietary fiber in the form of fruits (Pandya, 2002) and probiotics Yadav *et al.*, 2005) are some of the applications reported.

Guava (*Psidium guajava*) is a worldwide popular tropical fruit with high content of vitamins and phytochemicals. The traditional therapeutic benefits of

guava over metabolic disorders, gut infection, diabetes and obesity have been proven (Joseph and Priya, 2011). Its combination with probiotic fermented dairy food like yoghurt, curd and shrikhand will develop high value commodities to increase application of guava in the area of functional foods. It is a natural product, which contain dietary fiber as well as antioxidant compounds (Jimenez-Escrig *et al.*, 2001). Hence the present study was carried out to develop guava fruit pulp incorporated low fat misthi dahi.

MATERIALS AND METHODS

Guava pulp incorporated misthi dahi was prepared from toned milk (3.0% fat and 8.5% solids not fat; SNF) with addition of 7% sugar and 5% guava pulp. Guava pulp level was selected based on preliminary sensory trials where lower (3%) and higher (7%) levels were rejected. Pulp of well cleaned guava fruits (Cultivar: Hisar Surkha) was added in the sweetened pasteurized milk. Starter cultures of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* (NCDC-263, NDRI, Karnal) were added at the rate of 2% and was incubated at 42°C for 5-6 h. Guava pulp added misthi dahi samples were prepared using three levels of sugar viz. 5, 7 and 9% and three levels of guava pulp viz. 3, 5 and 7% leading to 9 treatment combinations. Three levels of sugar and guava pulp were taken initially but on sensory trials only one level from each of sugar and guava pulp was selected. Moreover, a control sample without guava pulp having 7% sugar was prepared for comparison. The physico-chemical qualities such as fat, total solids, protein,

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crude fiber, pH and titratable acidity of misthi dahi and the chemical analysis of guava pulp were determined as per methods of AOAC (2005). The sensory quality of the developed product was evaluated using 9-point hedonic scale. The whole set of experiment was conducted three times for consistency of results. Data were analyzed statistically on 'SPSS-16.0' (SPSS Inc., Chicago, II USA) software package as per standard methods (Snedecor and Cochran, 1994). The statistical significance was estimated at 5% level and evaluated with Duncan's Multiple Range Test. A semi trained panel consisting of six members (4 male and 2 female) evaluated the sensory attributes. Three trials were conducted (n=6×3=18).

RESULTS AND DISCUSSION

Per cent moisture, total solids, fat, SNF and titratable acidity (as per cent lactic acid) of toned milk were 88.48, 11.52, 3.03, 8.49 and 0.135, respectively. These values were in accordance with FSSAI standards. Fresh guava pulp was analyzed for proximate composition and results are presented in Table 1. These values are in agreement with Chauhan *et al.* (2015). Different levels of sugar (5%, 7% and 9%) and guava pulp (3%, 5% and 7%) were studied for the development of guava pulp enriched misthi dahi and these combinations were divided into 9 treatments and 1 control (7 % sugar without pulp) as represented in Table 2 with their sensory scores.

The color and appearance of S₇P₅ combination of misthi dahi scored significantly higher (P≤0.05) than all other combinations except S₅P₅, S₅P₇ and S₇P₃ where it was higher but non-significant (p≥0.05). The sensory score for flavour of S₇P₅ ratio scored significantly higher (P≤0.05) than all other combinations except S₉P₅ where, it was higher but non-significant. The body and texture (consistency) score of the treatment having 7% sugar

Table 1
Chemical composition of guava pulp*

Moisture (%)	80.38±0.01
Total solids (%)	19.62±0.01
Fat (%)	0.92±0.02
Protein (%)	2.37±0.01
Crude fiber (%)	4.84±0.02
Ash (%)	0.59±0.01

n=3, *mean±s.d.

without pulp (control) scored significantly higher than the all ratio's of guava pulp enriched misthi dahi except S₇P₅, from which, control was non-significantly (p≥0.05) higher. Acidity or sourness is a desirable attribute in misthi dahi although the level of desirable sourness depends on preferences of people of one geographical area to another. The sourness score of control misthi dahi scored significantly higher (P≤0.05) than all other treatments except S₅P₅ and S₇P₅ where it was higher but non-significantly. With regard to overall acceptability S₇P₅ combination got the highest sensory score. It was significantly higher than S₅P₇, S₇P₇, S₉P₃ and S₉P₇ combinations and non-significantly differ from control and other combinations. The higher overall acceptability score of S₇P₅ was due to better colour and appearance and consistency scores as compared to other combinations as well as control. These results are in close proximity to the results of earlier research workers (Walkunde *et al.*, 2008; Kale *et al.*, 2011; Johri and Chauhan, 2014; Chauhan *et al.*, 2015).

The proximate composition of developed product is presented in Table 3. The total solids (%) in guava pulp enriched product was non-significantly higher than control (C). But fat content (%) was significantly lower in S₇P₅ as compared to control. However, the decrease in protein percentage in S₇P₅ was found to be non significant. Crude fiber being significantly higher in S₇P₅ resulted in more total solid content but non-significant (p≥0.05) than control. The significant (P≤0.05) difference was noticed

Table 2
Sensory evaluation of toned milk dahi (Mean±S.E.)

Code	Colour and appearance	Flavour	Consistency/Body and texture	Sourness	Overall acceptability
Control/C	7.17 ^a ±0.17	7.33 ^b ±0.33	7.67 ^c ±0.17	8.00 ^c ±0.34	7.54 ^b ±0.25
S ₅ P ₃	7.17 ^a ±0.17	7.00 ^{ab} ±0.26	7.17 ^b ±0.17	7.00 ^b ±0.00	7.08 ^{ab} ±0.15
S ₅ P ₅	7.50 ^{ab} ±0.22	7.17 ^{ab} ±0.17	7.00 ^b ±0.00	7.33 ^{bc} ±0.21	7.37 ^b ±0.56
S ₅ P ₇	7.66 ^b ±0.33	6.67 ^a ±0.31	6.50 ^a ±0.22	6.33 ^a ±0.21	6.79 ^a ±0.14
S ₇ P ₃	7.33 ^{ab} ±0.21	7.33 ^b ±0.33	6.83 ^{ab} ±0.17	7.00 ^b ±0.45	7.12 ^{ab} ±0.11
S ₇ P ₅	7.83 ^b ±0.21	7.83 ^c ±0.21	7.33 ^{bc} ±0.33	7.50 ^{bc} ±0.00	7.62 ^b ±0.56
S ₇ P ₇	7.17 ^a ±0.17	7.16 ^{ab} ±0.31	6.33 ^a ±0.21	6.50 ^a ±0.34	6.79 ^a ±0.23
S ₉ P ₃	7.00 ^a ±0.00	7.17 ^{ab} ±0.17	6.33 ^a ±0.21	6.83 ^{ab} ±0.34	6.83 ^a ±0.21
S ₉ P ₅	7.17 ^a ±0.17	7.50 ^{bc} ±0.22	6.83 ^{ab} ±0.31	6.50 ^a ±0.31	7.00 ^{ab} ±0.00
S ₉ P ₇	7.00 ^a ±0.00	6.83 ^a ±0.31	6.33 ^a ±0.21	6.33 ^a ±0.33	6.62 ^a ±0.18

n=18; S=Sugar %; P=Pulp%. Any two means not sharing same letter superscripts differ significantly (p≤0.05) within the column

Table 3
Proximate composition of developed product (Mean±S.E.)*

Sample	Moisture %	Total solids %	Fat %	SNF %	Protein %	Crude fiber %	Ash %	Titratable acidity %	pH
C	81.51 ^a ±0.17	18.49 ^a ±0.17	2.99 ^b ±0.01	15.50 ^a ±0.17	3.42 ^a ±0.03	0.00 ^a	0.74 ^a ±0.01	0.76 ^a ±0.01	4.60 ^a ±0.02
S ₇ P ₅	81.46 ^a ±0.01	18.54 ^a ±0.01	2.89 ^a ±0.01	15.65 ^a ±0.02	3.36 ^a ±0.02	0.24 ^b ±0.00	0.74 ^a ±0.01	0.80 ^b ±0.00	4.48 ^b ±0.04

*n=3; C=Contol misthi dahi (7% sugar only); S₇P₅=Guava pulp enriched misthi dahi (7% sugar+ 5% guava pulp). Any two means not sharing same letter superscripts differ significantly (p≤0.05) within a column.

in titratable acidity in guava pulp added dahi as compared to control. There was also a significant decrease in pH in S₇P₅ as compared to control. These results are similar as reported earlier (Desai *et al.*, 1994; Kale *et al.*, 2011; Islam *et al.*, 2013).

Data related to sensory evaluation of developed product at different days of storage have been presented in Table 4. A significant (p≤0.05) decrease in colour and appearance score on 5th day and 7th day of storage period was observed in both the products. When the flavour attribute was perceived for sensory evaluation, on 3rd day of storage a non significant (p≥0.05) decrease was observed in both the products (C and S₇P₅). But on 5th day of storage the decrease was significant (p≤0.05) in both the products. Similarly on 7th day of storage there was a significant (p≤0.05) decrease in flavor score of S₇P₅ when compared with score achieved on 5th day. The flavor scores of C also decreased on 7th day but non-significantly as compared on 5th day (Table 4). Among the products, guava pulp enriched product has a significantly (p≤0.05) higher score of colour and appearance and flavor than control product on 0 and 3rd day but the difference in these sensory scores was non-significant (p≥0.05) on 5th and 7th day. However, the consistency, sourness and overall acceptability scores of the guava pulp enriched product differed non-significantly (p≥0.05) from the control during the whole storage period (Table 4).

The study revealed a significant (p≤0.05) decrease in consistency score on 5th day of storage in control as well as in the developed product. On 7th day there was also decrease in consistency scores of both C and S₇P₅ but non-significantly (p≥0.05) as compared on 5th day. When the sourness attribute was perceived, it was found a significant (p≤0.05) decrease in sourness score of C on 3rd day of storage period and non significant decrease in S₇P₅. On 5th day a significant decrease in sourness score was observed in S₇P₅. When we compared overall acceptability scores, in both the products, there was non-significant decrease (p≥0.05) on 3rd day. However, on 5th day there was a significant (p≤0.05) decrease in overall acceptability scores of all the products. Further on 7th day

of storage period there was a significant (p≤0.05) decrease in overall acceptability scores of C and G. Kale *et al.* (2011) also reported decrease in sensory scores of value added misthi dahi during the storage period.

A significant increase in titratable acidity was noticed on 3rd day in the developed product i.e. S₇P₅. On 5th day significant increase in titratable acidity of control was observed. Further on 7th day titratable acidity was significantly increased in both C as well as in S₇P₅ (Table 4). Similar results were found by Kale *et al.* (2011) and Walkunde *et al.* (2008).

Table 4
Colour and appearance scores of the developed products during storage at 4±1°C on the basis of 9-point hedonic scale (Mean±S.E.)

Product	Day	Parameter	
		C	G
Colour and appearance	0	7.17 ^{aA} ±0.17	7.83 ^{aB} ±0.21
	3	7.00 ^{aA} ±0.00	7.67 ^{aB} ±0.17
	5	6.17 ^{bA} ±0.17	6.33 ^{bA} ±0.21
	7	5.33 ^{cA} ±0.21	5.67 ^{cA} ±0.17
Flavour	0	7.33 ^{aA} ±0.33	7.83 ^{aB} ±0.21
	3	7.00 ^{aA} ±0.00	7.33 ^{aB} ±0.33
	5	5.67 ^{bA} ±0.21	6.17 ^{bA} ±0.31
	7	5.33 ^{bA} ±0.21	5.17 ^{cA} ±0.17
Consistency/Body and texture	0	7.67 ^{aA} ±0.26	7.33 ^{aA} ±0.33
	3	7.33 ^{aA} ±0.33	7.17 ^{aA} ±0.17
	5	5.67 ^{bA} ±0.21	5.33 ^{bA} ±0.21
	7	5.33 ^{bA} ±0.33	4.83 ^{bA} ±0.17
Sourness	0	8.00 ^{aA} ±0.34	7.50 ^{aA} ±0.00
	3	7.17 ^{bA} ±0.17	7.00 ^{aA} ±0.26
	5	6.33 ^{bA} ±0.21	5.83 ^{bA} ±0.21
	7	5.17 ^{cA} ±0.17	4.83 ^{cA} ±0.17
Overall acceptability	0	7.54 ^{aA} ±0.25	7.62 ^{aA} ±0.56
	3	7.17 ^{aA} ±0.15	7.21 ^{aA} ±0.12
	5	5.96 ^{bA} ±0.12	5.92 ^{bA} ±0.11
	7	5.21 ^{cA} ±0.04	5.00 ^{cA} ±0.06
Titratable acidity	0	0.76 ^a ±0.01	0.81 ^a ±0.00
	3	0.78 ^a ±0.01	0.85 ^b ±0.01
	5	0.82 ^b ±0.01	0.86 ^b ±0.00
	7	0.85 ^c ±0.01	0.92 ^c ±0.01

Average of three trials n=18; C=Control misthi dahi made from toned milk (7% sugar only); G=Guava pulp enriched misthi dahi made from toned milk (7% sugar+5% guava pulp). Values with different small superscripts differ significantly (P≤0.05) within the column for a parameter. Values with different capital superscripts differ significantly (P≤0.05) within the row for a parameter.

Table 5
Microbiological analysis of the developed product during storage

Parameter	Product	0 day	3 day	5 day	7 day
Total plate counts (log cfu/g)	C	5.84 ^{aA} ±0.02	6.24 ^{aB} ±0.07	6.40 ^{aBC} ±0.08	6.53 ^{aC} ±0.08
	G1	5.96 ^{bA} ±0.01	6.32 ^{aB} ±0.07	6.45 ^{aBC} ±0.08	6.55 ^{aC} ±0.08
Coliforms count (log cfu/g)	C	ND	ND	ND	ND
	G1	ND	ND	ND	ND
Yeast and moulds count(log cfu/g)	C	ND	ND	1.70 ^{aA} ±0.18	2.46 ^{aB} ±0.17
	G1	ND	ND	1.99 ^{bA} ±0.09	2.56 ^{aB} ±0.12

Average of three trials n=3; C=Contol misthi dahi (7% sugar only); G1=Guava pulp enriched misthi dahi (7% sugar+ 5% guava pulp). Values with different small letter superscripts differ significantly (p≤0.05) within the column. Values with different capital letter superscripts differ significantly (p≤0.05) within the row

It was observed that there was a significant (p≤0.05) increase in total plate count on 3rd day as compared to the day of preparation in both the products (Table 5). On 5th day there is also increase in total plate counts but non-significantly (p≥0.05). Further on 7th day there was also increase in total plate counts but again non-significantly (p≥0.05) as compared on 5th day of storage period. Results are in accordance as found by Kale *et al.* (2011). Total plate count was increased in guava pulp added dahi. It was observed that the increase was significant in S₇P₅ on the day of preparation but non-significant on 3rd, 5th and 7th day of storage at 4±1^oC as compared to the control. There was no coliform detected in both the products during the storage period. Further on the day of preparation no yeast and mould colony was detected in any product. A significant increase in yeast and mould colonies was found in both the products on 5th day of storage. Among the product significant increase in yeast and moulds count was noticed in S₇P₅ as compared to C (Table 5). On 7th day there was significant increase in yeast and moulds count in both the products. Among the products, there was an increase in yeast and moulds count of S₇P₅ than C also but non-significantly.

From the present study it may be concluded that guava pulp enriched misthi dahi can be prepared successfully from toned milk with highly acceptable sensory scores and may be stored at 4±1^oC for 3 days without any significant deterioration in microbiological and sensory qualities. Control product is better maintained than guava pulp enriched product during storage because of enhanced availability of simple sugars in the later product which acts as growth promoters for microbes. Further efforts are required to extend the shelf-life of the products by using some biopreservatives.

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