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Effect of wood apple (*Feronia limonia* L.) pulp on sensory and chemical properties of burfi

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Abstract

Burfi is a popular khoa based confection and it contains considerable amount of milk solids. The manufacture of value added products by using seasonal fruit like wood apple. The present investigation shows that, the flavour, body and texture and overall acceptability of the wood apple burfi prepared with 20 per cent wood apple pulp in treatment T₂ are (41.30), (31.21) and (89.67) was highest and superior. Treatment T₁ was more acceptable than all treatments in colour and appearance. The chemical composition of Burfi was affected due to addition of wood apple pulp to the total solids, moisture, fat, protein, total sugar, ash and acidity.

Keywords: wood apple, sensory, chemical composition, overall acceptability, total solids, total sugars, ash, acidity

1. Introduction

Burfi is one of the popular khoa based indigenous milk products prepared from cow milk or buffalo milk and is relished all over India (Sharma *et al* 1982)^[14]. It is highly nutritious product as it contains almost all milk solids in concentrated form, easily digestible carbohydrates in the form of cane sugar and variety of other additives. Several varieties of burfi are sold in the market viz, plain or mawa burfi, fruit, nut, chocolate, saffron and rawa burfi depending on the special ingredients used in the preparation of the product. The base for all these types of burfi is however khoa and cane sugar in different proportions. Other ingredients are also incorporated to cater to special taste. In some parts of the country chhana is also used as an ingredient for partial replacement of khoa (IS: 5550, 1970)^[5].

Burfi has a special importance in various social celebrations and in the expression of extreme joy and happiness at many occasions. In India about 50 to 55 per cent of total milk produced is converted into traditional milk products (Aneja, 1992)^[11]. Currently 46 per cent of total milk production in country is consumed as liquid milk and the balance 54 per cent is converted into milk products (Aneja, 1997)^[12].

Burfi retains its quality for a considerable length of time at atmospheric storage temperatures due to its low moisture content and higher sugar concentration. The method of preparation also ensures the distraction of almost all micro-organisms present in the raw material but there is much scope for post manufacture contamination from undesirable micro-organisms depending on the method of handling, packaging and storage.

Now a days halwais add different fruits like mango, orange, coconut etc. in burfi making. Unfortunately, whatever research work done, is on plain burfi, no systematic work has so far been traced on fruit flavoured burfi. Due to the government's new horticultural policy, area under cultivation of different dry land fruit crops including wood apple is increasing very fast in Maharashtra.

Certain perishable fruits are very conveniently used as flavouring ingredients in production of various dairy products. Wood apple is dry land fruit crop. Pulp of ripe wood apple fruit is eaten as such or with sugar, it can be used for making sherbet, jelly, chutney etc. The fruit has medicinal value too. It is learnt that at Nrushihwadi, Dist Kolhapur, wood apple burfi is prepared and got popularity in the adjoining area. The use of wood apple pulp in burfi will not only enhance flavour and sale of burfi, but will also help utilize this perishable acidic fruit in its production season and thereby its preservation cost be reduced. It is therefore, decided to undertake research work on preparation of wood apple burfi.

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2. Materials and Methods

The present research work was undertaken at Mula Agro Products Pvt. Ltd. Brahmani, Dist. Ahmednagar, in collaboration with Department of Animal Biotechnology and Dairy science, College of Agricultural Biotechnology, Loni, Dist. Ahmednagar, during the year 2012-2013.

Five levels each of sugar and wood apple pulp were examined in preparation of wood apple burfi. On the basis of the results of sensory evaluation (ranking test) three levels of pulp viz., 20, 30 and 40 per cent by weight of khoa were selected. For all the three treatments and sugar at 45 per cent was found optimum while control sample of plain burfi needed only 30 per cent sugar. Thus, in all four types of burfi samples three with 20, 30 and 40 per cent pulp and one control without pulp were decided to be studied in the experiment. Burfi samples prepared under selected four treatment combinations were studied in detail for their chemical composition and sensory quality. The experiment was conducted with five replicated trials.

Statistical analysis

The experiment was laid out in CRD with 4 treatments and 5 replications. The data obtained were analyzed statistically according method described by Snedecor and Cochran (1994) [15].

Treatment combinations

- T₁ Khoa + No wood apple pulp + 30 % sugar by weight of khoa (control)
- T₂ Khoa + 20 % wood apple pulp by weight of khoa + 45 % Sugar by weight of khoa
- T₃ Khoa + 30 % wood apple pulp by weight of khoa + 45 % Sugar by weight of khoa
- T₄ Khoa + 40 % wood apple pulp by weight of khoa + 45 % Sugar by weight of khoa

3. Result and Discussion

Chemical composition of cow milk

The results on chemical composition of cow milk

standardized at 4 per cent fat and used for the preparation of wood apple burfi are presented in Table 1.

Table 1: Chemical composition of milk

Constituents	Content (%)
Moisture (%)	86.44
Total solids (%)	13.56
Fat (%)	4.03

It is observed from the results presented in Table 1 that the values of different components in the standardized cow milk were within the normal range as reported Mohankumar (1980) [8], De (1980) [4], Patil (1982) [9].

Composition of wood apple pulp

Wood apple fruits were purchased from local farmer of the same tree with fairly uniform stage of ripeness. Selection of fruits tree was done after screening the local varieties in the area. Fruits had better flavour, soft seed, more pulp and less of waste material. Pulp was taken out from the fruits and blended along with seeds in food processor and then used for addition in khoa to prepare burfi. Chemical composition of wood apple pulp so obtained is given in Table 2.

Table 2: Chemical composition of wood apple pulp

Sr. No.	Constituents	Content (%)
1.	TSS	29.22
2.	Total sugars	16.80
3.	Acidity (citric %)	2.52

It was seen from results given in Table 2 that the total solids content in wood apple pulp was 29.22 per cent in which major share was of total sugar (16.80 %). The acidity of wood apple pulp was 2.52 per cent (citric). These results agree with findings reported by Salunkhe and Kadam (1995) [13], Kadam (1997) [6].

A) Sensory evaluation of wood apple burfi

Table 3: Sensory evaluation of wood apple burfi

Treatment	Flavour (perfect score 45)	Body and texture (perfect score 35)	Colour and appearance (perfect score 20)	Overall acceptability (perfect score 100)
T ₁	38.64	30.44	18.88	87.96
T ₂	41.30	31.21	17.16	89.67
T ₃	40.25	29.45	15.98	85.52
T ₄	39.50	28.18	14.75	82.40

a) Flavour

The data presented in Table 3 indicate that mean score for flavour was 38.64, 41.30, 40.25 and 39.50 for burfi samples prepared under T₁, T₂, T₃ and T₄ respectively. The differences in flavour scores for wood apple burfi made under various treatments were highly significant ($P < 0.05$). The highest flavour score (41.30) was received by the sample from wood apple with 20 per cent pulp and 45 per cent sugar (T₂). As the level of wood apple pulp increased there was decrease in flavour score indicating that stronger wood apple flavour declined.

Rajor and Pagote (1988) [10], conducted investigation on manufacture of burfi like product from ghee residue and soy solids. It was observed that higher the soy solids in product better was the colour, appearance and flavour. This may be due to the fact that ghee residue imparted darker colour, sourish burnt flavour to the product.

b) Body and texture

Body and texture attribute of burfi prepared under each treatment ranged from 28.18 (T₄) to 31.21 (T₂). Score of the control sample (30.44) was at par with the score of T₂ sample (31.21). It means that lower level of wood apple pulp (20 %) did not adversely affect the body and texture of the burfi on the contrary it slightly improved this attribute. Differences in the scores were significant ($P < 0.05$).

Srinivasan and Anantkrishnan (1964) [17] stated that the manufacture of khoa from buffalo milk was more preferable than from cow milk because a buffalo milk khoa is soft with loose body and granular texture. The cow milk khoa has an undesirable, slightly hard, sticky body and sandy texture and does not produce quality sweetmeats.

c) Colour and appearance

The mean scores for colour and appearance, of the product

prepared under treatment T₁, T₂, T₃ and T₄ were 18.88, 17.16, 15.98 and 14.75 respectively. The differences in the scores for colour and appearance of wood apple burfi were statistically significant ($P < 0.05$). The highest score (18.88) for colour and appearance was secured by the control sample (T₁).

De (1980) [4] reported physical quality of cow and buffalo khoa as colour straw/pale yellow with a tinge of brown in cow milk and Whitish (dull/light greenish white) with a tinge of brown in buffalo. Appearance of khoa was moist surface in cow while slightly oily/greasy surface in buffalo milk.

d) Overall acceptability

The mean scores for overall acceptability of T₁, T₂, T₃ and T₄

products were 87.96, 89.67, 85.52 and 82.40, respectively. Since overall acceptability score of all the samples were above 70.00 it could be stated that burfi prepared under all the treatments was acceptable.

B) Chemical composition of burfi

Samples of burfi prepared under each treatment were analysed for total solids, moisture, fat, protein, reducing sugar, non reducing sugar, total sugar, ash and acidity. Observations presented in each table are means of the duplicate set of analysis.

Table 4: Chemical composition (%) of wood apple burfi as influenced by treatment

Treatment	Total Solids (%)	Moisture (%)	Fat (%)	Protein (%)	Reducing Sugar (%)	Non Reducing Sugar (%)	Total Sugar (%)	Ash	Acidity
T ₁	80.30	19.70	20.19	13.50	19.99	25.94	44.93	2.90	0.28
T ₂	85.29	14.59	19.53	12.26	18.57	32.84	51.41	2.86	0.72
T ₃	84.16	15.84	19.23	11.32	19.66	32.24	51.90	2.79	1.07
T ₄	83.30	16.70	17.96	10.42	20.35	32.06	52.41	2.72	1.25
S.E. ±	0.22	0.20	0.110	0.20	0.13	0.10	0.13	0.006	0.02
CD at 5%	0.67	0.61	0.35	0.61	0.40	0.32	0.41	0.02	0.06

a) Total solids

The data presented in Table 4 indicate that the average total solids content in burfi under treatments T₁, T₂, T₃ and T₄ were 80.30, 85.29, 84.16 and 83.30 per cent respectively with range of 80.27 to 86.66 per cent. Differences in the total solid contents due to experimental treatments were highly significant ($P < 0.05$).

These values are in close agreement with the results reported by Sharma and Zariwala (1978) [15], Verma and De (1978) [18], Sachdeva and Rajorhia (1982) [12].

b) Moisture

The results presented in Table 4 show that the different levels of wood apple pulp had a significant ($P < 0.05$) influence on the moisture content in burfi. The moisture content in burfi samples ranged from 14.59 (T₂) to 19.70 per cent (T₁).

The results in respect of moisture content of wood apple burfi of this investigation are in close agreement with those reported by Bhatele and Balachandran (1983) [13], Mandokhot and Garg (1985) [7] and Rajorhia and Sen (1987) [11].

c) Fat

It is observed from data presented in Table 4. 10 that the average fat content in the burfi samples from the treatments T₁, T₂, T₃ and T₄ were 20.19, 19.53, 19.23 and 17.96 per cent, respectively. It was maximum (20.19 %) in plain burfi (T₁) since it was prepared without wood apple pulp and lowest sugar level (30 %) and minimum (17.96 %) in the product prepared by addition of highest proportion (40 %) of wood apple pulp and 45 per cent sugar (T₄). The above observations indicate that as the wood apple pulp content increased, the fat content of burfi was decreased.

The findings of this investigation are in close agreement with results reported by Sharma and Zariwala (1978) [15], Verma and De (1978) [18].

d) Protein

It is revealed that the different levels of wood apple pulp had a significant ($P < 0.05$) effect on the protein content in burfi samples. The average protein content in T₁, T₂, T₃ and T₄ treatments was 13.50, 12.26, 11.32 and 10.42 per cent,

respectively. The findings of the investigation are in close agreement with the results reported by Bhatele and Balachandran (1983) [13], Mandokhot and Garg (1985) [7] and Rajorhia and Sen (1987) [11].

e) Reducing Sugar

The reducing sugar content in the wood apple burfi made under treatments T₁, T₂, T₃ and T₄ was 19.99, 18.57, 19.66 and 20.35 per cent respectively with the range of 18.57 to 20.35 per cent (Table 4). The content of reducing sugar in the samples of wood apple burfi prepared under various treatments differed significantly ($P < 0.05$) due to the variable levels of wood apple pulp added.

The observations of this investigation are similar to those reported by Sharma and Gupta (1982) [14] and Rajorhia and Sen (1987) [11].

f) Non Reducing Sugar

It was maximum (32.84 %) in case of the samples with 20 per cent wood apple pulp and 45 per cent sugar (T₂).

Non reducing sugar content in burfi samples made with same levels of sugars (T₂, T₃ and T₄) did not differ significantly ($P < 0.05$), though pulp was used in different proportion indicating that pulp had maximum sugar of reducing type. Similar results were reported by Bhatele and Balachandran (1983) [13], Mandokhot and Garg (1985) [7] and Rajorhia and Sen (1987) [11].

g) Total Sugar

Total sugars in wood apple burfi is contributed by milk (Lactose as reducing sugar), wood apple pulp (reducing as well as non-reducing sugars) and cane sugar (non-reducing sugar) added externally.

It is observed that the total sugar content in burfi prepared under treatments T₁, T₂, T₃ and T₄ was 44.93, 51.41, 51.90 and 52.41 per cent respectively. The differences in total sugar content of wood apple burfi due to experimental treatments were found to be significant ($P < 0.05$). The results of this investigation are in close agreement with those reported by Sachdeva and Rajorhia (1982) [12], Sharma and Gupta (1982) [14] and Rajorhia and Sen (1987) [11].

h) Ash

Among the samples prepared with wood apple pulp there was decline in ash content as the level of pulp increased. It ranged from 2.72 to 2.86 per cent.

The results in respect of ash content in wood apple burfi of this investigation are in close agreement with those reported by Bhatele and Balachandran (1983)^[13] and Rajorhia and Sen (1987)^[11].

i) Acidity

It was observed that the (% lactic acid) acidity of burfi samples prepared under different treatments ranged from 0.28 (T₁) to 1.25 (T₄). Mean acidity for control samples (T₁) was minimum (0.28 %) which was substantially lower than the rest of the samples. Burfi samples from treatments T₂, T₃ and T₄ naturally had more acidity due to addition of wood apple pulp having quite high acidity (2.52 % citric) (Table 4). It also showed increasing trend as the level of pulp increased. These differences were also significantly ($P < 0.05$).

The acidity of burfi samples viz., T₁ T₂ and T₃ and T₄ closely agree with that reported by Sharma and Zariwala (1978)^[15], Sharma and Gupta (1982)^[14].

4. Conclusions

On the basis of present investigation, it was concluded that all the samples of burfi whether plain or wood apple, were acceptable. However, wood apple burfi prepared with addition of 20 per cent wood apple pulp and 45 per cent sugar (T₂) secured the top score (89.67) for its overall acceptability and was rated as "Liked very much" by the panel of judges for sensory quality. It was followed by control sample (score 87.96) of plain burfi T₁, T₃ (score 85.52) and T₄ (score 82.40) in the descending order for their liking on the basis of overall acceptability scores. Thus, judges liked wood apple burfi (T₂) more than plain burfi.

Thus considering the overall acceptability scores, preparation of wood apple burfi using cow milk with the addition of 20 per cent wood apple pulp and 45 per cent sugar (T₂) was found to be superior. Higher proportion of wood apple pulp reduced sensory properties of burfi and hence cannot be recommended. Removal of seeds from the pulp is not necessary on the contrary seeds give special effect for colour and appearance which may help to identify wood apple burfi. Moreover, while eating seeds give feel of dry fruits.

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