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Studies on development of suitable technology of utilizing wood apple (*Feronia limonia* L.) pulp in preparation of Khoa Burfi

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Abstract

Burfi is a popular khoa based confection and it contain 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 pulp 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

Milk is regarded as a complete food in a human diet. Milk provides almost all the nutrients essential for the nourishment of the human body. Milk consumed as a whole or by converting it into various milk products such as fermented milk product, coagulated and concentrated milk product (Kamble *et al.*, 2010) [7].

Burfi has been flavoured as one of the most popular khoa based sweets all over India. The unique adaptability of khoa in terms of its flavour, body and texture to blend with a wide range of food adjuncts is permitted in the development of an impressive array of burfi varieties. Among these, fruit, nut, chocolate, coconut, saffron and rawa burfi are popular. The artful ingenuity of the sweet maker in creating special qualities in burfi fetches the highest consumer price. The burfi is prepared with cashewnut as katli (a water thin slice), almond, pistachio, coconut, mango, orange, mud apple, bottle gourd and potato (Shelke *et al.*, 2008) [15].

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, chuteny 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.

Chemical compositions (per cent) of buffalo milk khoa are as follows (Srivastva, 1993) [17]

Moisture	19.2 per cent	Lactose	22.1 percent
Fat	37.1 percent	Ash	3.6 percent
Protein	17.8 per cent		

Chemical composition of wood apple pulp (Kadam (1997) [6].

TSS	29.22 per cent
Total sugar	16.80 per cent
Acidity (citric)	2.52 per cent

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Considering the flavour, nutritional and medicinal value of wood apple, it was considered worthwhile to blend it with sweetened khoa in different levels for testing nutritional value and overall acceptability.

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, during the year 2012-2013.

Method of preparation of burfi suggested by De (1980) was used with slight modification. The buffalo milk standardized to 6 per cent fat and concentrated to a pasty consistency by evaporating in open pan on gentle fire to prepare khoa. The sugar at the rate of 30 per cent for plain and 45 per cent for wood apple burfi was added and heated gently till pat formation. When the product started to leave the sides of Karahi (within 5 to 8 min) the wood apple pulp was added and further heated on low flame till the product again started to leave the side of Karahi. The product was taken off the flame and transferred into a ghee smeared tray and was allowed to cool for 10-20 hours and cut into desirable size.

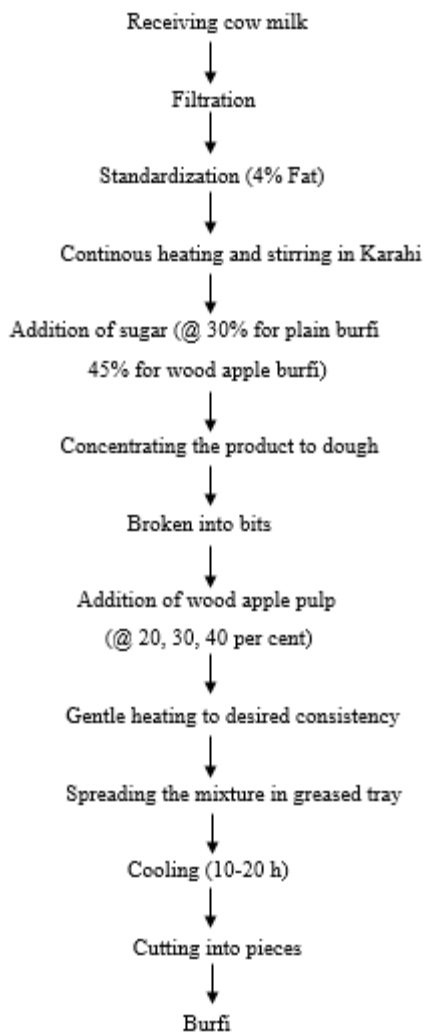


Fig 1: Flow chart of Preparation of wood apple burfi

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

Statistical analysis

The experiment was laid out in CRD with 4 treatments and 5 replications. The data obtained were analyzed statistically according to method described by Snedecor and Cochran (1994) [16].

3. Result and Discussion

Chemical analysis of burfi

a) Determination of total solids:

The total solids content of burfi was determined gravimetric method as per the procedure IS: 1479 (Part II) (Anonymous, 1961) [1].

The data presented in Table 1 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) [13], Verma and De (1978) [18], Sachdeva and Rajorhia (1982) [12].

b) Determination of moisture

Moisture content in burfi was determined by subtracting the total solids content from 100 in sample.

The results presented in Table 1 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 Bhatle and Balachandran (1983) [4], Mandokhot and Garg (1985) [8] and Rajorhia and Sen (1987) [11].

c) Determination of fat

Fat content in burfi was determined by Mojonnier fat extraction apparatus method as prescribed in B.I.S. Handbook of food analysis IS: 3889 (Anonymous, 1977) [3].

It is observed from data presented in Table 1. 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) [13], Verma and De (1978) [18].

d) Determination of protein

The protein content in burfi was determined by estimating per cent nitrogen by microkjeldhal method. The nitrogen percentage was multiplied by 6.25 to get trade protein percentage as recommended in IS: 1479 (part II) (Anonymous, 1961) [1].

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)^[4], Mandokhot and Garg (1985)^[8] and Rajorhia and Sen (1987)^[11].

e) Determination of reducing Sugar

The reducing sugar content in the wood apple burfi made under treatments T₁, T₂, T₃ and T₄ was 18.99, 18.57, 19.66 and 20.35 per cent respectively with the range of 17.26 to 20.83 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) and Mandokhot and Sen (1987)^[8].

f) Determination of 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 Bhatale and Balachandran (1983)^[4], Mandokhot and Garg (1985)^[8] and Rajorhia and Sen (1987)^[11].

g) Determination of 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) and Rajorhia and Sen (1987)^[11].

h) Determination of ash

The ash content in burfi was determined as per the method recommended in B.I.S. Handbook of food analysis IS: 1165 (Anonymous, 1967)^[2].

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)^[4] and Rajorhia and Sen (1987)^[11].

i) Determination of acidity

It was observed that the (% lactic acid) acidity of burfi samples prepared under different treatments ranged from 0.24 (T₁) to 1.30 (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 1). 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)^[13], Sharma and Gupta (1982).

Sensory evaluation

The quality of burfi was judged by offering the sample to the panel of 5 judges in each trial separately. Score card method for sensory evaluation of burfi as suggested by Pal and Gupta (1985) was adopted as details below.

Characters	Perfect score
Flavour	45
Body and texture	35
Colour and appearance	20

Overall acceptability was determined by a trained sensory panel (minimum of 5 members) on a 9-point hedonic scale as prescribed by Nelson and Trout (1964).

Hedonic rating

Sr. No.	Remarks	Score
1	Like extremely	9
2	Like very much	8
3	Like moderately	7
4	Like slightly	6
5	Neither like nor dislike	5
6	Dislike slightly	4
7	Dislike moderately	3
8	Dislike very much	2
9	Dislike extremely	1

Note: Score of 5.5 and above indicates acceptability within the score of 1 to 9.

4. Sensory evaluation of burfi

1) Flavour

It is observed from data presented in Table 2 significantly highest score (41.30 out of 45) was obtained by burfi prepared with 20 per cent of wood apple pulp as compared to other treatments. Hence, it indicated that 6 per cent level of wood apple pulp resulted in better flavour of burfi. As the level of wood apple pulp increased there was decrease in flavour score indicating that stronger wood apple flavour declined.

2) Body and texture

So far as body and texture was concerned (out of 35) the highest score of 31.21 was obtained in burfi prepared with 20 per cent of wood apple pulp and the lowest score of 28.18 was obtained without addition of wood apple pulp. From the data obtained by Table 2, it is revealed that as the levels of wood apple pulp increased, the score for body and texture of burfi also increased proportionately.

3) Colour and appearance

The highest colour and appearance score (18.88 out of 20) of burfi prepared without addition of wood apple pulp was superior over rest of the treatments. From the data obtained, it was revealed that as the levels of wood apple pulp increased, the score for colour and appearance of burfi also decrease proportionately.

4) Overall acceptability based on 9 point hedonic scale

The mean scores for overall acceptability of T₁, T₂, T₃ and T₄ products were 87.96, 89.67, 85.52 and 82.40, (Table 2) 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.

Cost of production

Cost of production of 1 kg burfi prepared under various treatments i.e 0, 20, 30 and 40 per cent was Rs.100.42, Rs.87.03, Rs. 84.36 and Rs. 81.95, respectively. The cost of production decreased with the increase in levels of wood apple pulp. The highest cost (Rs. 100.42) of production was

recorded in case of burfi prepared without addition of wood apple pulp. However, the burfi prepared with 20 per cent pulp obtained maximum score for sensory evaluation/ acceptability and costing Rs. 87.03 which was less than control hence can be compensated with value addition of wood apple pulp in burfi.

Table 1: 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

Table 2: 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

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