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Effects of Addition of Pumpkin (*Cucurbita pepo*) Pulp on the Physico-chemical and Sensory Properties of *Burfi* and its Cost Structure

Rahul Govinda Kolwate, Ashish Ashok Uikey[1], S.R. Shegokar[2]

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ABSTRACT

Background: During present investigation *burfi* was prepared from different combinations of cow milk *khoa* and pumpkin pulp [*viz.*, 100:00 (T_1), 75:25 (T_2), 70:30 (T_3), 65:35 (T_4) and 60:40 (T_5)] and the samples were subjected to sensory evaluation, chemical analysis and cost was computed considering the ingredients and processing costs. The pumpkin pulp (as per treatments) and sugar (30% by weight of *khoa*) were mixed with *khoa* at different stage of *khoa* preparation. Then, the mixture was heated till *burfi* was obtained.

Methods: For preparation of *burfi* fresh cow milk was obtained from Livestock Instructional Farm, Akola. The milk was standardized to 4.0 per cent fat and 9.0 per cent SNF for the preparation of *burfi.* The *khoa* blended with pumpkin (*Cucurbita pepo*) pulp at different ratios, the product without using pumpkin pulp served as control. The *burfi* was analyzed for chemical composition (*viz.*, fat protein, total sugars, ash and total solids). The organoleptic attributes of *burfi* were analyzed in terms of its flavor, body and texture and color and appearance, wherein the total score was out of 100; the judging panel comprised on 5 members.

Result: The total sensory scores of *burfi* obtained were 87.81, 90.46, 95.46, 92.99 and 84.30 for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. The *burfi* prepared from various combinations involving use of up to 70 per cent cow milk *khoa* in blend with pumpkin pulp was found acceptable. The fat content of *burfi*'s was 19.61, 15.40, 14.38, 13.40 and 12.37 per cent, protein content was 14.89, 12.64, 12.11, 11.61 and 11.04 per cent, total sugar content was 32.78, 36.73, 37.59, 38.45 and 39.31 per cent, ash content was 2.69, 2.55, 2.53, 2.49 and 2.45 per cent, total solids content was 69.94, 67.30, 66.60, 65.94 and 65.17 per cent for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. The fat, protein, ash and total solids of *burfi* tended to decrease while total sugar and moisture content tended to increase with an increase in the level of pumpkin pulp used as additive. The per kg cost of production of pumpkin based *burfi* decreased with increasing level of incorporation of pumpkin pulp in *burfi* formulation *i.e.* ₹ 240 (100:00 *khoa*), ₹ 204.51 (75:25, *khoa*: pulp), ₹ 199.11 (70:30 *khoa*: pulp), ₹ 194.33 (65:35 *khoa*: pulp), ₹ 189.25 (60:40, *khoa* : pulp) for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. The most acceptable *burfi i.e.* T_3 was computed to be priced at ₹ 199.11 per kg.

Key words: *Burfi*, Organoleptic, Pumpkin, Physico-chemical properties, Pumpkin pulp.

INTRODUCTION

Burfi is one of the most popular *khoa* based sweet, prepared from cow or buffalo milk. *Burfi* is prepared by heating the mixture of *khoa* and sugar to a near homogenous consistency followed by cooling and cutting it into small cuboids (Chetana *et al*., 2010). It basically has mild caramelized flavour. Its colour may vary from light off white to creamy to light brown. Good quality *burfi* is characterized by moderately sweet taste, soft and slightly greasy body and smooth texture. Due to unique adaptability of *khoa* in terms of its flavor, body and texture to blend with wide variety of food, various forms of *burfi* are available with different additives depending on regional preferences *viz.* plain, *mawa*, chocolate, fig, *rawa*, cashewnut, coconut. Pumpkin (*Cucurbita moschata* Duch. Ex Poir), commonly known as kashiphalor Pumpkin belongs to the family cucurbitaceae and the genus cucurbita. The genus cucurbita include various varieties such as *Cucurbita moschata* (winter squash), *Cucurbita pepo* (summer squash), *Cucurbita mixta*, *Cucurbita facifola*, *etc.* Out of these *Cucurbita moschatais* and *Cucurbita pepo* have commercial importance and are extensively grown in summer and rainy seasons throughout the country. Pumpkin fruit are rich source of carotenoids, vitamins, minerals and dietary fibres.

It is found that the smooth, slightly sweet taste of cooked pumpkin is actually quite delicious. Pumpkin is also

[1]Department of Animal Husbandry and Dairy Science, Dr. Punjabrao Deshmukh Agricultural University, Akola-444 104, Maharashtra, India.

[2]Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Agriculture University, Parbhani-431 402, Maharashtra, India.

Corresponding Author: Ashish Ashok Uikey, Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Agriculture University, Parbhani-431 402, Maharashtra, India. Email: ashishashokuikey@gmail.com

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considered a versatile vegetable and it can be used to make delicious soups, stews, cakes and muffins and of course the famous pumpkin pie (Rahman *et al.*, 2019). Pumpkin (*Cucurbita pepo*) pulp is a good supplement of protein, carbohydrate and fat with low anti nutrient. This coupled with high mineral content which is advantageous for man and animals (Adebayo *et al.*, 2013). Pumpkin has a range of fantastic benefits, including being one of the best-known sources of beta carotene. Beta carotene is a powerful antioxidant that gives orange vegetables and fruits their vibrant color. The body converts any ingested beta carotene into vitamin A. Consuming foods with high volumes of beta carotene may have the benefits like reducing the risk of developing certain types of cancer, offering protection against asthma and heart disease, decreasing the risk of age-related macular degeneration. Including pumpkin in the diet may help people control diabetes and their blood sugar levels. Pumpkins are a fantastic source of fiber (Ware, 2019). According to the United States Department of Agriculture's (Food Data Central, 2019) database, 1 cup or 245 g of cooked, boiled, or drained pumpkin, without salt, contains: 1.76 g of protein, 2.7 g of fiber, 49 calories (kcal), 0.17 g of fat, 0 g of cholesterol, 12 g of carbohydrate. Pumpkin also provides a range of essential vitamins and minerals, including: vitamin A, C, E, B1, B2, B3, B5, B6 and B9, potassium, copper, manganese, iron, magnesium and phosphorus.

Pumpkin provides valuable source of carotenoids that have a major role in the nutrition in the form of pro-vitamin A. Being rich source of carotenoids pumpkin-based food products can help in preventing skin diseases, eye disorders and cancer. Incorporation of beta carotene rich ingredients in the development of food products is considered a cost-effective approach to vitamin-A related health problems. Moreover, the anti-diabetic properties and anti-cancerous properties of pumpkin have generated interest in consuming this fruit and utilizing it as a source of various bio-actives for the development of value added products and nutraceuticals (Dar *et al.*, 2017).

Cucurbita pepo has been reported for their use as traditional medicine with antidiabetic, anti-hypertensive, anti-tumor, immune modulation, anti-hypercholesteralemia, anti-inflammation activities and anti-bacterial (Fu *et al.*, 2006). Pumpkin is used as a medicinal plant for prostate and bladder problems and as an anthelmintic, galactogogue and antiemetic (Magdeleine *et al.*, 2011). Looking to the diversification nutritive benefits of pumpkin and concentrated milk product, *burfi* was prepared from milk and pumpkin pulp. The present study was planned to add value to *burfi* through incorporation of pumpkin pulp.

MATERIALS AND METHODS

Preparation of pumpkin pulp

The pumpkin was procured from local market. It was cleaned and skin was removed. Then, the pumpkin was chopped into small pieces, boiled on medium flame for 10 minutes, cooled to room temperature and mashed.

Composition of pumpkin pulp (Table 1)

Treatment details

T_1 - 100 part of *khoa* (control)
T_2 - 75:25 *khoa*: pumpkin pulp
T_3 - 70:30 *khoa*: pumpkin pulp
T_4 - 65:35 *khoa*: pumpkin pulp
T_5 - 60:40 *khoa*: pumpkin pulp

In all treatment sugar was added at the rate of 30% by weight of *khoa.*

Preparation of *burfi*

For preparation of control *burfi* and experimental *burfi* fresh cow milk was obtained from Livestock Instructional Farm Department of Animal Husbandry and Dairy Science, Dr. P.D.K.V., Akola. The milk was standardized to 4 per cent fat and 9 per cent SNF before preparation of *burfi*. The *burfi* samples were prepared by using the standard procedure described by Aneja *et al.* (2002) with suitable modifications.

Process flow chart for the preparation of *burfi* is given in Fig 1.

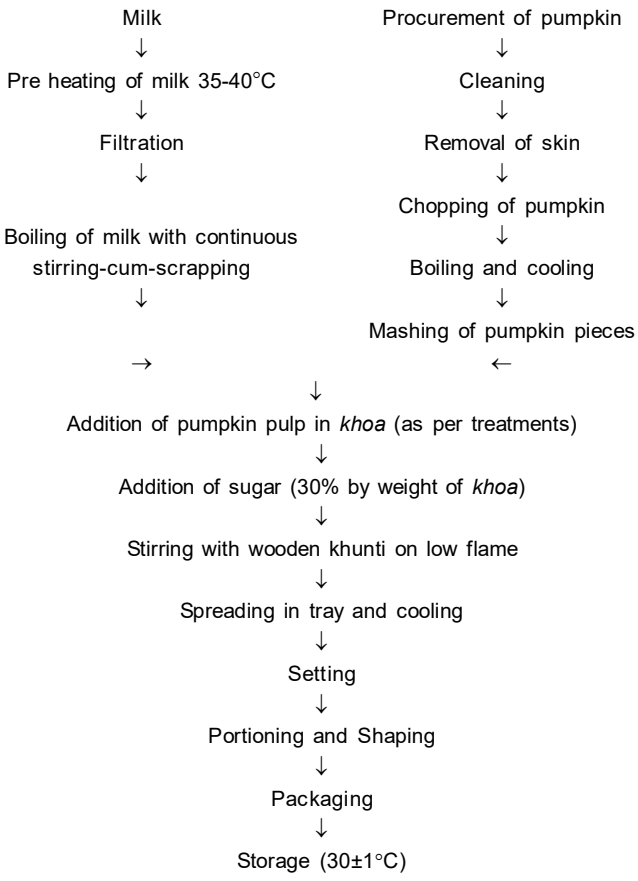

Fig 1: Flow diagram for preparation of *burfi* containing pumpkin pulp.
Source: Aneja *et al.* (2002).

Chemical analysis

The *burfi* prepared with and without use of pumpkin pulp were analyzed for fat by Gerber's method as described in IS: 1224 (part II) 1977, Protein by the Microkjeldahl's method as described in IS: 1981, Total sugars by the spectrophotometer method, ash by standard method (BIS, 1981), Total solids by standard method (BIS, 1961).

Organoleptic evaluation

The organoleptic attributes of *burfi* were analyzed in terms of its flavor, body and texture and color and appearance, by offering sample to the panel of 5 judges from the Department of Animal Husbandry and Dairy Science, Dr. P.D.K.V., Akola using 100 point scale prescribed by (Pal and Gupta, 1985).

Statistical analysis

The observations were analyzed as per the completely randomized design (CRD) in which five treatments were replicated four times. Data was analyzed by giving the statistical treatments to the findings describe by (Gomez and Gomez, 1984).

Cost structure

Cost structure of *burfi* was calculated considering the market cost of ingredients used for *burfi* making.

RESULTS AND DISCUSSION

Effect of incorporating pumpkin pulp on the chemical composition of *Burfi*

The effect of varying levels of pumpkin (*Cucurbita pepo*) pulp *viz.*, fat, protein, total sugar, ash and total solids of *burfi* was shown in Table 2. There was a significant (P<0.05) decrease in the fat, protein, ash and total solids content of *burfi* was observed with increasing the level of pumpkin pulp. Whereas, increase in total sugar was noted in *burfi* when the level of pumpkin pulp was raised in the blend. Decrease in fat and protein content was in consonance with the findings of Singh *et al.* (2017) who observed that with an increase in apple pomace levels led to proportionate decrease in the fat and protein content of *burfi*; such effect was found to be significant (P<0.05). The control *burfi* had significantly (P<0.05) higher fat, protein, ash and total solids than any of the experimental *burfi* samples. The fat, protein, ash and total solids content of *burfi* prepared using 30 parts of pumpkin pulp were highest (Table 2).

Table 1: Composition of pumpkin pulp.

Parameter determined	Composition (%)
Total ash	15.988±0.10
Moisture content	0.532±0.10
Fat ether extract	2.300±0.10
Crude fibre	11.463±0.10
Crude protein	3.070±0.10
Carbohydrate by difference	66.647±0.10

Effect of addition of pumpkin pulp on the sensory attributes of *Burfi*

The effect of varying levels of pumpkin pulp on the sensory scores *viz.*, flavour, body and texture, colour and appearance and overall acceptability of *burfi* as shown in Table 3. The highest score (43.50 out of 45.00) for flavour was obtained for *burfi* prepared with 30 parts of pumpkin pulp (T_3). This result was comparable to that of Dhande and Bhosale (2017) who observed that, the highest score (43.87 out of 45.00) for flavour was obtained by treatment with 80 parts of *khoa* + 20 parts of ash gourd pulp which was at par with the score (42.53 out of 45.00) of treatment 85 parts of *khoa* +15 parts of ash gourd pulp. The highest score (33.23 out of 35.00) for body and texture was obtained for *burfi* prepared with 30 parts of pumpkin pulp (T_3). This result was comparable to that of Talekar *et al.* (2015) who reported that, the *burfi* made with 85 parts of buffalo milk *khoa* + 15 parts of coconut paste secured the highest score (8.82 out of 9.0) for body and texture and it was liked very much by the judges among the treated samples. The highest score (18.52 out of 20.00) for colour and appearance was obtained for *burfi* prepared with 30 parts of pumpkin pulp (T_3). This result was comparable to that of Ramteke *et al.* (2018) who reported that, The highest score (18.50 out of 20) for colour and appearance was obtained by *burfi* prepared with 90 parts of cow milk *khoa* + 10 parts of potato flour. The lowest score (15.75 out of 20) was obtained by *burfi* prepared with 80 parts of cow milk *khoa* + 20 parts of potato flour. The highest total sensory score (95.56 out of 100.00) was noted for *burfi* prepared with 30 parts of pumpkin pulp (T_3) (Table 3).

Table 2: Effect of addition of pumpkin pulp on chemical composition of *burfi.*

Chemical constituent	Treatment					CD (P<0.05)
	T_1	T_2	T_3	T_4	T_5	
Fat	19.60±0.119^a	15.39±0.126^b	14.37±0.125^c	13.40±0.127^d	12.37±0.122^e	0.366
Protein	14.86±0.157^a	12.64±0.138^b	12.11±0.127^c	11.61±0.103^d	11.04±0.104^e	0.375
Total sugar	32.77±0.051^e	36.72±0.041^d	37.59±0.036^c	38.45±0.041^b	39.31±0.061^a	0.139
Ash	2.69±0.022^a	2.58±0.030^b	2.53±0.029^c	2.49±0.029^d	2.45±0.028^e	0.079
Total solids	69.81±0.233^a	67.18±0.208^b	66.50±0.179^c	65.45±0.447^d	65.03±0.187^e	0.590

Values are Mean ± Standard Error.

Values with different superscript are significantly (P<0.05) different from each other.

Table 3: Effect of varying levels of pumpkin pulp on the sensory scores of *burfi.*

Treatment	Sensory attributes			
	Flavour	Body and texture	Colour and appearance	Total score
T_1	40.79±0.287^d	30.77±0.011^d	16.25±0.294^d	87.81±0.420^d
T_2	42.12±0.163^c	31.47±0.228^c	16.87±0.145^c	90.46±0.361^c
T_3	43.50±0.045^a	33.23±0.165^a	18.52±0.080^a	95.26±0.210^a
T_4	42.96±0.173^b	32.58±0.162^b	17.43±0.131^b	93.04±0.260^b
T_5	39.75±0.012^e	29.36±0.013^e	15.19±0.014^e	84.30±0.015^e
CD P<0.05	0.497	0.458	0.480	0.831

Values are Mean ± Standard Error.

Value with different superscript are significantly differed at P<0.05.

Table 4: Cost structure for 1 kg pumpkin pulp *burfi* prepared under various treatments.

Particulars	Cost	Treatments				
		T_1	T_2	T_3	T_4	T_5
Quantity of cow milk (L.)		2	2	2	2	2
Cost of milk required as per treatment cost of milk	₹ 40/L.	80	80	80	80	80
Khoa obtained (g)		350	350	350	350	350
Pumpkin pulp (g)		0	92.5	110	127.5	145
Cost of pumpkin pulp	₹ 30/kg	0	2.77	3.3	3.82	4.35
Sugar (g)		105	105	105	105	105
Cost of sugar	₹ 40/kg	4.2	4.2	4.2	4.2	4.2
Miscellaneous cost		25	25	25	25	25
Burfi obtained (g)		455	547.5	565	582.5	600
Cost of *burfi* (₹)		109.2	111.97	112.5	113.02	113.55
Cost of *burfi* (₹/kg)		240	204.51	199.11	194.33	189.25

Cost structure for 1 kg pumpkin based *burfi* prepared under various treatments

The cost of production of 1 kg *burfi* under various treatments was calculated by considering cost of the finished product, the cost of the ingredients used in the preparation of pumpkin based *burfi* was calculated as per the prevailing (2018-19) market price of ingredients (Table 4). The data showed that the cost of production 1 kg *burfi* decreased as the level of pumpkin pulp was increased in the blend formulation. The miscellaneous charges were required ₹ 25 per 1 kg. The cost of *burfi* would be lower when large scale or industrial scale production of *burfi* is considered. The present investigation indicated that on the basis of sensory evaluation and chemical characterization, good quality *burfi* can be prepared from blend comprising of 70:30, khoa: pumpkin pulp; the product was computed to be priced at ₹ 199.11/kg. The cost of cow *burfi* containing pumpkin pulp per kg tended to decrease as the quantity of pumpkin pulp increased in the initial blend. Such result was comparable to that of Bhosale *et al.* (2017) who reported that the cost of production of *burfi* decreased when the level of bottle gourd added to *khoa* increased. The cost of production for *burfi* produced using 0 part of bottle gourd was ₹ 354.02 per kg while *burfi* prepared from blend comprising of *khoa*: bottle gourd paste (85:15) was ₹ 312.48 per kg (Table 4).

CONCLUSION

From the result obtained in the present investigation, it can be evident that, good quality *burfi* can be prepared using blend of 70 parts of *khoa* + 30 parts of pumpkin pulp. The resultant *burfi* had a light yellowish colour, pleasant flavor and appreciable total sensory score. The *burfi* tended to contain lower amount of fat, protein, ash and total solids while total sugar tended to increase as the proportion of pumpkin pulp was increased in the mix blend for *khoa* preparation. The cost of the recommended *burfi* involving use 70 parts of *khoa*: 30 parts of pumpkin pulp was ₹ 199.11 per kg. Production of value-added *burfi* with highly acceptable sensory score is feasible through addition of 30 parts of pumpkin pulp to 70 parts of *khoa* with cost benefit too.

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