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KD More
Ph.D. Scholar from Dairy Science, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India

KD Chavan
Associate Professor, Animal Husbandry and Dairy Science Directorate of Research, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India

Correspondence
KD More
Ph.D. Scholar from Dairy Science, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India

Physico-chemical quality of *burfi* prepared from red pumpkin (*Cucurbita pepo* L.) powder

KD More and KD Chavan

Abstract
In the present study red pumpkin powder was utilized to standardize the process to prepare *burfi*. The *burfi* samples were prepared without addition of red pumpkin powder in the *burfi* (control) (T_0), incorporation of 15 per cent (T_1), 17 per cent (T_2) and 19 per cent red pumpkin powder in the *burfi* (T_3), and 30 per cent sugar. The sample were analyzed for physical and chemical quality. The slandered procedures were used for analysis. The mean fat, protein, total solids, reducing sugar, total sugar, titratable acidity (per cent lactic acid), pH values ranged from 17.94 to 19.40 per cent, 11.44 to 13.82 per cent 75.96 to 79.37 per cent, 1.48 to 2.58 per cent, 14.66 to 19.82 per cent, 30.15 to 32.41 per cent, 0.27 to 0.31 % L.A. and 6.10 to 6.44, respectively.

Keywords: *Burfi*, cow milk, khoa, red pumpkin powder, physico-chemical quality

Introduction
Burfi is a khoa based indigenous milk product of considerable economic and nutritional importance. It is one of the most popular milk based sweet in India. It is prepared by heating a mixture of concentrated milk solids (khoa) and sugar to a near homogenous consistency followed by cooling and cutting into small cuboids. Beating and whipping operations prior to cooling are sometimes practiced to obtain a product with smooth texture and closely knit body. The most popular varieties of *burfi* are fruit, nut, chocolate, saffron and rawa *burfi*. These ingredients can be used single or in combination (Aneja *et al.*, 2002) [2]. Good quality *burfi* is characterized by moderately sweet taste, soft and slightly greasy body and smooth texture with very fine grains. Colour should be uniform, white or slightly yellowish depending on the type of the milk used. (Pal and Raju, 2006) [22]. The shelf life of *burfi* is about 7–10 days under ambient conditions (Khan *et al.*, 2008) [14].
Burfi is also prepared by using fruits like mango, orange, wood apple, fig etc, while in Andhra Pradesh coconut is mostly used as a ingredient of *burfi*. These fruits enhance the acceptability of *burfi* to the masses as well as choosy classes.
Presently, herbal products either in the form of cosmetics or food has become more popular in the world market. In fact, people are now suffering from various diseases. American dietetic association noted that regular consumption of fruits, vegetables, whole grains and other foods containing anti-oxidants can provide protection against certain diseases (Pszczola, 2001) [24]. Epidemiological data as well as *in vitro* studies strongly suggest that, foods containing phytochemicals with anti- oxidation potential have strong protective effects against major disease risks including cancer and cardiovascular diseases (Kaur and Kapoor, 2002) [13]. Herbal sweet preparation is a new concept in dairy industry. Herbal sweets are the sweets that are prepared with the herbs (include not only herbaceous plants but also to bark, roots, leaves, seeds, flowers and fruits, shrubs and woody vines) that have been used as a food and for medicinal purpose for centuries. Actually, milk itself act as a good source of anti-oxidants. The anti-oxidant activity of milk has been assigned to compounds such as urate (Chen *et al*, 2003), anti-oxidant vitamins (vitamin E, vitamin C) caratenoids and different forms of anti-oxidant proteins. The combination of dairy products with herbs will serve as a good source of anti-oxidant, which will be helpful for human, from health point of view.
Red Pumpkin (*Cucurbita pepo* L.) plant is a fast-growing vine that creeps along the ground surface in a similar fashion like that of other *Cucurbitaceae* family vegetables and fruits such as cucumber, squash, cantaloupes etc. It is one of the most popular field crops cultivated around the world, including USA at the commercial scale for its fruit and seeds. Pumpkin also called kashiphal or lal kadu occupies a prominent place among vegetables owing to its high

Productivity, nutritive value, good storability, and long period of availability and better transportation qualities.

Pumpkin belongs to genus *Cucurbita* of the family *Cucurbitaceae* is one of the largest families of vegetable kingdom. They are widely grown and consumed in many tropical and sub-tropical countries around the world (Juna *et al.*, 2006) [11]. Trace elements such as Copper, Calcium, Magnesium, Phosphorous and Vitamins such as carotenoids, tocopherol and other substances like proteins, phytosterols, poly-unsaturated fatty acids and flavonoid poly-phenolic antioxidants such as leutin, xanthin and carotenes are in abundance antioxidants which are naturally present in pumpkin that can be benefial to human health. (Pasha *et al.*, 2013) [23].

Pumpkin (*Cucurbita pepo*. L) has received considerable attention in recent years because of the nutritional and health protective values of the seeds. The seed is an excellent source of protein and also has pharmacological activities such as anti-diabetic, antifungal, antibacterial, anti-inflammation activities and antioxidant effects (Nkosi *et al.*, 2006) [21]. Besides, the pumpkin is economical and a nutrient dense source, the pumpkin seed flour fortified complementary food mix is economical, with highly acceptable sensory qualities and a rich nutritive value Dhiman *et al.*, (2009) [8]. Stevenson *et al*., (2007) [29] quoted that, pumpkin seeds offer a nutritious, sweet, somewhat soft and chewy snack or food additive (Adhau *et al*., 2015) [1]. The vegetable is one of the food items recommended by dieticians in cholesterol controlling and weight reduction programs. It is also an excellent source of many natural poly-phenolic flavonoid compounds such as α, ß carotenes, cryptoxanthin, lutein and zea-xanthin. Carotenes convert into vitamin A inside the body. Zea-xanthin is a natural anti-oxidant which has UV (ultra-violet) rays filtering actions in the macula lutea in retina of the eyes. Thus, it helps protect from "age-related macular disease" (ARMD) in the elderly. The fruit is a good source of B-complex group of vitamins like folates, niacin, vitamin B-6 (pyridoxine), thiamin and pantothenic acid.

Materials and Methods

The burfi samples under preliminary and experimental trials were subjected to sensory evaluation using the method described in IS: 6273, Part –I and II (1971) adopting 9 point Hedonic Scale. A panel of 5 trained judges was formulated for this purpose. The samples were coded every time to conceal their identity and were offered to the judges for evaluation of the quality attributes.

Experimental treatment details

T_0 (Control)	Khoa + 0 % without red pumpkin powder + 30 % Sugar
T_1	Khoa + 15 % red pumpkin powder + 30 % Sugar
T_2	Khoa + 17 % red pumpkin powder + 30 % Sugar
T_3	Khoa + 19 % red pumpkin powder + 30 % Sugar

Preparation of red pumpkin powder

Selection of fresh Red pumpkin fruit
↓
Washing
↓
Cut the pumpkin in 2 x 3 cm pieces
↓
Peeled and soaked in 0.1% citric acid solution (15 min)
↓
Chopped and juice extracted
↓
Drying of pumpkin residue (Sun Drying)
↓
Grinding
↓
Sieving
↓
Packaging

Flow chart for pumpkin powder preparation (Kumar *et al.*, 2015) [18]

Preparation of red pumpkin *burfi*

Cow milk
↓
Pre-heating (35-40^{0}C)
↓
Filtration
↓
Standardization (4.5 %)
↓
Boiling of milk with continuous stirring-cum-scrapping
↓
Khoa
↓
Addition of Red pumpkin powder + ground sugar (as per the treatments)
↓
Stirring with wooden khunti on low flame

↓
Spreading in tray and cooling
↓
Setting
↓
Cutting in to rectangular pieces
↓
Packaging
↓
Storage at room temperature (30±1^{0}C)

Flow chart for preparation of red pumpkin *burfi*

The *burfi* samples were prepared by using the standard procedure described by Aneja *et al.* (2002) [2] with suitable modifications.

Physico-chemical properties of red pumpkin burfi

Fat: As per the method described in BIS: 1981 [5]. Protein: As per the procedure describe BIS: 1981 [5]. Reducing sugar: Lane and Eynon (1923) [19]. Total sugar: As per the method described by Lane-Eynon in SP: 18 (Part-XI, 1981) [28]. Total solids: As per the method given in BIS (1981) [8]. pH: As per the method given in BIS (1981) [5]. Acidity: As per the method given in BIS (1981) [5].

Statistical analysis

Experiment was laid out in Completely Randomized Design (CRD) with 3 replications for preliminary trials and 5 replications for experimental trials. The data was tabulated and analyzed according to Snedecor and Cochran (1994) [26].

Result and Discussion

Table 1: Chemical composition of red pumpkin *burfi*

Treatments	Fat (%)	Protein (%)	Total Sugar (%)	Reducing sugar (%)	Total Solids (%)	Total Fibre (%)	Lactic acidity (% L.A)	pH
T_0	19.40^a	13.82^a	32.41^a	14.66^d	75.96^d	ND	0.27^d	6.10^d
T_1	18.70^b	12.91^b	24.17^d	15.92^c	76.86^c	2.86^c	0.29^c	6.32^c
T_2	18.34^c	12.02^c	27.66^c	17.22^b	78.57^b	2.96^b	0.31^b	6.43^b
T_3	17.94^d	11.44^d	30.15^b	19.82^a	79.37^a	3.11^a	0.31^a	6.44^a
S.E. ±	0.063	0.014	0.02	0.00	0.014	0.00	0.00	0.00
CD at 5 %	0.19	0.042	0.06	0.02	0.044	0.01	0.009	0.02

ND= Not detected

Fat

The fat content of fresh red pumpkin *burfi* is presented in the Table 1. The mean fat content of red pumpkin *burfi* for T_0, T_1, T_2 and T_3 was 19.40, 18.70, 18.34 and 17.94 per cent, respectively. All the experimental treatments differed significantly (P<0.05) among themselves. The fat content in the red pumpkin *burfi* increased with increased in the level of pumpkin powder in the burfi samples. The treatments T_0, T_1 and T_2 were at par. The extent of decrease in fat content was higher in the treatment T_3. It might be due to lipolytic activities in the burfi sample. Nawale *et al*. (2014) [20] reported 17.03 to 20.41 per cent fat content in the wood apple burfi. Wasnik *et al*. (2015) [31] reported 20 per cent fat content in the santra *burfi* prepared using buffalo milk. Khapre *et al*. (2015) [15] prepared fig *burfi* and reported fat content in the range of 18.2 to 20.02 per cent.

Protein

It was revealed that, the protein content in red pumpkin *burfi* sample were 13.82, 12.91, 12.02 and 11.44 per cent for T_0, T_1, T_2 and T_3 (Table 1). The protein content in red pumpkin *burfi* significantly (P<0.05) differed due the addition of pumpkin powder in the red pumpkin *burfi* samples. All the treatments significantly differed among themselves. The protein content in the red pumpkin *burfi* sample decreased with increase in the level of pumpkin powder in the *burfi*.

The influence of incorporation of red pumpkin powder on the protein content of *burfi* samples was significant (P<0.05). The protein content in the *burfi* samples decreased as the level of incorporation of red pumpkin powder increased. It might be due to in protein content of red pumpkin powder. Kamble *et al*. (2010) [12] reported 12.10 per cent protein content in the pineapple *burfi*. Waghmare (2012) [30] reported 12.72 per cent protein content in the bottle gourd *burfi*.

Total sugar

The mean total sugar content of red pumpkin burfi samples is presented in Table 1. The total sugar content in burfi samples significantly (P<0.05) differed due to the addition of pumpkin powder in the burfi. The mean total sugar content of red pumpkin burfi was 32.41, 24.17, 27.66 and 30.15 per cent in the treatment T_0, T_1, T_2 and T_3, respectively. It was noticed that as the level of addition of pumpkin powder increased in the red pumpkin burfi the total sugar content in the burfi samples increased significantly. It might be due to carbohydrate content present in the pumpkin powder. Bhingardive (2012) [4] prepared wood apple *burfi* and reported reducing sugar content in the range of 29.11 to 34.30 per cent.

Reducing sugar

Reducing sugar is a major reducing sugar in red pumpkin *burfi*. Significant variation was observed in the values of reducing sugar of drumstick whey beverage (Table 1) due to the addition of pumpkin powder in the red pumpkin burfi. The mean reducing sugar content of red pumpkin burfi was 14.66, 15.92, 17.22 and 19.82 per cent in the treatment T_0, T_1, T_2 and T_3, respectively. Deshmukh (2008) [7] prepared honey *burfi* and reported reducing sugar content in the range of 14.47 to 16.35 per cent. Bhingardive (2012) [4] prepared wood apple burfi and reported reducing sugar content in the range of 11.82 to 13.99 per cent.

Total solids

The mean total solids content of red pumpkin powder was

75.96, 76.86, 78.57 and 79.37 per cent in the treatments of T_0, T_1, T_2 and T_3, respectively (Table 1). The total solids content of experimental samples increased due to addition of pumpkin powder. There was significant (P< 0.05) differences in the total solids content of red pumpkin burfi due to addition of various level of pumpkin powder in the product. The control sample had significantly lower total solids content (75.96 %) over the rest of the treatments. While the sample under treatment T_3 (79.37 %) had significantly higher total solids content over rest of treatment treatments. All the treatments significantly differed among themselves. It was seen that, with increase in addition of pumpkin powder in the red pumpkin burfi, there was increase in total solids content in burfi samples. Optimum or little higher moisture on one hand give better body and texture to the product but on the other hand increased water activity which was promote faster microbial growth particularly for mould on the surface which leads to spoilage of the product. Kolhe (2003) [17] prepared papaya pulp *burfi* and reported total solids content in the range of 69.88 to 85.86 per cent.

The results of present study are very well comparable with the observation recorded by Hemavathy and Prabhakar (1973) [10], Sachdeva and Rajorhia (1982) [25], Bhatele (1983) [3], Solanki *et al*, (2002) [27] and Kamble (2010) [12], Bhingardive (2012) [4].

Total fibre

The mean total fibre content in the red pumpkin burfi samples of T_0, T_1, T_2 and T_3 were 0.0, 2.86, 2.96 and 3.11 per cent, respectively (Table 1). There was significantly (P<0.05) differed among themselves due to the addition of pumpkin powder in the burfi. Treatment T_3 had highest total fibre content i.e. 3.11 per cent. All the treatments significantly differed among themselves. It was noticed that as the level of addition of pumpkin powder in the burfi sample increased the total fibre content in the burfi sample treatments also increased. It may be due to the fibre content in the pumpkin powder.

Lactic acidity (%LA)

Lactic acidity content of red pumpkin burfi sample is presented in Table 1. The mean Lactic acidity content of red pumpkin burfi samples were 0.27, 0.29, 0.31 and 0.31 % Lactic acidity for T_0, T_1, T_2 and T_3, respectively. The Titratable acidity of burfi sample significantly (P<0.05) influenced due to the addition of different levels of pumpkin powder in the burfi. The control sample had significantly lower acidity (0.27 % LA) over the rest of treatments. While the treatment T_3 had significantly higher Titratable acidity (0.31 % LA) over all other experimental treatment samples. Treatment T_1 and T_2 were at par to each other. There was increasing in the Titratable acidity content in the treatment samples with increasing in the level of pumpkin powder in burfi. It might be due to ascorbic acid content of pumpkin powder. Kolhe (2003) [17] prepared papaya pulp *burfi* and reported Lactic acidity content in the range of 0.26 to 0.34 per cent. Khojare *et al*. (2016) [16] prepared bottle gourd *burfi* and reported Lactic acidity content in the range of 0.25 to 0.31 per cent.

pH

The mean pH of the red pumpkin burfi samples of T_0, T_1, T_2 and T_3 were 6.10, 6.32, 6.43 and 6.44, respectively. The pH of whey beverage samples significantly (P<0.05) differed due to the addition of pumpkin powder in the burfi. Treatment T_3 had highest pH (6.44). pH of burfi samples was inversely proportional to the acidity contents of the samples. Increasing in the acidity content increasing the pH.

Conclusion

The most acceptable quality burfi can be prepared using 17 per cent pumpkin powder and 30 per cent sugar. The burfi containing 17 per cent pumpkin powder had the 18.34 per cent fat, 12.02 per cent protein, 27.66 per cent total sugar, 17.22 per cent reducing sugar, 78.57 per cent total solids, 2.96 per cent total fibre, 0.31 titratable acidity (% lactic acid), 6.43 pH.

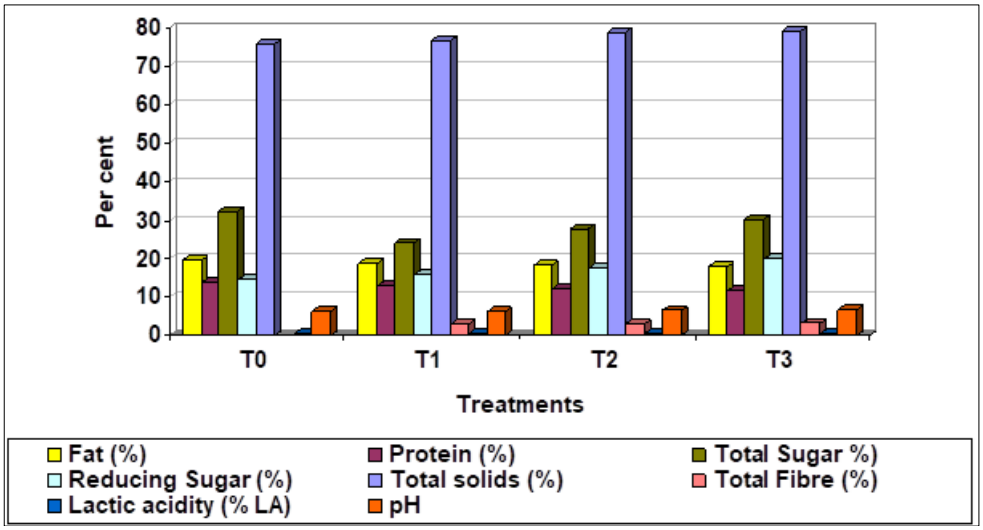

Fig 1: Treatments

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