Development and Quality Evaluation of Orange Barfi Fortified with Coconut (*Cocos nucifera*) and Walnut (*Juglans regia*) Powder

ASHVINI SHESHRAO GANORKAR*[1] AND HANMANT BODHANKAR[2]
[1]M.Sc. Student and [2]HOD
Department of Food Technology, Parul Institute of Applied Sciences
Parul University, Waghodia, Vadodara (Gujarat) India

ABSTRACT

The burfi prepared with addition of orange pulp in sweetened khoa is popularly known as Santra burfi in Maharashtra and it has great commercial potential owing to its typical taste. This project was an attempt to develop a sweet, which will not only be delicious, but will also provide nutrients to the body. The objective of this project was to formulate and develop an Orange Barfi by the value addition Walnut and Coconut Powder and determine its proximate composition and shelf life. The Santra burfi was prepared by varying the rates of orange pulp addition and was tested for various textural properties such as hardness, cohesiveness, gumminess, chewiness, adhesiveness and springiness. The Fiber content was highest in walnut powder also rich in protein. Three different formulations of burfi were made with varying ratios of orange pulp, Khoa, Sugar and walnut+Coconut powder (1:1). Sensory evaluation of all the three formulations was done. The Orange Pulp, Khoa Coconut and walnut powder as a functional ingredient, dried and coarse grinded were incorporated by substituting the proportions of Orange Pulp, Khoa and Coconut+ walnut (1:1) powder and Sugar at 10:40:30:20, 15:50:20:15, 20:45:20:15 in the barfi formulations. Proportion of 10:40:30:20 incorporated Barfi were found to be more acceptable than other during examination and Sensory evaluation. A novel fortified Barfi was successfully produced and it was observed as the concentration of the coconut increases there is also gradual increase in Fat, Ash, Protein whereas energy level was also observed in sample amount.

Key Words : Barfi, Orange pulp, Walnut powder, Khoa, Coconut powder, Nutritional composition, Sensory evaluation, Textural quality

INTRODUCTION

Burfi, an indigenous milk product from Khoa that is made from cow or buffalo milk, is one the most nutritious since it has a significant quantity of milk solids (Asati *et al.,* 2021; Ali *et al.*, 2021; Aggarwal *et al.,* 2019). Depending on what the customers want, additional substances are added in addition to sugar in varying amounts. Depending on the additions used, there are several types of burfi available in the market, including Mawa, Pista, Chocolate, Coconut, and Rava burfi's. High calories Burfi has a silky texture with extremely small grains, a soft, somewhat oily substance, and a flavour that is fairly sweet. Because of its greater concentration and low moisture content, it keeps its quality for a very long time at atmospheric storage temperature. Everyone enjoys sweets, and creating such nutritious treats may be a terrific way to get the nutrients you need each day. Every year, India produces about 132.4 million tons of milk. Traditional Indian dairy products are made from around half of the milk produced (Badola *et al.*, 2023; Choudhary *et al.,* 2019; Kaur, 2023). The primary ingredient used to produce sweet meat items is khoa, an indigenous Indian dairy product that has been heat-desiccated. Khoa is mostly used to make sweets like burfi, kala jamun, Gulab jamun, and kalakand. Sweets made with khoa are expected to have a 520-billion-rupee market (Golande *et al.*, 2012; Mohamed *et al.,* 2015).

The Indian state of Uttar Pradesh produces over 36% of the world's khoa. The majority of khoa is produced using a variety of traditional techniques in an uncontrolled fashion. Citrus fruits generate less than half of their weight in juice (Pineda-Lozano *et al.*, 2022; Wasnik *et al.,* 2015). Vitamin C, which is regarded as one of the most significant water-soluble antioxidants, is abundant in orange juice. A common Indian dairy product, khoa is made by heating whole milk in an open pan until it becomes semi-solid, with 68–70% total solids content. Primarily, it is used for ingestion or as the fundamental ingredient for various dairy goods in India. The purpose of adding a different kind of fruit and vegetable to the burfi is to enhance its nutritional value, sensory qualities, and scent characteristics. In India, flavoured burfi's are among the most well-liked desserts. Burfi gains more commercial acceptance when it is prepared with various fruits and vegetables to provide a variety of flavours (Kaur *et al*, 2022; Patil *et al.,* 2015). Walnuts are one of the many nuts that have a high nutritional density. In addition to being a great source of energy, walnuts also have vitamins, minerals, antioxidants, and other nutrients that are good for you. Consuming walnuts on a regular basis lowers blood levels of LDL, or bad cholesterol, and raises levels of HDL, or good cholesterol (walnut, 0000) (Bhat *et al.,* 2023). Thus, taking into account walnuts' nutritional and medicinal benefits. Fruits (like mango or coconut) or nuts (like cashew, pistachio, or peanut) and spices (like cardamom or rose water) are common additions to enhance the tastes of a barfi (Vanjari *et al.*, 2019). The fruit known as coconut is a member of the Cocos nucifera palm family. One of the most popular ingredients in Indian cooking is this ripe nut. Manganese, which is critical for bone health and the metabolism of proteins, carbs, and cholesterol, is particularly abundant in coconuts. They are also a good source of selenium, copper, and iron, all of which aid in the formation of red blood cells. In food technology, https://www.sciencedirect.com/topics/chemistry/food-coloring-agentfood colorants, of several types, are chemical substances that are added to food matrices, to enhance or sustain the sensory characteristics of the food product, which may be affected or lost during processing or storage, and in order to retain the desired colour appearance. The visual aspect plays an important role in the selection of food products by modern consumers, color is a key constituent of food and beverages (Prasad *et al.,* 2015; Singh *et al.,* 2022; Sriti *et al.,* 2018).

METHODOLOGY

The present research was carried out in the department of quality lab at HMJ Food LLP, Ahmedabad, India.

Materials:
Raw materials and ingredients:

Oranges, Khoa, Walnut, Coconut Powder, Sugar, Food Colour etc. these all were brought from local market.

Chemicals:

Chemicals of analytical grades were made available in the laboratories of department of analytical lab at industry.

Processing Equipment:

The analytical equipment like Hot air oven, Refrigerator, kjeldahl, muffle furnace, moisture meter, Electric grinder was made available in the laboratories of department of analytical lab in the industry.

Methods:
Formulation of Sundried Walnut Powder

Walnut seed

↓

Cleaned

↓

Sun-dried

↓

Ground to a coarse powder
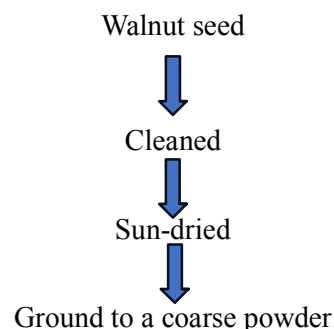
Formulation of Barfi:

Three different formulations of barfi are made coded as T_1, T_2 and T_3 prepared according to composition given in Table 1.

Table 1 : Different formulation of Barfi's				
Sr. No.	Ingredients	Treatments		
		T_1	T_2	T_3
1.	Orange Pulp	10	15	20
2.	Khoa	40	50	45
3.	Walnut + Coconut powder (1:1)	30	20	20
4.	Sugar	20	15	15

Preparation of Barfi:

Khoa made with Buffalo milk standardized to 6 % fat and 15 % total solids (TS) was used to make orange barfi. Approximately the required amounts of fresh orange fruits were taken from local market. Peels were removed by hand. Seeds also separated from segment and juice was extracted with the help of lime squeezer. Sugar was used as a sweetening agent for the preparation of sweet orange Burfi. Method of preparation of Burfi suggested by * was used to prepare plain Burfi, however, slight modifications in this method was made to prepare orange barfi. Sundried walnut is grounded before used it. The Grounded walnut powder and coconut added in the (1:1). After cutting into rectangular Blocks packaging in butter paper and store at Refrigerator to extent its shelf life (Fig. 1).

Fig. 1 : **Process Flow sheet**
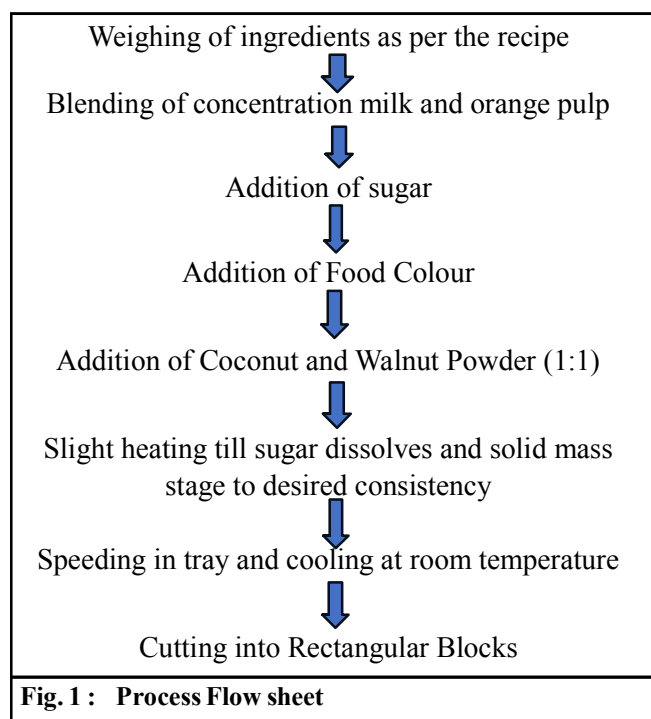
Proximate Analysis of Barfi:

Moisture content, protein content, fat content, ash content, total carbohydrate content, total energy was determined using procedures. The moisture content was determine using hot air oven method, Protein content was determine using the kjeldhal method, Fat is estimated by AOAC 950.54, and Ash content is determined by muffle furnace while Carbohydrate was by the difference method. Calcium content was determined using standard method mentioned in Ranganna (2009).

Determination of Moisture content:

A small amount of the crushed prepared barfi sample was kept in a pre-weighed glass petri-dish and dried in hot air oven at 130ºC for 4 hours. Then the loss in weight was calculated as the percentage of moisture content (MC) of a sample.

$$MC (\%) = \frac{W_2 - W_1}{2W} \times 100$$

where, W= weight of the sample, a W_1= weight of sample along with dish after heating and W_2= weight of sample along with dish before heating.

Determination of Ash content:

The samples were weighed before and after burning at 600º for 4-6 hours and the loss in weight were calculated as a percentage of the ash content of sample.

$$Ash (\%) = x = \frac{Weight\ of\ ash}{Weight\ of\ sample} \times 100$$

Determination of protein content:

Protein estimation was done in kjeldhal digestion flask, with the kjeldhal method given by AOAC (1980).

Determination of fiber content:

Digest the fat-free sample in the H_2SO_4 and NaOH by 30 minutes washing each and allow the residue to dry at 105ºC overnight and final residue was burnt at 600ºC for 4 hours, The amount of Fiber can be calculated as

$$Dietary\ fiber = \frac{(W_2 - W_1) - (W_3 - W_1)}{W} \times 100$$

where, W= weight of the sample, the W_1= weight of empty crucible, W_2= weight of sample + weight of empty crucible and W_3= weight of the sample after ignition+ weight of empty crucible.

Determination of Fat content:

Dissolve sample in an organic solvent (petroleum ether) and make the double extraction so that maximum amount of fat can be extracted by removal of organic solvent at 60ºC in the oven. The final calculation of fat was done by the help of a formula as:

$$FAT (\%) = \frac{Weight\ of\ extracted\ fat}{Weight\ of\ sample} \times 100$$

Determination of Carbohydrate content:

The FDA requires that food manufacturers calculate

total carbohydrates in their food with the following formula:

Total Carbohydrates =

Total Weight of Food Serving - (Weight of Crude Protein + Weight of Total Fat + Weight of Moisture + Weight of Ash).

Analysis of Calcium :

Preparation of the standard solution (EDTA, sodium hydroxide, dilute HCl solution and dilute NaOH solution) and reagents (buffer solution, standard calcium solution) were prepared in the fixed proportions.

Sample titration: Sample was taken in the diluted form and add a buffer to maintain pH (approx. 10). A pinch of erichrome black T (till red colour appeared) and titrated with EDTA (till blue colour appeared.

Sensory Evaluation of Barfi:

The recipe was finalized on the basis of sensory evaluation. Sensory evaluation was carried out by 10 semi trained panellist members by using 9-point hedonic scale as per procedure given by Ranganna (2009).

RESULTS AND DISCUSSION

Proximate Analysis of Prepared Barfi:

Proximate analysis of selected T_1 formulated Barfi showed the following result as per the Table 2. The moisture content of cookies was 10.74%, the protein content was 5.78%, total fibre content was 3.5g, total fat content was 6.9%, and total ash content was 3.0%. Total
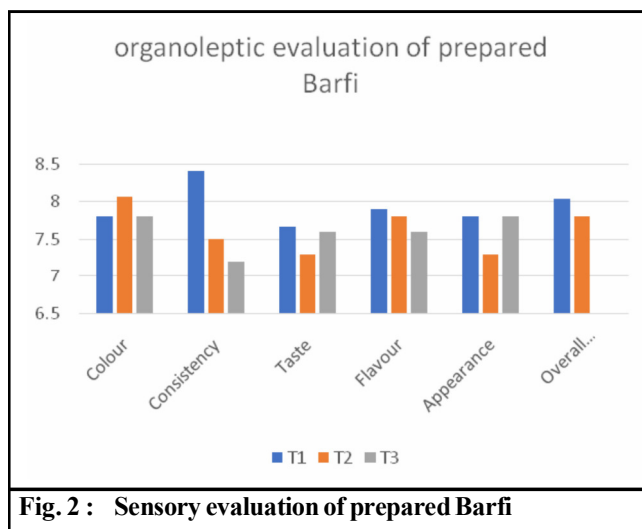
energy found was 377 kcal/100 g. The data shows that fortification of Walnut (15g) and Coconut (15g) resulted in increase the protein content and Fiber. Also, calcium content in barfi due to the khoa.

Sensory Evaluation of Barfi:

Sensory evaluation of prepared barfis was done by 9-point hedonic scale; 10 semi trained panel members were employed for this sensory evaluation. The product was evaluated on the basis of colour, taste, texture, flavour, appearance and overall acceptability. According to result among three different formulation the maximum overall

Fig. 2 :   Sensory evaluation of prepared Barfi

Fig. 3 :   Walnut and Coconut Fortified Orange Barfi (T_1)

Table 2 : Proximate analysis of prepared cookies		
Sr. No.	Parameters	Results
1.	Moisture	10.74
2.	Ash	3.0
3.	Protein	5.78
4.	Total Fat	6.9
5.	Carbohydrate	77.98
6.	Dietary fibre	3.5
7.	Acidity	0.24
8.	Energy	377
9.	pH	6.57

Table 3: sensory evaluation of prepared Barfi					
Sample	Colour	Consistency	Taste	Flavour	Appearance	Overall Acceptability
T_1	7.8	8.4	7.6	7.9	7.8	8.03
T_2	8.06	7.5	7.3	7.8	7.3	7.8
T_3	7.8	7.2	7.6	7.6	7.8	7.6

acceptability score was found in the first variation that is T_1 8.03 where T_2 had 7.8 and T_3 7.6 which might be due to increase in walnut and coconut powder content. Obtained result shows that ratio of 15 % walnut powder, 15% coconut powder, 40 % Khoa and 10 % Orange pulp found to be more acceptable.

Conclusion:

The result of the study indicates that, Orange Barfi were formulated by combination of Walnut powder, Coconut Powder and Khoa with Orange Pulp in the ratio 15:15:40:10 was more acceptable in all format such as in sensory evaluation and in physio chemical properties. It can be concluded that 15 % Walnut powder, 10% Orange Pulp and 15% Coconut Powder can be successfully incorporated in the Khoa for acceptable sensory attributes. As Walnut is rich source of protein, Khoa is good source of calcium, it helps to reduce Blood Pressure, also walnut play a role in a weight regulation and their utilization improves the nutritional status of consumer. It can be stored 13 days at refrigerator, and 8 days room temperature

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