International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(1): 168-173

Received: 01-11-2018
Accepted: 05-12-2018

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Effect of peanut powder on sensory and chemical properties of optimized burfi

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Abstract
Burfi is a popular khoa based confection and it's containing considerable amount of milk solids. Amongst the traditional milk products, khoa is an important indigenous heat coagulated, partially dehydrated milk product which is very popular in large section of population throughout the country. Indian milk product, it is prepared by continuous boiling of milk until desired concentration (65-72% T.S.) and texture is attained. Buffalo milk is preferred for making khoa because it gives a product with soft body and smooth texture. The present investigation shows that Process optimization for the development of burfi incorporated with peanut" In laboratory experiment conducted to process for manufacturing of burfi enriched with peanut powder, sugar and burfi as main ingredients were optimized by applying response surface methodology. The best formulation was experiment no. 6 with 10% peanut powder, 20% sugar and 80% khoa on sensory and physico-chemical properties basis. Peanuts are considered as a vital source of nutrients. Nutrition plays an important role in growth and energy gain of living organisms. Peanuts are rich in calories and contain many nutrients, minerals, antioxidants, and vitamins that are essential for optimum health. Due to presence of Peanut nutritional value of *burfi* is increased as compare to other burfi available in market it is cheap and nutritious too.

Keywords: sensory, physico-chemical, burfi, sugar, peanut, response surface methodology

Introduction
Milk sweets are an integral part of the socio cultural life in the Indian sub-continent. These are consumed on special religious occasions, social events and at the end of our daily meals. In present era in addition to religious and social need, the milk sweet are prepared for value addition and earn profit to the traders. That is why, now their manufacture is not confined to only small confectioners (halwai) but many organized dairies and large players in the milk business have entered in this lucrative venture. Amongst the various milk sweets, khoa based sweets, namely Burfi, Peda, Gulab jamun, Milk cake; Kalakand and Kunda occupy more commercial significance than other sweets. Burfi is one of the khoa based indigenous milk product prepared from cow and buffalo milk and is relished in India. It is highly nutritious product as it containing almost all milk solids in concentrated from easily digest able carbohydrate in the form of cane sugar and variety of other additives. Several varieties of burfi are sold in the market depending on the additives present, viz., plain mawa, pista, nut, chocolate, coconut and rawa burfi, depending on the ingredients used in the preparation of the products. The base for all these varieties of burfi is khoa and cane sugar in varying proportions. Other ingredients are also incorporated to cater for special taste. In some parts of the country chhana is also used as an ingredient for partial replacement of khoa. Burfi has a special importance in social celebration and in the expression of joy and happiness on many occasions. In India 50 to 55 per cent of total milk produced is converted into traditional milk products (Aneja, 1992) [2]. Currently 46 per cent of total milk production in country is consumed is liquid milk and 54 per cent is converted into milk products (Aneja, 1997) [3]. It is estimated that 6.5 per cent of the total milk produced in India is converted into khoa and condensed milk. 900,000 tonnes of khoa worth Rs. 45000 million was produced and consumed by during 1995 (Anonymous, 1997) [4]. The criteria for determining general requirements like production procedure, hygienic condition, good quality ingredients and proper packaging and storage for burfi are not based on scientific principles but generally the halwa is rely on their experience. Burfi retains its quality for a considerable length of time at atmospheric storage temperatures due to its low moisture content and higher sugar concentration. Cow milk usually

yields 17–19% of khoa by weight. The yield of khoa from buffalo milk is reported to be 21–23% by weight (De 1980) [7]. The shelf life of khoa is short which limits its marketing (Ghatak *et al*. 2003 and Zia-ur Rehman and Salariya 2006) [11, 26]. Khoa is the major constituent as raw material for the preparation of Burfi, Peda, Gulabjamun, Doda *burfi*, Malai role and certain other sweets. Traditional dairy products have great commercial significance as they account for over 90% of all dairy products consumed in the country (Aneja *et al*. 2002) [1]. Burfi is also called as Indian cheesecake, as the dessert exudes a hint of cheese and also resembles different kinds of hard cheeses, even though these sweets taste entirely different from any cheese recipes. Some of the most common varieties of burfi includes Doda burfi (Jha 2003), Kaju-burfi (Rao *et al*. 1993) [18], Groundnut burfi (Khan *et al*. 2006) [15], mango burfi (Shelke *et al*. 2008) [21], coconut burfi (Gupta *et al*. 2010) [12], bitter gourd burfi (Srivastava and Saxena 2012) [20], and burfi with honey (Kadam 2010) [13].

Peanuts are believed to have originated in Central American region from where they spread to other parts of the world. They are widely cultivated in India, Africa, South America, United States (DD Tom 2007) [6], China (G. Yao 2004) [9] and a few other countries. Peanuts often are enriched with health benefiting nutrients that are beneficial to human health. They are actually legumes but are the most frequently eaten "nut" in the United States. Studies show that peanuts, peanut butter, and peanut oil significantly reduce the risk of heart disease when consumed daily, similar to other nuts. More than 300 different varieties of peanuts are grown worldwide, which include Virginia, Valencia, Georgia runner, Tennessee red, Tennessee white and many others. They are usually consumed after roasting or boiling, and also processed into different forms such as peanut butter, candy, chocolates, cakes, and others. Peanut butter and jelly sandwiches are popular in the American culture (WHF 2007) [22], with raw, roasted, shelled or unshelled forms of peanuts being available in United States throughout the year. Peanuts vary in color from red to brown and are usually coarse in their appearance. Raw peanuts and peanuts prepared without salt are naturally low in sodium, having 18 mg of sodium per 100 g. This equates to only 5.4 mg of salt in a 30 g serving. The nutritional importance of peanuts is due to the energy and growth supplementing constituents present in them. These include carbohydrates, lipids, proteins, vitamins, minerals, some organic acids and purines. It is estimated that as much as 30% of the population from many countries in the world are suffering from malnutrition (FAO 2000) [8]. Peanuts, which are a rich source of protein and essential amino acids, can help in preventing malnutrition (GH Pelto and M Armar-Klemesu., 2011) [10]. Moreover, peanuts contain lipids and carbohydrates which are energy rich compounds, capable of complementing the basic energy demands of the human body. In this article the chemical composition of peanuts, all types, dry-roasted, without salt is reviewed, and their importance as a useful source of nutrition is discussed.

The present experiment was undertaken to optimize production of peanut powder-based Indian dairy dessert (*Burfi*) using a statistical software tool namely response surface methodology (RSM) to optimize the various parameters in the production of food products with desired quality four. The solution was obtained for optimized peanut enriched *burfi* condition by incorporation of 10% peanut, 20% sugar and 80% khoa. Several workers have used response surface methodology (RSM) for optimization studies of cake formulations (Macdonald and Bly 1966) [17].

Materials and methods

The experimental work was performed in the research laboratory of Animal Husbandry and Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. A laboratory experiment conducted for manufacturing of *peanut* blended with khoa, and sugar as main ingredients was optimized. Peanut and sugar were procured from local market. Buffalo milk was procured from dairy farm of Banaras Hindu University. Various levels of peanut (10-20%) sugar (30-40%) & khoa (60-80%) (Table1.) and three different temperatures (85 °C, 87 °C and 90 °C) were used in the investigation. 20 trials generated by the Central composite rotatable design (CCRD) of Design expert, which were conducted to obtain a combination of selected parameters for production of the best quality peanut enriched *burfi.*

Table 1: Independent variables used for optimization\

Independent Variables	Symbol Code	Unit	Actual levels	
			Low	High
Peanut powder	A	%	10	20
Sugar	B	%	30	40
Khoa	C	%	60	80

Table 2: Experimental runs and Actual values of factors used in Central Composite Rotatable Design

Runs	Variables			Sensory properties				
	Khoa	Sugar	Peanut	Color and Appearance	Flavors	Taste	Consistency	OAA
1	70	25	15	8.63	8.18	9.9	8.18	8.48
2	60	20	20	7.27	7.22	8.3	7.22	8.22
3	70	25	15	7.82	7.46	8.9	7.46	7.96
4	80	30	10	7.25	8.08	8.3	8.08	8.00
5	60	30	10	7.86	7.57	9.0	7.57	7.87
6	80	20	10	8.58	8.37	9.8	8.37	8.47
7	80	30	20	7.21	7.18	8.2	7.18	7.28
8	60	30	20	8.22	8.64	9.4	8.64	7.34
9	70	25	15	8.28	8.89	9.5	8.89	7.89
10	80	20	20	7.98	7.54	9.1	7.54	7.84
11	70	25	15	8.76	8.56	8.5	8.56	8.06
12	87	25	15	8.26	8.84	9.4	8.84	7.84
13	70	25	15	7.26	7.31	8.3	7.31	8.31
14	60	20	10	7.33	7.78	8.4	7.78	7.78
15	70	25	23	8.27	8.67	9.5	8.67	8.47
16	70	17	15	7.38	8.55	8.4	8.55	8.55
17	70	25	15	8.24	8.68	9.4	8.68	8.68
18	70	33	15	8.05	8.25	9.2	8.25	7.25
19	53	25	15	7.37	8.79	8.4	8.79	7.79
20	70	25	7	7.11	8.56	8.1	8.56	7.56

Table 3: Central Composite Design for the optimization of nutrition bars statistical analysis of data

Runs	Chemical Properties				
	Moisture (%)	Fat (%)	Carbohydrate (%)	Protein (%)	Ash (%)
1	12.33	27.58	33.29	24.66	2.47
2	10.38	24.93	28.04	20.77	2.08
3	11.17	26.81	30.16	22.34	2.23
4	10.35	24.86	27.96	20.71	2.07
5	11.23	26.95	30.32	22.46	2.25
6	12.25	28.32	33.09	23.34	2.45
7	10.30	24.72	27.81	20.60	2.06
8	11.74	28.18	31.71	23.49	2.35
9	11.83	28.39	31.94	23.66	2.37
10	11.40	27.36	30.78	22.80	2.28
11	12.50	30.03	33.00	22.03	2.50
12	11.80	28.32	31.86	23.60	2.36
13	10.37	24.89	28.00	20.74	2.07
14	10.47	25.13	28.27	20.94	2.09
15	11.81	28.35	31.90	23.63	2.36
16	10.54	25.30	28.47	21.09	2.11
17	11.77	28.25	31.78	23.54	2.35
18	11.50	27.60	31.05	23.00	2.30
19	10.53	25.27	28.43	21.06	2.11
20	10.15	24.38	27.42	20.31	2.03

Table 4: Optimized Recipe as level by RSM software

Constitute	Level
Khoa	80
Sugar	20
Peanut	10
Composition of optimized Burfi	
Color and Appearance	8.58 ± 0.38
Flavour	8.37 ± 0.44
Taste	9.8 ± 0.65
Consistency	8.37 ± 0.55
Overall acceptability	8.47 ± 0.57
Moisture	12.255 ± 0.34
Fat	28.32 ± 0.46
Carbohydrate	33.09 ± 0.51
Protein	23.34 ±0.46
Ash	2.45 ± 0.34

Results and Discussion

Effect on colour and appearance

The colour and appearance score varied from 7.33 to 8.93 (Table 2). The minimum colour and appearance was obtained for experiment no. 20 while maximum was obtained in experiment no. 1. Fig. (A) Shows that response surface plot for colour and appearance as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (A) and it can observe that there was significant effect on colour and appearance with the increase in the level of sugar.

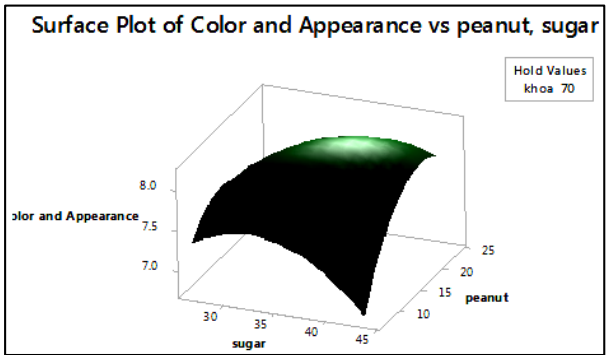

Fig (A): surface plot of color and appearance vs peanut, sugar

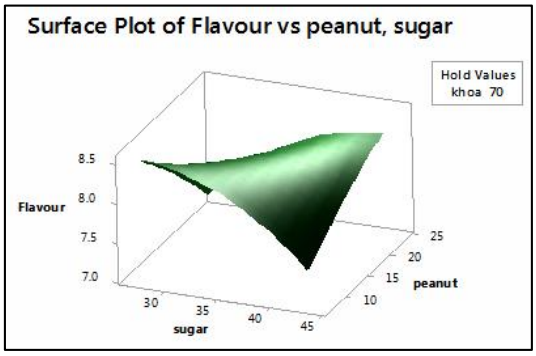

Fig (B): surface plot of flavour vs peanut, sugar

Effect on flavour

The flavour varied from 7.18 to 8.89 (Table 2). The minimum flavour was obtained for experiment no. 7 while maximum was obtained in experiment no. 11. Fig. (B) Shows that response surface plot for flavour as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (B) and it can observed that there was significant effect on flavour with the increase in the level of sugar.

Effect on Taste

The Taste varied from 8.1 to 9.9 (Table 2). The minimum taste was obtained for experiment no. 20 while maximum was obtained in experiment no. 1. Fig. (C) Shows that response surface plot for taste as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (C) and it can observed that there was significant effect on taste with the increase in the level of sugar.

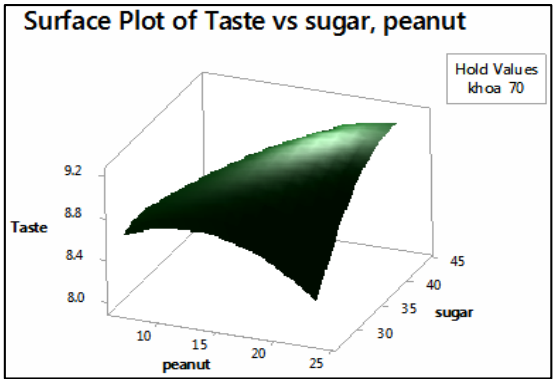

Fig (C): surface plot of taste vs sugar, peanut

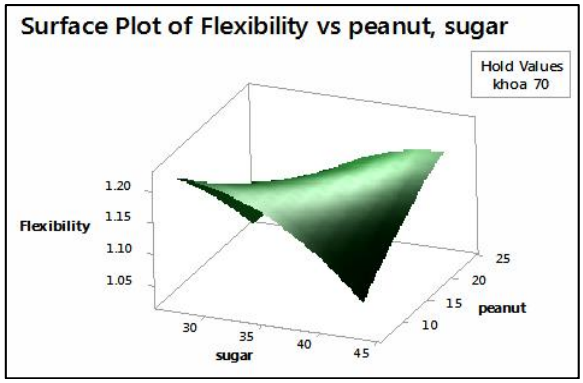

Fig (D): surface plot of flexibility vs peanut, sugar

Effect on overall acceptability

The overall acceptability varied from 7.25 to 8.68 (Table 2). The minimum overall acceptability was obtained for experiment no.18 while maximum was obtained in experiment no. 17. Fig. (F) Shows that response surface plot for acceptability as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (F) and it can observed that there was significant effect on acceptability with the increase in the level of sugar.

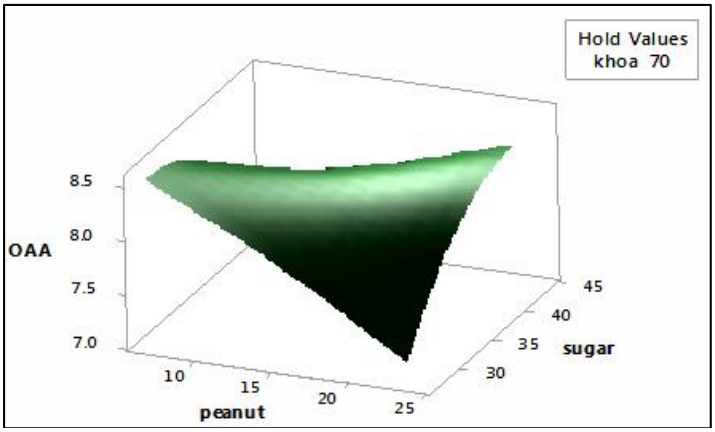

Fig: Surface plot of oaa vs sugar, peanut

Effect on moisture

The Moisture score varied from 12.50 to 12.33 (Table 3). The minimum moisture was obtained for experiment no.11 while maximum was obtained in experiment no. 1. Fig. (A) Shows that response surface plot for Moisture as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (A) and it can observed that there was significant effect on Moisture with the increase in the level of sugar. These finding are agreement with Sachadeva and Rajorhia (1982) [19] found the moisture content in Burfi 12.71 to 18.96 per cent.

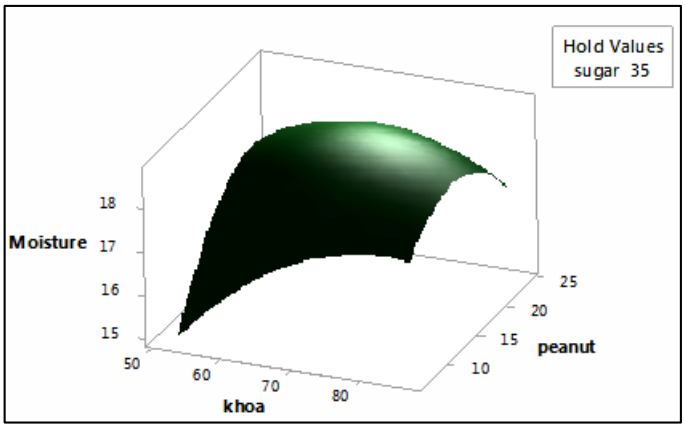

Fig. (A): surface plot of moisture vs peanut, khoa

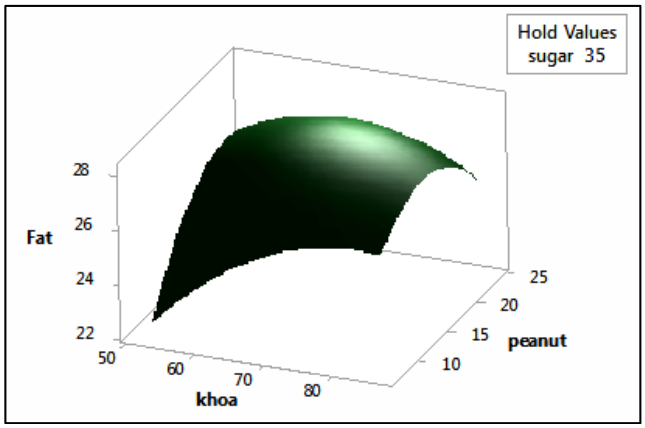

Fig. (B): surface plot of fat vs peanut, khoa

Effect on Fat

The Fat varied from 24.38 to 30.03 (Table 3). The minimum fat was obtained for experiment no.20 while maximum was obtained in experiment no.6. Fig. (B) Shows the response surface plot for fat as influenced by increase in the level of khoa, sugar and peanut. From the figure, it can be observed that with the increase in the level of khoa, sugar and peanut the fat was affected by optimum level of khoa, sugar and peanut. This investigation are agree with results obtained by Verma and De (1978) as 16.83 to 18.73, Wankhede (2005) [24] in mango burfi.

Effect on Carbohydrate

The Carbohydrate varied from 49.42 to 62.29 (Table 3). The minimum carbohydrate was obtained for experiment no. 20 while maximum was obtained in experiment no. 1. Fig. (C) Shows the response surface plot for carbohydrate as influenced by increase in the level of khoa and peanut. From the figure, it can be observed that with the increase in the level of khoa, sugar and peanut the carbohydrate was affected by optimum level of khoa and peanut. Kathalkar (1995) [14] reported the carbohydrate content of milk ber pulp burfi ranged between 51.52 to 63.14 per cent.

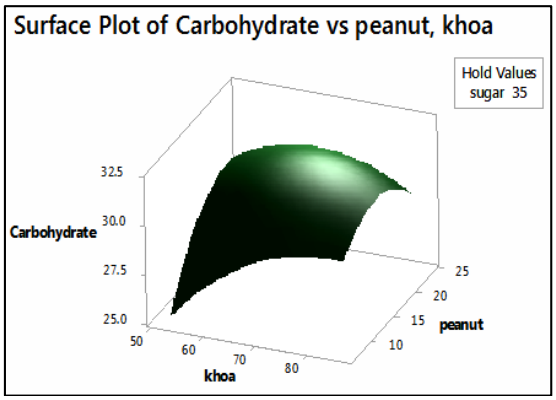

Fig (C): Surface plot of carbohydrate vs peanut, khoa

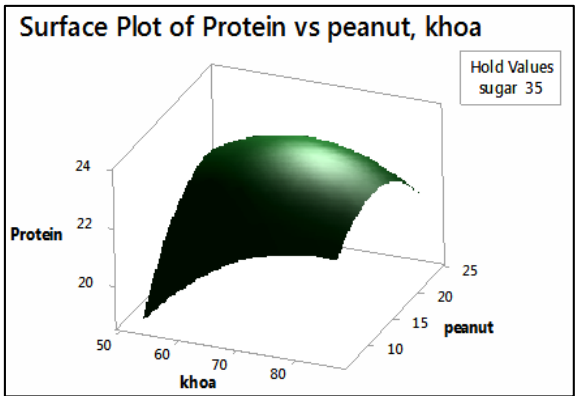

Fig (D) Suface plot of protein vs peanut, khoa

Effect of Protein

The protein varied from 20.31 to 24.66 (Table 3). The minimum protein was obtained for experiment no.20 while maximum was obtained in experiment no. 1. Fig. (D) Shows the response surface plot for protein as influenced by increase in the level of khoa, sugar and peanut. From the figure, it can be observed that with the increase in the level of khoa, sugar and peanut the protein was affected by optimum level of khoa, sugar and peanut. Bankar (2011) [5] prepared pineapple burfi and found that protein content of the product ranged between 13.29 to 15.21 per cent.

Effect on Ash

The Ash varied from 2.03 to 2.50 (Table 3). The minimum ash was obtained for experiment no. 20 while maximum was obtained in experiment no. 11. Fig. (E) Shows the response surface plot for ash as influenced by increase in the level of khoa, sugar and peanut. From the figure, it can be observed that with the increase in the level of khoa, sugar and peanut the ash was affected by optimum level of khoa, sugar and peanut. Wakchaure (2003) [25] recorded the ash content of sapota pulp burfi as 2.11 to 2.41 per cent.

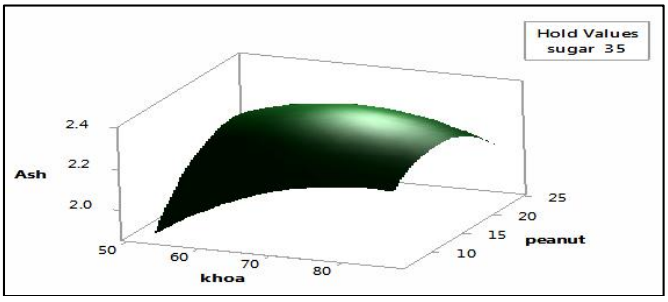

Fig (E): surface plot of ash vs peanut, khoa

Conclusion

Due to presence of Peanut nutritional value of *burfi* is increased. Hence, the formulation with 10% peanut powder, 20% sugar and 80% khoa, experiment no.6 was considered to be the most appropriate for manufacturing of optimized peanut enriched burfi with sensory and chemical properties the scores of 8.58 for colour and appearance, 8.37 for flavour, 9.8 for taste, 8.37 for consistency, 8.47 for overall, 12.25%, 62.29%, 33.09, 23.34 and 2.45% to get maximum possible quality parameter ie. Moisture, fat, carbohydrate, protein, and ash respectively. From these results, it could be concluded that peanut powder enriched burfi can be manufactured by the dairy industry to promote value addition, export promotion and product diversification.

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