International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 2688-2693

Received: 05-05-2018
Accepted: 12-06-2018

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Effect of different variables on sensory and textural properties of developed peanut enriched burfi

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Abstract
Milk *burfi* is an Indian traditional confectionery prepared using concentrated milk and sugar. The texture and quality of *burfi* was vary depending on processing conditions. *Burfi* is a prevalent drain based sweet in which the base material is basically *khoa*. Sugar is included diverse extents and different fixings joined by the request of buyer. Peanuts are rich in protein, oil and filaments. 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 textural properties basis. This formulation was found to be most appropriate for manufacture of peanut powder enriched *burfi* with predicted scores of, 8.58 for colour and appearance, 8.37 for flavour, 9.8 for taste, 8.37 for consistency, 8.47 for overall, 1.196 flexibility, 13.153 for Springiness, 1.226 for Crunchiness, 4.451 for Hardness, Body and Texture 9.8. 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: Central composite rotatable design, sensory, textural, khoa, sugar, peanut, response surface methodology

Introduction
India is rising as a largest milk producing country in the world with an annual growth rate of 4.53 per cent as well as annual milk production is 165.4MT during 2016 -17 with per capita availability of milk in India has increased from 176 grams per day in 1990-91 to 355 gm/day (NDDB statistics, 2016) [10]. It was more than the world normal of 294 grams for every day amid 2013. Close around 56 for every penny of aggregate drain created in India is used for readiness of assortment of customary drain items i.e. *ghee, curd, khoa, margarine, drains powder, paneer, chhana* and so forth. Out of aggregate drain created 6.5 for every penny is used for khoa (Anonymous, 2016) [1].

Milk *burfi* is one of the most popular milk based sweets in India. *Burfi* 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 sometimes practiced to obtain a product with smooth texture and closely knit body. Several varieties of *burfi* are available in the market such as plain or *mawa/khoa burfi*, fruit and nut, cashew *burfi*, chocolate, saffron and *rava burfi*. *Burfi* sold commercially varies widely in colour, body, texture, sweetness and flavour characteristics (Sarkar *et al*. 2002) [15]. Variations in ingredients, their proportions and processing conditions affect the quality of burfi, and lack of knowledge in these aspects is a serious limitation for the process standardization and quality control. Although the Bureau of Indian Standards has laid down a standard for chemical and microbiological quality of milk Burfi (ISI 1970) [5], there is a need for generating data on optimising processing and quality of milk burfi. 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) [6], Kaju-burfi (Rao *et al*. 1993) [11], Groundnut burfi (Khan *et al*. 2006) [8], mango burfi (Shelke *et al*. 2008) [16], coconut burfi (Gupta *et al*. 2010) [4], bitter gourd burfi (Srivastava and Saxena 2012) [17], and burfi with honey (Kadam 2010) [7].

Peanuts or "groundnuts" as they are known in a few sections of the world are the palatable seeds of a legume. India is second biggest maker of peanuts in world, with total production of approximately 7.131 million metric tons per year (USDA, PS&D database 1996-2000). Peanuts are rich in protein, oil and filaments (Suchoszek-Lukaniuk *et al*. 2011) [18]. Aside from oil, peanuts are generally utilized for creation of peanut butter, confections, roasted peanuts, and snack products, extenders in meat product formulation, soups and desserts. Most Runner cultivars are utilized to influence nut to margarine (Woodroof 1983). China leads underway of peanuts, having an offer of around 45 % of general world creation, while India has (16 %) share and the United States of America has (5 %) (USDA 2015).

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 numerical process optimization was carried out by Design Expert 9.0.5 by applying response surface methodology, many solutions were obtained for the optimum covering criteria with a highest desirability of 1.0 under these circumstances, the solution contained the maximum peanut powder, sugar and khoa were in the normal range. The solution was obtained for optimized peanut enriched *burfi* condition by incorporation of 10 % peanut, 20% sugar and 80% khoa. If value added products are made by using peanut that will lead to the benefit of both consumer and producer. Several workers have used response surface methodology (RSM) for optimization studies of cake formulations (Macdonald 1966) [9] Tandoori roti (Saxena and Rao 1986) [11] and puri and south Indian parotta (Dasappa and Venkateshwara Rao 2001) [2].

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 %) (Table 1.) 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.*

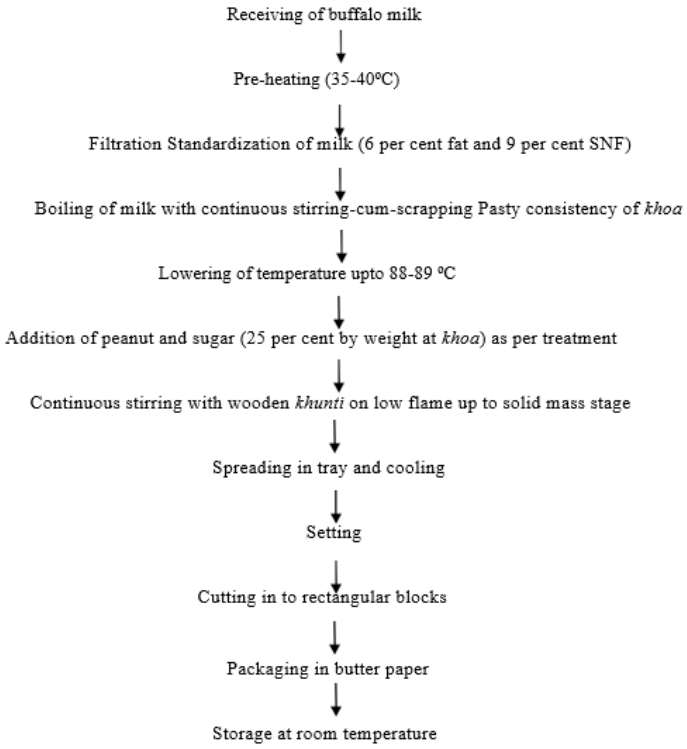
Table 1: Independent variables used for optimization

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

Preparation of peanut powder based enriched burfi

Burfi was prepared by following the traditional method of preparation (Sachdeva and Rajorhia 1982, Sarkar *et al*. 2002) [14, 12]. Received milk was preheated at 35-40 ºC before filtration. Then milk was filtered in order to remove the visible dust and dirt particle. The buffalo milk standardized to 6 per cent fat and 9 per cent SNF was taken in an iron *karahi* and heated on gentle fire. At the time of boiling, milk was stirred with the help of a *khunti* in a circular manner. The stirring-cum-scrapping process was continued till a pasty consistency was reached. Then temperature was lowered upto 88-89 ºC. At this stage, peanut as per treatment and sugar @ 25per cent of *khoa* were added. Finally this mixture was heated on a low fire with stirring till the desired texture was obtained. It was then spread in a tray and allowed to cool. After setting, peanut *burfi* was cut into rectangular blocks

Procedure of Methodology



Flow-chart for preparation of *peanut* enriched burfi

Results and Discussion

Optimization of Product

Experiment Design

In this present investigation, Central Composite Rotatable Design (CCRD) was employed as it reduces the number of experiments for studies including more than two independent variables. In the present study, CCRD was used to design experiment with three variables at five levels with six centre points. The chosen variables for present research work comprised, concentration of peanut powder, sugar and khoa. The Peanut powder, sugar and khoa should be taken in the range of 10 to 20 %, 30 to 40 %, and 60 to 80 % respectively. In the present study an attempt was made to understand Interactive effect of chosen variables varying concentration of ingredient on Sensory and textural characteristics of final product.

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

Runs	Variables			Sensory properties					Textural properties				
	Khoa	Sugar	Peanut	Color and Appearance	Flavors	Taste	Consistency	OAA	Flexibility (g)	Springiness (mj)	Crunchiness (mj)	Hardness (mj)	Body and Texture
1	70	35	15	8.63	8.18	9.9	8.18	8.18	1.169	12.854	1.233	2.466	9.9
2	60	30	20	7.27	7.22	8.3	7.22	7.22	1.031	11.346	1.039	2.077	8.3
3	70	35	15	7.82	7.46	8.9	7.46	7.46	1.066	11.723	1.117	2.234	8.9
4	80	40	10	7.25	8.08	8.3	8.08	8.08	1.154	12.697	1.036	2.071	8.3
5	60	40	10	7.86	7.57	9.0	7.57	7.57	1.081	11.896	1.123	2.246	9.0
6	80	30	10	8.58	8.37	9.8	8.37	8.47	1.196	13.153	1.226	4.451	9.8
7	80	40	20	7.21	7.18	8.2	7.18	7.18	1.026	11.283	1.03	2.060	8.2
8	60	40	20	8.22	8.64	9.4	8.64	8.64	1.234	13.577	1.174	2.349	9.4
9	70	35	15	8.28	8.89	9.5	8.89	8.89	1.27	13.97	1.183	2.366	9.5
10	80	30	20	7.98	7.54	9.1	7.54	7.54	1.077	11.849	1.14	2.280	9.1
11	70	35	15	8.76	8.56	8.5	8.56	8.56	1.223	13.451	1.251	2.503	10.0
12	87	35	15	8.26	8.84	9.4	8.84	8.84	1.263	13.891	1.18	2.360	9.4
13	70	35	15	7.26	7.31	8.3	7.31	7.31	1.044	11.487	1.037	2.074	8.3
14	60	30	10	7.33	7.78	8.4	7.78	7.78	1.111	12.226	1.047	2.094	8.4
15	70	35	23	8.27	8.67	9.5	8.67	8.67	1.239	13.624	1.181	2.363	9.5
16	70	27	15	7.38	8.55	8.4	8.55	8.55	1.221	13.436	1.054	2.109	8.4
17	70	35	15	8.24	8.68	9.4	8.68	8.68	1.24	13.64	1.177	2.354	9.4
18	70	43	15	8.05	8.25	9.2	8.25	8.25	1.179	12.964	1.15	2.300	9.2
19	53	35	15	7.37	8.79	8.4	8.79	8.79	1.256	13.813	1.053	2.106	8.4
20	70	35	7	7.11	8.56	8.1	8.56	8.56	1.223	13.451	1.016	2.031	8.1

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 observed that there was significant effect on colour and appearance with the increase in the level of sugar.

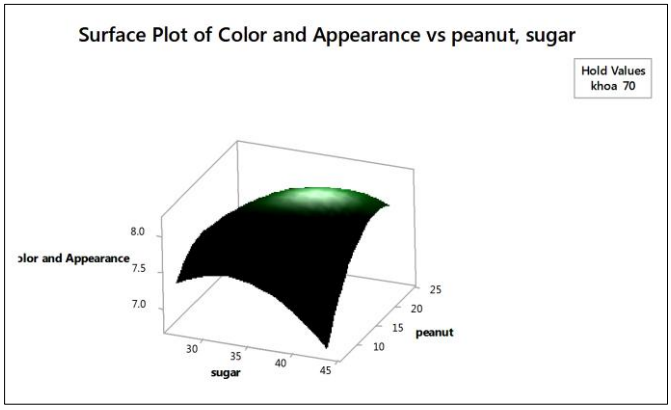


Fig (A)

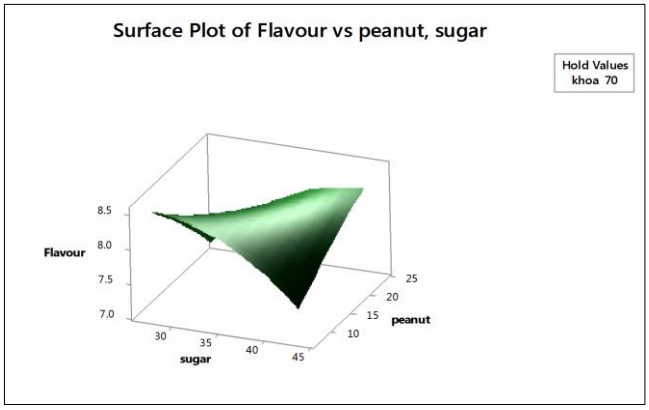


Fig (B)

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.

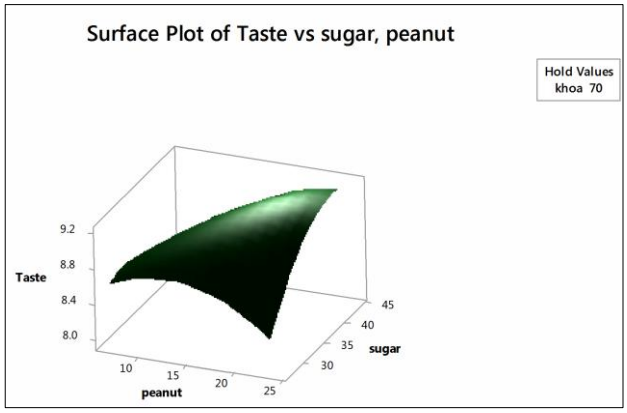


Fig (C)

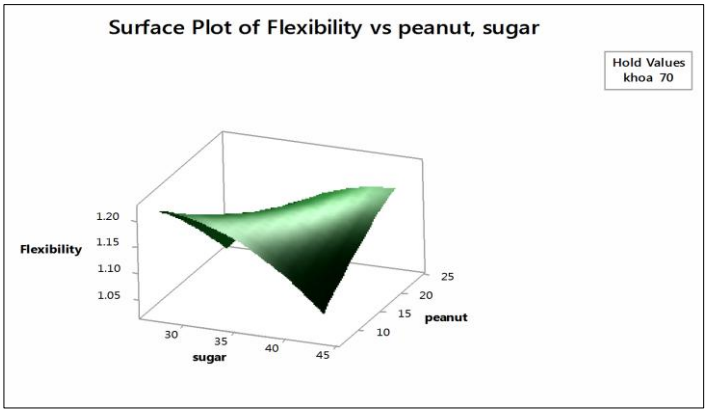


Fig (D)

Effect of Flexibility

The flexibility varied from 1.026 to 1.263 (Table 2). The minimum flexibility was obtained for experiment no. 7 while maximum was obtained in experiment no. 12. Fig. (D) Shows that response surface plot for flexibility as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (D) and it can observed that there was significant effect on flexibility with the increase in the level of sugar.

Effect on Consistency

The Consistency varied from 7.18 to 8.89 (Table 2). The minimum consistency was obtained for experiment no. 7 while maximum was obtained in experiment no. 12. Fig. (E) Shows that response surface plot for Consistency as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (E) and it can observed that there was significant effect on Consistency with the increase in the level of sugar.

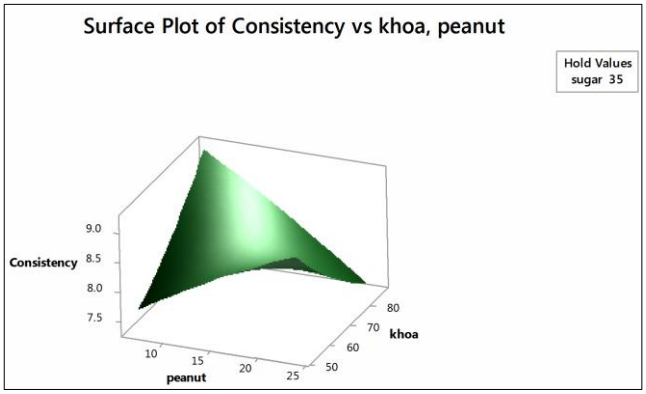


Fig (E)

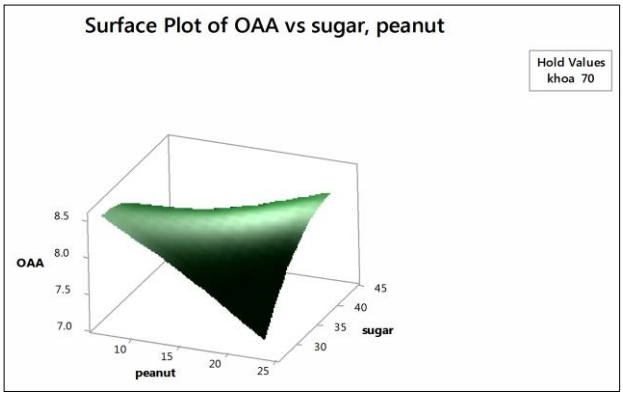


Fig (F)

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.

Effect on Flexibility

The flexibility varied from 1.026 to 1.263 (Table 2). The minimum flexibility was obtained for experiment no. 7. Fig. (G) Shows that response surface plot for flexibility as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (G) and it can observed that there was significant effect on flexibility with the increase in the level of sugar.

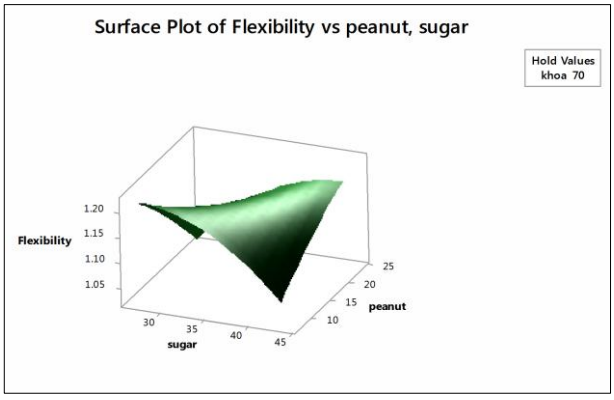


Fig (G)

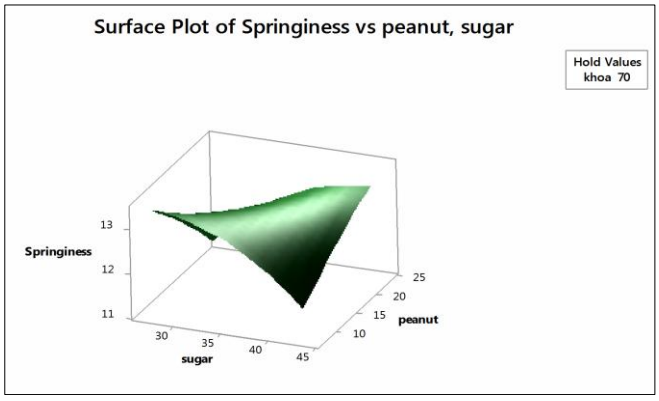


Fig (H)

Effect of springiness

The springiness varied from 11.283 to 13.813 (Table 2). The minimum springiness was obtained for experiment no. 7 while maximum was obtained in experiment no. 19. Fig. (H) Shows that response surface plot for springiness as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (H) and it can observed that there was significant effect on springiness with the increase in the level of sugar.

Effect of visual crunchiness

The crunchiness varied from 1.036 to 1.251 (Table 2). The minimum crunchiness was obtained for experiment no. 4 while maximum was obtained in experiment no. 11. Fig. (I) Shows that response surface plot for crunchiness as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (I) and it can observed that there was significant effect on crunchiness with the increase in the level of sugar.

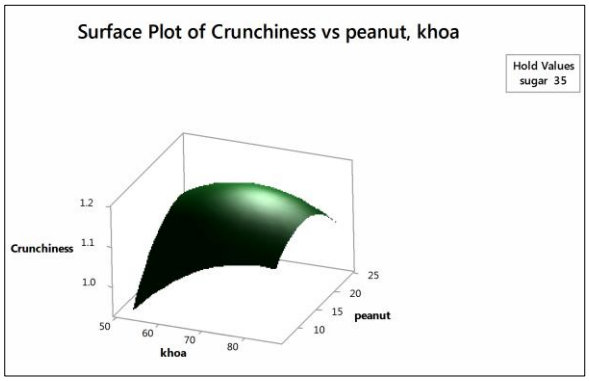


Fig (I)

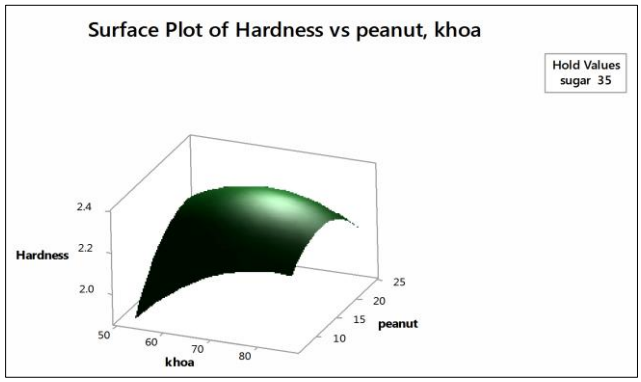


Fig (J)

Effect of Hardness

The hardness varied from 2.031 to 4.451 (Table 2). The minimum hardness was obtained for experiment no. 20 while maximum was obtained in experiment no. 6. Fig. (J) Shows that response surface plot for hardness as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (J) and it can observed that there was significant effect on hardness with the increase in the level of sugar.

Effect of body and texture

The Body and texture varied from 8.1 to 9.9 (Table 2). The minimum Body and texture was obtained for experiment no. 20 while maximum was obtained in experiment no. 1.while maximum was obtained in experiment no. 6. Fig. (K) Shows that response surface plot for Body and texture as influenced by the level of sugar and peanut, by keeping khoa constant. From the figure (K) and it can observed that there was significant effect on texture with the increase in the level of sugar.

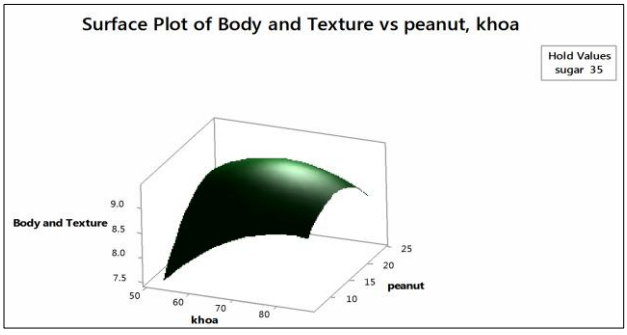


Fig (K)

Conclusion

For all sensory evaluation, and textural properties experiment no. 6 is better, while comparing various levels of peanut 10% is acceptable with like very much score (8.47) and lowest score was found for *burfi* blended with peanut was (7.25). The hardness is directly relationship with moisture content of the *burfi* sample. The lower content of moisture per cent in *burfi* sample increases the hardness. Due to presence of Peanut nutritional value of *burfi* is increased. Hence, the formulation with 10% peanut powder, 20% sugar and 80% khoa was considered to be the most appropriate for manufacturing peanut enriched burfi with the predicted scores of 8.58 for colour and appearance, 8.37 for flavour, 9.8 for taste, 8.37 for consistency, 8.47 for overall, 1.196 flexibility, 13.153 for Springiness, 1.226 for Crunchiness, 4.451 for Hardness, Body and Texture 9.8. 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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