RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 41 Issue 2: 231-236 (June 2022)

Effect of Sensory Properties, Shelf Life and Cost of Production on Black Gram (*Vigna mungo*) Flour *Burfi*

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10.18805/ajdfr.DR-1891

ABSTRACT

Background: Among the traditional dairy products, *burfi* is the most popular *khoa* based confection in Indian subcontinent. *Burfi* has special importance in different functions like birthday, anniversary, wedding, *etc.* Consumers in India are becoming more health conscious and demand for healthier food because of rise in disposable income, educational level and awareness of nutrition. In wedding ceremony, now a days, *besan burfi* is famous instead of laddoos because of nutrition in pulses. Therefore, black gram can be also used in burfi due to it is rich in protein and having best results against many diseases in humans.

Methods: *Burfi* was prepared from milk with constant level of sugar (30 per cent by weight of *khoa*) and different levels of black gram flour (2.5, 5, 7.5 and 10 per cent by weight of *khoa*). Properly blending *khoa* and sugar with black gram flour on low flame and then cut into pieces after setting.

Result: The overall acceptability score for treatment T_1, T_2, T_3, T_4 and T_5 were 8.27, 8.38, 8.51, 8.03 and 7.64 respectively. *Burfi* sample was evaluated for storage study conducted at room (30±2°C) temperature and refrigerated (7±2°C) temperature conditions. The cost of production of *burfi* with black gram powder was Rs. 255.38, Rs. 252.45, Rs. 249.62, Rs. 246.90 and Rs. 244.28 per kg for treatment T_1, T_2, T_3, T_4 and T_5 respectively.

Key words: Black gram, *Burfi*, Cost, Flavour, Product, Pulses, Sensory, Shelf life.

INTRODUCTION

Traditionally, *burfi* is prepared by vigorous mixing of *khoa* and sugar in open shallow kettle till a homogenous, smooth and fine grain mass appears and then it transferred hot into a tray for cooling and setting. “A good quality *burfi,* however, specialized by moderately sweet taste, white to light creamy colour with soft and slightly greasy body and smooth texture with very fine grains.” Sugar is added in different proportion depends on product prepared and other ingredients incorporated according to demand of the consumer. It is prepared by blending different proportions of *khoa* and specified amount of sugar along with some other ingredients like dry fruits, fruit pulps, different cereals and pulses with their flours and flavouring materials. *Burfi* has special importance in different functions like birthday, anniversary, wedding, to celebrate success in examination or in such other events. *Burfi* shows wide variation in Indian market depending upon the regional performance. Several varieties of *burfi* are sold in market *i.e.*, plain or mawa *burfi*, cashewnut *burfi*, orange *burfi*, almond *burfi*, mango *burfi*, wood apple *burfi*, *etc.* Consumers in India are becoming more health conscious and demand for healthier food because of rise in disposable income, educational level and awareness of nutrition. Among the different additives which are used in *burfi*, pulses also play an important role in Indian market. In wedding ceremony, the recent trend is to prepare the *besan burfi* or chickpea *burfi* instead of *laddu* because of the nutritional importance of pulses. Different pulses like chickpea, moong bean, black gram are also used in diet through different dishes.

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How to cite this article: Patil, S.P., Narwade, S.G., Londhe, G.K. and Patil, R.A. (2022). Effect of Sensory Properties, Shelf Life and Cost of Production on Black Gram (*Vigna mungo*) Flour *Burfi.* Asian Journal of Dairy and Food Research. 41(2): 231-236. DOI: 10.18805/ajdfr.DR-1891.

Submitted: 11-02-2022 **Accepted:** 06-04-2022 **Online:** 02-05-2022

Pulses plays an important role in farming system throughout the world. Among the different pulse crops, black gram is important crop in India. Black gram (*Vigna mungo* L.) reported to be originated in India. India is the highest producer and consumer of black gram in world. Black gram (*Vigna mungo* L.) belongs to family Leguminoseae. It is a protein rich food. It provides a major share of protein requirement of vegetarians. The black gram contains 25.21 gm/100 gm proteins, 1.2 gm/100 gm fat, 56.6 gm/100 gm carbohydrate, calcium 185 mg/100 gm, ferrons 8.7 gm/100 gm, phosphorous 345 mg/100 gm (Pulse crops, IARI, New Delhi). The black gram beans are referred as ‘*masha’* in the ayurvedic texts and highly recommended for gaining weight and improving immunity. Patients suffering from asthma, paralysis, constipation are recommended to include black gram in daily diet for its innumerable healing properties.

It has many health benefits as-energy booster, improves digestion, keep heart healthy, anti-ageing, control diabetes, builds muscles, prevents kidney stones, promotes hair growth, reduces pain and inflammation, support bone health, strengthen nervous system, good for pregnant women (Kanade, 2006). Realizing the health benefits of black gram flour, it is decided to undertake this research project.

MATERIALS AND METHODS

The research study carried out on "Studies on utilization of black gram (*Vigna mungo*) flour in preparation of *burfi*" taken at department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Materials

The whole, clean, fresh buffalo milk was obtained from market. Black gram flour, sugar obtained from local market. Different equipments *viz*., karahi, khunti, stainless steel trays, mixer grinder were available in the department.

Methods

The burfi with different combinations was prepared by addition of black gram flour in proportion of 2.5, 5, 7.5 and 10% of black gram flour in *khoa*.

Firstly, fresh clean buffalo milk was taken and filtered through muslin cloth to remove dust particles. Meanwhile, powdered black gram was roasted in other *karahi* at 50°C for 5 minutes. This roasted powder was used at different trials during *burfi* preparation. Buffalo milk was standardized to 6 per cent fat. Then it was poured into iron *karahi* and started heating the milk. Continuous vigorous heating at 55-60°C in open pan on gentle fire with continuous stirring cum scrapping was carried out with the help of stainless steel *khunti*. The milk was concentrated to pasty consistency by evaporating the moisture. When the product started to leave sides of *karahi i.e*., at pat formation stage (*khoa*), reduce the flame and add roasted black gram flour as per the treatments and sugar @ 30 per cent by weight of *khoa* was added and properly mixed. Heating and stirring at low flame were carried out till the desired textured product was obtained. Then the mixture was transferred into greasy stainless steel tray, spread it and allow it for cooling. After setting, *burfi* was cut into square shape. The following method was used as per Sharma *et al*., (2017) with slight modifications:

Receiving of fresh buffalo milk
↓
Filtration/Clarification
↓
Standardization (6% fat)
↓
Continuous vigorous heating (55°-60°C) in open pan with continuous stirring and scrapping while boiling
↓
Viscous product with pasty consistency
↓
Khoa
↓
Addition of sugar (30% by weight of *khoa*) and black gram flour (roasted in *karahi* at 60°C for 10 minutes and sieved) as per treatment (at 40-45°C)
↓
Stirring cum scrapping with the help of stainless steel *khunti*.
↓
Spreading the mixture into greasy stainless steel tray for cooling
↓
Cutting into square block
↓
Packaging
↓
Storage at room temperature

RESULTS AND DISCUSSION

Sensory evaluation of black gram flour *burfi*

The different treatment combinations of *burfi* were subjected to sensory evaluation of colour and appearance, flavour, body and texture, overall acceptability characteristics by a panel of judges using 9th point hedonic scale.

Colour and appearance

The data presented in Table 1 indicated that, colour and appearance score for various treatments ranged between 7.58 to 8.50. This score for T_3 treatment was higher than

Table 1: Colour and appearance score of *burfi* influenced by different blends of black gram flour.

Treatments/ replications	Colour and appearance score				Mean score
	R I	R II	R III	R IV	
T_1	8.00	8.10	8.40	8.40	8.23^{ab}
T_2	8.00	8.10	8.60	8.50	8.30^{ab}
T_3	8.20	8.30	8.70	8.80	8.50^{a}
T_4	7.70	7.80	8.10	8.20	7.95^{b}
T_5	7.40	7.50	7.60	7.80	7.58^{c}
S.E.± 0.122814					
C.D. at 5% 0.3702					

Values with superscripts are significantly different at (P<0.05).

rest of the treatments. The acceptable highest score was for T_3 (8.50) which has yellow brownish colour as compared to other *burfi* trials. The lowest score was for T_5 (7.58) with very dull appearance having 10 per cent black gram flour. Among the added levels of black gram flour, the highest score for general appearance was *burfi* having 5 per cent black gram flour with faint yellowish brown colour and appeared fresh whereas *burfi* obtained from 10 per cent black gram flour gave dark shades with totally dull appearance which was not liked so much by judges.

Jadhav (2015) experimented on *besan burfi* suggest that as the level of *besan* increases, acceptability of *burfi* decreases because *besan* imparts dark, uneven, dull appearance. Khapre (2015) recorded colour and appearance score for fig fruit powder enriched *burfi* ranging from 7.68 to 8.24. Colour and appearance score goes on increasing upto the sample S_2, after that it was decreased.

Flavour

Data presented in Table 2 indicated that flavour score were 8.35, 8.48, 8.56, 8.13 and 7.73 for *burfi* prepared under T_1, T_2, T_3, T_4 and T_5 treatments respectively. This showed that as the level of black gram flour increases the flavour score of *burfi* also increases to 5%, but in T_4 and T_5 treatments the flavour score decreases. For flavour characteristic, *burfi* prepared under different treatments differ significantly. The highest score of flavour was for T_3 (8.56) with 5 per cent black gram flour due to acceptable amount of added black gram flour gives typical flavour while the lowest score was for T_5 (7.73) treatment with 10 per cent of black gram flour having deep beany flavor to *burfi*.

These results were found to be in close agreement with Jadhav (2015). For specified treatments it was observed as 7.01, 7.36, 7.63, 6.93 and 6.00 respectively. This showed that there was instant reduction of score with an increasing level of *besan*. Yadav and Peter (2015) observed that *burfi* prepared from the blend of whole milk and soymilk increased upto desired limit for flavour score ranged from 8.14, 8.26, 8.50 and 8.28. It showed that further decrease from treatment T_3. Kamble *et al.*, (2019) reported that flavour score of green chickpea *burfi* ranged from 7.25 to 8.00. Score increased upto treatment T_3, but for treatment T_5 it decreased and get score of 7.25.

Body and texture

From Table 3 it was observed that body and texture score for treatments T_1, T_2, T_3, T_4 and T_5 were 8.25, 8.38, 8.46, 8.03 and 7.63 respectively. The highest body and texture score was obtained for the *burfi* blended with 5% black gram flour. Then after the level of black gram flour increases the body and texture score was decreases.

Kapare (2017) reported that the level of finger millet increases the body and texture scores also decreases and reported the average body and score ranges between 7.30 to 8.93. Kamble *et al.,* (2019) reported that body and texture score decreased with increased in green chickpea level from 8.18 to 7.00.

Overall acceptability

From the Table 4 it is seen that overall acceptability score were 8.27, 8.38, 8.51, 8.03 and 7.64 under the treatments T_1, T_2, T_3, T_4 and T_5 respectively. Since the overall acceptability score of all the samples were above 5.5, it was

Table 2: Flavour score of *burfi* influenced by different blends of black gram flour.

Treatments/ replications	Flavour score				Mean score
	R I	R II	R III	R IV	
T_1	8.20	8.10	8.60	8.50	8.35[a]
T_2	8.30	8.20	8.80	8.60	8.48[a]
T_3	8.35	8.30	8.90	8.70	8.56[a]
T_4	7.70	7.60	8.65	8.55	8.13[ab]
T_5	7.40	7.50	8.40	7.60	7.73[a]
S.E. ± 0.190804					
C.D. at 5% 0.5715					

Values with superscripts are significantly different at (P<0.05).

Table 3: Body and texture score of *burfi* influenced by different blends of black gram flour.

Treatments/ replications	Body and texture score				Mean score
	R I	R II	R III	R IV	
T_1	8.10	8.00	8.50	8.40	8.25[a]
T_2	8.20	8.10	8.70	8.50	8.38[a]
T_3	8.25	8.20	8.80	8.60	8.46[a]
T_4	7.60	7.50	8.55	8.45	8.03[ab]
T_5	7.30	7.40	8.30	7.50	7.63[b]
S.E. ± 0.190804					
C.D. at 5% 0.57515					

Values with superscripts are significantly different at (P<0.05).

defined that black gram *burfi* which prepared under all treatments were acceptable. Total sensory score of black gram *burfi* differed significantly due to the different levels of flour added. Treatment T_3 (8.51) was highly acceptable over T_1 (8.27), T_2 (8.38), T_4 (8.03) and T_5 (7.64). Among all the samples, T_3 sample has good flavour, body and texture with no deleterious effect on colour and appearance. It was having significant natural flavour of black gram and slightly smooth to granular texture. Therefore, it was liked by all judges among all the treatments including control sample.

The results of present investigation are more or less similar with findings of Jadhav (2015) recorded the overall acceptability score 7.07, 7.17, 7.70, 6.78 and 6.14 for treatments T_0 to T_4. Total sensory score of *besan burfi* differed significantly due to *besan* level used. It had superior body, smooth texture with no deleterious effects on colour and appearance.

Shelf life of black gram *burfi*

Storage study was conducted to know the shelf life of product at room (30±2°C) temperature and refrigerated (7±2°C) temperature. The sample was evaluated for organoleptic changes at 3 days interval upto 12 days at room temperature and upto 21 days at refrigerated temperature. Sensory evaluation of *burfi* was carried out by panel of judges in respect of colour and appearance, flavour, body and texture and overall acceptability.

Effect on sensory parameters of black gram *burfi* samples

From the Table 5, it was observed that, Sensory scores of standardized T_3 *burfi* sample which stored at room (30±2°C) temperature conditions in terms of colour and appearance, flavour, body and texture and overall acceptability were observed in the range of 8.60-5.00, 8.70-4.80, 8.70-5.00 and 8.67-4.93 and at refrigerated (7±2°C) temperature it was 8.60-5.65, 8.50-5.60, 8.50-6.10 and 8.53-5.78 respectively. The consecutive changes in overall acceptability score were non-significant upto 6 days after that it was decreased to 4.93 ($p \leq 0.05$). This indicated that product was no more acceptable for consumption. This was attributed to characteristic colour changes from creamy white to dark, change in flavour and hardness due to the loss of moisture and rancidity occurred in the samples which stored at room temperature. Whereas, in refrigerated condition overall acceptability score changes non-significant upto 9 days thereafter, change was found to be significant. The score above 6 shows that *burfi* samples were acceptable and consumable.

Effect on microbial attributes of black gram *burfi* samples

From the Table 6, it was observed that, the SPC and YMC counts represents collective enumeration of the overall microbial quality of *burfi*, just after preparation and during storage period. The absence of coliform count was detected throughout storage period at both room (30±2°C) temperature and refrigerated (7±2°C) temperature. During the storage period, SPC and YMC counts increased significantly ($p \leq 0.05$). At the end of 9th day, fungal growth was clearly observed on *burfi* surface. The SPC and YMC values of *burfi* samples at 9th day were 4.34 and 2.36 log cfu/g respectively. Therefore, further microbial study was discontinued and concluded that product stored at room temperature was unsafe for consumption. At refrigerated storage temperature, the rate of increase in SPC and YMC

Table 4: Overall acceptability score of *burfi* influenced by different blends of black gram flour.

Treatments/ replications	Overall acceptability score				Mean score
	R I	R II	R III	R IV	
T_1	8.10	8.06	8.50	8.43	8.27^{a}
T_2	8.16	8.13	8.70	8.53	8.38^{a}
T_3	8.26	8.26	8.80	8.70	8.51^{a}
T_4	7.67	7.63	8.43	8.40	8.03^{ab}
T_5	7.36	7.46	8.10	7.63	7.64^{b}
S.E. ± 0.036997					
C.D. at 5% 0.11152					

Values with superscripts are significantly different at (P<0.05).

Table 5: Sensory and microbial attributes of standardized (T_3) *burfi* sample stored at 30±2°C.

Attributes		Days				
		0	3	6	9	12
Sensory	Colour and appearance	8.60	8.00	7.50	6.00	5.00
	Flavour	8.70	8.40	8.00	5.60	4.80
	Body and texture	8.70	8.30	7.90	5.40	5.00
	Overall acceptability	8.67	8.23	7.80	5.67	4.93
Microbial	SPC or TPC (log cfu/g)	2.38	3.36	4.11	4.34	ND
	YMC (log cfu/g)	0.00	1.72	1.95	2.36	ND
	Coliform count (log cfu/g)	Nil	Nil	Nil	Nil	Nil

Table 6: Sensory and microbial attributes of standardized (T_3) *burfi* sample stored at 7±2°C.

Attributes		Days							
		0	3	6	9	12	15	18	21
Sensory	Colour and appearance	8.60	8.00	7.00	6.80	6.20	6.10	5.90	5.65
	Flavour	8.50	8.10	7.80	7.10	6.30	6.00	5.85	5.60
	Body and texture	8.50	8.00	7.80	7.10	6.80	6.50	6.25	6.10
	Overall acceptability	8.53	8.03	7.53	7.00	6.43	6.20	6.00	5.78
Microbial	SPC (log cfu/g)	2.38	3.35	3.92	4.15	4.21	4.29	4.34	4.57
	YMC (log cfu/g)	0.00	1.19	1.12	1.58	1.72	1.80	1.89	2.01
	Coliform count (log cfu/g)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Table 7: Estimation of cost of production of black gram *burfi*.

Treatment	(Milk) quantity of milk taken (g) / *Khoa* obtained (g)	Cost (Rs.)	Sugar (g)		Black gram (g)		Miscellaneous charges (Rs.) [Packaging (5) + Fuel (10) + Electricity (5)]	Recovery of final product obtained (*Burfi*) (g)	Total cost (Rs.)	Cost of *burfi* per 1 kg (Rs.)
			Qty (g)	Cost (Rs.)	Qty (g)	Cost (Rs.)				
T_1	1000 250	60	75	3	-	-	20	325.00	83.00	255.38
T_2	1000 250	60	75	3	6.25	0.625	20	331.25	83.625	252.45
T_3	1000 250	60	75	3	12.50	1.250	20	337.50	84.250	249.62
T_4	1000 250	60	75	3	18.75	1.875	20	343.75	84.875	246.90
T_5	1000 250	60	75	3	25.00	2.500	20	350.00	85.00	244.28

counts was low. It was ranges from 2.38 to 4.57 and 0 to 2.01 log cfu/g for SPC and YMC at 21 days respectively.

Sharma *et al.*, (2017) reported shelf life of standardized kajukatli. It contained SPC and YMC count as 4.35 and 2.38 log cfu/g at room temperature (30±2°C) for 0 to 12 days and 2.42 to 4.32 log cfu/g for SPC and 0 to 1.82 log cfu/g for YMC at refrigerated (7±2°C) temperature for 0 to 30 days.

Cost of preparation of black gram flour burfi

From the Table 7, it was observed that, the production cost of *burfi* prepared using different levels of black gram flour was minimum as compared to that of controlled *burfi*. The cost of production of *burfi* with black gram powder was Rs. 255.38, Rs. 252.45, Rs. 249.62, Rs. 246.90 and Rs. 244.28 per kg for treatment T_1, T_2, T_3, T_4 and T_5 respectively. Above results showed that cost of 1 kg *burfi* for treatment T_1 (control sample *i.e.*, prepared entirely from buffalo milk) was highest (Rs. 255.38). While the cost was noted for treatment T_5 (with 10% black gram flour) was lowest (Rs. 244.28). It was noticed that cost of product decreased from Rs. 255.38 to Rs. 244.28 with increased in the incorporation of black gram powder. It was further noticed that production cost of *udid dal burfi* goes on decreasing simultaneously at 2.5, 5, 7.5 and 10 per cent level of black gram flour because of higher recovery and low cost of black gram as compared to controlled *burfi*. On the basis of sensory evaluation, the cost of most acceptable *burfi* (T_3) was found Rs. 249.62.

Similar findings are found by Jadhav (2015) in *besan burfi* as production cost goes on decreasing with added level of *besan i.e.*, Rs. 221.80, Rs. 216.30, Rs. 215.00, Rs. 214.10 and Rs. 213.10 per kg for treatment T_0, T_1, T_2, T_3 and T_4 respectively. Yadav and Peter (2015) showed in *burfi* prepared from whole milk with soymilk that for treatments T_0, T_1, T_2 and T_3 the production cost was Rs. 163.20, Rs. 152.32, Rs. 141.4 and Rs. 130.26 per kg. Kale (2018) reported similar results in sesamum powder *burfi* having cost of production was Rs. 350.33, Rs. 343.14, Rs. 326.26 and Rs. 321.22 per kg under treatments T_0, T_1, T_2 and T_3.

CONCLUSION

On the basis of sensory evaluation, the burfi prepared from 95% khoa and 5% black gram flour (T_3) was found highly acceptable over other treatments in respect to colour and appearance, flavour, body and texture and overall acceptability. Storage study was conducted at room (30±2°C) temperature and refrigerated (7±2°C) temperature conditions. The cost of more acceptable burfi prepared from incorporation of 5% black gram flour was Rs. 249.62 per kg.

ACKNOWLEDGEMENT

This research would not have been possible without the support of many people. I would like to express my deepest sense of gratitude and high indebtedness towards my dedicated, enthusiastic honourable guide Dr. S.G. Narwade, Associate Professor, College of Agriculture, VNMKV, Parbhani for his noble advice, constructive criticism, sustained interest and constant encouragement till the final shaping of present investigation. I am sincerely thankful to the advisory committee members Dr. G.K. Londhe, Professor and Head (COA), Dr. R.A. Patil, Assistant Professor (COA) and Dr. D.S. Chavan, Senior Scientist, Cattle Cross Breeding Project, Department of Animal Husbandry and Dairy Science, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani for their co-operation and valuable suggestion during research work.

Conflict of interest: None.

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