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Effect of Physico-chemical and Textural Properties on Black Gram (*Vigna mungo*) Flour *Burfi*

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A B S T R A C T

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*). On an average black gram flour *burfi* of treatments T_1, T_2, T_3, T_4 and T_5 contained moisture 15.90, 15.50, 14.90, 14.35 and 13.30 per cent, fat 20.88, 19.52, 18.63, 17.93 and 16.95 per cent, protein 14.60, 15.63, 16.03, 16.54 and 16.94 per cent, ash 2.45, 2.52, 2.59, 2.64 and 2.72 per cent, total solids 84.10, 84.50, 85.10, 85.65 and 86.70 per cent, crude fiber 0.15, 0.16, 0.17, 0.20 and 0.21 per cent, total sugar 46.17, 46.83, 47.85, 48.54 and 50.09 per cent, titratable acidity 0.539, 0.525, 0.502, 0.487 and 0.474 per cent L.A., pH 6.44, 6.62, 6.68, 6.79 and 6.88 respectively. In textural parameters, hardness ranges from 0.617 to 1.827 kg, cohesiveness 2.192 to 1.333, adhesiveness -0.001 to -0.005 kg, springiness were 1.5068 to 1.4304 mm, gumminess scored 1.352 to 2.435 and chewiness ranges from 2.037 to 3.483 for treatments T_1, T_2, T_3, T_4 and T_5 respectively.

Introduction

Among the traditional dairy products, *burfi* is most popular *khoa*-based confection in Indian sub-continent. 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. 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. *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.

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/100gm carbohydrate, calcium 185 mg/100 gm, ferrons 8.7 gm/100 gm, phosphorous 345 mg/100gm (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 the research project on "Studies on utilization of black gram flour in preparation of *burfi*."

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.

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.

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.

Procedure for preparation of burfi

The standard procedure for preparation of *burfi* was used (Sharma *et al.*, 2017) with slight modifications. 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 50ºC 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 55-60ºC 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.

Results and Discussion

Chemical composition of burfi

The black gram *burfi* prepared under various treatments were subjected to analysis viz., moisture, fat, protein, ash, titratable acidity, total sugar, pH, crude fiber and total solids.

Moisture content

It was observed in Table no.1 that mean moisture content in T_1, T_2, T_3, T_4 and T_5 were 15.90, 15.50, 14.90, 14.35 and 13.30 per cent, respectively. Basically, all the treatments showed the significant difference for moisture content in black gram *burfi*. As black gram flour increased in *burfi*, the moisture content in *burfi* was decreased. This might be due to the black gram powder soak the moisture content in *burfi*. `The maximum moisture observed for treatment T_1 (15.90 %) whereas, minimum moisture obtained for T_5 (13.30 %).

Kapare (2017) revealed that moisture content of *burfi* blended with finger millet was decreased with increased level of finger millet powder. However, treatments T_0, T_1, T_2, T_3 and T_4 contains moisture content 16.84, 16.62, 16.35, 16.09 and 15.87 per cent respectively.

Fat content

From the above table 1, it was observed that the average fat content in black gram *burfi* was 20.88, 19.52, 18.63, 17.93 and 16.95 per cent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. It was also observed that maximum fat content was in T_1 (20.88) and minimum fat content in T_5 (16.95). The fat content of *burfi* was significantly influenced by the addition of black gram powder in *burfi*. As the black gram powder level increases the fat content of *burfi* decrease significantly.

Jadhav (2015) narrated that fat content of *besan burfi* was decreased with increased levels of *besan* i.e., 25.50 (T_0), 21.17 (T_1), 19.83 (T_2), 18.89 (T_3) and 17.28 (T_4) per cent. The data indicated that average fat content of *burfi* was significantly affected addition of *besan* in *burfi* preparation.

Protein content

From table 1, it was observed that for treatments T_1, T_2, T_3, T_4 and T_5, the protein content of the product 14.60, 15.63, 16.03, 16.54 and 16.94 per cent respectively. The differences were statistically significant among the various treatments in *burfi* preparation. It was observed that as the addition of black gram flour level increases, the protein content of the product was also increased. This might be due to protein content in black gram flour because it is rich in proteins. Therefore, treatment T_1 (14.60) has low amount of proteins as compared to T_5 (16.94).

Jadhav (2015) reported the protein content of *besan burfi* ranged from 12.59, 13.20, 13.71, 14.69 and 16.48 per cent for treatments T_0, T_1, T_2, T_3 and T_4 respectively. Protein content of *burfi* increases with addition of *besan*.

Yadav and Peter (2015) observed protein content ranged from 13.35 per cent to 14.59 per cent in *burfi* blended with whole milk and soymilk.

Ash content

The data obtained in table 1 indicate that the ash content of *burfi* in treatments T_1, T_2, T_3, T_4 and T_5 were 2.45, 2.52, 2.59, 2.64 and 2.72 per cent respectively. As the black gram flour level increases the ash content level of the product was also increased. This was might be due to the high content of mineral and high amount of total solids in *burfi*.

Kapare (2017) studied on preparation of *burfi* blended with finger millet powder observed the average values for ash content of *burfi* in range of 2.43 to 2.63 per cent. Results of Mete *et al.,* (2017); Pal *et al.,* (2018) and Asati *et al.,* (2019) described

similar results for preparation of *Khajoor burfi*, bottle gourd *burfi* and *burfi* from orange rind.

Titratable acidity content

Results obtained from table 1 was considered where titratable acidity content was decreases from treatments T_1 to T_5 as 0.54, 0.53, 0.50, 0.49 and 0.47 per cent respectively. As the black gram flour increases in *burfi*, the acidity content in *burfi* was decreases continuously. Highest titratable acidity in treatment T_1 (0.54) was observed whereas lowest acidity in treatment T_5 (0.47). Decrease in acidity content showed because of increases the level of black gram flour added in *burfi* preparation.

Basically, results were finalized with association of Jadhav (2015) and Mohod *et al.,* (2020) with *besan* and finger millet *burfi*. *Besan burfi* contain 0.734, 0.682, 0.617, 0.575 and 0.492 per cent acidity whereas finger millet *burfi* contains 0.24 to 0.19 per cent titratable acidity respectively.

Total sugar content

Data calculated from table 1 was measured that total sugar content was increases from treatments T_1, T_2, T_3, T_4 and T_5 as 46.17, 46.83, 47.85, 48.54 and 50.09 per cent respectively. Highest total sugar in treatment T_5 (50.09 %) was observed whereas lowest one in treatment T_1 (46.17 %). These differences may occur because of total sugar already present in black gram flour.

Simultaneously, results were match with Pawar (2011) reported dried date *burfi* contains total sugar in treatments T_0, T_1, T_2 and T_3 as 47, 49, 51 and 53 per cent respectively. Gadekar *et al.,* (2018) narrated total sugar content of 44.93, 51.41, 51.90 and 52.41 per cent for treatments T_1 to T_4 respectively.

Crude fiber content

Among the results observed in the table 1, it was presented that the average crude fiber content of products was 0.15, 0.16, 0.17, 0.20 and 0.21 per cent for treatment T_1, T_2, T_3, T_4 and T_5, respectively. The highest crude fiber content was recorded for treatment T_5 (0.21) and the lowest crude fiber content was recorded for treatment T_1 (0.15). All trials were significantly differed from each other. It was also concluded that as the addition of black gram powder level increases the crude fiber content of product increases.

The findings were close agreement as it also increasing manner with the reports of More and Chavan (2019) and Asati *et al.,* (2019) on finger millet *burfi* and orange rind *burfi* respectively.

Total solids content

Among the results presented in the table 1, it was observed that the average total solids content of product was found to be 84.10, 84.50, 85.10, 85.65 and 86.70 per cent for treatment T_1, T_2, T_3, T_4 and T_5, respectively. The highest total solids content was recorded for treatment T_5 (86.70) and the lowest total solids content was recorded for treatment T_1 (84.10). All trials were significantly differed from each other. It was also presented that as the addition of black gram powder level increases the total solids content of product increases with decrease in moisture content. This might be due to the high total solids content of black gram flour.

Jadhav (2015) reported that total solids content for treatment T_0 to T_4 ranged from 90.66 to 93.70 per cent respectively. Kapare (2017) who was reported that the total solid content of finger millet *burfi* was in the increasing range of 83.16 to 84.13 per cent.

pH content

Results presented in the table 1, it was observed that the average pH content of product was found to be 6.44, 6.62, 6.68, 6.79 and 6.88 for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The highest pH content was recorded for treatment T_5 (6.88) and the lowest pH content was recorded for treatment T_1 (6.44). All treatments were differed from each other. It was also presented that as the addition of black gram powder

level increases the pH content of product increases with decrease in titratable acidity.

This was influenced by More and Chavan (2019) studied on red pumpkin *burfi*. In that, treatments ranged from T_0 to T_3 contains pH of 6.10, 6.32, 6.43 and 6.44 respectively.

Textural properties of black gram burfi

Texture describes what we experienced in our mouth while eating *burfi* i.e., initial mouthfeel, hardness, adhesiveness, cohesiveness, springiness, gumminess and chewiness. Texture profile analysis is the double compression test in which bite- sized *burfi* (1 cm^3) is compressed twice to mimic the action caused during chewing of *burfi* and hence it is called "two-bite test". It can quantify multiple textural parameters in just one experiment.

Hardness

Hardness is the most assessed parameters of black gram *burfi* in determining the texture of *burfi*. As the level of added black gram powder increases, there was simultaneous increase in hardness of *burfi*. From the table 6, the hardness of product was lowest in T_1 treatment (0.617) whereas highest in T_5 (1.827). This highest hardness was observed due to low moisture content and high amount of black gram powder.

Similarly, it was observed by Satav *et al.,* (2014) in walnut *burfi*. The results revealed that hardness goes on increasing from T_1 to T_5 as 0.4623 to 1.1939 kg when walnut powder added in *burfi*. Kapare (2017) reported that the value of hardness ranged from T_0 to T_4 as 1.757 to 3.297 kg in finger millet *burfi*.

Adhesiveness

The sensory stickiness was due to adhesiveness. It was ranges for black gram *burfi* from -0.001 to -0.005 due to different sugar levels.

Dey and Amin (2017) observed that adhesiveness ranged from -0.01 to -0.14 in jackfruit seed flour *burfi*.

Cohesiveness

Cohesiveness showed the decreasing trend from treatment T_1 to T_5 as 2.192 to 1.333 in black gram *burfi*. It may be attributed with loss of moisture content and increasing total solids in *burfi*.

Dey and Amin (2017) observed that cohesiveness in jackfruit seed flour *burfi* ranges from 0.07 to 0.19. Kapare (2017) reported that the value of cohesiveness ranged from T_0 to T_4 as 1.293 to 1.442 in finger millet *burfi*. Pandey and Poonia (2020) reported that cohesiveness ranges from 0.26 to 0.34 as moisture decreases in ber powder *burfi*.

Springiness

Springiness varied from 1.5068 to 1.4304 for black gram powder *burfi*. It was influenced by various levels of added black gram flour, sugar and by maintaining *khoa* constant.

Tanuja *et al.,* (2017) studied springiness ranges from 0.39 to 0.84 cm apple pomace incorporated *burfi*. Shrivas *et al.,* (2017) concluded that springiness ranges from 1.27 to 1.32 mm in *rava burfi* with *mawa burfi*. Dey and Amin (2017) observed that springiness ranged from 2.52 to 5.37 in jackfruit seed flour *burfi*.

Gumminess

As the level of added black gram powder increases, there was simultaneous increase in gumminess of *burfi*. For black gram *burfi*, it was ranged from T_1 (1.352) to T_5 (2.435).

Shrivas *et al.,* (2017) concluded that gumminess ranges from 0.30 to 1.369 N in *rava burfi* with *mawa burfi*.

Fig.1 Flow chart for preparation of burfi

The following method was used as per Sharma *et al*., (2017) with slight modifications:

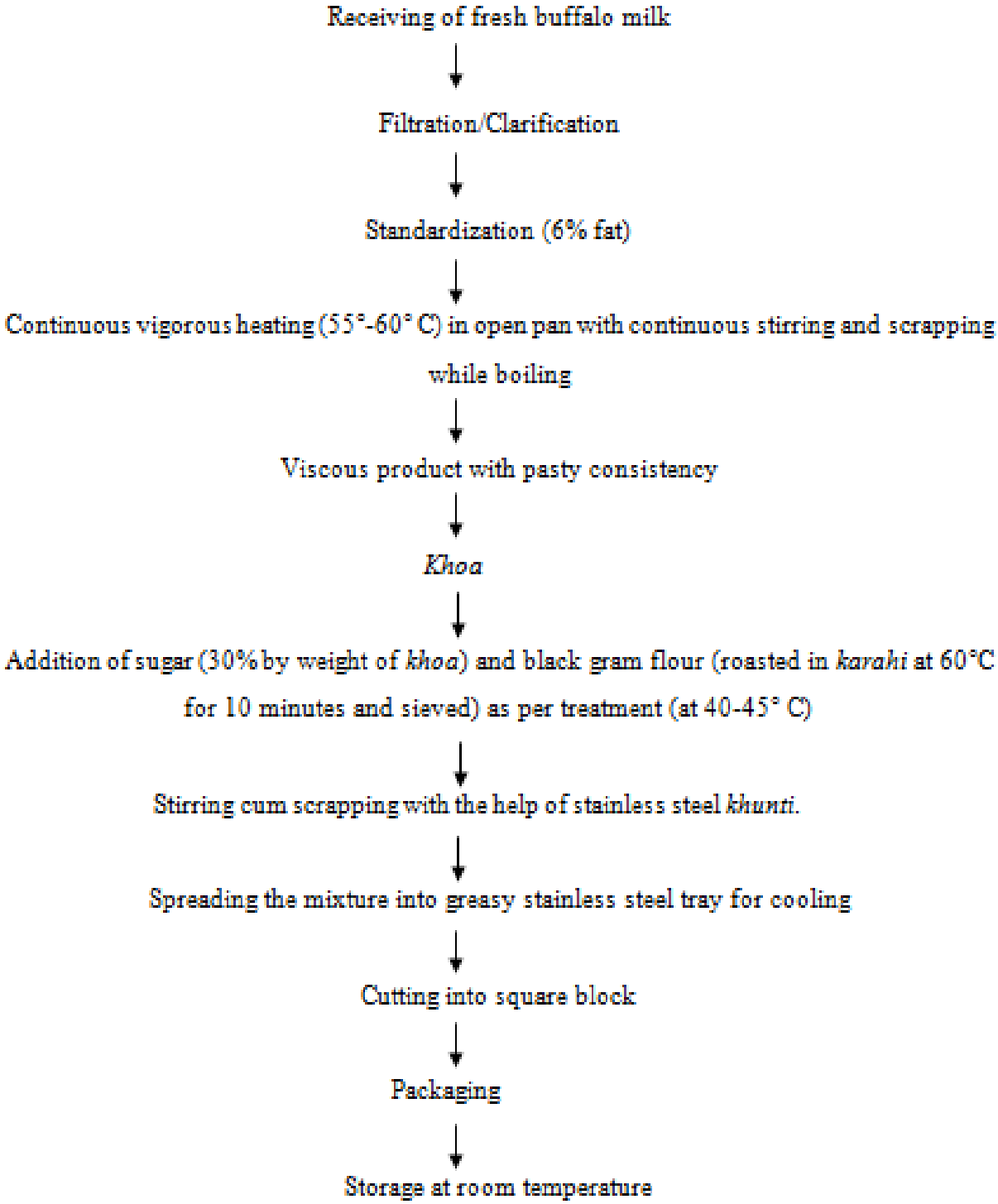

Table.1 Mean chemical composition of finished product

Sr. No.	Chemical constituents	T_1	T_2	T_3	T_4	T_5
1.	Moisture	15.90	15.50	14.90	14.35	13.30
2.	Fat	20.88	19.52	18.63	17.93	16.95
3.	Protein	14.60	15.63	16.03	16.54	16.94
4.	Ash	2.45	2.52	2.59	2.64	2.72
5.	Titratable acidity	0.539	0.525	0.502	0.487	0.474
6.	Total sugar	46.17	46.83	47.85	48.54	50.09
7.	Crude fiber	0.15	0.16	0.17	0.20	0.21
8.	Total solids	84.10	84.50	85.10	85.65	86.70
9.	Ph	6.44	6.62	6.68	6.79	6.88

Table.2 Textural properties of black gram *burfi*

Treatments	Hardness (kg)	Cohesiveness	Adhesiveness (kg. sec.)	Springiness (mm)	Gumminess	Chewiness (kg)
T_1	0.617	2.192	-0.001	1.5068	1.352	2.037
T_2	0.963	1.473	-0.002	1.4426	1.418	2.045
T_3	1.241	1.318	-0.003	1.4424	1.635	2.358
T_4	1.307	1.517	-0.005	1.4520	1.982	2.877
T_5	1.827	1.333	-0.002	1.4304	2.435	3.483
S.E. ±	0.93669	1.1921	0.00219	1.08456	1.34864	1.95221
C.D. at 5%	2.81971	3.58857	0.00658	3.26484	4.0598	5.87672

Chewiness

Chewiness also increased with added black gram powder. It was increased from T_1 (2.037) to T_5 (3.483) which was highest.

Satav *et al.*, (2014) in walnut *burfi* revealed that chewiness goes on increasing from T_1 to T_5 as 0.8056 to 1.8556 kg when walnut powder added in *burfi*.

On the basis of sensory evaluation, the burfi prepared from 95% khoa and 5 % black gram flour (T_3) was found highly acceptable. The chemical composition of T_3 contains moisture 14.90 per cent, fat 18.63 per cent, proteins 16.03 per cent, ash 2.59 per cent, titratable acidity 0.502 per cent LA, total sugar 47.85 per cent, crude fiber 0.17 per cent, total solids 85.10 per cent and pH 6.68. In textural parameters, hardness ranges from 0.617 to 1.827 kg, cohesiveness 2.192 to 1.333, adhesiveness -0.001 to -0.005 kg, springiness were 1.5068 to 1.4304 mm, gumminess scored 1.352 to 2.435 and chewiness ranges from 2.037 to 3.483 for treatments T_1, T_2, T_3, T_4 and T_5 respectively.

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