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## Effect of black pepper (*Piper nigrum*) and turmeric (*Curcuma longa*) powder on sensory and rheological quality of *burfi*

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### Abstract

The present investigation was carried out to prepare a *burfi* with addition of black pepper (*Piper nigrum*) and turmeric (*Curcuma longa*) powder to study the sensory and rheological quality of *burfi*. The study was conducted in the Department of Animal Husbandry and Dairy Science, College of Agriculture, VNMKV, Parbhani. The sensory characteristics of thirteen formulations with three levels of black pepper (0.6%, 0.8%, 1.0%) and turmeric powder (0.5%, 1.0%, 1.5%) was evaluated as per Central Composite Rotatable Design (CCRD) and the different component was optimized using Response Surface Methodology. Besides, optimized *burfi* comprising 1.01 per cent turmeric and 0.90 per cent black pepper powder on *khoa* weight basis was analyzed for rheological properties. Sensory evaluation of product was carried out from the panel of experts for the parameters, color and appearance, body and texture, flavor and overall acceptability by using 9 point hedonic scale. It was observed that due to incorporation of black pepper and turmeric powder there is increase in nutritional content of *burfi* as well as shelf life as both ingredients are acting as natural preservatives. Hence the major contribution have been made to formulate healthy, nutrients rich *burfi*.

**Keywords:** *burfi*, black pepper, turmeric, sensory evaluation, central composite rotatable design, response surface methodology

### Introduction

*Burfi* is one of the most popular traditional dairy based sweet in Indian market. It is prepared by heating special type of *khoa* called *dhap khoa* with sugar to a homogenous consistency (Chetna *et al.*, 2009). Spices and herbs have been in use for long time, both for culinary and medicinal purposes. Spices enhance the flavor, aroma and color of food and beverages as well as protect from acute and chronic diseases (Jiang, 2019) [7]. People are now more conscious of health and health risks, so there is a need to develop sweet products fortified with health beneficiary herbs and spices.

Turmeric, *Curcuma longa* L. (Zingiberaceae) a common spice used traditionally for cancer fighting. It is a golden spice resulting from the rhizome of the *Curcuma longa* plant. Turmeric exhibits anti-HIV, anti-bacterial, nematocidal, antiparasitic, antispasmodic and anti-carcinogenic activities (Tanvir *et al.*, 2017) [18]. A hot water extract of the dried rhizome has been taken orally to slow lactation and to regulate fat metabolism (Bhowmik *et al.*, 2009) [1]. Black pepper is one of the worldwide most used spices. It is obtained from unripe fruits, called peppercorns, of the plant species *Piper nigrum* L, of the *Piperaceae* family. Piperine is the main chemical constituent of this plant, which has diverse activities such as central nervous system depression, cytotoxic, anti-inflammatory and hepatoprotective effects, as well as the ability to enhance bioavailability (Hammouti *et al.*, 2019) [6].

Black pepper and turmeric powder added *burfi* is prepared like the indigenous *burfi* where *khoa*, black pepper and turmeric (powder) are used in combination along with appropriate level of sugar. The present study was undertaken to optimize the preparation of black pepper and turmeric powder-based Indian dairy dessert (*Burfi*) using a statistical software tool namely Response Surface Methodology (RSM).

### Materials and Methods

The experiment research work was carried to prepare a *burfi* with addition of black pepper (*Piper nigrum*) and turmeric powder (*Curcuma longa*) which was conducted in the laboratory of Department of Animal Husbandry and Dairy Science, College of Agriculture, VNMKV,

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Parbhani, Maharashtra, India, during the year 2020-21. The materials used and the methodologies adapted are as under.

### Materials

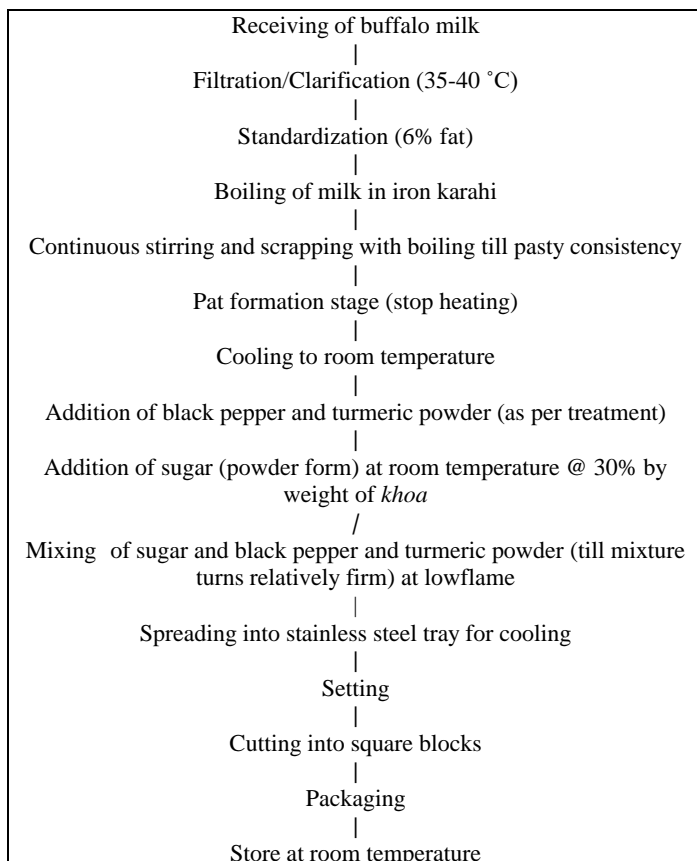
Good quality buffalo milk was obtained from Dairy Unit of Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani, was standardized to 6% fat and filtered to remove dirt and other extraneous matter, before use. Good quality of sugar, black pepper and turmeric powder were procured from Parbhani local market. *Khoa* was prepared by heating milk in iron pan (*karahi* having 31 cm diameter and 8.5 cm depth) as per the method described Dharampal (1998) with slight modification.

### Methods

#### Preparation of black pepper and turmeric added *burfi*

*Burfi* was prepared by following the traditional method of preparation as suggested by Dharampal (1998) with slight modification. Received milk was preheated at 35-40 °C before filtration. The standardized buffalo milk was taken in an iron *karahi* and heated on gentle fire. The stirring-cum-scraping process was continued till a pasty consistency was reached. After *khoa* formation stage, as per the treatment, parts of black pepper, turmeric powder and sugar 30% by weight of *khoa* was added. Stirring it continuously with wooden khunti on low flame until solid mass stage. Spread this solid mass into the tray and keep it for cooling. After setting, cut it into square blocks and store at room temperature in cardboard boxes for further study.

### Procedure of Methodology



**Fig 1:** Flow-chart for preparation of *Burfi* with addition of black pepper powder and turmeric powder (Procedure according to (Dharampal 1998), with slight modification)

### Sensory evaluation

The samples of black pepper and turmeric powder added *burfi* prepared from thirteen formulations were evaluated by the panel of ten judges from Department of Animal Husbandry and Dairy Science and College of Food Technology, VNMKV, Parbhani with respect to flavor, colour and appearance, body and texture and overall acceptability attributes by using 9-point hedonic scale describe by (Gupta 1976) [5]. Water and taste breakers (Potato chips) were also presented to each panellist for rinsing of their mouths between samples evaluation.

### Optimization of levels of black pepper and turmeric powder:

The levels of black pepper powder and turmeric powder in *khoa* (w/w) based on sensory attributes was evaluated and optimized by response surface methodology (RSM) by the method described by (Myers and Montgomery, 2002) [13]. The levels of turmeric powder and black pepper powder factors was two and experimental design was setup with experimental points having 5 replicates at the center. The center points of the experimental design was defined as 1.0 per cent turmeric powder and 0.8 per cent black pepper powder as shown in Table 1.

**Table 1:** Optimization of Levels of turmeric powder and black pepper powder using RSM

Variables	-1	0	+1
Turmeric powder (A)	0.5	1.0	1.5
Black pepper powder (B)	0.6	0.8	1.0

The thirteen formulations in standard order of turmeric and black pepper powder were given in Table 2

**Table 2:** Experimental variables, their coded level and decoded

Standard Order	Factor 1 A : Turmeric %	Factor 2 B:Black pepper %
1	0.50	0.60
2	1.50	0.60
3	0.50	1.00
4	1.50	1.00
5	0.29	0.80
6	1.71	0.80
7	1.00	0.52
8	1.00	1.08
9	1.00	0.80
10	1.00	0.80
11	1.00	0.80
12	1.00	0.80
13	1.00	0.80

### Textural profile analyzer

The textural properties i.e. hardness, cohesiveness, springiness, adhesiveness, chewiness, gumminess was determined with the help of TA.XT plus Textural Profile Analyzer available at Niche area laboratory, College of Food Technology, VNMKV, Parbhani, Maharashtra, India. The textural properties was evaluated using the TA.XT plus Texture analyzer of Stable Micro System equipped with 50 kg load cell. The analyzer is linked to a computer that recorded the data via a software programme. *Burfi* sample of length 1cm<sup>3</sup> was cut from the central portion of tofu cake with a stainless steel cutter.

### Results and Discussion

The sensory parameters chosen to evaluate the quality of black pepper and turmeric powder added *burfi* were flavor, body and texture, colour and appearance and overall

acceptability. The sensory scores of thirteen formulations of black pepper and turmeric powder added *burfi* with different proportions of black pepper (0.52 - 1.08%) and turmeric (0.29 - 1.71%) depicted in Table-3, revealed that black pepper and

turmeric powder added *burfi* with 1% turmeric and 0.80% black pepper powder obtained the highest scores in respect of flavour (8.7), body and texture (8.7), colour and appearance (7.6) and overall acceptability (8.4).

**Table 3:** Sensory scores of blackpepper and turmeric powder added *burfi* with different combinations of black pepper and turmeric powder

Stand and order	turmeric powder	black pepper powder	Flavour	Colour and appearance	Body and Texture	Overall acceptability
1	0.50	0.60	6	6.9	6.9	6.6
2	1.50	0.60	6.6	7	7	6.8
3	0.50	1.00	8.6	7	7.3	7.6
4	1.50	1.00	8.5	7.4	7.4	7.7
5	0.29	0.80	7.8	6.5	7	7.1
6	1.71	0.80	6.9	7	7.2	7.0
7	1.00	0.52	6.2	7.9	7.3	7.1
8	1.00	1.08	8.9	8.0	8.0	8.3
9	1.00	0.80	8.7	7.6	8.7	8.4
10	1.00	0.80	7.8	8.5	8.4	8.2
11	1.00	0.80	8.0	8.4	8.1	8.1
12	1.00	0.80	8.0	8.1	8.0	8.0
13	1.00	0.80	7.9	8.3	8.1	8.1

### Optimization of product formulation

Based on the results obtained from sensory evaluation of blackpepper and turmeric powder added *burfi* with different levels of black pepper and turmeric on *khoa* basis, suitable levels of black pepper and turmeric powder was selected for verification of their sensory status. The goals for factors were chosen in the range from minimum to maximum, whereas

sensory scores were targeted towards maximum values. The results revealed that the best formulation contained 1.01 per cent turmeric and 0.90 per cent black pepper powder on *khoa* basis. The predicted sensory scores were rated 8.7 for flavour, 8.7 for body and texture, 7.6 for colour and appearance and 8.4 for overall acceptability as shown in Table-4.

**Table 4:** Verification of predicted sensory quality of optimized blackpepper and turmeric powder added *burfi* prepared with optimum combination of blackpepper and turmeric

Parameter	Predicted score*	Actual score*	* Calculated t value
Flavour	8.7	8.9	2.46
Body and Texture	8.7	8.8	2.45
Colour and appearance	7.6	8.0	2.26
Overall acceptability	8.4	8.6	3.88

◆Average of triplicate experiments Table't' 0.05 is 7.54

The sensory scores for the flavour of the *burfi* prepared by addition of black pepper and turmeric powder ranged from 6 to 8.9 (Table 3). From fig 2-a, It is concluded that the vertical line indicates flavour score, while horizontal line indicates black pepper and turmeric. The flavour score increased with the increase in black pepper powder irrespective with turmeric level. However the present findings are in close agreement with Matkar *et al.*, (2016) [10] and Mete *et al.*, (2017) who observed increase in flavour scores of *burfi* with increasing levels of fig paste in fig *burfi* and honey in khajoor *burfi* respectively.

The colour and appearance score of *burfi* prepared by addition of black pepper and turmeric powder varied from 6.5 to 8.5 (Table 3). Fig 2-b shows the Response Surface Plot for effect of black pepper and turmeric powder on the colour and appearance of *burfi*. It can be observed from the figure that colour and appearance score increased as the level of both ingredient i.e. turmeric and black pepper powder increase with equal effect. The present findings are in close agreement with Dhande and Bhosale (2017) [3] and (Patil *et al.*, 2015) [14] who reported increase in colour and appearance score of *burfi* with increasing levels of ash gourd pulp and dried date respectively.

The body and texture score of *burfi* prepared by addition of black pepper powder and turmeric powder varied from 6.9 to 8.7 (Table 3). It is also evident from RSM plot (fig 2-c) that there has been a significant effect on the body and texture

score of *burfi* which is prepared by addition of turmeric and black pepper powder with the increase in the level of black pepper. The black pepper powder content upto level of 0.80 per cent resulted in increase in body and texture score. Very slight increase in body and texture score was observed with increase in turmeric powder level upto 1.00 per cent. The present findings are in close agreement with Navale *et al.*, (2014) [15], Mohod *et al.*, (2020) [12] and Patil *et al.*, (2015) [14] who reported increasing trend of wood apple pulp, finger millet flour and dried dates with increase in body and texture score in wood apple *burfi*, finger millet *burfi* and dried dates *burfi* respectively.

The sensory score for overall acceptability of *burfi* prepared by addition of black pepper powder and turmeric powder ranged from 6.6 to 8.4 (Table 3). The response surface plot (fig 2-d) showed the level of ingredients affects the overall acceptability of *burfi* prepared with addition of black pepper and turmeric powder. Close examination of response surface revealed that the curvature of the surface was more pronounced along the black pepper axis than turmeric powder axis indicating that the changes in black pepper level had a greater effect on overall acceptability than turmeric powder level. Similarly, Navale *et al.*, (2014) [15] and Mohod *et al.*, (2020) [12] reported the increasing overall acceptability trend in wood apple *burfi* and finger millet flour *burfi* by increasing level of wood apple pulp and finger millet flour respectively.

**Textural properties of optimized burfi**

**Table 5:** Textural properties of optimized burfi prepared by addition of black pepper and turmeric powder

Characteristics	Optimized Burfi
Hardness (H)	2.908 kg
Cohesivness (A2/A1)	1.993
Adhesivness (A3)	-0.005 kg.sec
Springiness (D2/D1)	1.570 mm
Guminess (H x A2/A1)	5.795
Chewiness (G X Springiness)	9.098

The Table 5 given above is the Textural properties of the optimized burfi prepared using 1.01 per cent turmeric and 0.90 per cent black pepper powder on the basis of sensory evaluation.

**Hardness**

Hardness is important factor for the investigation of texture of khoa burfi. It is defined as the force necessary to attain a given deformation. The optimized burfi gives 2.908 kg hardness as given in Table 5. It was observed that burfi with highest moisture content had lowest hardness value this is because of negative correlation between moisture content and hardness. Tulavi (2018) [19-20] reported increase in the hardness inulin fiber burfi with increase in addition of inulin powder. Similarly, Lahankar (2018) [9] and Singh et al., (2020) also reported increase in the hardness of green pea burfi and camel and buffalo milk based khoa burfi blended with watermelon seeds respectively.

**Cohesiveness**

Cohesiveness is the ratio of areas under the first and second bite. The optimized burfi gives 1.993 Cohesiveness as given in Table 5. The obtained results justify the decrease in moisture per cent in burfi sample increases the cohesiveness. Tulavi (2018) [19-20] and

Khobragade et al., (2021) [8] reported increase in the cohesiveness of burfi with increase in concentration of inulin in inulin fiber burfi and raw turmeric extract in buffalo milk Paneer respectively.

**Adhesiveness**

The optimized burfi gives -0.005 kg. sec Adhesiveness as given in table 5 Tulavi (2018) [19-20] reported increase in the Adhesiveness of Inulin fiber burfi with increase in concentration of inulin from (0 to 7 per cent). It ranged from -0.298 Kg. sec (T1) to -0.419 Kg. sec (T4).

**Springiness**

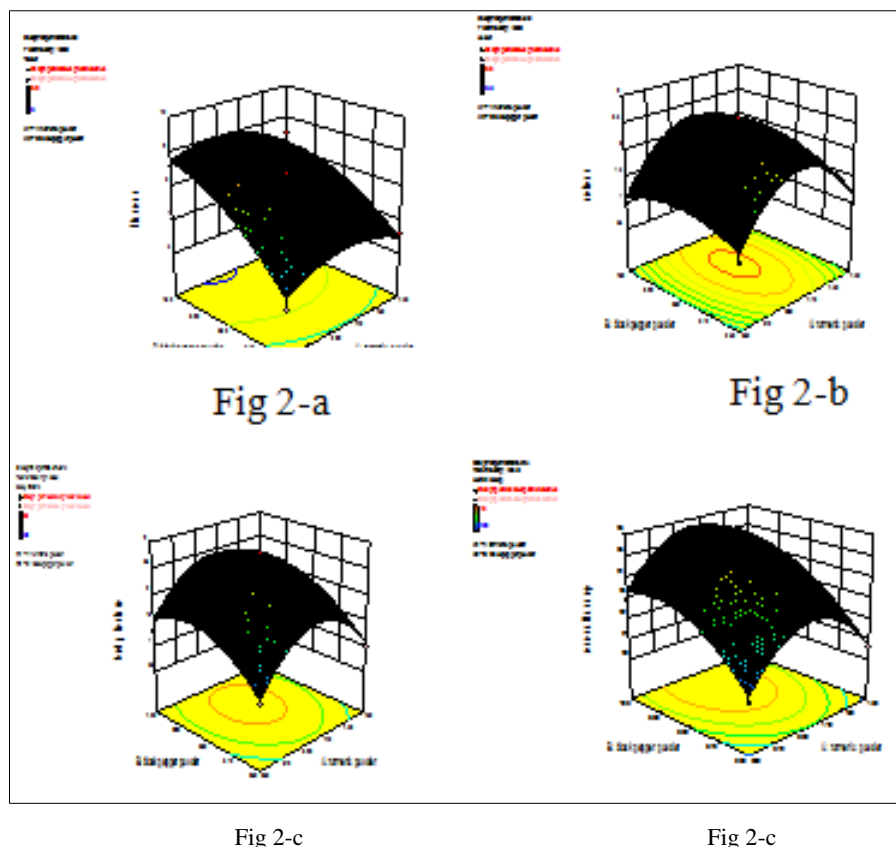
The optimized burfi gives 1.570 mm Springiness as given in table 5. Tulavi (2018) [19-20] and Wasnik et al., (2013) [21] suggested decrease in the springiness of inulin fiber Burfi and santra pulp burfi with increase in concentration of inulin and orange pulp content respectively.

**Guminess**

The optimized burfi gives 5.795 Guminess as given in table 5. Tulavi (2018) [19-20] and Khobragade et al., (2021) [8] reported increase in the guminess of inulin fiber burfi and paneer blended with raw turmeric extract with increase in concentration of inulin and raw turmeric extract respectively.

**Chewiness**

The energy required to masticate food into a state ready for swallowing and is a product of hardness, cohesiveness and springiness. The optimized burfi gives 9.098 Chewiness as given in table 5. The present findings were in accordance with the reports of Singh et al., (2020) who reported increased in Chewiness watermelon seeds added camel and buffalo milk burfi blended with increase in level of watermelon seeds and Khobragade et al. (2021) [8] with increased proportion of raw turmeric extract in paneer.



**Fig 2:** Following are Figures 2a-2d of the response surface relating to sensory scores as influenced by black pepper and turmeric powder burfi.



**Fig 3:** Optimized burfi

### Conclusion

It is concluded from the optimization study using CCRD and RSM analysis that black pepper and turmeric powder added burfi containing 1.01 per cent turmeric and 0.90 per cent black pepper powder scored maximum with respect to flavor, body and texture, colour and appearance, and overall acceptability and was nutritionally better as compared to the control burfi.

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