

# SHELF LIFE ENHANCEMENT OF FUNCTIONAL DODA BURFI (INDIAN MILK CAKE) WITH BIOPRESERVATIVES APPLICATION

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## ABSTRACT

Doda burfi is a popular traditional sweetmeat of northern India resembling milk cake of westernized culture. At normal ambient temperature conditions, shelf life of doda burfi is 10-12 days and to further extend the same, use of biopreservatives was tried. During storage period, physico-chemical, sensory as well as microbiological assay was taken into consideration to mark distinguish changes between control and biopreserved product. The two different products control and treated, were evaluated and a shelf life of 27 days of treated product counterpart to 12 days of control product kept at 30°C was recorded. The results indicated a significant decrease of moisture content and pH and increase in acidity, free fatty acids, HMF content, and tyrosine value during storage.

**Keywords** Traditional sweetmeat, functional, Biopreservatives, Chemical preservatives, Shelf-life, Sensory attributes.

## INTRODUCTION

Doda burfi simply called as “Doda” or “Dhoda”, is an immense popular traditional milk-cereal based sweet of Northern India. The sweet is particularly famous in states like Punjab, Haryana, and Western U.P [55] and the product is made from germinated wheat flour (*angoori atta*), buffalo milk and sugar with small amounts of Indian cultured dahi and citric acid and garnished with various nuts such as almonds, cashews and pistachio. However, the garnishing entities are purely optional and vary from one manufacturer to another. Product is characterized by pleasant caramelized flavor, dark brown color and sticky granular body. Conventional doda burfi contains most of its nutrients in pre-digested form owing to germination process of wheat and serves as an excellent source of dietary fiber, which is usually absent in other dairy products. Recently various traditional products such as *rasogolla*, milk cake, *kalakand*, *kheer* and some other regional specific products like range of *burfi*, *channa murki*, *payasam* etc. are being explored and gaining popularity in various countries. Though the recent practice of manufacturing such traditional dairy products is being undertaken by some renowned manufacturers but still the product carries the limitation of short shelf life and early spoilage due to microbial contamination especially yeast and mould growth in sweetmeats due to high sugar content.

Recently, awaken regime of increased health consciousness has created a reluctant behavior in consumer acceptance towards the non-healthy foods and foods containing artificial or synthetic

food ingredients. To overcome this problem, value addition of traditional products with vital nutraceuticals and preservation of such functional products with various biopreservatives in food for shelf life extension is becoming demand of modern consumer as well as choice of the producer. The concept of enhanced shelf life not only attracts consumer, retailer, and wholesaler but also to producer. A long shelf life product symbolizes healthy profits over a longer period. Preservation of consumables can be done by many ways and in food- stuffs, thermal treatment in conjunction with sugar addition is the most acceptable means to preserve the milk based indigenous sweets. Several other methods like drying e.g. freeze drying [55] (Nkama *et al.* 2010), vacuum drying (Sunjka *et al.* 2008), reduction in water activity through incorporation of sugar and humectants (Thomas *et al.* 2008), and addition of biopreservatives (Salih *et al.* 1990; Keeffe and Hill 1999) have also been attempted for shelf life enhancement of various products. Different products can be queued in this category are *kalakand*, milk cake, *pera*, *burfi*, *kheer*, *payasam*, etc.

Among various choices of chemical and non-chemical methods available for preservation, preservatives of biological origin known as biopreservatives are gaining importance day after day. Thus, bacteriocins by definition are the proteins containing macromolecules, which exert a bacteriostatic mode of action on susceptible bacteria (Tagg *et al.* 1976). Bactericidal action of bacteriocins attributed to may be due to loss of cellular potassium ions, depolarization of the cytoplasmic membrane of microbial cells, hydrolysis of internal ATP in sensitive cells (Cintas *et al.* 2001), affecting the proton motive force (PMF) dependent processes such as amino acid transport and formation of potassium selective channels by the  $\alpha$  and  $\beta$  peptides in the bacterial membrane (Deegan *et al.* 2006; Eijsink *et al.* 1998; Jack *et al.* 1995).

Various means can be opted for bacteriocins addition, however, direct method where addition of bacteriocin (purified/semi purified) can be done directly in the food product is most acceptable. The utilization of previously fermented product using bacteriocin producing strain in food processing is also a well known practice (Schillinger *et al.* 1996). Various studies using bacteriocins have been undertaken like, nisin, a well known preservative was used at level of 200 IU in *kheer* by Singh *et al.* (1987). Similarly *khoa* and yoghurt have been prepared using nisin at the rate 100-200 IU/g and 85-100 IU/g, respectively (Gupta *et al.* 1989). Rao (1990) reported an initial level of at least 500 IU/g nisin as an essential level for attaining a residual value of around 50 IU/g following thermal processing of in-package sterilized *paneer* at 118°C for 5 minutes. Apart from this, studies on the addition of chemical preservatives such as potassium sorbate have been conducted on *Kalakand* by Suresh and Jha (1994a) and reported an extended shelf life of 24 days over 3 days at 30°C when used at 0.20 % concentration.

Also, nutritionally conventional *doda burfi* contains good amount of fiber in it, but to further enrich the product with dietary fiber, the study was planned in such a manner so that the extent of fairly acceptable level of fiber addition can be made. Fiber not only increases bulk of the food and moves it through the colon more rapidly, but also helps in preventing constipation and possible colon and rectal cancer (Niness 1999; Thompson 2005). Epidemiological studies correlating the high consumption of dietary fiber and lower incidence of certain diseases such as cardiovascular and cancer of colon & rectum, boosted searches on dietary fiber. Several diseases such as diabetes,

arthrosclerosis, breast cancer, diverticulitis, hemorrhoids, have been connected with a low fiber intake (Gutkoski *et al.* 2007) and high risk of obesity (Alfieri *et al.* 1995; Van Itallie 1978). Apart from this, fiber also improves the bulkiness of product and acts as a prebiotic for the growth of essential bacteria.

But addition of such ingredients for shelf life extension and to enhance functionality in any food product requires clear understanding of mechanisms involved in developing desirable quality characteristics, process modification, selection of suitable packaging material and storage characteristics. Though the shelf life of conventional doda burfi is 10-12 days at ambient temperature conditions, which can be marked as good, comparing with other dairy based sweetmeats, but to further enhance its shelf life, addition of biopreservatives was undertaken along with little quantity of chemical preservative to get the desirable results in the ultimate product's shelf life.

## MATERIAL AND METHODS

### Raw materials and ingredients

#### *Milk*

Fresh raw buffalo whole milk was procured from the Experimental Dairy of the National Dairy Research Institute (Karnal), India.

#### *Starter culture*

The mixed *dahi* starter culture NCDC-167 was obtained from the National Collection of Dairy Cultures, NDRI, Karnal. The starter culture was maintained in autoclaved reconstituted skimmed milk by sub-culturing once in fortnight for attaining high activity.

#### *Dietary fibers*

In total five different fibers were tried for preparing value added doda burfi, and based upon the results obtained best two fibers were carried further for final product preparation.

*Diesol*<sup>TM</sup> (*Hydrolyzed gum acacia*) Free sample of hydrolyzed gum acacia (Batch Number 75060) available with a brand name *Diesol*<sup>TM</sup>, was supplied by M/s Drytech processes (I) Pvt. Ltd, India.

*Wheat bran* Wheat bran was availed from M/s S.A. Pharmachem, Chemicals Limited, Mumbai (MH), India.

*Oat fiber* Oat bran (300-33) (Batch Number CA8 259) was procured from M/s S.A. Pharmachem Chemicals Limited, Mumbai (MH), India.

*Microcrystalline cellulose (MCC)* Microcrystalline cellulose (MCC) pure grade 2037 (Batch Number 2037) was procured from M/s Vikaash chemicals, Chennai (TN), India.

*Inulin* Inulin (Batch Number RTDCW8 DCW8) with brand name *Beneo ST* was procured from M/s DPO Food Internationals Pvt. Limited, Mumbai (MH), India.

### **Biopreservatives and additives**

Two biopreservatives viz. Microgard™-100 and pediocin were used in the study former of which was obtained from M/s Danisco India Pvt Ltd., Gurgaon and later was obtained as a gift from Dr. R.K. Malik, Professor, Department of Microbiology, NDRI, Karnal. Chemical additives viz. potassium sorbate and sodium EDTA were procured from SRL chemicals, Mumbai.

Other ingredients such as refined cane sugar and nuts of good quality for garnishing of doda burfi were procured from the local market.

### **Functional doda burfi preparation**

Doda burfi was prepared using the recipe given by Singh and Jha (2006) with little modifications. Germinated wheat flour (GWF), sugar and milk along with a small quantity of NCDC culture 167 were used as basic ingredients in the recipe of doda burfi. Near the end of process development, selected fibers of the study, calcium salt (in soluble form) and biopreservatives like pediocin (0.12%), microgard- 100 (0.5%), along with chemical preservatives such as potassium sorbate (0.1%) and sodium EDTA as chelating agent (20mM) were added in combination to enhance the shelf life of the product. Similarly control samples were prepared without addition of any biopreservative or chemical additive. However, addition of fibers and calcium was also undertaken in control product as well.

### **Packing and storage**

Functional doda burfi was hot filled (temperature about 70°C) directly from kettle in the previously cleaned and greased trays. Disinfected packaging material (using chlorinated water 25 ppm) (multilayer co- extruded nylon film; PE/Tie layer/Nylon/Tie layer/PE) was employed to pack the product under aseptic conditions to prevent post processing contamination. The package is sealed further to provide a close environment to the product and the samples were stored at 30°C. Samples were withdrawn and monitored at predetermined intervals of 3 days and analyzed for different sensory and physico-chemical attributes. The analysis of stored samples was discontinued when the product was declared spoiled by the sensory panel or got contaminated with visible microbial growth. For statistical analysis purposes, data up to 12 days of storage for control samples (control); i.e. prepared without preservative and 27 days of storage for samples prepared with preservative i.e. treated (T), was considered.

### **Physico-chemical analysis**

Different physico-chemical parameters were analyzed using BIS or AOAC standards like moisture (IS: 2785 1964), acidity (AOAC 1975), tyrosine (Hull 1947), HMF (Keeney and Bassette 1959), and free fatty acids (Deeth *et al.* 1975).

pH, was recorded using digital pH meter, LABINDIA pH analyzer using standard buffers of 7.0, 4.0, and 9.2 for calibration purpose.

Dietary fiber estimation was done using dietary fiber kit obtained from M/s Sigma Aldrich Chemicals, U.S.A., which uses a combination of enzymatic and gravimetric methods based on

AOAC (2000). The principle involves gelatinization of samples with heat-stable  $\alpha$ -amylase and enzymatic digestion with protease and amyloglucosidase to remove the protein and starch present in the sample. Ethanol precipitates the soluble dietary fibre. The filtered residue is washed with ethanol and acetone and weighed after drying. Half of the residue is analyzed for protein and the other half for ash. Total dietary fibre is the weight of the residue less the weight of the protein and ash

### Mineral estimation

Calcium analysis was undertaken using AAS in which one gram sample of doda burfi was digested in Kjeldhal tube at very low heat initially by adding 15 mL of tri acid mixture ( $\text{HNO}_3$ :  $\text{HClO}_4$ :  $\text{H}_2\text{SO}_4 = 3:1:1$ ) and at a higher temperature till the content were clear and perchloric acid fumes ceased to come out. The final volume after digestion was made to 25 mL and filtered and through ash free filter paper to remove silicates and other insoluble material. Mineral content in terms of calcium was measured the help of Hitachi Z- 5000 Polarized Zeeman Atomic Absorption Spectrophotometer (AAS) using acetylene as fuel and air as oxidant. Specific hollow cathode lamp was used to determination of three elements.

In the estimation of calcium, the elements such as aluminum, beryllium, phosphorous, silicon, titanium and mineral acids are known to mask the response of calcium in air acetylene flame. Therefore, strontium as strontium chloride was added as a damasking agent in the process of dilution of acid extract so that a concentration of 0.2 per cent strontium was achieved in the sample as well as in the standards as recommended in the AAS manual.

### Sensory analysis

Male panelists (n=5) and female panelists (n=2) between the ages of 30 to 55 years participated in this study and provided informed consent. For better acceptance of the results at wider scale, 9-point hedonic scale was used for the sensory evaluation of the product. Five different attributes namely, color and appearance, body and texture, sweetness, flavor and overall acceptability were observed for sensory evaluation.

### Microbiological assay

Stored burfi samples were examined for total plate count, yeast and mould and coliform count as per the standard methods (IS: SP XI 1981). Sample for microbial assay was drawn aseptically to obtain error free results and stringent control over conditions was maintained during storage period.

### Statistical analysis

The results obtained in the present study were subjected to two way analysis of variance (ANOVA) using MS-Excel software (V-2007) (Microsoft Corporation (I) Pvt. Ltd., Gurgaon, India). Significance was established at 95 percent confidence interval. To compare the two class means at a time, critical difference (C.D), also called least significant difference (LSD) and Duncan's multiple range test (DMRT) were applied. In the present study, LSD was calculated as per the method described by Rangaswamy (1995).

## RESULT AND DISCUSSION

### Selection of fiber and optimizing desirable acceptable value

In the earlier phase of this study, several preliminary trials were conducted to choose the best appropriate fibers and to optimize their maximum and minimum levels that could be incorporated in the preparation of value added doda burfi. The basic ingredients of doda burfi constitute as-germinated wheat flour (GWF), milk, and sugar wherein GWF is the source of dietary fiber to the product. To further fortify the product with dietary fiber, minimum values were decided keeping in mind so as to reach at a point where the product could be labeled as “fortified with dietary fibers”. The maximum and minimum range for various fibers except Diesol™ (hydrolyzed gum acacia) were taken as 5% and 2.5 per cent, respectively whereas the minimum and maximum limits for Diesol™ were came out as 0.5 and 0.75 per cent, respectively. Diesol™ was used at lower range comparative to other fibers owing to its high soluble fiber content and consequent more retention ability of moisture content in the final product. High amount of soluble fiber disintegrated the distinctive texture of doda burfi and was observed during preliminary trials. Hence, the values were chosen in a manner to meet the specific requirements of the product. To evaluate the performance of these fibers, fibers were added individually at above said rates and the samples prepared thereof, were evaluated sensorily by trained panelists. Results of the sensory evaluation have been shown in the comparative form in Table 1. As the literature pertaining to doda burfi is scanty, wherever it is possible the results are compared with other sweetmeats or dairy based products. The overall acceptability results of MCC, wheat fiber and inulin revealed that product prepared using these fibers secured almost comparable sensory scores, whereas the maximum acceptable scores were fetched by oat fiber (2.5%) and Diesol™ (0.75%), when used at specific concentration. It can be observed that sweetness scores decreased in all cases when fiber was added at higher rate. However, the reverse was found in case of Diesol™ wherein high sweetness scores were obtained at higher values of fiber addition. This can be due to the lesser percentage of the fiber used in the product preparation, which did not hinder with the perceivable intensity of sweetness in the product. Similar trend was observed for overall acceptability with decreased acceptability with increasing ratios of fiber addition. Comparable results were recorded by Hashim *et al.* (2009) in yoghurt, when tested fibers (date fiber and wheat bran) were used beyond 4.5 and 1.5 per cent, respectively.

Based on the results obtained (overall acceptability scores), it can be observed that product prepared with oat fiber and Diesol™ were adjudged best and were used further for the preparation of value added doda burfi. Oat, is well known for its nutritional and functional properties (Tiwari and Cummins 2012) due to the presence of soluble dietary fibers ( $\beta$ -glucan) and contains significant amount of phytochemicals that can exhibit anti-oxidant activity (Panfili *et al.* 2003; Tiwari and Cummins 2009). Considering the health benefits of  $\beta$ -glucans, now a day's researches has been focused on increasing the  $\beta$ -glucan content of commonly consumed food and food products (Brennan and Cleary 2005). Various studies using oat fiber as an active ingredient for improving the functional properties of the food have been carried out in products like bread (Flander *et al.* 2006), poori (Yadav and Rajan 2011), chapatti (Yadav *et al.* 2010) and pasta (Kaur *et al.* 2011). However, studies pertaining to the effect of hydrolyzed gum acacia are yet to be

reported. Apart from various functional properties, oat fibre has also been reported as a fat replacer in a study conducted by (Pintero *et al.* 2008) in low-fat beef patties. Thus, addition of oat fiber hold a promising option for preparation of value added doda burfi in reducing amount of pure fat addition conventionally applicable to product preparation.

### Composition of functional doda burfi

The selected fibers with their respective range were used for the preparation of functional product and the gross composition of doda burfi depicted moisture content, fat, protein, total sugars, ash, acidity and total dietary fiber (TDF) as 15.28, 18.0, 15.0, 25.27, 2.43, 1.15 and 17.0 per cent respectively, with remaining refers to the carbohydrates. It could be observed that finished product had composition almost similar to the conventional *doda burfi* available in market (Chawla *et al.* 2015), except for the per cent dietary fiber, which was found higher in case of fiber fortified doda burfi having a water activity of 0.76 (Table 2).

### Changes in physico-chemical parameters during storage

The changes occurred during storage in chemical composition of *doda burfi* prepared using a combination of biopreservatives and chemical additives is shown in Figure 1. During storage, loss of moisture content from both the samples was expected and both the samples showed a significant decreasing behaviour in moisture content where values dropped from an initial value of 18.5 per cent to 13.95 and 15.1 per cent after 27 and 12 days in treated and control product, respectively. Statistically, the decreasing moisture content was found significant ( $p \leq 0.01$ ). Similar trend of decreasing moisture content was also observed in different products such as *pinni*, carrot milk cake, *burfi* and *kalakand* by Saxena *et al.* 1996; Bajwa *et al.* 2005; Palit and Pal 2005; and Rao and Goyal (2007). Similar trend of decreased moisture content during storage was observed by Jha *et al.* (2014), in *lal peda*. However, the loss was rapid in control sample compared to the treated sample. This could possibly be due to the effect of added chemical additive especially EDTA in the treated *burfi* which had acted as a humectant and thereby made the free water unavailable for easy escape from the product. Loss in moisture content during storage even occurs in vacuum packaging, though at a slower pace and the same was observed by Verma *et al.* (2007) in *paneer tikka*.

pH of fresh doda burfi samples showed a gradual but statistically significant decreasing trend ( $p \leq 0.01$ ) (Table 4) in both the stored samples. The final pH of treated burfi decreased from 5.77 to 5.0 in 27 days whereas control sample showed a final pH of 5.37 at the end of 12 days. Similar decrease in pH observations were recorded by Suresh and Jha (1994 b) in case of *Kalakand* and Pandey and Singh (2010) in soy containing chocolate. The decrease in pH might be due to lactic acid production by spoilage organisms (Daifas *et al.* 1999). Reverse with the pH, acidity increased from 1.18 per cent to 1.89 per cent after 27 days while in control sample 1.46 per cent acidity was recorded (Fig. 1). It could be observed that combination of biopreservatives and chemical additives had significant effect ( $p < 0.01$ ) on the acidity of doda burfi (Table 4) during storage. Similar observations for acidity and pH, were recorded by Londhe (2006), Suresh and Jha (1994<sub>b</sub>) and Prabha (2006), in traditional sweetmeats like *Peda*, *Kalakand* and dietetic *burfi*, respectively.

Indigenous proteases in milk along with microbial proteases degrade native proteins of food and lead to release of free amino acids like tyrosine, producing bitter taste in dairy products. The degree of proteolysis was also assessed during storage in the terms of tyrosine value which showed a statistically significant increasing trend ( $p < 0.01$ ) and value rose to 102.12 mg/100g after 12 days and 173.19 mg/100g after 27 days of storage from initial value of 10.35 mg/100g, in control and treated product. The results are in agreement with earlier work performed on *Khoa* by Patel (1985), *Kalakand* by Suresh and Jha (1994 b), *Burfi* by Prabha (2006) and Kesenkas *et al.* (2011) in Kefir. Effect of proteolysis can also be observed even under gas packaging (Alam and Goyal, 2006), who observed proteolysis in case of cheese samples packed and stored under 100% CO<sub>2</sub>. However, in *doda burfi* the effect of treatment on tyrosine value was not found significant (Table 4).

Hydroxy methyl furfural (HMF), an indicator of maillard type browning reaction is accelerated in dairy products during storage of heated milk products especially at elevated temperatures and results in poor palatability, diminished physical appeal and losses in nutritive value of the product. A highly significant ( $p < 0.01$ ) increase in HMF content of *doda burfi* samples was recorded during storage and values increased from an initial content of 9.34  $\mu\text{moles}/100\text{ gm}$  of TS to 23.96 micro moles/100 gm after a storage period of 12 days in control sample whereas the treated product showed an average value of 33.30  $\mu\text{moles}/100\text{ gm}$  on 27<sup>th</sup> day (Fig. 1). Increase in HMF content of various dairy based delicacies like *burfi*, *peda* and *rasogolla* during storage has also been reported by earlier workers (Reddy 1985; Kumar *et al.* 1997; Chavan *et al.* 2010). Drastic increase in HMF value was also reported by Duru *et al.* (2011) in nectar. Similarly, increase in FFA value was observed in freshly prepared *doda burfi* samples where on '0' day, the recorded value of 4.29  $\mu\text{eq/g}$  gradually shoot to 9.18  $\mu\text{eq/g}$  after a period of 12 days of storage at 30°C whereas in treated product a value of 12.83  $\mu\text{eq/g}$  was observed after 27 days storage period. The values recorded were quite comparable with the ones recorded by Prabha (2006) in *burfi* and Itagi *et al.* (2011) in multigrain *halwa* mixes. Effect of different storage temperatures on increasing FFA and peroxide value has also been reported by Tiwari *et al.* (2011) in snack products.

### Changes in sensory scores during storage

Changes in the sensory scores of *doda burfi* during storage have been presented in Figure 2. The average colour score of freshly prepared *burfi* was 7.67. During storage the sample became dark with advancement of storage period and it resulted in a steady and little decrease in sensory scores. Finally the score reached to 7.25 and 6.60 after 12 and 27 days of storage of *doda burfi* kept at 30°C. Progressive dark colour in the product can be attributed to the loss of moisture content and is also notified with increase in HMF value. The sensory analysis was terminated once the surface growth appeared over the product. The decrease in colour score during storage intervals was found statistically significant at ( $p < 0.01$ ). Decrease in colour scores was also observed during storage of chocolate by Pandey and Singh (2011). Also, findings for decrease in colour values also occur instrumentally and were noted down by Olivera *et al.* (2013) in beef during storage.

With advancing storage period, both the samples exhibited a steady but statistically significant decrease in body and texture scores. The stored samples progressively became brittle and showed



decrease in cohesiveness. The decrease in body and texture score of samples was observed in both the samples but the trend was much progressive in control product. Similar observations with respect to decrease in texture scores were observed in multigrain *halwa* mixes kept at ambient and elevated temperature conditions (Itagi *et al.* 2011). The difference between scores for both the samples were found statistically significant during storage as well as the treatment applied ( $p < 0.05$ ) (Table 4). Similarly, decreasing trend of flavor was observed with due course of time and the declining trend was faster in the control product (Fig. 2). Highly significant changes ( $p < 0.01$ ) were observed in flavour during storage intervals. The decrease in flavour may be attributed to slight loss in freshness, which is inherent with any food product. Similar observations w.r.t flavor degradation was recorded on stored *kalakand* by Rao and Goyal (2007).

The overall acceptability of stored samples depends upon several factors like degree of proteolysis, lipolysis, flavour changes and microbial activity. The overall acceptability score declined from 7.25 to 6.42 in treated *doda burfi* after 27 days whereas the control product showed decrease in scores from an initial value to 6.37 after 12 days. Also, in control *burfi*, the rate of reaction appeared to be very fast at 30° C whereas the same product survived well for 27 days without any sign of spoilage when treatment was given. Hence the results corroborates with the expected findings of this research. During storage intervals overall acceptability showed a significant ( $p < 0.01$ ) declining trend in *doda burfi*. Similar observations were recorded by Sharma *et al.* (2011) in apricot bar.

#### **Microbiology of biopreserved *doda burfi***

Microbiology of the stored product showed an increase in standard plate count (SPC), coliform & yeast and mould count during storage. Initially, on '0' day, no microbial growth was observed in terms of standard plate count and yeast and mould count. However, the count increased during the entire storage period irrespective of the treatment applied. During storage, the SPC increased from "nil" count to 3.36 log cfu/g after 12 days in control sample and to 3.63 log cfu/g after 27 days of storage in treated samples (Table 3). The data revealed that treated product could remarkably retard the rate of microbial proliferation. However, the effect was not found statistically significant during storage. The recorded results are in concord with the finding of Palit and Pal (2005) for *burfi*, Prabha (2006) for dietetic *burfi*, and Londhe (2006) for *peda*. Increase in SPC of *burfi* samples during storage had been also reported by several other workers (Sachdeva 1980; Bhatele 1983; Reddy 1985; Mandokhot and Garg 1985; Mishra and Kuila 1988) in various other products as well. However, Kumar *et al.* (1997) did not observe any microbial growth in *peda* packaged under modified atmosphere packaging (MAP).

Yeast and mould growth is one of the main factor of spoilage of the milk based sweets thus limits the shelf-life of major sweetmeats due to high sugar content and low water activity requirement. In the present investigation, no mould or yeast count was detected in the stored samples of *doda burfi* during earlier days of storage at 30°C. But after 9 days, the presence of yeast and moulds were encountered and spoilage of the product can be entirely considered due to growth of yeast and mould count. At the end of storage studies, control and treated samples showed an average increase in count from initial "nil" count to 2.39 and 2.50 log cfu/g after 12 and 27 days,

respectively (Table 3). Results are in agreement with the earlier finding of Palit and Pal (2005), Rajarajan *et al.* (2006) and Kumbhar *et al.* (2009). Statistically count had a non-significant effect with respect to storage and treatment applied (Table 4). Coliform count, an indicator of hygienic conditions maintained during processing and packaging of a product, were remained absent in fresh as well as stored samples irrespective of treatment applied

## CONCLUSION

Considering the recent trend of consumers towards value added foods and food with natural preservatives, doda burfi was prepared with oat and Diesol™ incorporated as soluble fibers. For long term preservation of such value added commodities, various anti-microbial systems residing in milk with anti microbial substances elaborated by LAB could be successfully utilized for preservation of variety of food products including sweetmeats. But the inherent narrow spectrum of these antimicrobials puts demand to use these in combination with certain chemical additives. Adoption of such techniques could be used to enhance shelf life of various products including doda burfi where storage period could be extended upto more than twice than conventional product even at ambient temperature. Combination of biopreservatives along with certain additives remarkably increased the shelf life by decreasing rates of various ongoing reaction systems within the food matrix.

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