Effect of cardamom powder and rosemary extract on textural, sensory, microbiological and colour properties of *pinni* during storage

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Abstract: *Pinni* is an immensely popular milk cereal based composite sweet having dark brown colour with granular texture. The shelf life of *pinni* was studied by using natural preservatives i.e., cardamom powder and rosemary extract. Two packaging techniques viz., cardboard boxes and polystyrene tray were compared for sensory, textural, microbiological and colour quality of *pinni* during storage for 21 days and 28 days respectively at 30±1°C. The extent of loss of most sensory attributes was rapid in control samples packed in both packaging materials as compared to cardamom and rosemary extract added *pinni* samples. Based on the results obtained in the study it was concluded that *pinni* could be best preserved up to 28 days at room temperature (30±1°C) without appreciable quality loss and should be packed in polystyrene trays with rosemary extract and have shelf life 14 days more than control sample.

Keywords: Cardamom, Pinni, Rosemary extract, Shelf-life

Introduction

Conversion of raw milk into a wide variety of milk products has been practiced in our country since time immemorial. Amongst various categories of Indian milk based sweets available, heat desiccated variants presents a pleasing and healthful variety of

products compared to others because whole milk is used for producing those products. India has the largest repository of such products and out of them *pinni* is an immensely popular traditional milk-cereal based sweet of Northern states of India mainly Punjab, Haryana and Delhi. The product is a rich source of nutrients derived from milk solids as well as goodness of wheat or gram flour, nuts, dry fruits etc. It is also a concentrated source of fat, protein, minerals and energy. Considering its high nutritive value, traditionally *pinni* is considered as an ideal food for young ones in their grow-ing stage, pregnant and lactating women (Talwar and Brar, 2015).

Milk products undergo changes during storage, showing adverse effects on quality, ranging from minor sensory defects to complete spoilage (Kotsianis et al. 2002). Several physico-chemical and microbiological changes may take place making them unfit for human consumption. Food products, especially dairy products prepared under strict hygienic conditions are likely to be spoiled quickly if they are not stored properly. Like other milk products *pinni* also has limited shelf life about 10 days packed in high density polythene pouches, (Saxena et al. 1996). Because of its high fat content and non-acidic nature, spoilage in *pinni* is mostly caused by growth of surface yeasts and moulds and manifests as fermentative and acidic as well as rancid odour also observed during storage. This is a recurrent problem in humid and warm atmospheric conditions that are prevalent in tropics.

With the increasing demand of cheap, non-toxic and natural food preservatives globally, it was possible to extend the shelf life of many perishable and non-perishable foods by using cardamom and rosemary extract (Jessica et al. 2015). However, commercial application of cardamom and rosemary extract for Indian milk products is still at a nascent stage. Several studies have been reported to extend the shelf life of different food products using cardamom; Palit and Pal (2005) observed that vacuum packaging and addition of cardamom and potassium sorbate, each at the rate of 0.1% of *khoa* (w/w) increased the shelf life of *burfi* upto 60 days at 30±1°C. Prasad et al. (2017a) reported that the flavour score of cardamom added *burfi* was not significantly ($p>0.05$) different from that of control *burfi*. Cardamom incorporated yoghurt (Vijaylakhshmi et al. 2014) and rosemary extract (RME) enriched ghee showed significantly higher anti-oxidant activity.

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The presence of antioxidants reduces oxidative changes of fats and enhances shelf-life. Quality and properties of packaging material affects shelf life of a food product. Several studies have been reported on increased shelf-life of traditional dairy products using spices and herbs (Londhe et al. 2012 and Ghayal et al. 2015). Sweets like *kalakand*, milk-cake and other sweets have been packaged in paper cartons or duplex board boxes as reported by Goyal and Rajoriha (1991) to enhance shelf life. The present study was conducted to study the effect of two natural preservatives *i.e.*, cardamom powder and rosemary extract on physico-chemical, sensory and microbiological attributes of *pinni* packed in two different packaging materials *viz.*, cardboard boxes and polystyrene trays.

Materials and Methods

Raw materials

Freshly pooled buffalo milk obtained from NDRI Karnal Cattle Yard, was standardized to 6.0% fat and 9.0% SNF. Food grade cane sugar (sucrose) and cardamom powder were obtained from the local market. Wheat flour of Aashirvad brand was procured from local market; it contained 11.8 % protein, 1.7% fat and 75.1 % carbohydrate. Ghee prepared from buffalo milk was procured from the Experimental Dairy of the Institute and it contained 99.5% fat and 0.5 % moisture. Free sample of rosemary extract was supplied by M/s Zakini Biotech private limited (Chamrajnagar, Karnataka, India).

Preparation of *khoa*

Khoa samples were prepared from buffalo milk using the method of Bhatele (1983) with some modification such as open double jacketed stainless-steel kettle at a steam pressure of 2 kg/cm² instead of a *karahi* over a brisk non - smoky fire.

Preparation and compositional analyses of *pinni*

A batch of approximately 2 kg of *pinni* was prepared in triplicate for each experiment. Ghee (540 g) was taken in a heavy bottom pan then heated to 90°C and wheat flour (682 g) was added. Roasting of wheat flour was done at 90°C till typical roasted flavour and color was developed. The *khoa* (400g) was then added accompanied by continuous stirring to break the large lumps into small granules. Roasting was continued and sugar (360 g) was added and stirred to properly mix the ingredients. After this stage heating was discontinued and the mixture was allowed to cool to room temperature (30°C). Cardamom powder was added @ 2.5 % (of *pinni*) and rosemary extract 200 mg and then using a hand operated cylindrical mould the product was moulded into 25 g cylinders each. The proximate composition of the *pinni* in terms of moisture (IS: SP: Part 18 XI, 1981), fat (IS, 1981), protein (Meneffee & Overman, 1940), sucrose (IS: SP: Part 18 XI, 1981) and ash IS: SP:18 (Part XI, 1981) was estimated.

Packaging of *pinni*

Packaging materials for *pinni* *i.e.* cardboard boxes of 15 x 12 x 15 (L x B x H) cm were procured from the local market of Karnal, Haryana and Polystyrene (PS) trays (thickness: 1.50 mm; WVTR: 1.96 g/m² - 24 h; OTR: 26 mL/m² - 24 h) were procured from M/s Elixir Technologies, Bangalore. Trays were sealed with Polyamide-Polyethylene films.

Sensory evaluation

Sensory evaluation of fresh and stored samples of *pinni* was carried out in terms of flavor, body and texture and colour and appearance using a 9-point Hedonic scale. Seven members of semi-trained sensory evaluation panelists constituted from the faculty of Dairy Technology Division, National Dairy Research Institute, Karnal performed the sensory evaluation. Panel members carried out sensory evaluation in individual booths where an intact piece of *pinni* (tempered to 15°C) was presented with random three-digit codes in closed glass containers. Samples were served monadically with de-ionized water. Each panelist offered independent observation on randomized samples of *pinni*.

Colour measurement

Colour measurements were conducted as described by Nalwade et al. (2014) using Color Flex (Hunter Associates Laboratory, Inc., Reston VA, USA) colour measurement system equipped with dual beam xenon flash lamp and universal software. The instrument was calibrated prior to sample measurements with standard black, white and green tile as prescribed by the supplier. The results were represented by the Hunter L*, a*, b* notation.

Texture Profile Analysis (TPA)

Stable Micro System Texture Analyser, Model No: - TAXT2i; as described in Khamrui and Solanki (2010) fitted with a 25 kg load cell was used to measure the textural attributes of cylindrical samples of *pinni* measuring 15mm height and 20mm diameter. Samples tempered to 25°C were compressed to 70% of their initial height using an aluminium 75mm diameter compression plate (P-75), maximum force exerted by the sample, *i.e.*, the peak of the force-time curve was measured as hardness (N) and fracturability is a force at the first significant break at the TPA curve. The texture analyzer settings that were employed to determine the textural attributes were; program: return to start, load cell: 25 kg, probe type: P-75 compression plate; pre-test, test, and post-test speed: 2 mm/s trigger type: auto, trigger force: 5 g, threshold: 50 g, time: 2 S data acquisition rate: 250 pps. This measurement was performed in triplicate on the three random samples of a batch.

Statistical analysis

The data generated from present study was analyzed using ANOVA for determining difference in mean using SAS ver. 5.3

(SAS Institute Inc., Cary, NC). Wherever, required in the study, the overall mean and standard error of the data was calculated.

Results and Discussion

The proximate composition of the *pinni* was found to be moisture $5.2\% \pm 0.34$ fat $36.74\% \pm 0.33$, protein $9.13\% \pm 0.5$, sucrose $40.67\% \pm 0.45$ and ash $1\% \pm 0.5$.

Changes in sensory quality of *pinni* during storage

The sensory scores showed a decreasing trend during storage in all samples of *pinni* irrespective of packaging techniques (Fig. 1). Significant ($p < 0.05$) effect of addition of cardamom and rosemary was noticed on flavour score of *pinni* in both the packaging materials at 30°C . Maximum score was recorded in rosemary added and polystyrene tray packed samples since PS has better moisture and oxygen barrier properties. In present study *pinni* was criticized for lack of freshness at the end of storage period of 28 days. Similar observations with respect to flavour degradation were reported for *doda burfi* by Chawla et al. 2015b. During storage of *pinni* in cardboard boxes and polystyrene trays at $30 \pm 1^\circ\text{C}$ significant ($p < 0.05$) decrease in body and texture score was observed. (Fig. 1). The stored samples progressively became brittle and showed decrease in cohesiveness. Londhe et al. (2012) reported rapid reduction in body texture score for control samples of brown *peda* at 30°C as compared to vacuum packed samples which were acceptable upto 40 days. Decreasing trend in colour and appearance score was observed in case of control, cardamom and rosemary extract added *pinni* samples respectively (Fig. 1). Different treatments showed significant ($p < 0.05$) effect on colour and appearance score of *pinni* in both the packaging materials at any particular storage interval. Probable reason for reduction in colour and appearance score could be due to change in surface appearance of *pinni* caused by loss of moisture from surface and darkening of samples with progress of storage period. Decrease in colour scores was also observed during storage of brown *peda* by Londhe et al. (2012). During storage of *pinni* in cardboard boxes as well as in PS trays at $30 \pm 1^\circ\text{C}$ significant ($p < 0.05$) decrease in sweetness score was recorded except in rosemary added samples in both the packaging material. Addition of rosemary extract and cardamom had significant ($p < 0.05$) effect on overall acceptability score of *pinni* samples packed in both the packaging materials. The reduction in overall acceptability score of *pinni* was possibly due to formation of stale flavour, and increased brittleness with storage. Controlled samples stored at 30°C were found to have mould growth after 14 days of storage in both packaging materials which resulted in reduced acceptability. However, cardamom added samples were found to have mould growth after 21 days of storage in both packaging materials and rosemary added *pinni* samples have shelf life 21 days in cardboard boxes and 28 days in PS trays that results indicated antioxidant effects of rosemary. Despite decreasing trend, the samples were found to score well

over the minimum acceptable limit (*i.e.*, a score of 7). The overall acceptability of *doda burfi* was reported to decrease and caused dark colour formation with storage (Chawla et al. 2015b). These results are in agreement with the finding of Prabha (2006) and Londhe (2006). These changes in sensory scores during storage are reflection of the predominant flavour reduction of *pinni*, with increased staleness as storage preceded, and followed by deteriorating colour and appearance and body and texture due to drying, dark colour formation and brittle texture development of the product.

Textural changes of *pinni* during storage

The changes in textural quality of *pinni* in terms of texture profile analysis (TPA) during storage packaged under different packaging conditions are given in Fig. 2. In the present study, a gradual increase in hardness in all *pinni* samples irrespective of the packaging material was observed, which could be attributed to the decrease in moisture content in the product (data not reported) This result was in accordance with the earlier findings of Saxena et al. (1996) who reported that increase in hardness of *pinni* with increase of storage period. While some worker likes Jha et al. (2014b), Gupta et al. (1990) and Suresh et al. (1994), found that increase of hardness of *khoa* correlates with the increase in the total solid content and that the moisture content of *peda* had direct relationship with hardness of the product.

Fracturability of fresh *pinni* decreased significantly ($p < 0.05$) in both packaging materials. In general, as the moisture content increased (data not reported) fracturability of *pinni* indicating that the samples having higher moisture content was softer, hence broke on application of lower amount of force. Springiness refers to a food's ability to return to its original form after compression. It is the height that the sample recovers between the first and second compression. Cohesiveness is the ratio of area under the second bite curve before reversal of compression to that under the first bite curve. It is the measure of the extent to which the food structure is disrupted during the first compression (Bourne, 2002). Cohesiveness value of fresh *pinni* decreased non-significantly ($p > 0.05$) in both packaging material (Fig. 2).

Gumminess is related to the primary parameters such as hardness and cohesiveness. Gumminess of freshly prepared *pinni* increased non-significantly ($p > 0.05$) at the end of storage period in both packaging materials. Gumminess of *pinni* showed a trend similar to one noticed for hardness and cohesiveness the former being a secondary parameter based on hardness. Gumminess of brown *peda* (12.56 N) increased to 20.51N after 40 days in vacuum packaging (Londhe et al.2012). Chewiness refers to the energy required to masticate food into a state ready for swallowing and is the product of gumminess and springiness. Chewiness value of *pinni* increased significantly ($p < 0.05$) in both packaging materials. Chewiness of fresh cow, buffalo and mixed milk *rasogolla* was reported to be 28.70, 73.70 and 34.50 N by Adhikari

Fig. 1 Effect of natural preservatives and packaging techniques on sensory attributes of *pinni* during storage at $30 \pm 1^\circ\text{C}$ (A: Flavour, B: Body & Texture Score, C: Colour & Appearance Score and D: Overall acceptability)

(Control sample, Cardamom added and Rosemary added *pinni* sample

Fig. 2 Effect of natural preservatives and packaging techniques on textural parameters of *pinni* during storage at $30\pm 1^\circ\text{C}$ (A: Hardness; B: Fracturability; C: Cohesiveness; D: Gumminess; E: Chewiness) (◆ Control sample, ■ Cardamom added and ▲ Rosemary added *pinni* sample)

Fig. 3 Effect of natural preservatives and packaging techniques on colour attributes of *pinni* during storage at $30\pm1^{\circ}\text{C}$ (A: L* value; B: a* value; C: b* value) (◆ Control sample, ■ Cardamom added and ▲ Rosemary added *pinni* sample)

Fig. 4 Effect of natural preservatives and packaging techniques on microbiological parameters of *pinni* during storage at $30\pm 1^{\circ}\text{C}$ (A: Total standard plate count; B: Total yeast mould count) (◆ Control sample, ■ Cardamom added and ▲ Rosemary added *pinni* sample)

et al. (1992a). Khamrui and Solanki (2010) reported increase in chewiness of *sandesh* during storage. As because cardamom and rosemary extract added in ppm levels their addition had no effect on any of the textural attributes of *pinni* in both the packaging materials.

Changes in colour attributes of *pinni* during storage

Colour of any food product assumes a great significance from consumers' acceptance point of view. Changes in L^* value of *pinni* packed in cardboard boxes and PS trays store at $30\pm 1^{\circ}\text{C}$ is presented in Fig. 3. The average L^* value of control and cardamom added *pinni* samples decreased significantly ($p<0.05$) in cardboard boxes after 21 days and in rosemary added *pinni* samples PS tray packed samples after 28 days. Gothwal and Shukla (1995) reported the effect of refined wheat flour and sugar on the browning of

khoa-based sweets such as *burfi* and *kalakand*. The average a^* value of rosemary added *pinni* samples increased significantly ($p<0.05$) in cardboard boxes after 21 days and significantly ($p<0.05$) decreased after 28 days when *pinni* packed in PS trays Prasad et al. (2017b) also observed increased redness value of control and herbal *burfi* during storage at $37\pm 1^{\circ}\text{C}$ and $4\pm 1^{\circ}\text{C}$ when packed in cardboard and high-density polyethylene (HDPE) boxes. Samples packaged in PS trays had significant ($p<0.05$) increase in b^* value after 28 days of storage in case of rosemary added *pinni* samples and 21 days in case of cardamom added *pinni* samples. Londhe et al. (2012) reported increase in b^* value of *peda* when packaged in cardboard boxes and found decrease in the b^* value of samples packed in vacuum packed 5-layer nylon from initial value of 34.28 to 33.48 after 40 days of storage.

Microbiological changes in *pinni* during storage

The microbiological changes in *pinni* packaged under different packaging conditions during storage are given in Fig. 4. During storage all the samples showed an increasing trend in standard plate count in both the packaging materials. Total plate counts were significantly higher in control product than cardamom and rosemary added *pinni* samples indicating preservation effect of cardamom and rosemary extract. Increase in SPC of *burfi* and brown *peda* during storage had been reported by earlier workers (Reddy, 1992; Londhe 2006). However, Kumar and Srinivasan, (2010) did not observe any microbial growth in *peda* packed under MAP and with oxygen scavengers. Yeasts and moulds in fresh *pinni* were not detected during initial period of storage however it significantly ($p < 0.05$) increased controlled *pinni* samples after 14 days of stored at $30 \pm 1^\circ\text{C}$ in both packaging materials (Fig 4). Lower extent of increase in yeast and mould count in PS trays was probably due to higher barrier properties of polystyrene tray as compared to cardboard boxes. Results are in agreement with the earlier finding of Palit and Pal (2005) and Rajarajan and Lango, (2006). Germicidal effect of cardamom has also been reported by Gaikwad and Hembade (2012) in *Ujani Basundi*.

Conclusions

The present study attempted for enhancement of shelf life of *pinni* by adding two natural preservatives viz., cardamom powder and rosemary extract and by using different packaging interventions. It was observed that control samples of *pinni* were organoleptically unacceptable after 14 days in both the packaging materials when stored at 30°C . However, cardamom powder added *pinni* samples have a shelf life 21 days when packed in cardboard boxes as well as when packed PS trays. Total plate counts and yeast and mould counts were significantly higher in control sample than cardamom and rosemary extract added *pinni* samples indicating preservation effect of cardamom and rosemary extract. *Pinni* could be best preserved up to 28 days at room temperature ($30 \pm 1^\circ\text{C}$) without much quality loss when packed in polystyrene trays and added with rosemary extract.

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References

- Adhikari AK, Mathur ON, Patil GR (1992a) Micro-and macro-structure of cow, buffalo and mixed milk *rasogolla*: a comparative scanning electron and light microscope study. *Le Lait* 72: 475-489
- Bhatele ID (1983) Studies on the production, packaging and preservation of *burfi*. Ph.D Thesis Kurukshetra University, Kurukshetra
- Bourne MC (2002) Texture Profile Analysis. Food Texture and Viscosity, Academic Press London, pp 182-188
- Chawla R, Patil GR, Singh AK (2015a) Effect of temperature on sensory and textural attributes of functional *doda burfi* (Indian milk cake). *J Food Sci Technol* 52: 586-591
- Chawla R, Singh AK, Patil GR (2015b) Shelf life enhancement of functional *doda burfi* (indian milk cake) with bio preservatives application. *Int J Res Sci Technol* 5: 26-40
- De S (2004) Outlines of Dairy Technology. 2nd ed. Oxford University Press, New Delhi
- Gaikwad SM, Hembade AS (2012) Effect of storage temperature on shelf life of standardized buffalo milk basundi. *Int J Livest Prod* 2: 205-211
- Ghayal G, Jha A, Kumar A, Gautam AK, Rasane P (2015) Effect of modified atmospheric packaging on chemical and microbial changes in dietetic *rabri* during storage. *J Food Sci Technol* 52: 1825-1829
- Gothwal PP, Bhavadasan MK (1992) The role of proteins in browning in milk. *Indian J Dairy Sci* 45: 419-423
- Gothwal PP, Shukla IC (1995) Effect of refined wheat flour (maida) and sugar on the browning of milk, *khoa* and *khoa*-based sweets. *J Food Sci Technol* 32 :301-304
- Goyal GK, Rajorhia GS (1991) Role of modern packaging in marketing of Indigenous dairy products. *Indian Food Indu* 10: 32-34
- Gupta SK, Patil GR, Patel AA, Garg FC, Rajorhia GS (1990) Instron texture profile parameters of *khoa* as influenced by composition. *J Food Sci Technol* 27: 209-213
- IS: SP 18 (Part XI) (1981) Handbook of food analysis. Part XI., Dairy Products. Bureau of Indian Standards. Manak Bhavan, New Delhi
- Jha A, Kumar A, Jain P, Gautam AK, Rasane P (2014a) Effect of modified atmosphere packaging on the shelf life of *lal peda*. *J Food Sci Technol* 52: 1068-1074
- Jha A, Kumar A, Jain P, Om H, Singh R, Bunkar DS (2014b) Physico-chemical and sensory changes during the storage of *lal peda*. *J Food Sci Technol* 51: 1173-1178
- Jessica EDLT, Gassara F, Kouassi AP, Brar SK, Belkacemi K (2015) Spice use in food: Properties and benefits. *Crit Rev Food Sci Nutr* 57: 1078-1088
- Khamrui K, Solanki DC (2010) The relationship of textural characteristics with composition of *sandesh* produced from various market milk classes. *Int J Dairy Technol* 63: 451-456
- Kotsianis IS, Giannou V, Tzia C (2002) Production and packaging of bakery products using MAP technology. *Trends Food Sci Technol* 13: 319-324
- Kumar G, Srinivasan MR (2010) Effect of antioxidants on shelf life of *khoa* under refrigerated conditions. *Egyptian J Dairy Sci* 38: 211-218
- Loliger J (1983) Natural antioxidants. In J.C. Allen, and R. J. Hamilton (Eds.). *Rancidity in Foods*, pp. 89-107
- Londhe GK (2006) Development of a process for manufacture and shelf life extension of brown *peda*, PhD Thesis, Dairy Technology Division, National Dairy Research Institute, Deemed University, Karnal, India
- Londhe G, Pal D, Raju PN (2012) Effect of packaging techniques on shelf life of brown *peda*, a milk-based confection. *LWT-Food Sci Tech* 47: 117-125
- Menefee SG, Overman OR (1940) A semimicro-kjeldahl method for the determination of total nitrogen in milk. *J Dairy Sci* 23: 1177-1185
- Mishra AK, Kuila RK (1988) Microbiological quality of *burfi* and *sandesh*. *Asian J Dairy Res* 7: 51-55
- Nalwade V, Puri R, Lodh J, Khamrui K (2014) Instrumental colour profile of dietetic *sandesh* as function of ingredients using response surface methodology. *Indian J Dairy Sci* 67: 467-475

- Palit C, Pal D (2005) Studies on mechanized production and shelf life extension of burfi. *Indian J Dairy Sci* 58: 12-16
- Pandey A, Singh G (2011) Development and storage study of reduced sugar soy containing compound chocolate. *J Food Sci Technol* 48: 76-82
- Peiretti P, Gai F, Ortoffi M, Aigotti R, Medana C (2012) Effects of rosemary oil (*Rosmarinus officinalis*) on the shelf-life of minced rainbow trout (*Oncorhynchus mykiss*) during refrigerated storage. *Foods* 1: 28-39
- Prabha S (2006) Development of Technology for the Manufacture of Dietetic *Burfi*, Ph.D Thesis, ICAR- National Dairy Research Institute, Deemed University, Karnal, India
- Prasad W, Khamrui K, Mandal S, Badola R (2017a) Anti-oxidative, physico-chemical and sensory attributes of *burfi* affected by incorporation of different herbs and its comparison with synthetic anti-oxidant (BHA). *J Food Sci Tech* 54: 3802-3809.
- Prasad W, Khamrui K, Sheshgiri S (2017b) Effect of packaging materials and essential oils on the storage stability of burfi, a dairy dessert. *J Pack Technol Res* 1: 181-192
- Rahila MP, Surendra Nath B, Laxmana Naik N, Pushpadass HA, Manjunatha M, Franklin MEE (2017) Rosemary (*Rosmarinus officinalis* Linn.) extract. A source of natural antioxidants for imparting autoxidative and thermal stability to *ghee*. *J Food Proc Pres* 24: 1445-1451
- Rajarajan N, Kumar, AE Lango (2006) Incidence of yeast and mould in *khoa*. *J Dairy Food Home Sci* 25: 152-154
- Reddy CR, Rajorhia GS (1992) Present status of *peda* and *burfi* technology- a review. *Indian J Dairy Sci* 45: 220-225
- Saxena AK, Kulkarni SG, Berry SK, Sehgal RC, Beerh OP (1996) Preparation, packaging and storage of *pinni*. an Indian traditional sweet. *J Food Sci Technol* 33: 503-505
- Sharma HK, Singhal RS, Kulkarni PR (2003) Effect of modified atmosphere packaging on the keeping quality of malai *peda*. *J Food Sci Technol* 40: 543-545
- Suresh I, Jha YK (1994) Sensory, biochemical and microbiological qualities of *kalakand*. *J Food Sci Technol* 31: 330-332
- Talwar G, Brar SK (2015) Study of physiochemical, sensory and color properties of pinni variants. *Indian J Sci Technol* 8: 629
- Vijaylakhshmi V, Smith SC, Gamlath S (2014) Consumer acceptability and antioxidant potential of probiotic-yogurt with spices. *LWT-Food Sci Technol* 55: 255-262