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Recent innovations in value added khoa based sweets: An opportunity for dairy entrepreneurship: A review

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Abstract

Traditional Dairy Products especially Khoa and Khoa - based sweets like Gulabjamun, Kalajamun, Kalakand and Burfi etc have wide market potential in India, because of its economic and nutritional benefits. This review elaborates the technological development of different varieties of khoa based sweets, quality characteristics and packaging applications for shelf-life extension for the benefit of dairy entrepreneurship.

Keywords: Traditional dairy product, Khoa, Khoa based sweets, Nutritional value, Packaging applications, Shelf life

Introduction

Dairy products are being rich in nutrients contribute more to human health. India is the world's leading producer of milk with a production of 221.06 million tonnes in 2020-21 (DAHDF, 2023) [5]. The Indigenous dairy products are symbol of Indian heritage. Khoa is obtained by heat desiccation of milk, one of the technologies adopted to process the milk and milk products for shelf-life extension which is popular around South Asia and the product is spreading throughout the world. Khoa, otherwise called as khoya, mava, kava and khava, and based on total solids, fat %, the khoa varieties are classified as Pindi, Dhap and Danedar. The sweets like gulabjamun, kalajamun, kalakand, and burfi etc. are prepared from khoa. In India, Khoa is consumed in maximum quantity as compared to other dairy products like cheese and butter. The physico chemical composition, sensory characteristics, and the uses of khoa vary differently (De, 1982^[6] & Aneja *et al.*, 2002) [3]. The production of khoa depends largely in the hands of unorganised dairy sector which follow the traditional method of preparation. This method lacks in uniformity of production in various quality parameters. The upgradation of traditional method of preparation of khoa was carried out by various scientists. Due to wide popularity and demand for khoa and khoa based sweets, the academic and industrial personnel are focussing on to develop new varieties of khoa based sweets with health benefits. Indigenous milk products have not only influenced the people's economic but also social, cultural, nutritional, and religious status. The factors like simple technology and infrastructure, minimal investment, low-cost production and operational overheads, high profit margins and established markets are resulting in enormous production volumes of traditional dairy products.

FSSAI standards of Khoa (2011)

As per FSSR (2011) [7] of India, khoa is prepared from buffalo / cow/ sheep/ goat milk or milk solids or a combination followed by desiccation/ drying. The final product should have milk fat content of more than 30% based on dry weight and citric acid less than 0.1% by weight. It should be free from added sugar, starch, and colouring matter.

Table 1: FSSR 2011 Standards of Khoa

Types	Total solids (minimum)	Milk fat, %, (m/m), dry matter basis	Ash %, (m/m), dry matter basis	Sweets preparation	Aerobic count (cfu/g)	Coliform count (cfu/g)	Yeast and mold (cfu/g)
Pindi	65	37	6.0	Burfi, Peda	Not more than 50000/g (Khoa)	Not more than 90/g (Khoa)	Not more than 250/ g
Dhap	55	37	6.0	Gulabjamun, Kalajamun, Pantooa, carrot halwa			
Danedar	60	37	6.0	Kalakand, milk cake			

Mechanized Processes for Khoa Production

Inclined Scrapped Surface Heat Exchanger (ISSHE), Thin Film Scrapped Surface Heat Exchanger (TSSHE), Membrane Technology, Reverse Osmosis and Roller drying process are employed for mechanized production of khoa. For mechanized production of khoa from roller dryer, following parameters like distance between rollers and scrappers, steam pressure and flow rate were regulated to obtain the required product. The losses were high in the beginning, lacking grainy texture and obtained uneven product during roller drying process. (Singh and Rajorhia 1989) [14]. The scraped surface heat exchanger having a conical vat process was also tried to produce khoa but losses were high in this machine. Contherm-Convap system developed by Alfa-Laval was also utilized to produce khoa having sticky, pasty, burnt particles, and lacking typical khoa flavour with grainy structure, and uniform colour. Here, also milk solids losses were high in the beginning. (Rajorhia *et al.*, 1991) [10]

Quality characteristics of khoa based sweets

Khoa is usually brownish in colour with greasy or granular in texture. The high concentration of lactose is the reason for rich nutty flavour, mildly cooked and sweet taste. The cow milk khoa exhibits moist surface, salty taste with sticky and sandy texture which is not useful for the preparation of sweets and its yield varies from 17-19% which is lower than buffalo milk khoa (21-23%) by weight (De, 1982) [6]. The presence of butyric acid containing triglycerides and liberation of more free fat in buffalo milk fat might be the reason for smooth and mellow texture of khoa (Sindhu, 1996) [15].

In unorganised sector, marketing of khoa often makes it chances for adulteration to increase the profit because of its high price. Gas Chromatography profile of 43% khoa samples had a fatty acids composition not in compliance to that of milk fat (Amrutha Kala, 2012) [2]. In the recent reports, synthetic khoa made of cheaper oils and fats are being sold in the market is utilized for the preparation of khoa-based sweets which causes various health hazards.

The variations in milk fat during the production and storage of khoa were studied in three different periodic times. The extracted fat samples were examined for Reichert–Meissl, (RM) Polenske, saponification, iodine values and butyro-refractometer reading (BR) at 40 °C and free fatty acids (FFAs). Here, FFA content was increased and also observed slight alterations in other physicochemical properties of milk fat during conversion and storage of khoa at room temperature (Amit *et al.*, 2016) [1].

Burfi

The low moisture content and sugar content help to keep the burfi for long periods. There are numerous varieties of burfi like Mawa burfi, Fruit and nut burfi, Cashew burfi, Chocolate burfi and Coconut burfi are available for consumers choice. The shelf life was 15 days (30 °C) and 50 days (5 °C) when the burfi was packed in parchment paper. The antioxidants like propyl gallate and dodecyl gallate added in burfi were helpful to extend the shelf life up to 12 months. When kept in

tins at 30 °C ±10 °C, it had the shelf life up to 150 days. The incorporation of 0.15% anti-fungal agent sorbic acid in burfi and packaged in polyethylene pouches has increased the shelf life for 90 days.

The burfi was prepared with incorporation of pineapple pulp, khoa and sugar. The addition of 10 parts of pineapple pulp showed maximum sensory scores. The higher proportions of added pineapple pulp increased the titratable acidity. The production expenditure was Rs. 120 per kg (Bankar, 2011) [4]. Coconut burfi, popular product in South India, having higher % of saturated fat present in the product leads to hydrolytic rancidity. This might be the reason for increase in free fatty acid content and mold growth which limits its shelf life up to 7–10 days in unpacked condition. In heat processed samples, the shelf life of the product was of 75 days where as it was 15 days for aerobic and 45 days for vacuum-packed samples (Vikas *et al.*, 2010) [16].

The buffalo milk (6% fat) was used for the preparation of khoa. The peels and seeds are separated from required sweet orange fruits and then juice was extracted and the desired amount of sugar was added to manufacture sweet orange Burfi. The slight modification was made as suggested by Golande (2007) [8] for incorporation of these ingredients.

During Mango burfi preparation, the ingredients like khoa (prepared from buffalo milk), mango pulp (15%), sugar (5), turmeric powder (0.15%) on the basis of w/v of milk were added at pat formation stage of khoa making helpful to extend the shelf life of the product up to 6 days at ambient storage temperature (Kadam, 2008) [9].

Burfi was prepared from buffalo milk with sugar (30% by weight of Khoa) and walnut powder (levels 2, 4, 6 and 8% by weight of Khoa). The overall acceptability score was decreased with increased level of walnut powder. From the sensory score and texture quality it was concluded that 2% walnut powder could be successfully incorporated in Burfi for maximum acceptability (Satav *et al.*, 2014) [12].

Peda

Dharwad peda is named from its region of Karnataka State. During preparation of the product, khoa is fried in ghee with sugar which developed brown colour along with sugar crystals on the surface. The factors like low moisture content and high sugar content with ghee frying has helped for longer shelf life than doodh peda. A little quantity of sour milk or curd is added to hot milk while preparing Thirattupal to get granular texture which is popular in Tamil Nadu and Kerala. Lal peda highly browned peda with intense cooked flavour along with cardamom flavour is popular in some places of Eastern Uttar Pradesh and Varanasi. Sugam Dairy, Baroda is the first organised dairy prepared the peda on industrial scale. With the help of continuous khoa making unit, the khoa was prepared (72% of total solids). This was then shifted to a planetary mixer along with sugar @ 30% of khoa, flavouring/colouring ingredients and other additives to prepare the peda mass. It was kept at 4 °C / 10 hours, which is necessary for shaping of peda balls in Rheon machine and followed by wrapping and packaging (Aneja *et al.*, 2002) [3].

Kalakand

Kalakand is prone to enzymatic and microbial spoilage due to its high-water activity. The shelf life is 3-5 days at 30 °C and 15-20 days at 8-10°C. The kalakand wrapped in parchment paper has 21 days of shelf life at 8-9 °C. Kalakand packed in metalized polyester and saran-coated cellophane/ LDPE pouches under vacuum conditions were acceptable up to 50 days at 6-10 °C and 21 days at 30 °C. The addition of 0.2% potassium sorbate in the product when packed in polyethylene bags and then pre-exposed to UV irradiation for 20 minutes was acceptable up to 24 days (30 ± 1 °C) and 15 days (37 ± 1 °C) (Ranganadham *et al.*, 2016)^[11].

Milk Cake

Milk cake is prepared from danedar variety of Khoa. Higher sugar content, lower moisture content, colour variations, stickiness and grainy texture are the parameters that differentiate the milk cake from kalakand. Further, milk cake packed in vegetable parchment lined paper board boxes has shelf life of 15-20 days at room temperature (Ranganadham *et al.*, 2016)^[11].

Gulabjamuns

The NDDB has developed the meat ball forming machine and potato chip fryer to prepare the Gulabjamun from khoa. To manage the khoa shortage and to manufacture Gulabjamun on a commercial scale during summer seasons and festival season, the Central Food Technology Research Institute (CFTRI), Mysore has optimized the technology of instant Gulabjamun mix consists spray dried skimmed milk powder, refined wheat flour, vanaspati, citric acid, tartaric acid, and baking soda. National Dairy Research Institute, Karnal formulated the instant Gulabjamun mix based on roller dried skimmed milk.

The Gulabjamun stored in sugar syrup has shelf life of 5-7 days at ambient temperature. This might be extended to 21days with addition of 0.1% potassium sorbate with hot filling in polystyrene tubs. At room temperature, the shelf life of the product is 6 months when packed under sterilized metal cans. (Aneja *et al.*, 2002)^[3].

Khoa roll

The khoa roll samples were prepared using cocoa powder in the varied range from 0.5 to 3.5% and sugar at 22%. The sensory attributes and physico chemical parameters of the khoa roll samples significantly differed ($p<0.05$) due to the addition of cocoa powder. The product prepared by the addition of 2.5% cocoa powder and 22% sugar in khoa has better sensory scores as compared to other combinations (Shrimanwar and Chavan, 2019)^[13].

Kunda prepared in the Belgaum district of Karnataka has spreaded to other parts of the country due to its popularity. The product characteristics like light brown to dark brown colour, creamy taste, caramelized flavour, and grainy texture with distinct greasy surface might be the reason to start the Kunda production in commercial scale (Aneja *et al.*, 2002)^[3]. Pantooa has originated in the eastern region of India. The method of preparation of pantooa is almost same as of gulabjamun. The dough of pantooa consists of ingredients like khoa, and chhana (each 40%), maida (3%), baking powder (0.3%), arrowroot (3%), suji (3%) and ground sugar (0.6%) are kneaded well to form a smooth dough consisting of 40% moisture. The spherical balls were fried in vanaspati /ghee at 120 °C to reach deep brown colour and then transferred to sugar syrup (60 °C/55° Brix) (Ranganadham *et al.*, 2016)^[11].

Conclusion

Khoa based sweets are different from other sweets due to its rich aroma, pleasant taste, and more shelf life. The organised dairy industries have understood the potential /value addition of khoa based sweets due to its high profit and started manufacturing these products for domestic and export purpose. Now, focus towards unorganised dairies for preparation of khoa based sweets using mechanised way of production for maintaining the uniform quality parameters.

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