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KULFI A TRADITIONAL AND NUTRITIONAL FROZEN DESSERT: A REVIEW

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ABSTRACT

Kulfi is popular Indian frozen dessert; it is produced by concentrating whole milk to about two folds followed by addition of sugar and freezing it in aluminium or plastic moulds, usually of conical shape. There are options of substituting sugar with artificial sweeteners like aspartame, sorbitol and maltodextrin. Addition of nutritive sweetening agents e.g. sugar, dextrose, fructose, liquid glucose, dried liquid glucose, maltodextrin, high maltose corn syrup, honey, fruit and fruit products, eggs and egg products, coffee, cocoa, ginger and nuts give significant improvement to the taste, texture and nutritive value.

Keywords: *kulfi*, milk, freezing, ice cream and frozen dessert

Introduction

This review depicts the current status of our knowledge regarding the technology of *kulfi*, difference between *kulfi* and ice cream, factors affecting on processing and preservation of *kulfi*.

Kulfi is a 500 year old popular frozen dessert (Aneja, 1992) of Indian origin and it occupies a privileged position amongst the traditional Indian dairy products. *Kulfi* is also known as *qulfi*, *kulfa*, *kulphy* etc (Pandit, 2004). The word *kulfi* derives its origin from the Hindustani word *kulaf* meaning a 'lock' or a 'container' that has to be unlocked. And, indeed the recess of the metal cone that encases the frozen delight has to be pried open to release the confection (Aneja, 1992).

Preparation of *kulfi*

Manufacturing practices of *kulfi* reported in literature are scanty (Warner, 1951; Itzerott, 1960; Rao and Ghodeker, 1978; Salooja, 1979; Ghodeker and Rao, 1982; Ashokraju *et al*, 1989). *Kulfi* is usually produced by concentrating whole milk to about 2 folds followed by addition of sugar and freezing it in aluminium or plastic moulds, usually of conical shape, the mixture is suitably heat treated before freezing. The product is characterised with a pleasant agreeable aroma and taste with uniform consistency, free from big sized crystals and coagulated milk particles (Pal, 2006). The freezing of *kulfi* is conventionally carried out by immersion freezing in an ice and salt or liquid brine solution or by extrusion through a freezer with very low overrun. It is generally prepared and sold on a small scale by *halwais* or *kulfiwallahs* and street vendors in earthen container called '*matkas'* the size of which varies from *halwai* to *halwai* (Vani,1990). Ghosh (1991) presented a process flow diagram for preparation of *kulfi* in different market as shown in Fig. 1.1.

The dairy ingredients like Milk fat and MSNF and non-dairy ingredients like sweetness, stabilizers, flavours and other additives for formulation of *kulfi* mix (Yerriswami *et al*. 1983) are determined by regulatory standards and the desired quality of frozen dessert, marketing strategy, consumer demand, relative price and availability of ingredients.

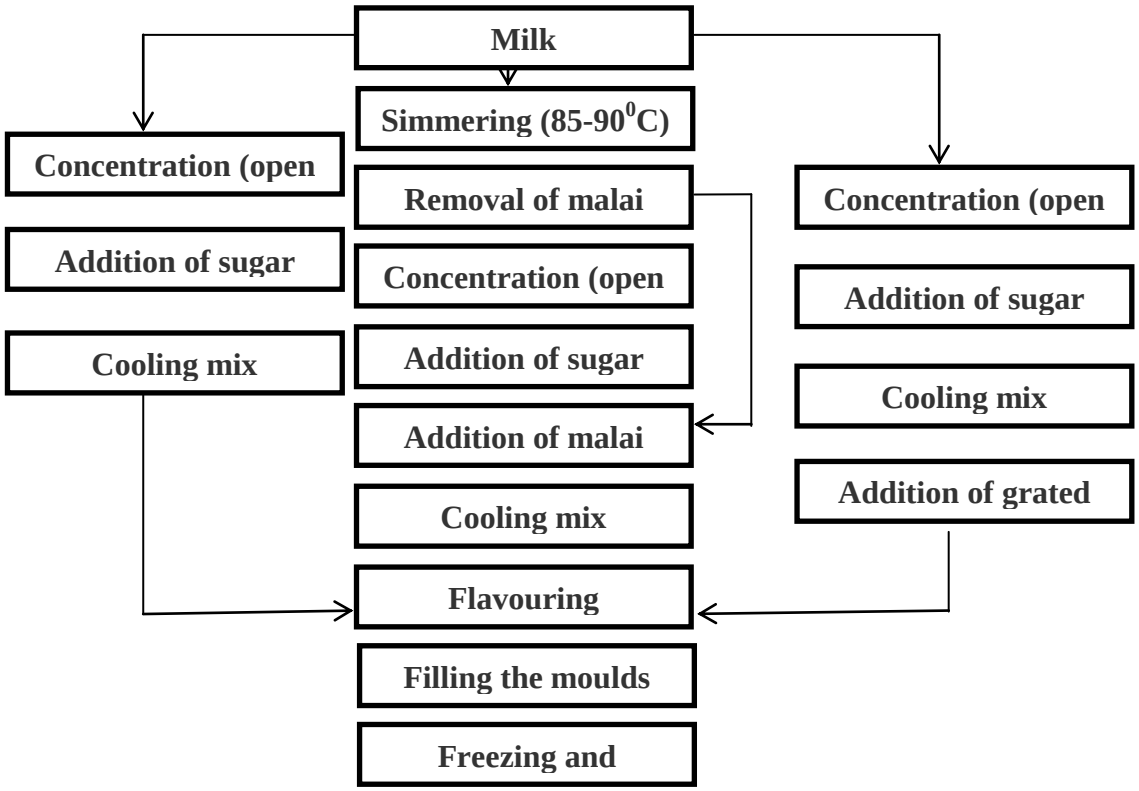

Fig. 1.1 Process flow diagram for preparation of *kulfi* in different market (Ghosh, 1991)

FSSAI Specification for preparations *kulfi* is not evidently revealed but as per PFA specifications: *kulfi* means the product obtained by freezing a pasteurized mix prepared from milk and/or other products derived from milk with the addition of nutritive sweetening agents e.g. sugar, dextrose, fructose, liquid glucose, dried liquid glucose, maltodextrin, high maltose corn syrup, honey, fruit and fruit products, eggs and egg products, coffee, cocoa, ginger and nuts. It may also contain chocolate, and bakery products such as cake, or cookies as a separate layer and/or coating. It may be frozen hard or frozen to a soft consistency. It shall be free from artificial sweeteners. It shall have pleasant taste and smell free from off flavour and rancidity. It shall conform to following requirements (IS 1050: 1983; IS: 10974 (Part 4) 1984; Pal, 2006).

According to BIS specifications (IS 10501: 1983; Dharm Pal, 2006) *kulfi* is frozen product obtained from cow milk or buffalo milk or with combination of both milk or from cream and other milk products, with or without addition of cane sugar, dextrose, liquid glucose or dried liquid glucose, egg, fruit and fruit juices, nuts, chocolate, edible flavours and

food colours. The product shall not contain any added starch. It may contain permitted stabilizers and emulsifiers, not exceeding 0.5 per cent by weight. Colouring matter and flavouring agent as permitted under PFA Rule, 1955 may be added.

Difference between *kulfi* and ice cream

Kulfi, due to its palatability and low price, is very popular in many parts of the country. It is similar to ice cream in formulation and processing, but differs from ice cream in that it contains little or no air (Aneja, 1992). *Kulfi* is also reported to contain higher total solids per unit volume in comparison to ice cream (Naik and Londhe, 2011). PFA had specified different requirements/standards for ice cream and *kulfi* which was later raised to identical specification. *Kulfi* is usally frozen in pack while for ice cream packaging is done post freezing, hence sanitary condition for ice cream, manufacture is more strictly addressed. *Kulfi* posses hard body compared to ice cream which is attributed to the near-nil overrun in the *kulfi* (De, 2006). Reports on involvement of equipment and machinery in manufacture of *kulfi* is minimal (Naik and Londhe, 2011).

Factors responsible for overall quality of *kulfi*

Several factors like quality and quantity of raw materials/components, sanitary care during mix preparation, processing parameters, flavouring used, freezing techniques and storage conditions play a major role the quality of *kulfi* (Aneja, 1992).

Role of various components of *kulfi*

***Milk fat*:** A source of fat soluble vitamins, it imparts the desirable creamy rich flavour and improves the both body texture and melting resistance of the product (Aneja, 1992). The content of milk fat may be proportionately reduced in cases where fruits and nuts are added to *kulfi* but shall not be less than 8.0 per cent by weight (Naik and Londhe, 2011). Prakash (2002) developed process technology for a filled probiotic *kulfi*. The milk fat present in the *kulfi* was replaced with vegetable fat and its effects on the quality were discuss the effect. The *kulfi* samples were inoculated with *L. acidophillus* and *B. bifidum* and these organisms were found to remain viable in large numbers even after four week of storage.

***Milk solids-not fat*:** A source of protein, minerals and vitamins, it is considered the major inflation on body and texture of the product, improper levels is reported to cause the "sandiness" defect (Aneja, 1992). The sources for milk solid are dry milk, fluid whole milk, fluid skim milk, condensed skim milk or skim milk powder. Nutritional awareness amongst the consumers regarding cholesterol and lactose level necessitates replacement of solids from plant source which is cheaper and have health benefits (Ramachandran *et al*, 2005). Bhadakawad, *et al* (2009) used safflower milk and buffalo milk mix as the source of milk solid for preparation of golden *kulfi*, the advantages of safflower milk being that it does not contain cholesterol and is rich in polyunsaturated fatty acids. The sensory score for overall acceptability of golden *kulfi* prepared from 80 parts buffalo milk and 20 parts safflower milk was analogous to control and the cost of production was reduced to around Rs 4/kg. Similarly the *kulfi* produced from admixtures of partially de-oiled groundnut meal and milk/milk powders reduced fat content of *kulfi* with an added advantage of warding off health hazards such as obesity, atherosclerosis and heart failure common in the affluent society (Ramachandran *et al,* 2005). Rajor and Vani (1990) made an attempt of prepare *kulfi* like product using soy solids and milk solids in the ratio of 50:50, 70:30 and 90:10, out of which product with a ratio of 50:50 (soy: milk solids) was found to give better results for flavour, colour and appearance, but its body and texture was unsatisfactory as it was reportedly weak and icy. Yerriswamy *et al*.(1983) made an attempt to make experimental *kulfi* by making up the total solid by addition of various ingredients like whole milk cream and skim milk powder and tried to compare the same with the one prepared by traditional method. It was observed that the total solids level of commercial samples were always higher due to excessive and uncontrolled evaporation, however, the TS level in experimental *kulfi* could be easily maintained in the range of 37 to 40 per cent TS level with 13-14 per cent milk fat and 10-12 percent of SNF. The product was found to be economical and had better body and texture and bacteriological quality.

***Sugar*:** It is an important ingredient of *kulfi*. It is the most widely used sweetener in the food industry importing the sweet flavour and pleasant taste, it is low cost and high energy value make it the most desirable food sweetener (Giri *et al*, 2012; Aneja, 1992). The increasing level of sugar in the mix is cumulative to the total soluble compounds. The change in the product composition leads to change in the product properties (Heldman, 2007). Giri *et al*, (2012) reported that reduction of sugar level in the *kulfi* mix increases freezing point,

hardness, fat, protein, ash and moisture percentage significantly and decrease the specific gravity, carbohydrate percentage and total calorie content and the melting rate. The decreased melting rate was attained to higher levels of sugar replacement, increase in free moisture content and subsequent increase in large ice crystal formation. The decreasing melting rate in *kulfi* was attained to samples. Tharp and Gottemoller , (1990) stated that while the calculated freezing point of typical 10% fat ice cream is -2.61^{o}C, removal of sweetener from the system raises the freezing point to 0.78 ^{o}C.

Conventionally sugar is sourced from cane sugar, sugar beet etc. But it cannot be used by people suffering from diabetes because along with sweetness it produces properties like high calorie intake (20-30% total calorie intake) so low calorie (dietary) options substituting sugar with artifical sweaterns like aspartame, sorbitol and maltodextrin etc may be especially helpful in management of ailments like obesity, diabetes and Dental caries. (Arora, S. *et al*., 2011; George, V. *et al*., 2006). Giri *et al,* (2012); Naik and Londhe, (2011); Pandit (2004), have attempted to develop the technology for preparation of *kulfi* using different artificial sweeteners and natural sweetner like stevia.

Pandit (2004) developed *kulfi* using a combination of artificial sweeteners and bulking agents (maltodextrin, sorbital and aspartame). The study revealed that while maltodextrin and sorbitol were necessary to get the desirable body and texture in the final product; aspartame was needed to compensate for sweetness. Giri *et al,* (2012) also made an attempt to optimize the level of sugar replacement with stevia (natural sweetener) for producing dietetic *kulfi* without affecting physicochemical and sensory properties of the product. Naik and Londhe, (2011) optimized the levels of artificial sweeteners for preparation of sugar free *kulfi*.

***Stabiliser*/*Emulsifier*:** The body or consistency of *kulfi* is related to the mechanical strength of the mix and its resistance to melting. Heat shock resistance is dependent on the nature and concentration of the stabilizer/emulsifier system used (Aneja, 1992). Raju *et al*. (1989) found that under different stabilizers, as the concentration of milk was increased the mean values of melt-down property was found to decrease indicating increased melting resistance. The addition of sodium alginate showed greater melt-down resistance than the addition of starch. This resistance to melting may be due to the stabilizing action of sodium alginate as reported by Glickman (1963) and Broszkowsha *et al*., (1968).

Effect of process parameter on *kulfi*

The method of freezing reported in literature varies from worker to worker. The earlier reports indicate that the *kulfi* mix in mould was frozen in a large earthen vessel containing a mixture of ice and salt in the ratio of 1:1 (Warner, 1953; De, 1977). Raju *et al.* (1989) recommended freezing of *kulfi* mix moulds in ice and salt mixture in the ratio of 4:1 in an earthen pot. Yerriswamy *et al* (1983) found that *kulfi* mix whipped and partially frozen in refrigerator and hardened in salt and ice mixture at -15^{o}C for 3 to 4 h resulted in a product of good organoleptic quality. Gosh, (1991) suggested that *kulfi* frozen by the traditional method was superior in quality and also recommended a method suitable for industrial production of *kulfi* wherein the *kulfi* mix was frozen in a brine tank at -20^{o}C with continuous agitation.

Microbiological quality of *kulfi*

The microbial quality of most of *kulfi* samples needs to be monitored in order to avoid any food poisoning and to safeguard the health of the consumers (Elango *et al*, 2010). The product is highly susceptible to contamination by different types of micro-organisms including potential pathogens (Vani, 1990). The critical points for potential contamination of *kulfi* were identified as improper heating of milk, utensils, from water, sugar, flavour and also through personnel handling (Gosh, 1970; Rao, 1978).

Kulfi sample prepared from usual method of condensing milk in an open pan was found to contain higher bacterial count than *kulfi* prepared by the addition of various ingredients (Yerriswamy *et al*, 1983). Elango *et al*, (2010) made an attempt to estimation of total coliform count and psychrotrophic count to determine the microbiological quality of *kulfi* sold in Chennai, twenty four samples of *kulfi*, eight from each of the following sources *viz*. road side stalls, small shops and organised sectors were collected. The level of psychrotrophic count was found to be more in the road side local vendor samples (1.8 x 103 cfu/g) followed by that of samples of small scale producers (1.01 x 10^3 cfu / g) and branded samples from organised sector (3.5 x 10^2 cfu / g). Road side local vendor samples contributed 56.90 % of organisms to the psychrotrophic count, followed by small scale producers (32.03 %), while organised sector contributed the least (11.07 %).Pseudomonas fluorescens was found to have greater proteolytic and lipolytic effect when compared with the activity of Pseudomonas aeruginosa and Pseudomonas putrifaciens. The mean total count and coliform

count were found to be maximum in road side local vendor samples followed by samples of small scale producers. In another study by Singh and Ranganathan, (1974) in microbial analysis of ice cream and *kulfi* indicated the presence of enteropathogenic E.coli. serotypes which suggested the unhygienic conditions during production and handling of the frozen products.

Ghosh (1970) reported that maximum enterotoxigenic strains were present in ice cream (10.2 %) followed by *kulfi* (6.7%). Therefore, consumption of such a product could pose a potential health hazard to consumer. An attempt was made by Yerriswamy *et al*, (1984) to make the sterilized *kulfi* mix which could be sealed in bottles. Sample mixes with 37, 38, 39 or 40 per cent T.S. were made from milk, cream, skim milk powder, sugar and stabilizer and were sterilized at 121^0C for 10, 15 or 20 minute. All sample were bacteria free and could be kept over three months at room temperature and could be made available from grocery stores. The *kulfi* mix with 39 per cent T.S. gave the highest organoleptic scores, after the standardised mix was frozen to *kulfi.*

References

Aneja R. P. (1992). Traditional milk specialities: A survey, In: Dairy India. Devarsons Stylish Printing Press, New Delhi, 269.

Arora S, Nayak S. K., Sindhu J.S., Seth R. (2001). Artificial sweeteners in formulation of dairy products. Indian Food Industry, 20(4): 62-65.

Ashokraju A., Pasha A. M., Kondal R. K., Reddy C. R., Rao R.M. (1989). Studies on the preparation and quality of *kulfi*. Indian Journal of Dairy Science, 42: 127-129.

Batish V.K., Chander H., Ranganathan B. (1984). Screening of milk and milk product for thermonuclease. Journal of Food science, 49(4): 1196-1197.

Broszkhowsha B., Klepacka M., Zesnauleszk G.S. (1968). In Dairy science abstract. 31: 36-56.

De S. (1991). Outlines of dairy technology. Oxford University Press, New Delhi, 402-403.

Elango A.V., Jayalalitha T. R., Pugazhenthi, Dhanalakshmi B. (2010). Prevalence of psychrotrophic bacteria in *Kulfi* sold in Chennai market. Journal of Dairying, Foods and Home Science, 29 (2): 97-101.

Ghosdekar D. R., Rao K. S. (1982). Microbiology of *kulfi*, Indian Dairyman, 34: 257-262.

Giri A., Rao R. H. G., Ramesh V. (2012). Effect of partial replacement of sugar with stevia on the quality of *kulfi*. Journal of Food Science and Technology, 51(8), 1612-1616.

Glickman M. (1983). Gum technology in food Industry. Academic Press, New York.

Gosh J. (1991). Process development for manufacture of instant *kulfi* mixes powder. Ph.D. thesis, National Dairy Research Institute, Karnal, India.

Heldman D. R. (2007). Food freezing, Handbook of Food Engineering, Taylor and Francis Group, LLC, 427-470.

IS 10501: 1983 (2012). Specification for *kulfi*, Indian Standards Institution, New Delhi.

IS 10974 (Part 4): 1984 (2012). Code for hygienic conditions for production, transport, storage and distribution of indigenous milk products. Part 4 frozen products *kulfi*, Indian Standards Institution, New Delhi.

Itzerott G. (1960). Notes on milk and indigenous dairy products in Pakistan, Dairy Science Abstract, 22:325.

Naik A.P., Londhe G. K. (2011). Optimization of levels of artificial sweeteners for preparation of sugar free *kulfi*. Journal of Dairying, Foods & Home Science, 30 (1): 15 – 24.

Pagaria M. L., Saraswat D.S. (1969). Studies on bacteriological quality of ice cream in India. Australian Journal of Dairy Technology, 24:200-203.

Pal D. (2006). Developments in traditional dairy products-lecture compendium, Center of advanced studies, Dairy Technology division, National Dairy Research Institute, Karnal, India, 55-57.

Pandit P. (2004). Technology studies on the manufacture of *kulfi* using artificial sweeteners. M. Tech. thesis, National Dairy Research Institute, Karnal, India.

Rajor R. B., Vani B. (1991). A new approach for manufacture of *kulfi*, Indian dairy man, 43:256-259.

Raju A. A., Ali M. P., Reddy K. K., Reddy C. R., Rao M. R. (1989). Studies on preparation and quality of *kulfi*. The Indian Journal of Dairy Science, 17.

Ramachandran L., Suhminder S., Ashwin K. R. (2005). Preparation of *kulfi* from admixtures of partially de-oiled groundnut meal and milk/milk powders. Natural Product Radiance, 4(2): 90-96.

Rao K. S., Ghodeker D. R., (1978). Microbiological quality of *kulfi*, M.Sc. dissertation, Kurukshetra University, Kurukshetra, 1978.

Salooja M. K., (1979). Studies on standardization of techniques for *kulfi* production. M.Sc. thesis, Kurukshetra University, Kurukshetra.

Sing R. S., Ranganathan B. (1974). Occurance of enteropathogenic E coil sero types in milk products, Milchwissenchaft, 29: 529-32.

Tracy P. H., Gibson G. L., Truckey S. L. (1936). Journal of Dairy Science, 19:509.

Vani B. (1990). Studies on manufacture of *kulfi* like product using soy solids and milk solids. M. Sc. Thesis, National Dairy Research Institute, Karnal, India.

Warner J. N. (1951). Dairying in India, Mac Millan & Co. Ltd., Calcutta, 91.

Yerriswamy K., Atmaram K., Natarajan A. M., Anatakrishnan C. P., (1983). Quality of *kulfi* manufactured by different methods. Cheiron, 121(3): 130.

Yerriswamy K., Atmaram K., Natrajan A. M., Anatakrisnshn C. P. (1983). Preparation of starilized *kulfi* mix. Cherion, 13: 223.