“Studies in development of Indian traditional fermented dairy food: Shrikhand”

Dissertation- 1 Report

Submitted by

ROHIT SHARMA

Registration No. – 11717634

Programme – M.Sc. (FOOD TECHNOLOGY)

Section H1730

School of Agriculture

Lovely Professional University, Phagwara

Under the Guidance of

Dr. Yogesh Gat

Assistant Professor

School of Agriculture

Lovely Professional University, Phagwara

CERTIFICATE

This is to certify that **Rohit Sharma** has personally completed M.Sc. dissertation- 1entitled, **"Studies in development of Indian traditional fermented dairy food: Shrikhand"** under my guidance and supervision. To the best of my knowledge, the present work is the result of his original investigation and study. No part of pre-dissertation has ever been submitted for any other purpose at any University.

The project report is appropriate for the submission and the partial fulfilment of the conditions for the evaluation leading to the award of Master of Food Technology.

Signature of Supervisor

Dr. Yogesh Gat
Assistant Professor
School of Agriculture
Lovely Professional University,
Phagwara

DECLARATION

I hereby declare that the work presented in the dissertation- 1 report entitled **"Studies in development of Indian traditional fermented dairy food: Shrikhand"** is my own and original. The work has been carried out by me at School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Dr. Yogesh Gat,** Assistant Professor (Food Technology) of School of Agriculture, Lovely Professional University, Phagwara, Punjab, India, for the award of the degree of Master of Science in Food Technology.

Date: **Rohit Sharma**

Place: Phagwara, Punjab (India) **Registration No. :** 11717634

I certified that the above statement made by the student is correct to the best of my knowledge and belief.

Place: Phagwara, Punjab (India) **Dr. Yogesh Gat**

Date:

Assistant Professor
School of Agriculture
Lovely Professional University
Phagwara, Punjab,India

INDEX

Chapter- 1 Introduction

Fermentation is an enhancement of nutritional value and increase in sensory properties, an affordable and economical technology which introduce a new variety of food product. It also helps in elimination and detoxification of objectionable compounds present in the unprocessed form of food i.e. tannins, polyphenols and phytates (Gadaga *et al.*, 1999). Initially, milk fermented product was developed by "nomadic Asian cattle" breeders. Fermented milk products manufactured by the microorganisms of a particular group by the decrease in pH of milk which leads to coagulation of proteins and microorganisms remain active until product expose to heat (Kabak and Dobson, 2011). More than 3500 traditional fermented food present in worldwide. Fermented foods are provided and preserve both quantities and quality of nutritional foods as wide diversity of texture, aroma and flavour which enrich the diet of human (Anon, 2003).

Fermented milk products can contribute to boosting the immune system, helps in restoring the balance of intestinal microflora, helps in digestion and improve health disorders. Health benefits of fermented food product depend upon the microorganism used during fermentation. India is one of the largest milk producer in world from the total milk production, only 7% milk is utilized for the production of fermented milk products (Aneja *et al.* 2002). In 7% mainly include curd (Dahi), sweetened concentrated curd (Shrikhand) and stirred curd (Lassi). Fermented milk and Probiotic yogurt showed stimulate cellular immunity which contains an agent such as L. casei. Recently, probiotic yogurt becomes popular for improved nutrition and health by incorporating probiotic cultures (Bifidobacterium bifidum and Lactobacillus acidofilus) (Sarkar, 2008).

Milk is more perishable product, by converting it into by–product its shelf life can increase with the new verities of product, which are easy to digest, use the unutilized to utilized products.

Traditionally milk is converted into sweets and by-products from a milk bulk to increase shelf life and value added products. But traditional dairy products remain confined to the small scale with the tremendous economic potential, which are more manual process and energy intensive.

Shrikhand is indigenous ethnic fermented milk food assumes special importance due to pleasant taste. Shrikhand is very popular in Indian states i.e. Maharashtra, Gujarat, Karnataka and some part of Rajasthan because of its high nutritive, therapeutic value, palatable nature, characteristic flavour and taste. An indigenous semi-soft milk product is Shrikhand manufacture by Chakka (strained Dahi). Removal of water (whey) through muslin cloth from freshly prepared Dahi is Chakka. Finally, Chakka as base material mix with sugar, fruits and flavouring agent. Shrikhand contain moisture (39%), total solid (fat-10%, protein-11.5%, carbohydrate-78%), ash content (0.5%), on dry basis pH is around 4.2-4.4 (Kulkarni *et al*., 2006; Boghra and Mathur, 2000).

Shrikhand considered as a refreshing food product during the summer season. The procedure for making fruit Shrikhand followed in household level**.** For special patients suffer from cardiovascular disease and obesity can be recommended healthy food due to low sugar and fat contents. Shrikhand has longer shelf life then Dahi due to higher sugar content and lower moisture content. At 5ºC Shrikhand a have the shelf life of 35-40 days, while at room temperature shelf life is around 2-3 days. With the addition of some fruit pulp improved nutritive and sensory characteristics of Shrikhand is obtained. "The effect of papaya pulp on the quality characteristics of Shrikhand" studied by (Nigam *et al*., 2009). Fruits and vegetables can be used in dairy products as a suitable substrate, these are inherently healthy, pleasing taste, refreshing and lots of beneficial nutrients. Nutritional value, digestibility, shelf life, safety and sensory attributes can be enhancing by the fermentation of product otherwise these can be destroyed during thermal processing of food.

Fermentation is a metabolic process of microorganisms feeds on an organic substrate and librated organic acids or alcohol and gasses. Fermented dairy products are well known as functional foods, it is nutritionally and therapeutically beneficial for human beings (Yadav *et al.*, 2007). Fermented foods have great nutrition and health-enhancing properties which includes prevention from gastrointestinal infections, decrease in serum cholesterol levels and antimutagenic activity in the human body. Fermentation of milk is beneficial for ingestion by lactose intolerant human being and the patients experiencing atherosclerosis (Shiby and Mishra, 2013). Symptoms of atopy can diminish by the consumption of fermented products (Cross et al., 2001). There are Indian ethnic dairy fermented products such as Dahi (curd), Mishti Doi (sweetened curd), Shrikhand, Lassi (buttermilk), Chhurpi, Chhach and mattha (Dewan and Tamang, 2007).

Dahi

Dahi is a fermented dairy product made from mainly cow and buffalo milk by adding 1% starter culture. Curd is known with a local name as 'Dahi' in India (Dewan and Tamang, 2007). Dahi can be consumed as such and also be converted into many other products such as buttermilk (Chhach) which is used largely mainly in summer as a thirst quencher. In the eastern part of India, Mishti Doi/Dahi is prepared by the addition of jaggery as a sweetener, colour and caramelized flavor. Dahi has health promoting and therapeutic benefits along with nutritional properties due to living cultures present in it. During fermentation lactose present in milk converted to lactic acid in presence of beneficial microorganism by lowering down the pH (4.5-5.0) which act as a preservative and increase shelf life (Sodini *et al.*, 2002). Fermentation can partially be degraded milk proteins by the bacterial proteases action on peptides which possessing health benefits. Dahi can be manufactured by using single culture or mix culture

Lactococcus lactis, L. cremoris, L. diacetylactis with Leuconostoc species, a combination of different acid and flavor developing bacteria. Bacteria are responsible for forming a firm body, a combination of sweet and mild acidic taste to Dahi (Vinderola *et al.*, 2002). According to Prevention of food adulteration Act, Dahi is ‘a semi-solid product', produce from boiled or pasteurized milk by lowering down pH using lactic acid or other harmless bacterial culture. It should contains a minimum percentage of solid not fat and fat same as it is present in milk from which prepare. According to Bureau of Indian Standards, difference in fermented milk based products depends on the type of starter culture used in milk (Anon, 1990).

Mishti Dahi

Payodhi or lal Dahi is also known Mishti doi/Dahi, it is a popular Dahi product in eastern parts of India. It is mostly consumed occasionally in the festival. Earthen pots generally used as packaging material for Mishti Dahi (Tomasik, 1993; Tamang, 2016).traditionally, manufacturing of Mishti Dahi is from thickened milk with sugar and mix then allow to stand or set by adding bacterial culture. Sugar cane, jaggery is common sweetener is used as sweetener agent in Mishti Dahi. Starter culture is responsible for the texture and flavour development in Mishti Dahi. Most commonly used mix culture of lactobacillus spp. and streptococcus thermophilus gives the superior quality product and reliable in various conditions. Good quality of culture used with 1% inoculums produce 0.7% acidity within 6-8 hours (Chandan, 1982; Mandal, 2014). For the earthy flavor, the fermentation process is carried out in earthen pot and excess of whey absorbed. Mishti Dahi consumed when it is chilled. Mishti Dahi is creamish to yellow in color with pleasant aroma, firm and smooth texture (Raju and Pal, 2008). There is no PFA standardization for Mishti Dahi. It is commonly prepared at household level or cottage scale. It is present in market as low, medium and high fat Mishti dohi on the basis of fat content

present in it. Mishti Dahi acidity should be less than 0.16%LA and pH should be between 5.2-5.4. Mishti Dahi should be free from any off flavours (Goel, 1998).

Lassi (buttermilk)

In India, buttermilk is known with a local name as Lassi, also known as stirred Dahi. Lassi is slight acidic sweet taste, viscous liquid, creamy white colour and can be flavoured with condiments, spices, sugar and salt. Lassi available in two flavours contain sugar or salt and with condiments, spices depend upon the preference of the consumer. It is manufactured using pasteurized and boiled milk cultured with microorganisms which produce flavor. Originally Lassi is a product of rural part of India and it is a by-product of Dahi obtained while the separation of makkhan by churning. It was manufactured at cottage level earlier. Salted Lassi is commercially available in market packaged aseptically in UHT boxes/ milk cartons/sachets (Ramana, 1994; Antunes *et al.*, 2007).

Mattha/ chhach

Mattha/chhach is similar to buttermilk, which is drink as refreshing beverage all over the country. It is a by-product of Dahi obtained during production of makkhan by churning. It is a famous product for its slightly sour taste and aroma developed in fermentation by mixed types of microflora used in lactic acid conversion Moru is Kerala's product, Dahi is churned to obtain thick buttermilk and dilute with water to decrease acidity along with the addition of salt for flavour. In Moru when crushed curry leaves, green chilli and ginger is added it becomes ‘shambharaam’ which is popular in the southern region of India. Manufacture technology of chhach initially, raw milk is boiled and allow it to cool down to 37 ºC and add 1.0 - 1.5% inoculums to milk. When milk is curdled /set, add some water and stirred with wooden impellers

locally known as ‘mathani’ along with rope driven circularly to move ‘to and fro’ motion. Makkhan is separate by regular beating at the top layer and collects makkhan time to time. When makkhan is completely removed from the mixture, then left part is called mattha or chhach Mattha is a white liquid product which is acidic and highly flavourful. It is high in water content and contains 1-2% fat content and 6-7 % milk solids. Mattha is high protein and lactose content. The defects in quality of mattha are similar to Dahi and Lassi (P. Rasane *et al.*2017).

Chapter 2 Problem background

Fermentation is a process of microbial metabolism in which chemical changes takes place on organic substrate in which degradation of protein, carbohydrates or fats by the action of enzymes produced by living organisms. Milk considered as the whole food and it contain almost all the nutrients, the fermentation of milk into curd increases the digestibility. In Indian human diet cultured dairy products are taken as the vital components. Apart from incorporation of nutrition and novelty, fermentation helps in preserving required nutrients and prevents from quick deterioration. Fermented dairy products are used as the supplements in various parts of India i.e. Shrikhand, dahi, makkhan, lassi due to high nutritive value, characteristics taste, therapeutic value and palatable nature. Shrikhand have special delicacy, in festivals and ceremonial occasions usually prepared. Shrikhand is available in various flavours Kesar, Cardamom, Badam-pista, Dry fruit, Mango, Pineapple, strawberry, Butter scotch, Rajbhog Shrikhand. Fruit added Shrikhand have more nutritional and consumer acceptance due to its fruit and Shrikhand mix flavour.

Fermentation is affordable and economical cheap technology which can be easily affordable which enhance the shelf life, protect food from undesirable degradation and helps to improve sensory properties. It can also eliminate and detoxified the objectionable factors present in unprocessed form of food such as phytates, polyphenols and tannins. Fermentation is a non thermal process which helps in improvement of physic-chemical properties without loss of any nutrients.

Shrikhand is a sweetish sour taste, semi-soft in texture and made from whole milk fermented curd (Kulkarni *et al.,* 2006). Chakka is the base ingredient for manufacturing of Shrikhand. To yield Shrikhand chakka is mixed with sugar. The Shrikhand is garnished with condiments and nuts. It is a refreshing product similar to Dahi, particularly for the summer season. Shrikhand is made-up of natural flavoring and coloring substances like fruits, nuts and condiments etc. According to PFA definition Shrikhand is fermented milk product made from whole, skimmed milk, SMP or chakka in which fat can add. Shrikhand may contain natural additives like sugar, fruits, nuts, cardamom and other condiments. PFA has given standard nutritional composition to the Shrikhand. It should be free any type of synthetic colouring and flavouring agents. The varieties of Shrikhand available in the market are plain, strawberry, mango, saffron, cardamom etc.

Shrikhand – definitions

Shrikhand is a sweetish- sour with semi-soft consistency made from whole milk produced from lactic acid fermented curd (De, 2011). The coagulated portion partial stained through a muslin cloth for the removal of whey content and produce solid mass known as ‘chakka' used as base ingredient for Shrikhand production. A blend of chakka, sugar, fruits and natural flavoring agents like saffron, cardamom, dry fruits and other spices prepared for Shrikhand manufacturing.

According to the definition of FSSAI 2011 (Food Safety and Standards Authority of India), Shrikhand obtained from whole milk chakka or skim milk chakka with added fat. Shrikhand may contain natural ingredients like fruits, nuts, sugar, condiments and other spices. It should be free from any type of artificial colour and flavouring agents. The composition of nutrients

present in Shrikhand given by FSSAI. The colonies count of yeast, mold and coliform should not above than 50 CFU/g and 10 CFU/g.

Shrikhand is an indigenous, sweetish sour taste, semi-soft and made from whole milk healthful and delicious dairy fermented product, prepared in particularly western part in India from lactic fermented Dahi (curd). Chakka is a base material mix with fruit sugar, flavouring and colouring agent, with the nutritive enrichment of both milk and fermented product (Sonawane *et al*. 2007).

Process technology

Process technology used for the manufacturing of Shrikhand is the manufacturing of Dahi, separation of chakka from Dahi, addition of sugar, fruits and other flavoring agents. The quantity of addition of these components depends upon the required in final product manufacture.

Shrikhand is a sweet-sour in taste fermented dairy product popular in some Indian origin such as Maharashtra, Gujarat, Madhya Pradesh, Rajasthan and in some part of the Karnataka. It is semi-solid in consistency which contributes to palatability and firmness in the product. Consistency makes it suitable for consuming it with ‘bread' and ‘puri'. The consistency of Shrikhand extended by the increase in the level of sugar, fat and moisture content (Singh 2006).

Themization treatment on Shrikhand had appreciable beneficial effect during refrigeration temperature and ambient condition on textural and body characteristics (Prajapati, 1992). It is also found that in treatment range of 4.23-4.73 out of 5.5 statistically score was not significant during the storage, colour and appearance.

Using ceramic membrane module during ultrafiltration chakka can be made successfully (Sharma and Reuter, 1992).they were found 23% extra yield in chakka due to whey protein recovery in chakka.

For Shrikhand preparation, a rapid method evolved by (suryawanshi *et al.* 1993). By heat-acid treatment and verifying size of inoculums of curd reduce the time of curd setting and whey separation during manufacturing of Shrikhand. Increase in inoculums level of Streptococcus thermophillus, Lactobacillus acidophilus starter 2-6% then there is decrease in acidity of curd from 1.13% with 2% inoculums to 0.81with 4- 6 % inoculums. Whey separation time is decreased as the increase in heat treatment temperature from 50-70 ºC, best result at 60 ºC for 10 minutes. As for these result, they conclude that Shrikhand manufacture time could be reduced by 6% inoculums and by giving heat treatment to Dahi at 60-70 ºC for 10 minutes and reduced time from 20 hours to 6 hours for manufacturing of Shrikhand.

In NDDB developed the industrial process of manufacturing chakka and Shrikhand was explained (P. Rasane *et al.*2017). For a production of chakka basket centrifuge was used to centrifuge skim milk curd. Then chakka was mix in a planetary mixture with sugar, cream, flavouring material to manufacture Shrikhand. Further process was improved by concentrating curd by quarg separator and for mixing, pasteurization of Shrikhand SSHE (scraped surface heat exchanger) used.

The significant decrease in pH value and lactose content observed when progressive fermentation of milk to Dahi (Boghara and Mathur 2000). Other than pH and lactose there is no or little change in the fat protein and milk solids. After separation of chakka from Dahi advanced fermentation of lactose.

Whey concentrate used during Shrikhand manufacturing and studied the effect on sensory, physic-chemical and yield of Shrikhand (Giram *et al.* 2001). The yield of Shrikhand increases by 5% by the addition of 5% whey concentrate in chakka then traditional method.

The sample of Shrikhand analyzed from illustrated and traditional manufacture from some selected Gujarat's cities (Jain *et al.* 2003). Shrikhand manufactured in industries has significantly higher protein, moisture, minerals content and pH than traditionally made.

Improvement in the flavour of Shrikhand by using fruit pulp without losing the acceptability of product (Renu Dadarwal *et al*.2005). In milk addition of 5% fruit pulp increases the chakka protein and fat recovery content. Chakka made with 10-20% fruit pulp and milk made with 10% had acceptable microbiological and sensory properties, milk was free from coliform. The product made from direct addition of fruit pulp had the higher microbial load.

Ultrafiltered skim milk retentates are used for the production of Shrikhand (Ansari *et al.* 2006). Preconcentrated skim milk was used for Shrikhand extracted by Ultrafiltration (UF). Maximum 20% total solid of concentrated milk used for curd formation and then Shrikhand.

Ultrafiltration process is used for manufacturing of Shrikhand (Shukla *et al.* 2007). Obtained skim milk coagulum by fermentation with yogurt culture stirring gently to break at 60°C for 5 minutes for whey separation and 16.6% total solid concentration ultrafilter in tubular module membrane.

Modification in process of Shrikhand

Use of ashwagandha powder at 0.3%,0.5% and 0.7% along with 40% cane sugar in of Shrikhand (Landge, *et al.* 2011). With the increase in powder level of ashwagandha there was increase in

protein content and decrease in moisture content. A sample of 0.5 % of ashwagandha powder has more acceptance than other. The storage temperature of the product was 7 0c in the refrigerator.

Shrikhand manufacture from buffalo milk using Dahi (T0) and yogurt (T1) culture was prepared and check its acceptability (Devshete *et al,* 2012).After observation, it is concluded that there is no difference between and equally good to prepare Shrikhand using Dahi and yogurt culture.

Shrikhand prepared from gulkand and rose petal powder had a significant impact on aroma texture taste and overall acceptability other than color (Nadaf *et al*, 2012).

Shrikhand prepared by using stevia powder which is a replacement of sugar (Mehrotra *et al*, 2014). Different combination stevia powder or extract use in the experimental product. For control, 100% sugar was also taken. The prepared product has most acceptance level by a panel of judges

Incorporation of different sesame seed oil level in preparation Shrikhand conducted (Abilasha *et al.* 2016). The level of sesame seed oil taken as 4, 8, 12 and 16% were analyzed to identify the presence of phytosterol. Sample with 8% sesame seed oil has more sensory acceptance than other. Product developed from sesame seed oil has higher antioxidant property and contain phytosterol.

The chemical composition of chakka

The coagulated/solid mass of Dahi separated from whey is known as chakka. Chakka is a base material of Shrikhand, Chakka physical and chemical property influences on the final quality of Shrikhand. The composition of milk and its types depend upon the availability, bread and species

of animal. Mixing of cow and buffalo milk is a common practice to make standardize milk for distribution and curd preparation which is used for Shrikhand making.

Study the effect of mixing of cow and buffalo during Shrikhand manufacture (Ghatak and Dutta 1998).Shrikhand was manufactured from a mix of cow and buffalo milk in specific ratio 1:3, 1:1, 3:1 from which. 1:1, milk show the best quality of Shrikhand with improved texture, soft firm body with desirable gumminess.

Shrikhand prepared blends of dairy milk and soy milk (Sumedha Deshpande *et al.* 2008) the total solid content of milk was standardize blend of homogenize milk at 10% in two stages homogenizer, milk was pasteurized at 72°C for 20 minutes and cool down at room temperature for Shrikhand production.

Nutritional and Functional Properties of Shrikhand

Average nutritional composition of *Shrikhand i*.e. Moisture (30.33-42.70%), Fat (1.57-22.49%), protein (7.72-11.53%), Lactose (1.50-5.68%), Sucrose (63.70-82.42%), Ash (0.417-0.683%).Milk is a rich source of nutrients, after fermentation milk is rich in protein, vitamin and mineral content. Fermented milk has effective against many diseases like diarrhea, constipation, gastroenteritis, acidity, hyperc holesterolemia, tumor genesis etc. reported by researchers. In India, fermented dairy products play an important by providing vital importance in human diet.

Gupta and Sharma (2015) reported the comparison between probiotic fortified and non-fortified Shrikhand. Probiotic fortified Shrikhand significant higher in Proteins 8.6 %, ascorbic acid (3.8-5.46 mg), dietary fibers 1.5 g, titrable acidity (1.6-4.4 %), total sugars 38.4 g and antioxidants (25.3-54.73 %).

Physico-Chemical Properties of Shrikhand

In a investigation Salunke *et al.* (2006) collected samples of Shrikhand from 5 major manufactures and from 4 cities in Maharashtra. The compositional difference is obtained in collected samples total solids (57- 67.8%), fat content (3- 8.9%), protein (4.6-6.7%), sucrose content (44.5-51%), ash (0.3-0.45%). In another analysis acidity 1.04-1.54 % lactic acid, pH 3.9-4.3, content of soluble nitrogen 0.1-0.29 %, fatty acids 0.68-0.78 % oleic acid respectively. In Shrikhand comparison, variation in fatty acids and titratable acidity found in four cities samples. The majority of samples collected did not meet standards given for protein and sucrose on dry basis by bureau of Indian standards and Indian prevention of food adulteration act.

Gavane et al. (2010) prepared Shrikhand from cow milk mixed with custard apple pulp in replicated samples R1, R2, R3 and R4 which contain moisture content 87.52, 86.25, 85.41 and 87.29 respectively. Flavour treatment T0, T1, T2, T3, T4 and T5 observed as 37.17, 40.15, 35.33, 36.05 and 37.60 respectively,

Landge *et al.* (2010) conduct a study on preparation of Shrikhand with additive as ashwagandha powder impact on acidity varied from 7.41-7.67 on day of production. Increase in acidity observed for first seven days thereafter the decrease in trend observed in control T0 and sample T1 during storage. The higher level in acidity observed due to ashwagandha.

Shrikhand prepare with the addition of 20% Papaya pulp is lower in protein, total solids and fat as compare to Shrikhand prepared without Papaya pulp. Constant level of sugar (40% by weight of chakka) used for Shrikhand with different concentration of papaya pulp 5 %, 10 %, 15 % and 20 %. Different concentration of papaya pulp used in Shrikhand effect the chemical composition. Moisture level is higher in 20% papaya pulp but lower in without papaya pulp (Mali *et al.* 2010).

Shelf life of Shrikhand

The shelf life of a final product is retention of edible quality after production in days or months. Shrikhand has a higher shelf life then Dahi and yogurt due to higher sugar content and low moisture content. The shelf life of Shrikhand is depending upon keeping condition, packaging material, type of fruit added, sugar content and method of preparation. Increase in acidity of the product leads to off flavour of the product. The shelf life of Shrikhand mainly characterized by

Organoleptic changes

Addition of papaya pulp in different concentrations 20%, 40% and 60% in Shrikhand (Nigam *et al.*, 2009). During sensory evolution Shrikhand with 20% papaya pulp found most keeping quality was to be two weeks at storage temperature 5 ºC and acceptance of the product.

Study the effectiveness apple pulp at different concentrations on the quality parameters of Shrikhand (Kumar et al., 2011). The apple pulp concentrations (0, 10, 20, and 30%) are used in replacing chakka formulation during Shrikhand preparation. Different concentration of apple pulp along with 'celosia argentea' was used as a colouring agent for the optimization for Shrikhand preparation. An optimum level of apple pulp (20%) with dried celosia argentea flower was selected on the basis of product sensory parameters. The storage life of the product in polyester cups under refrigerated condition 4 ºC for three weeks. With the increase in storage period sensory score starts decreasing.

Study on aswaganda powder as the additive used during preparation of Shrikhand (Landge *et al.*, 2011). Aswaganda powder used in 0, 0.3, 0.5 and 0.7% with 40% cane sugar on dry basis was

used for formation of Shrikhand. On the basis of sensory parameters sample Shrikhand prepared with the addition of aswaganda 0.5% in treatment T(2) had more acceptability then other sample treatments. The storage temperature of the sample was 7 ºC in refrigerated condition and quality evaluate at regular interval. The total shelf life of Shrikhand sample T(2) was acceptable up to 52 days while sample T(0) had the shelf life up to 37 days remain sample T(1) and T(4) had up to 45 days shelf life.

Study on sugar replacement effect on the chemical composition of Shrikhand (Mehrotra *et al.*, 2014). The most acceptable sample was with 30% sugar along with 20% stevia extract. Sample and control were stored up to 21 days in refrigeration conditions. In an interval of every 7 days, samples with 30 % stevia leaves and 100% sugar were analyzed for a sensory score during storage conditions. During storage of control and sample there was decrease notice in flavour score, colour, body, appearance, texture, mouth feel, and overall acceptability of the product.

Flavoured Shrikhand prepared by addition of sapota and orange pulp in equal proportion (Parveez Ahmad Para 2015). Sapota and orange pulp contribute around 14% to the total bulk of chakka as compared to normal Shrikhand. The given score on the basis of hedonic scale flavour Shrikhand colour and appearance (7.23 ± 0.13), flavour (7.33 ± 0.14), texture (7.41 ± 0.12), sweetness (7.05 ± 0.16), and overall acceptability (7.53 ± 0.20). On the other hand, simple Shrikhand score on the basis of hedonic scale colour and appearance (7.09 ± 0.09), flavor ((7.28 ± 0.10), texture (7.47 ± 0.11), sweetness (6.85 ± 0.14), and overall acceptability (7.65 ± 0.11). the score was high when a fresh sample is taken, with the increase in store time there was significant decrease observed. Beyond 14 days f storage life the exact difference in appearance & color observed clearly.

Physico-chemical changes

Study the effect on chemical composition of Shrikhand during storage by addition of a different level of strawberry and sugar (Sonawane *et al.,* 2007). Three level of strawberry pulp and two level of sugar used on the weight basis of chakka P (1) 10%, P (2) 15%, P (3) 20% and S (1) 30%, S (2) 40% with control sample. The moisture content of experimental samples decreased with the increase in storage time. In sample S (2) P (2) has acidity 1.305% and control has 1.305%, acidity of product increase with the increase in pulp level in Shrikhand. In fresh sample average soluble 'N' was 0.081% which increased with storage time 0.20% on the 11^{th} day under refrigerated conditions.

Incorporation of papaya pulp in chakka to increases the nutritional quality and overall acceptability of Shrikhand (Navita *et al.,* 2009). Different level of papaya pulp (20%, 30% and 60%) added to Shrikhand. Total SNF and fat content significantly increase with an increase in storage time at refrigeration temperature 5 ºC.

Study on aswaganda powder as the additive used during preparation of Shrikhand (Landge *et al.,* 2011). Aswaganda powder used in 0, 0.3, 0.5 and 0.7% with 40% cane sugar on dry basis was used for formation of Shrikhand. The storage temperature of the sample was 7 ºC in refrigerated condition and chemically was monitored at regular interval. As the aswaganda powder level increase found the decrease in moisture content level. The fat level in Shrikhand was increased slightly with the increase in storage period up to 22 days, after day 22 indication of decreasing trend. Sample T(2) was superior to other samples, level of aswaganda power increase the level of protein in the sample. Sugar content shows decreasing trend in the sample as well as control. The

acidity of the sample shows increasing trend because it depends upon lactic acid contenting Shrikhand.

Study the effect of source and storage interval on the Shrikhand for reducing, non reducing sugars (Raghuwanshi *et al.,* 2011). From market the 10 samples of akola and amaravati collected and prepared in laboratory and store in refrigerated temperature 5±1 ^{o}C) and room temperature (30±2 ^{o}C). The samples were analyzed until they get spoiled. After 35 days the sample was analyzed for reducing and non-reducing content. In fresh Shrikhand sample, 3.96% of reducing sugar was present on the fifth day it increases to 3.39%, on the last 35 day it was finally reached to 4.70%. On another hand, there was a decrease in non-reducing sugar observed, in fresh sample 48.41% was present, on the fifth day it was 48.05% and on the 35th day it was 40.80%.

Study on sugar replacement effect on the chemical composition of Shrikhand (Mehrotra *et al.,* 2014). Basis on organoleptic evaluation the most acceptable sample was with 30% sugar along with 20% stevia extract. Sample and control were stored up to 21 days in refrigeration conditions. In an interval of every 7 days samples with 30 % stevia leaves and 100% sugar physic-chemical analysis during storage condition. The study shows during storage the increase in titrable acidity, pH and decrease in fat, protein, ash and moisture in both sample and control Shrikhand.

Microbial changes

The microorganisms and enzymes brought changes in chemical and microbiological states which influence on the storage period, keeping quality and acceptability of fermented milk product. The storage time of product depends upon temperature, type of food and storage conditions. As the higher the temperature than lower will be the shelf of product and lower the temperature higher

the shelf life of the product. Even at lower temperature contaminants can survive and grow but their multiplication rate is low. Microorganisms deteriorate the quality of product and make it unsafe for the consumption.

A Study was conducted in Maharashtra state on Microbiological quality of Shrikhand sold (Salunke et al., 2005). From each popular manufacturer collected twenty samples and five samples from each city of Maharashtra for microbiological quality analysis. In the analysis in standard plate counts (SPC) of sample ranged start from 5.59 to 8.3 CFU/g, in yeast and mold counts (YMC) of sample ranged from of sample ranged from 3.52 to 5.24 log CFU/g and coliforms present in the range of 1.00 to 5.67 CFU/g. Samples from different cites, microbiological differences among manufacturers too low to be significant. According to standard given by BIS, the YMC did not meet the requirement.

Study the effect of apple pulp at different concentrations on Shrikhand shelf life and acceptability (Kumar *et al.,* 2011).Apple pulp was taken in 0, 10, 20, and 30% for the preparation of Shrikhand which replace the chakka formulation. As a colouring agent celosia argentea was used with the optimum level of added apple pulp in Shrikhand. Based on sensory parameter basis, the combination of dried celosia argentea along with added 20% apple pulp was selected as optimum for Shrikhand. The storage life of the product in polyester cups under refrigerated condition 4 ºC for three weeks. Psycrophilic count and plate count during storage observed increased significantly but there was no detection of the coliform count.

Study on aswaganda powder as the additive used during preparation of Shrikhand (Landge *et al.,* 2011). Aswaganda powder used in 0, 0.3, 0.5 and 0.7% with 40% cane sugar on dry basis was used for formation of Shrikhand. Highest microbial load (27.32x106 CFU/g) found in control

sample T (0) the rest of samples. Aswaganda sample T (1) has microbial count 25x106 CFU/g, T (2) and T (3) have least count then T (0) due to level aswaganda level. In the storage life treated sample with aswaganda decrease microbial load up to 15 days. In yeast and mold count similar result obtained as bacterial count.

Study on sugar replacement effect on the chemical composition of Shrikhand (Mehrotra *et al*., 2014). The most acceptable sample was with 30% sugar along with 20% stevia extract. Sample and control were stored up to 21 days in refrigeration conditions. In the interval of every 7 days, samples with 30 % stevia leaves and 100% sugar TPC count analyzed during storage condition. The sample with 30 % stevia leaves and 100% sugar show similar TPC results during initial days. The increased in TPC count were observed with increase in storage period. In control, Shrikhand sample mean TPC range from 1.00 - 2.34 CFU g-1 and for control Shrikhand range from 1.34 - 2.67 CFU g-1. The Shrikhand samples can be stored for three weeks under refrigerated conditions on the basis of microbial characteristics.

There are several reports about the determination of effect of addition of fruits, vegetables and condiments incorporation in Shrikhand. Shrikhand contain the properties of fermented foods along with the goodness of added fruits and condiments. Addition of different additives leads to the enhancement of colour, textural properties, nutritional value, shelf life and along with consumer acceptance. To the best of our knowledge very few literature reports are available on comparative of addition of fruits, vegetables and condiments on physico-chemical and organoleptic properties of Shrikhand.

Chapter 5 Objectives

1. Optimization of method to determine fruit juice /pulp concentration used for preparation of *Shrikhand*.
2. Effect of various constituents/ingredients on nutritive value, acceptance, shelf life and final cost of *Shrikhand*.
3. Evaluation of organoleptic and physico-chemical properties of *Shrikhand* using fruits or vegetables.
4. To determine physico-chemical and antioxidant activity of *Shrikhand* during storage.

Chapter 6 Methodology

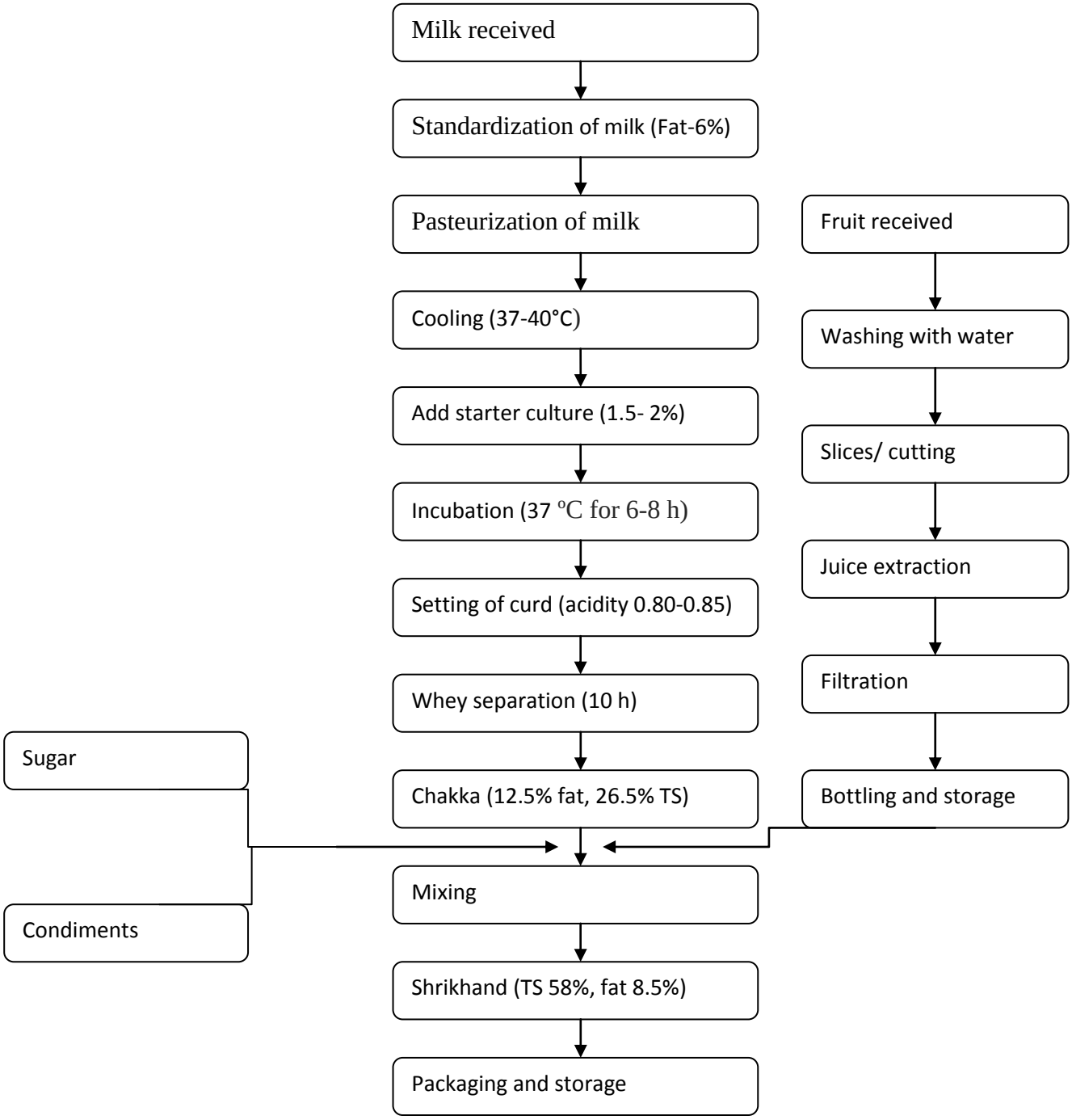
Collection of raw material

The study in development of Indian traditional fermented dairy product with the addition of fruits, vegetables and condiments. The required material for the development of product will be collected from local market in Phagwara, Punjab. The work will be carried out in the food technology lab, Department of Food Science and Technology, L.P.U., Phagwara.

Experiment 1: Conduct proximate analysis of raw material.

Test	method
Total solids	FSSAI manual, 2015
Fat	AOAC 2005
Protein	AOAC 1990
Titratable Acidity	FSSAI manual, 2015
Ash	AOAC 2005
Sucrose	FSSAI manual, 2015

Experiment 2: preparation of product procedure



Source: - (P. Rasane *et al.*2017)

Experiment 3: Organoleptic evaluation of Shrikhand

Sensory evaluation of shrikhand after preparation and during storage condition will be conducted by using 9-point hedonic scale designed and describe by (Gupta 1976).

Experiment 4: physico-chemical analysis of Shrikhand.

Test	Method
Titratable acidity	FSSAI manual, 2015
Fat	AOAC 2005
Protein	AOAC 1990
Lactose/Sucrose	FSSAI manual, 2015
Ash	AOAC 2005
Moisture	AOAC 2005
Total Solid	FSSAI manual, 2015
pH	AOAC 2000
Viscosity	AOAC 2005
Antioxidant activity	AOAC 2005

Experiment 5: storage study of Shrikhand.

Test	Method
Standard plate count	AOAC 2005
Yeast and mould	AOAC 2005
Coliform count	AOAC 2005

Chapter 7 Proposed work with plan timeline

Work plan	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov
Review of literature	√	√	√								
Report submission				√							
Estimated analysis of raw material							√	√			
Product formation								√	√		
Final product analysis									√	√	
Result compilation											√

Chapter 8 Expected research outcome

Fermented dairy products are the outcome of metabolic process of microbe's liberation of enzymes which degrade the complex structure of protein, carbohydrate and fat which act as the nutrients for microorganisms. Shrikhand is one of those by product obtained by fermentation of milk into dahi by inoculation of culture, dahi is strained and production of chakka as solid mass which act as base ingredient of Shrikhand. It is sweet-sour taste, semi soft consistency and it is traditional product very popular western part of India i.e. Gujarat and Maharashtra. This product may contain natural colours and flavours of fruits, vegetables, herbs, spices and condiments. The combination of fruits with Shrikhand increases its acceptance and nutritive value.

The product manufacture by the combination of fruits and vegetables increases the nutritional value i.e. proteins, carbohydrates, dietary fibers, antioxidants and minerals. The product obtained with higher shelf life with the reduce moisture content. Incorporation of separated whey, converted into whey powder to increase protein content, reduction in loss of processing or final yield of product. Final cost of product will be going to reduce by the incorporation of fruits and vegetables and whey. It introduces a new product with the higher consumer acceptance with various health benefits.

References

Abilasha R, Geetha P. and Arivazhagan R. Evaluvation of phytosterol in sesame seed oil and study its effect on the fermented dairy product. European journal of Food Science and Technology 2016;4:10–7.

Aneja, R.P., Mathur, B.N., Chandan, R.C. Cultured/Fermented Products. Technology of Indian milk products. Gupta, PR New Delhi: Priyadarshini Vihar 2002:159.

Anon. European Food information council online 2003;16.

Anon. Technology of traditional milk products in developing countries: dahi. FAO Animal Production and Health Paper 85, FAO/WHO, Rome, Italy 1990:250–2.

Ansari, M. I. A., Rai, P., Sahoo, P. K., Datta, A. K. Manufacture of Shrikhand from ultrafiltered skim milk retentates. Journal of Food Science Technology 2006;43:49–52.

Antunes AEC, Grael ET, Moreno I, Rodrigues LG, Dourado FM, Saccaro DM, et al. Selective enumeration and viability of Bifidobacterium animalis subsp. lactis in a new fermented milk product. Brazilian Journal of Microbiology 2007;38:173–7. doi:10.1590/s1517-83822007000100035.

Boghra, V. R. and O. N. Mathur. Physico-chemical status of major milk constituents and minerals at various stages of shrikhand preparation. Journal of Food Science Technology, Mysore 2000;37:111–5.

Chandan, R.C. Chapter 5. Prescott and Dunn's Industrial Microbiology. 4th ed., Westport, USA: AVI Publishers; 1982, p. 113–84.

Cross M, Stevenson L, Gill H. Anti-allergy properties of fermented foods: an important immunoregulatory mechanism of lactic acid bacteria? International Immunopharmacology 2001;1:891–901. doi:10.1016/s1567-5769(01)00025-x.

De, S. Outlines of dairy technology. vol. 29th impression. 419th ed. Delhi: Oxford University, press; 2011.

Devshete, N. G. Preparation of probiotic shrikhand using yogurt culture. MSc (Agri) Thesis (Unpub) MAU, Parbhani 2012.

Dewan S, Tamang JP. Dominant lactic acid bacteria and their technological properties isolated from the Himalayan ethnic fermented milk products. Antonie van Leeuwenhoek 2007;92:343–52. doi:10.1007/s10482-007-9163-5.

Food Safety and Standards Regulations FSSAI. Food Safety and Standards Authority of India. 2011.

Gadaga T. A review of traditional fermented foods and beverages of Zimbabwe. International Journal of Food Microbiology 1999;53:1–11. doi:10.1016/s0168-1605(99)00154-3.

Gavane, P.M., R.M. Zinjarde and S.N. Rokde. Studies on preparation of shrikhand blended with custard apple pulp- A new fermented milk product. Indian Journal of Dairy Science 2010;63:11–5.

Ghatak, P. K. and S. Dutta. Effect of admixing of cow milk and buffalo milks on compositional and sensory quality of shrikhand. The Indian Journal of Nutrition and Dietetics 1998;35:43.

Giram, S. D.; R. P.Barbind; V. D. Pawar; B. K. Sakhale and B. S. Agarkar. Studies of fortification of sour whey concentrate in chakka for preparation of shrikhand. Journal of Food Science Technology 2001;38:294–5.

Goel, B.K. Studies on the feasibility of commercial production of mishti doi, A techno-economic aspect. Indian Dairyman 1998;50:11–5.

Gupta, A and Sharma, N. Nutritional, physicochemical and microbial evaluation of antioxidant-rich mango fortified probiotic shrikhand. World journal of pharmaceutical research and technology 2015;3.

Jain A, H.K. Desai and K.G. Upadhay. Sensory profile of market shrikhand sold in Gujarat state. Indian Journal of Dairy Science 2003;56:292–4.

Kabak B, Dobson ADW. An Introduction to the Traditional Fermented Foods and Beverages of Turkey. Critical Reviews in Food Science and Nutrition 2011;51:248–60. doi:10.1080/10408390903569640.

Kulkarni C, Belsare N, Lele A. Studies on shrikhand rheology. Journal of Food Engineering 2006;74:169–77. doi:10.1016/j.jfoodeng.2005.02.029.

Kumar S, Bhat Z, Kumar P. Effect of Apple Pulp and Celosia argentea on the Quality Characteristics of Shrikhand. American Journal of Food Technology 2011;6:817–26. doi:10.3923/ajft.2011.817.826.

Landge, U. B. Pawar, B. K. Choudhari, D. M.Preparation of Shrikhand using ashwagandha powder as the additive. Journal of Dairying, Foods & Home Science 2011;30:79–84.

Mali, R. S. Dhapke, D. H. Zinjarde, R. M. Effect of papaya pulp on the quality and cost structure of Shrikhand. Journal of Soils and Crops 2010;20:290–4.

Mandal, S. Production of Direct Vat Set (DVS) Misti Dahi. Doctoral dissertation, NDRI, Karnal (India) 2014.

Mehrotra Rolly, D. Singh, and A. Tiwari. Effect of sugar replacement on chemical composition and organoleptic properties of shrikhand. Innovare Journal of Food Science 2014;2:22–5.

Nadaf, N.Y., Renuka S. Patil and Chaitanya H. Zanzurne. Effect of addition of gulkand and rose petal powder on chemical composition and organoleptic properties of Shrikhand. Recent Research in Science and Technology 2012;4:52–5.

Navita Nigam, Rashmi Singh and P. K. Upadhayay. .Incorporation of chakka by papaya pulp in the manufacture of shrikhand. J Dairying, Foods and H S 2009;28:115–8.

old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/MILK_AND_MILK_PRODUCTS.pdf

Parveez Ahmad Para. . Microbial and sensory attributed of flavored shrikhand at different days of storage under refrigeration. Animal Science Reporter 2015;9:83–8.

Prajapati. Thermization as a method for enhancing the shelf life of cultured buttermilk. Indian Journal of Dairy Science 1992;60:86–90.

Raghuwanshi R.T., Mankar N.A., Deshmukh P.A. and Deshmukh S.B. Effect of source and storage interval on reducing, the non-reducing sugar content of shrikhand. Journal of Dairying, Foods & Home Science 2011;30:105–9.

Raju PN, Pal D. The Physico-chemical, Sensory, and Textural Properties of Misti Dahi Prepared from Reduced Fat Buffalo Milk. Food and Bioprocess Technology 2008;2:101–8. doi:10.1007/s11947-008-0137-z.

Ramana, B.L.V. Standardization of a method of manufacture of lassi with enhanced shelf stability. M.Sc. Thesis. NDRI Deemed University, Karnal, India 1994.

Rasane P, Kailey R, Singh S. Fermented Indigenous Indian Dairy Products: Standards, Nutrition, Technological Significance and Opportunities for its Processing. Journal of Pure and Applied Microbiology 2017;11:1199–213. doi:10.22207/jpam.11.2.68.

Renu Dadarwal, Beniwal, B. S., Singh, R. Process standardization for preparation of fruit flavored. Journal of Food Science Technology 2005;42:22–6.

Salunke, P., Patel, H. A and Thakar, P. N. (2006). Physico-chemical properties of Shrikhand sold in Maharashtra state. J. Food Sci. Technol. 43(3): 276-281.

Salunke.P. Comperitive studies on the physic-chemical properties of shrikhand manufactured by traders using the traditional and mechanized method. Journal of Dairy Science 2005;17:3203–13.

Sarkar S. Innovations in Indian Fermented Milk Products — A Review. Food Biotechnology 2008;22:78–97. doi:10.1080/08905430701864025.

Sharma, D. K. and H. Reuter. Ultrafiltration technique for shrikhand manufacture. Indian Journal of Dairy Science 1992;45:209–13.

Shiby, V.K., Mishra, H.N. Fermented milk and milk products as a functional Foods-a review. Critical Reviews in Food Science and Nutrition 2013;59:482–96.

Shukla, K. K.; V. K. Gupta; G. R. Patil and Shiv Kumar. Studies on the production of shrikhand using ultrafiltration process. Indian Journal of Dairy Science 2007;60:393–8.

Singh, R. Characteristics and technology of traditional Indian culture dairy product. Indian Dairyman 2006;58:49–56.

Sodini I, Lucas A, Oliveira M, Remeuf F, Corrieu G. Effect of Milk Base and Starter Culture on Acidification, Texture, and Probiotic Cell Counts in Fermented Milk Processing. Journal of Dairy Science 2002;85:2479–88. doi:10.3168/jds.s0022-0302(02)74330-0.

Sonawane, V. M., Chavan, K. D. and Pawar, B. K. (2007). Effect of levels of strawberry pulp and sugar on chemical composition during storage of Shrikhand. Journal of Dairying, Foods & Home Science. 26(3/4): 153-158.

Sonawane, V. M., Chavan, K. D. and Pawar, B. K. Effect of levels of strawberry pulp and sugar on chemical composition during storage of shrikhand. Journal of Dairying, Foods & Home Science 2007;26:153–8.

Sumedha Deshpande, Bargale, P. C., Krishna Jha. Suitability of soy milk for development of shrikhand. Journal of Food Science Technology 2008;45:284–6.

Suryawanshi, S. U.; A. F. Lembhe; C. D. Khedekar and H. V. Kaurwar. Study to evolve a rapid method for shrikhand manufacture. Indian Journal of Dairy Science 1993;46:269.

Tomasik, P.C. Encyclopedia of food science, food technology and nutrition. vol. 1. R. NY, USA: Macrae, R.K. Robinson and M.J. Sadler. Academic Press; 1993. Tamang, J.P. Indian dietary culture. Journal of Ethnic Foods 2016:243–5: 655-64.

Vinderola C, Mocchiutti P, Reinheimer J. Interactions Among Lactic Acid Starter and Probiotic Bacteria Used for Fermented Dairy Products. Journal of Dairy Science 2002;85:721–9. doi:10.3168/jds.s0022-0302(02)74129-5.

Yadav H, Jain S, Sinha P. Antidiabetic effect of probiotic dahi containing Lactobacillus acidophilus and Lactobacillus casei in high fructose-fed rats. Nutrition 2007;23:62–8. doi:10.1016/j.nut.2006.09.002.