

# **TECHNOLOGY OF MILK AND MILK PRODUCTS**

## **Fermented Traditional Indian dairy products – Dahi, lassi, Shrikhand**

### **INTRODUCTION**

Preservation of milk by fermentation is an old age technique. Fermented milks have assumed prominent position in diet and they are enjoyed everywhere in the world for their characteristics refreshing acid taste and excellent nutritive value. The milk, which could not be preserved overnight in a tropical environment, led the Aryans to benefit with the phenomenon of fermentation. Having known the nutritional and therapeutic benefits, the Aryans have embraced dahi as a natural healthful delicacy of their diet. Fermentation of milk imparts acidic taste to milk, which is refreshing in warm climate. It is claimed that these products help in prevention of cardiovascular diseases by decreasing the blood cholesterol and colon cancer by activating the immune system. These products can be manufactured easily utilizing the existing facilities in the milk plant without investing on costly equipments. The important fermented dairy product being produced and consumed in our country are, Dahi, Misti Dahi, Shrikhand, Lassi and Yoghurt.

### **STARTER CULTURES USED FOR MANUFACTURE OF DAHI, LASSI, SHRIKHAND**

The primary function of starter culture is to develop desired amount of acidity in the products. The secondary effects of acid production include coagulation, expulsion of moisture, texture formation, and initiation of flavour production. In addition to these, the starters also help in imparting pleasant acid taste confirming protection against potential pathogens and spoilage causing microorganisms and providing a longer shelf life to the product. Traditional fermented milk products are prepared from cow or buffalo milk or combination thereof. Table 1 shows various starter cultures used for manufacture of dahi, lassi and shrikhand.

**Table 1: Traditional Indian Fermented Milk Products and Starter Cultures Used for their Manufacture**

Name of product	Country of origin	Type of milk used	Starter cultures used for manufacture
Dahi	India, Persia	Cow or Buffalo milk or combination thereof	<i>L. lactis</i> subsp. <i>lactis</i> <i>S. salivarius</i> subsp. <i>thermophilus</i> <i>L. delbrueckii</i> subsp. <i>bulgaricus</i> , <i>plantarum</i> Lactose fermenting yeasts Mixed culture (not defined)
Lassi	India	Cow or Buffalo milk or combination thereof	<i>S. salivarius</i> subsp. <i>thermophilus</i> <i>L. delbrueckii</i> subsp. <i>bulgaricus</i>
Shrikhand	India	Cow or Buffalo milk or combination thereof	<i>S. salivarius</i> subsp. <i>thermophilus</i> <i>L. delbrueckii</i> subsp. <i>bulgaricus</i>

## DAHI

Dahi (Indian curd) is well known fermented milk product consumed by large sections of the population throughout the country, either as a part of the daily diet or as a refreshing beverage. Dahi is prepared from heated milk (generally boiled milk) after inoculation with starter culture. Dahi is produced with varieties of taste varying with region-to-region and individual food habits. It is estimated that about 6.9 per cent of total milk produced in India is utilized for making dahi.

### Definition of Dahi

Dahi or curd is a semi solid product, obtained from pasteurized or boiled milk by souring, using harmless lactic acid or other bacterial cultures. Dahi may contain additional cane sugar. It should have the same minimum percentage of fat and solids- not- fat as the milk from which it is prepared. Where Dahi or curd, other than skimmed milk Dahi, is sold or offered for sale without any indication of the class of milk, the standards prescribed for Dahi prepared from buffalo milk shall apply.

Dahi made from buffalo milk produces a thick bodied product because of its high SNF content. Dahi prepared from whole milk contains about 5 – 8% fat, 3.2 – 3.4% protein, 4.6 – 5.2% lactose, 0.70 – 0.72% ash, and titratable acidity 0.60–0.80 % lactic acid.

**Table 2 FSSR (2011) and BIS standards of Dahi**

<b>Characteristics</b>	<b>FSSR(2011)</b>	<b>BIS</b>
Acidity % lactic acid	-	0.6 - 0.8
Total Plate count	Not more than 1000000/g	
Coliform count	10 per g max	10 per g max
<i>Escherechia coli</i>	Absent in 1g	
Salmonella	Absent in 25g	
Shigella	Absent in 25g	
<i>Stephylococcus aureus</i>	Not more than 100/g	
Yeast and Mould	100 per g max	100 per g max
Anaerobic spore	Absent in 1g	
<i>Listeria monocytogenes</i>	Absent in 1g	
Phosphatase test		Negative
Other requirements	It should have the same minimum percentage of fat and SNF as the milk from which it is prepared. If no standards declared then standards prescribed for dahi from buffalo milk shall apply	Dahi shall conform to the requirements of milk fat and MSNF, as laid down in FSSR, 2011

**Classification of Dahi**

Dahi is prepared in different varieties with region specific tastes. Dahi may be classified on the following basis.

- Dahi for consumption
- Dahi for production of desi butter
- Dahi for preparation of chakka, shrikhand and lassi
- Dahi prepared from whole milk, skim milk, standard milk, and special milk
- Dahi prepared with added sugar and fruits

Optimum acidity of normal dahi is less than 0.7% lactic acid while acidity of sour dahi is more than 0.7% lactic acid. Dahi made from buffalo milk produces a thick bodied product because of its high total solids content. It is recommended to make dahi from a milk containing 11- 13% total solids. Higher milk solids yield dahi with higher consistency and also keep the product from wheying off.

**Method of Manufacture of Dahi**

**Traditional method:** In traditional method dahi is prepared at small scale, either in the consumer's household or in the confectionary (*Halwais*) shop. Milk is heated intensively to boil for 5 to 10 min, cooled to room temperature and inoculated with previous day's curd or

butter milk at the rate of 0.5 to 1.0 %. Milk is then stirred and allowed to set undisturbed for about overnight. At the confectionary shops, the method employed for preparation of dahi is more or less same except that the milk is concentrated in open pan before inoculation. Concentration of milk results in custard like consistency of dahi and keeps the product from wheying off.

**Industrial Method of Dahi Making:** Organized sector produces dahi on the basis of scientific lines. Fresh, sweet, good quality milk is received, preheated to 35°- 40°C and subjected to filtration and clarification to ensure that, the milk is free from extraneous matter. The milk is standardized to 2.5 - 3.0 % fat and 10 – 12% solids not fat, preheated to 60°C and homogenized at a pressure of 175 kg/ cm<sup>2</sup> in single stage. The milk is heated to 85° – 90°C for 15-30 minutes, cooled to 37°C and inoculated with 1 – 1.5 % of specific dahi starter culture. It is then filled in suitable packaging containers (food grade polystyrene and polypropylene cups) of the appropriate size and incubated at 37°C for suitable time. After proper setting of the dahi, the acidity of dahi reaches 0.6 to 0.7 percent and a firm curd is formed. The product mix is incubated till its pH reaches 4.4 to 4.5 and then it is cooled rapidly to less than 5°C by exposing the cups to high velocity cold air. Dahi is normally stored at 4 – 5°C. Storage area should be maintained clean and tidy to avoid any cross contamination. The flow diagram for manufacture of dahi is presented in Fig. 1.

## **LASSI**

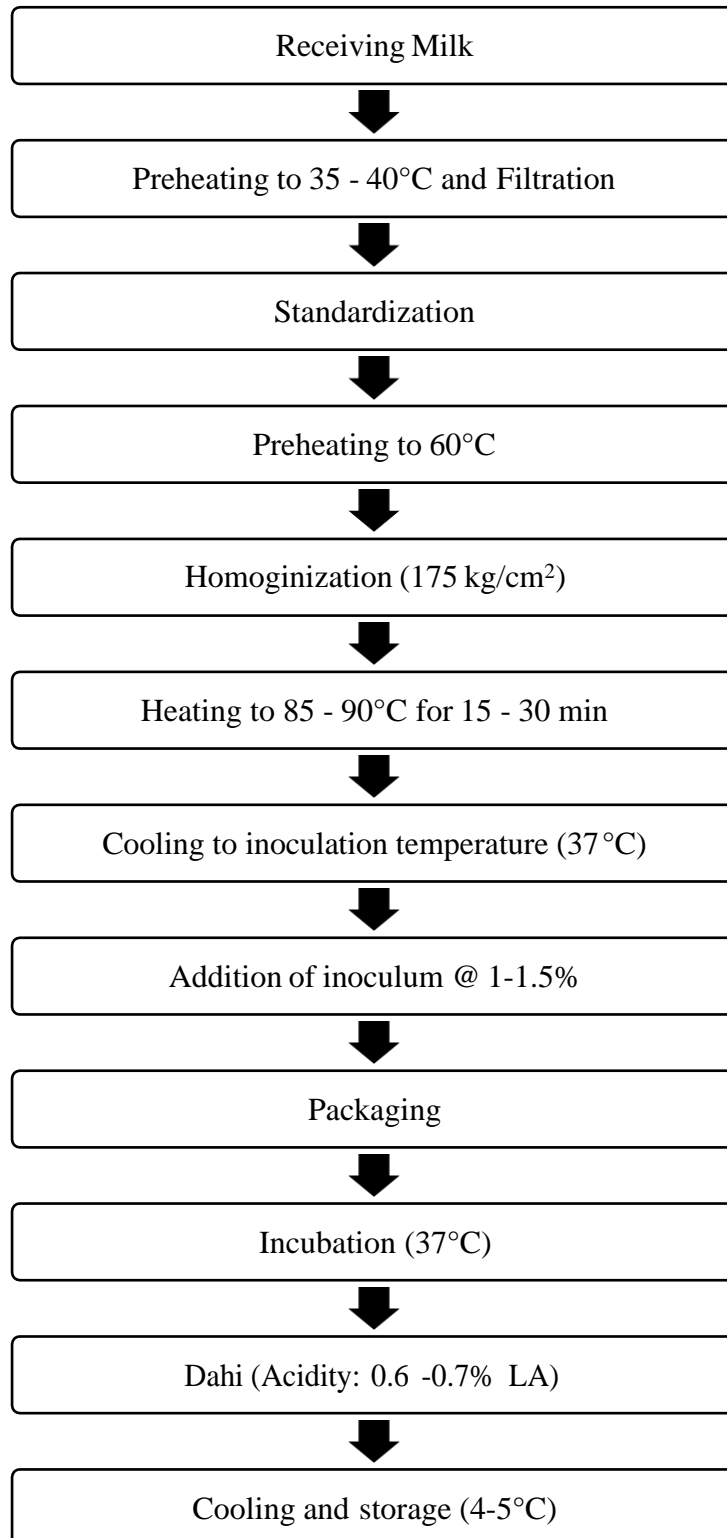
Lassi (stirred dahi) is a ready-to-serve fermented milk beverage, popular in north India particularly in summer months. Lassi is a white to creamy-white viscous liquid with a sweetish, rich aroma and pleasant mild acidic taste. It is flavored either with salt or sugar and other condiments or spices like ginger, coriander, and mint, depending on regional preferences.

### **Manufacture of Lassi**

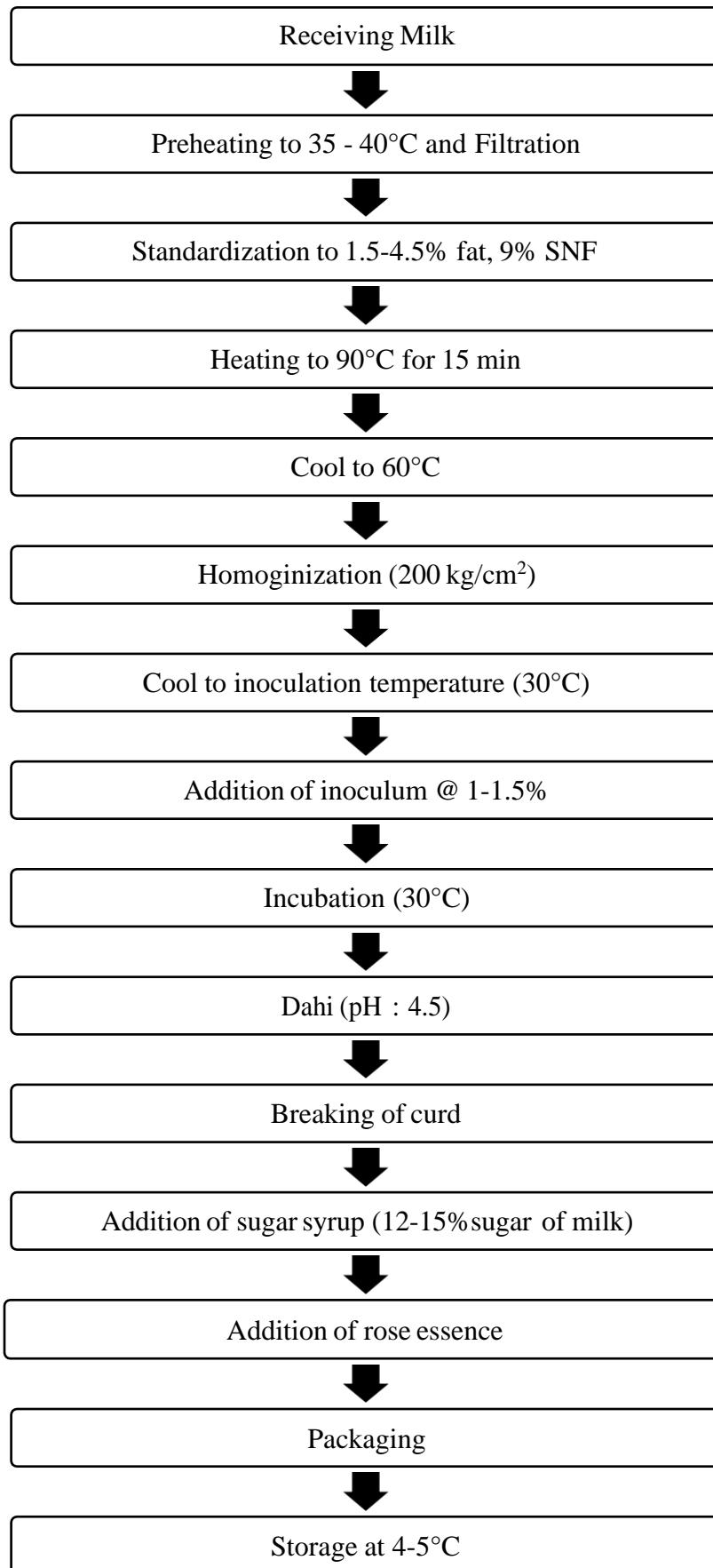
Lassi is becoming popular and attracting demand throughout the year. Production of lassi has been confined, to a large extent, to the households and local *Halwais*. To meet the consumer demand many dairies have started producing lassi on commercial scale.

The method of manufacture of lassi involves standardization of milk to 1.5 – 4.5% fat and 9% SNF and heating of milk to 90°C/15 min. The milk is then cooled to 60°C and homogenized at 150 kg/cm<sup>2</sup> and 50 kg/cm<sup>2</sup> in first and second stage, respectively. After homogenization the milk is cooled to inoculation temperature (30 – 32°C). The milk is inoculated with lactic

culture and incubated to attain the pH of 4.5. The curd is broken with the help of a power driven agitator. Sugar @ 12-15% of milk dissolved in equal quantity of water is added in the form of syrup which has been pasteurized and cooled separately. The mixture can be flavored with rose water and homogenized to improve body and texture. It is packed and stored at refrigeration temperature. The flow diagram for manufacture of lassi is presented in Fig. 2.



### Flow chart for manufacture of *Dahi*



## **Flow chart for manufacture of *Lassi***

### **SHRIKHAND**

Shrikhand is a popular fermented, sweetened, indigenous dairy product having semi-solid consistency. It has typical sweetish-sour taste. Shrikhand is fermented milk product which is very close to flavoured quarg of Germany. It is very popular dessert of Gujarat, Maharashtra and part of Karnataka. Shrikhand is prepared by fermentation of milk with lactic acid bacteria, expulsion of whey from the curd, followed by mixing with sugar, flavouring, spices and other ingredients like fruit pulp, nuts etc. to form soft homogenous mass.

### **Standards for Shrikhand**

The standards prescribed for Shrikhand by the Bureau of Indian Standards (BIS) and under the Food Safety and Standards Regulations (FSSR) are presented in table 3

### **Manufacture of Shrikhand**

**Traditional method:** The traditional method of manufacture of shrikhand involves the preparation of curd or dahi by fermentation of cow or buffalo or mixed milk with starter culture, preparation of chakka by draining whey from the curd and blending additives like sugar, color, flavour, species and fruits to obtain a desired composition and consistency.

Milk of cow or buffalo, or mixed milk is heated to boiling and then cooled to room temperature. Heated and cooled milk is inoculated with previous day dahi (lactic culture) @ 0.5 to 1 %. Milk is then left undisturbed at room temperature (30°-35°C) until it sets firmly. It

is then stirred and hung in a muslin cloth for 10 to 12 hours, to drain off whey. The curd mass so obtained is called chakka or maska. The chakka is mixed with the calculated amount of sugar, flavour, colour, herbs and spices and served chilled. The shrikhand yield is about 1.5 to 2.0 kg per kg of chakka used.

**Industrial method:** The chakka obtained from whole milk/ standardized milk has smooth body, whereas the one obtained from skim milk is little rough and dry. When whole milk is used for chakka making, high fat loss occurs in whey thereby affecting the recovery of fat in chakka. Therefore, it is preferred to use skim milk for chakka making and then mixing of cream or unsalted butter to adjust the fat in the finished product. The fully mechanized and continuous process has been developed for industrial production of shrikhand. The first modern plant has been established at the Baroda District Cooperative Milk Producers Union Ltd. Baroda Dairy has adopted a process which involves use of basket centrifuge for speedy draining of whey and a planetary mixer for kneading and mixing of ingredients.

Skim milk (9% SNF, 0.05% fat) is heated to 85°C for 30 min, cooled to 30°C and inoculated with LF-40 culture containing *Lactococcus lactis* subsp. *lactis* and *Lactococcus Lactis* var. *diacetylactis* at the rate of 1.0 – 1.5%. After the required acidity of 0.8 to 1.0% lactic acid (8 – 12 hrs) is reached, the curd is taken into basket centrifuge (28 inch diameter, 1100 rpm) or quarg separator to remove whey from the curd.

The processing conditions for the manufacture of shrikhand have been standardized. The curd mass or chakka is taken into planetary mixer or scraped surface heat exchanger. Sugar at the rate of 80% w/w, calculated amount of plastic cream (80% fat) to give at least 8.5% FDM in the finished product are added and mixed thoroughly. The final product contains 5 %fat, 42% sugar and 60% total solids. The acidity of the product is usually between 1.10 and 1.40 % lactic acid. The protein content of the product is 10.5%. Optional ingredients like color, flavor, fruits, nuts etc. can also be added at this stage. Then it is packed at room temperature and stored at refrigeration temperature. The flow diagram for manufacture of shrikhand is presented in Fig. 3.



