11.10 Dahi

11.10.1 Introduction. Indian curd, known as dahi, is a 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. In 1966, the production of dahi was estimated to be about 7.8 per cent of the total milk production in India and 14.0 per cent of the milk used for the manufacture of dairy products. (See Table 1.6.)

Since conversion of milk into dahi is an important intermediary step in the manufacture of indigenous butter and ghee, it can be said that over 40 per cent of the total milk production in India today is converted into dahi.

An extensive all-India survey project on dahi was carried out nearly three decades ago (32–34). It revealed that there are, broadly speaking, two types of dahi prevalent in the country for direct consumption, viz. a sweet/mildly sour variety with a pleasant flavour, and a sour variety with a sharp, acid flavour. The micro-organisms responsible for these two types were also identified, and are maintained in selected centres as freeze-dried cultures for sale to the industry and public alike.

11.10.2 Definition. According to the PFA Rules (1976), dahi or curd is the product obtained from pasteurized or boiled milk by souring, natural or otherwise, by a harmless lactic acid or other bacterial culture. Dahi may contain additional cane sugar. It should have the same 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.

The Indian Standard Specifications for designation of fermented milk products based on the types of culture used are given in Table 11.11, and requirements in Table 11.12.

(32) H. Laxminarayana and K. K. Iya: *Indian J. Vet. Sci.*, 22(1), 1 (1952).
(33) H. Laxminarayana, V. K. N. Nambudripad, N. V. Lakshmi, S. N.

TABLE 11.11

Designation of fermented milk products

Designation	Culture used
Sweet dahi	*Str. lactis*, *Str. diacetilactis*, *Str. cremoris* } Single or in combination with or without *Leuconostoc* species
Sour dahi	Same as above, along with *Lact. bulgaricus* or *Str. thermophillus* or both

TABLE 11.12

Requirements for fermented milk products

Characteristics	Requirement	
	Sweet dahi	Sour dahi
Acidity, lactic (% wt) (Max)	0.70	1.0
Yeast and mould count per g. (Max)	100	100
Coliform count per g. (Max)	10	10
Phosphatase test	—ve	—ve

SOURCE: *IS : 7035*, 1973.

11.10.3 Classification. Broadly speaking, dahi may be classified into two types:

I. For churning into desi (or indigenous) butter (makkhan);

II. For direct consumption.

Dahi for direct consumption may be further classified into:

(a) (i) Whole milk dahi; (ii) skim milk dahi.

(b) (i) Sweet (or mildly sour) dahi; (ii) sour dahi; (iii) sweetened dahi.

11.10.4 Food and nutritive value. It has been established that fermented milk products including dahi increase in food and nutritive value as compared to the original milk. The following points are cited in their favour:

(i) Dahi is more palatable, and those who usually do not like drinking milk would consume it readily;

(ii) dahi is more easily digested and assimilated than milk;

(iii) dahi seems to exert a possible therapeutic value in the stomach and during intestinal disorders, due possibly to its content

of antibiotics (35).

11.10.5 Composition. An average composition of (whole) milk dahi is given in Table 11.13.

TABLE 11.13

Composition of (whole) milk dahi (percentage)

Water	Fat	Protein	Lactose	Ash	Lactic Acid
85–88	5–8	3.2–3.4	4.6–5.2	0.70–0.72	0.5–0.11

Note: There is a slight increase in the concentration of milk solids to the extent of 5–10 per cent in dahi as compared with the initial milk.

11.10.6 Method of production

A. *For churning into desi butter (makkhan).* (See 11.14.)

B. *For direct consumption*

I. *Sweet/Sour dahi*

(aa) *Traditional method.* This invariably involves production on a small scale, either in the consumer's household or in the sweet-meat-maker's (halwai's) shop in urban areas. In the household, the milk is boiled, cooled to body temperature, inoculated with 0.5–1 per cent starter (previous day's dahi or buttermilk) and then allowed to set undisturbed overnight. In cooler weather, the dahi-setting vessel is usually wrapped up with woollen cloth to maintain warmth. In the shops, the method is more or less the same except that the milk is concentrated somewhat before inoculation and the dahi is usually set in a circular earthenware mould.

(bb) *Standardized method.*

(a) *Need.* The quality of market dahi presently sold in halwai shops in the country is generally sub-standard and variable. The factors responsible for this are:

(i) use of low-quality milk;

(ii) use of unsuitable starter cultures;

(iii) unfavourable temperatures of incubation;

(iv) contamination from badly-cleaned utensils.

In view of the nutritional and economic importance of dahi, it has long been realized that this product should be produced on scientific

(35) D. N. Gandhi and V. K. N. Nambudripad: *Indian J. Dairy Sci.*, 28(1), 72 (1975).

Enlighten – give greater knowledge

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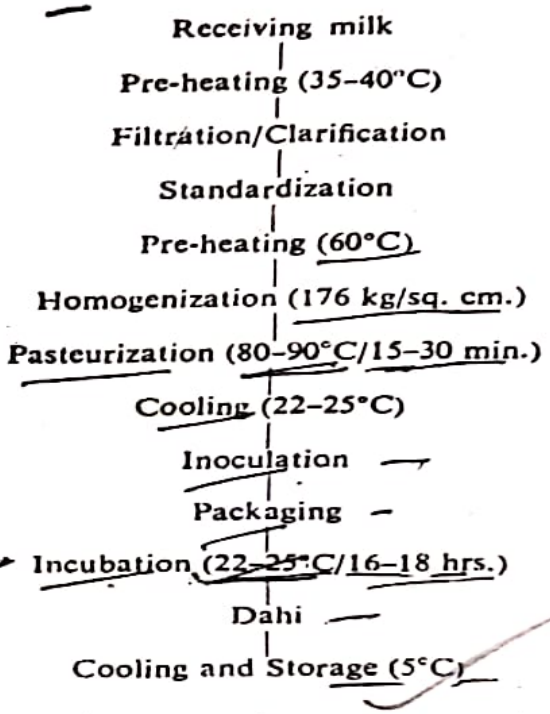
lines in the organized sector of the Indian dairy industry (36–38). The conditions of production, packaging and distribution should be standardized so as to ensure the supply of an uniformly good quality product from day to day.

(b) *Technique*

(i) *Flow diagram of production*



(ii) *Details of production.* Fresh, sweet, good-quality milk (cow, buffalo or mixed) is received, pre-heated to 35–40°C, and subjected to filtration/clarification. It is then standardized to 2.5–3.0 per cent fat and 10 per cent solids-not-fats (in order to improve the body), pre-heated to 60°C and homogenized single-stage at a pressure of 176 kg/sq. cm. The milk is pasteurized at 80–90°C for 15–30 minutes, cooled to 22–25°C and inoculated with 1–3 per cent of specific starter culture (see Table 11.10). It is then filled in suitable containers (glass bottles/plastic cups, etc.) of the required capacity and

(36) K. K. Iya and H. Laxminarayana: *Indian Farming*, 2(1), 18 (1953).
(37) K. S. Rangappa: *Indian Dairyman*, 14(8), 251 (1962).
(38) H. Laxminarayana and V. K. N. Nambudripad: *NDRI Publication No. 54* (1971).

incubated at 22–25°C for 16–18 hours, during which period the acidity reaches 0.6–0.7 per cent and a firm curd is formed. The curd is cooled to less than 12°C in about 1 hour (by circulating chilled water or air around the containers) and then stored at about 5°C in a cold room.

Note: During overnight storage, the acidity may increase slightly.

II. *Sweetened dahi.* In the eastern region of the country, especially West Bengal, a sweetened variety of dahi known as *misti* dahi, *lal* dahi or *payodhi* (the trade name of one particular manufacturer in Calcutta) is quite popular. It has a characteristic brown colour, a cooked and caramelized flavour and a firm body. It is prepared commercially by adding 6.25 per cent cane sugar to milk (cow or mixed) either before boiling or at the time of setting. The pronounced and intense heating causes the milk to brown and get partially concentrated. (The volume gets reduced to about three-fourths of the original.) Artificial colour, sugar-caramel and *gur* (jaggery) are also added during production. After heat-treatment, the milk is cooled to room temperature and then seeded (in variable amounts) with the previous day's product. It is usually set in earthenware basins and the finished product obtained after 15–16 hours. The method for the production of sweet dahi has been standardized (39).

Note: Studies have been made on: (i) utilization of colostrum for the preparation of dahi (40); (ii) development of dahi-making equipment (41), and (iii) production of new varieties of dahi (42). A suggestion has also been made for a new product named dahi-kusum (43).

11.10.7 Market quality. The desirable qualities in dahi offered for sale for direct consumption have been given in Table 11.14.

(39) H. P. Ray and R. A. Srinivasan. *J. Fd. Sci. Technol.*, 9(2), 62 [illegible]
[illegible]h and K. K. Iya: *Indian J. Dairy Sci.*, 5(1

TABLE 11.14

Market quality of dahi

Qualities	Requirements
Colour	Yellowish creamy-white for cow and creamy-white for buffalo milk; free from browning.
Appearance	Smooth and glossy surface; creamy layer on top (with whole milk product); free from extraneous matter.
Flavour	Mild, pleasant smell, clean acid taste, free from off-flavours
Body	Soft and firm, free from gas-holes and whey-pockets.
Acidity (per cent lactic)	0.75 to 0.85.

Note: The effect of different salts and chemical additives on the quality of dahi has been observed (44). The effect of starter cultures and incubation (period and temperature) on the acidity and quality of dahi has been ascertained (45–47) and the survival of pathogens in dahi investigated (48–49).

11.10.8 Packaging and storage. The traditional container for dahi is an earthenware cup. However, modern packaging includes glass bottle and plastic/plastic-coated cup. The recommended storage temperature is around 5–10°C.

11.10.9 Keeping quality. When prepared in the conventional manner, dahi has a short keeping quality at room temperature; on prolonged storage, it becomes highly acidic; this is accompanied by whey formation, making the product unfit for human consumption. Under refrigerated storage (5–10°C), it usually keeps well for a maximum period of one week.

11.10.10 Increasing keeping quality. Efforts to increase the keeping quality of dahi at room temperatures have led to the development of a carbonated product, which has a storage life of 15–30 days without refrigeration. It is prepared as follows: good-quality

(44) R. K. Baisya and A. N. Bose: *J. Fd. Sci. Technol.*, **11**(2), 70 (1974).
(45) C. K. Sharma and S. C. Jain: *J. Fd. Sci. Technol.*, **11**(6), 277 (1974).
(46) C. K. Sharma and S. C. Jain: *J. Fd. Sci. Technol.*, **12**(2), 81 (1975).
(47) R. K. Baisya and A. N. Bose: *Indian J. Dairy Sci.*, **28**(3), 179 (1975).
(48) P. Tiwari and I. P. Singh: *Indian J. Dairy Sci.*, **17**(3), 97 (1964).
(49) Tiwari and I. P. Singh: *Indian J. Dairy Sci.*, **19**(3), 162 (1966).

milk, after heat-treatment (preferably boiling for 3–5 minutes) is cooled to 30–35°C. It is then inoculated with a starter culture @ 1 per cent and mixed well. The culture may consist of lactic acid producers such as *Str. lactis* and/or *Str. cremoris*, together with an aroma producer such as *Str. diacetilactis*. The inoculated milk is filled up to the neck of each glass bottle. Now carbon dioxide gas is bubbled through the milk at 1 psi for 1 minute and the bottles are crown-corked. The milk is then incubated at 25–30°C for 16–18 hours until a firm curd is obtained.

Note: The role of contaminating yeasts in the spoilage of dahi has been reported.

11.10.11 Dahi powder. Studies have been conducted on the dehydration of dahi on a laboratory scale (50) and by various methods (51–53).

11.10.12 Uses of dahi

(a) *Whole milk dahi*

(i) For direct consumption: either as such with salt/sugar; or as a beverage after beating the curd and mixing it with water, salt/sugar, etc.;

(ii) for the preparation of chakka and srikhand (see 10.11);

(iii) for the preparation of makkhan.

(b) *Skim milk dahi*

For direct consumption: especially by heart patients since it is low in fat, and by the low-income group of the population because it is cheap yet nutritious.