

# Scientific Study on Indigenous Technology of *Dahi* Making of Eastern Nepal

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## Abstract

*Dahi* is the traditional fermented milk product indigenous to Nepal having its history dating back to ancient times. The preparation method is unique with steps like *saans marne*, *naato banne* and uses special close necked wooden vessel carved out of wood called *theki* for fermentation. Caramelization during heating and duration of fermentation affects color, appearance and form of *dahi*. The best flavor comes from *dahi* prepared in *daar theki*. Heat treatment affects microstructure, texture and rheology of *dahi*. A good *dahi* should possess firm body, consistent quality with equal ratio of sweetness and sourness. *Dahi* is indispensable item in Nepalese religious and cultural occasions which is nutritionally and therapeutically superior to milk. Storage life of *dahi* can be extended by a semi-continuous mode.

**Keywords:** *Dahi*; Traditional knowledge; Method of preparation; Sensory quality; Nepal

## Introduction

Nepal is a country of diverse culture, religion and ethnicity. The country is divided into three main physiographic regions namely Mountain, Hill and Plains or Terai. Different ethnic communities living in hills and mountains are Brahmin, Chhetri, Newar, Limbu, Rai, Gurung, Sherpa, Bhote, Tamang, Magar, Damai, Kami, Sharki and others. Dhimal, Tharu, Satar, Rajbansi and other ethnic groups are indigenous people of Terai. Due to migration and other reasons, Terai now has mixed society contained of large different ethnic groups. The different races and ethnic groups have their own cultural practices and food habits conceived from their ancestors [1].

There are a variety of traditional food products found in different parts of the country. Among these, some are location or region specific e.g. *chhurpi* in mountain area and *bhakka* in terai, some are community specific e.g. *chhoyala* and *kachila* in Newar, *kinema* in Limbu, and Rai, whereas some foods e.g. *gundruk*, *sinki*, *sel-roti*, *dahi* etc. are common to almost all geographic regions and ethnic groups. The indigenous foods have been prepared by traditional methods and the technology is being transferred from generation to generation [1].

Fermentation is one of the oldest methods practiced by human beings for the transformation of milk into products with an extended shelf life [2]. Fermented milk has been claimed by some research findings for being more nutritious and health promoting than fresh milk [3,4]. The conversion of lactose to lactic acid has preservative effect on milk, moreover, the low pH of cultured milk inhibit the growth of putrefactive bacteria and other determined organisms, thereby, prolonging the shelf life of the products [5].

*Dahi* or curd is the traditional fermented milk product obtained from pasteurized or boiled milk by souring with natural microflora or by the harmless lactics or other bacterial culture. *Dahi* is popular throughout the Indian subcontinent. It is consumed either in the main course of meal, as a refreshing beverage or as dessert. It is assumed that over 50% of total milk produced in Nepalese households is converted into *dahi*: only a small amount of the milk produced is sold. The conversion of milk into *dahi* is an important intermediary step in the manufacture of *nauni*, *ghee* [6], *mohi* and *chhurpi* [7]. *Dahi* is also consumed by the Nepalese with boiled rice or “*chewra*” (beaten-

rice) [7] or as *lassi* (sweet, salted or spiced), stirred and diluted *dahi* as steeping media for *dahi-wada* making.

Indigenous *dahi* is prepared in *theki* or earthenware pots at home and as well as local level for sell. It is interesting to note that proper documentation of its traditional technology is lacking specially *dahi* prepared in *daar theki*. Furthermore, no work on collection of important information and scientific approach as regards its production, nutritive value, quality; consumer perception and so on seems already undertaken. This is required not only to authenticate its origin, preserve its culture but also to improve and standardize its technology and commercialize this product.

## Objective of the Study

The objective of this study has been to collect the production technology related information such as definition and origin, ingredients and functions, preparation procedure and method of preparation, utensils, cooking fuel, desirable quality characteristics and factors influencing them, production and marketing, occasions of use, nutritive and therapeutic value and storage of indigenous *dahi* and provide suitable scientific justifications.

## Materials and Methods

### Survey for information collection

A Survey was conducted in randomly selected households in eastern part of Nepal, representing the major ethnic Nepali as the producers of *dahi*. Information was collected with minimum of 10 respondents from each district belonging to different ethnicity, religion, age and sex groups on preparation and consumption of *dahi*, using the

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questionnaire (Appendix B), personal interviews and communication by telephone method. These samples of respondents were used as purposive sampling method [8]. The main criterium of sample selection was the knowledge of persons they possessed about *dahi*. That is, those people who often or regularly prepare *dahi* either for market or home consumption was selected as sample. The information was collected on respondent's identity, knowledge and experience of *dahi* making, their knowledge about origin and definition, type of ingredients used and their functions, recipe, preparation procedure and method of preparation, utensils, cooking fuel, desirable quality characteristics and factors influencing them, production statistics, marketing, occasions of use, ethnical importance, nutritive and therapeutic value, storage practice and safety issues of *dahi*. The collected data were analyzed for mean, mode and standard deviation following the method of Ott et al. [9].

### Scientific data

Temperature was measured by digital thermometer. pH was measured by pH meter and TSS by hand refractometer of milk/*dahi* at survey sites.

### Response and its scientific analysis

**Respondent profile:** The total number of respondents was two hundred thirty six. Basically age groups > 30 years were chosen. Their profile is presented in Table 1.

The highest percentage (42.54) of respondents comprised of age between 50 and 70 years followed by 30-50 years. Among racial groups the highest number represented Brahmins and Chhetri followed by Rai and Magar. Likewise among the religious groups Hindu was highest (93%) and Christian the lowest (0.79%). For the case of locations the highest percentage (9.32%) of respondents was from Dhankuta followed by Ilam and other districts.

Demographics	Percentage	Demographics	Percentage
<b>Age Group</b>		<b>Resident of</b>	
<30	12.17	Bhojpur	7.2
30-50	35.23	Dhankuta	9.32
50-70	42.54	Khotang	4.23
>70	10.06	Ilam	8.05
<b>Gender</b>		Jhapa	8.05
Male	29.72	Morang	8.05
Female	70.28	Okhaldhunga	4.23
<b>Cast/Tribe</b>		Panchthar	4.23
Brahmin and Chhetri	53.67	Sankhuwasabha	8.47
Rai and Magar	17.51	Saptari	4.66
Newar	7.34	Siraha	4.66
Limbu	6.32	Solukhumbu	4.23
Choudhary	5.54	Sunsari	8.05
Tamang	5.23	Taplegunj	5.08
Dhimal	4.66	Terhathum	7.62
Rajbansi	3.33	Udaypur	3.81
<b>Religion</b>			
Hindu	93		
Buddha	4.46		
Christian	1.69		
Not Mentioned	0.85		

Table 1: Respondent Profile (n=236).

### Origin, nomenclature and definition of *dahi*

*Dahi* which is Nepalese indigenous fermented milk analogous to yoghurt is consumed by large sections of population in the country as an indispensable item of the diet since time immemorial. *Dahi* has been spelled out in the old religious epics like *Swasthani Bratakatha*, *Satyanarayan*, *Bratakatha* and *Puran* giving the evidence of its ancient origin and spelt as *argha*. The term *dahi* might have been derived as originated in the different languages spoken in the country as depicted below:

Sanskrit: *argha*

Nepali: *dahi*

### Ingredients and their functions

It was found that the majority of the respondents used cow, buffalo or combination and yak milk as major raw material when some of respondents used sheep and goat milk too. Different species of cow such as local, jersey and hybrid have been used in different region for milk production. Some respondents particularly the *dahi* traders used buffalo milk to prepare *dahi* because of good texture and thick consistency. Most of the respondents from mountains and hills used *theki* for fermentation purpose while rest of respondents belonging to terai region used earthenware pots (*kantari*) in place of *theki* for fermentation purpose. Most respondents stated not using back slopping method for *dahi* preparation. They do not used previous day culture if fermentation is done in *theki*. In case, when fermentation was done in other utensils, 5-8 g/L starter culture was used. In terai where fermentation was done in *kantari*, back slopping was mandatory. Response to addition of culture in *theki* while fermentation was obtained in two ways:

1. If *theki* is new, either they add 5-8 g of pervious day *dahi* or *mohi*
2. If *theki* is new, they let 4-5 times *dahi* to go as waste until natural and good microflora established.

Dahal [10] reported best quality *dahi* was obtained using 10% old *dahi* as inoculums for 22 hours fermentation time at room temperature ( $22 \pm 2^\circ\text{C}$ ). Zaman et al. [11] reported 5-8% as inoculum for *dahi* making in Bangladesh. Kharel et al. [6] reported 1-3% starter culture for *dahi* making.

### Equipment and accessories

The equipment required and used during *dahi* preparation and their functions were as following:

- a. *Balti*: It is a bucket made of steel or silver for milking purpose.
- b. *Dhungro*: It is a bucket made of wooden or bamboo for milking purpose/fermentation purpose.
- c. *Daadu*: It is a stirrer made up of coconut and bamboo or silver or wood used to stir the milk while heating.
- d. *Kunde*: It is a vessel made of brass to boil the milk.
- e. *Karahi*: It is a heavy deep iron pan with two holding rings which is used for boiling milk.
- f. *Dhungri*: It is a hollow iron cylinder used to provide air to coal or firewood during milk boiling.
- g. *Theki*: It is a close-necked wooden vessel carved out of wood

like *daar* (*Boehmeria rugulosa*) Wed, or other tree used for fermenting milk. Most respondents used *theki* to ferment *dahi*. Majority possesses and prefers *daar* and *katar theki*. Due to high cost, some respondents had *theki* made of other wood like *katar* (*Artocarpus heterophyllus*), *chilaune* (*Schima wallichii*), *karam* (*Adina orientalis*), *khamari* (*Gmelina arborea*), *khirro* (*Sapium insigne*), etc.

- h. *Kantari*: It is circular earthenware pot used to ferment *dahi* especially in Terai regions. Majority of people of terai community prefer this. The earthenware pot can be cup, *chhanch* or *taulo/ghyampo*.

### Cooking fuel

About 72.2% of respondents used firewood as fuel as it is easily obtainable from forest and in the market; 23.8% of respondents used gas stove and 4% used kerosene stove for the preparation of *dahi*. High temperature and long time heating is necessary to boil milk. Hard wood is preferred as this type of wood can produce high heat and gives constant temperature for a long time. The respondents of Terai especially *Tharu/Choudhary* used dried cow-dung and firewood together.

### Method of preparation

There were some variations with respect to milk used, season of *dahi* making, culture addition, and availability of milk. No significant difference was found in the procedure, however. The procedure followed in *dahi* making was found as in Figure 1.

**Milk procurement:** Fresh cow, buffalo or yak milk is drawn and filtered by muslin cloth. Alternately, milk is collected from local level for commercial purposes.

**Boiling:** Filtered milk is transferred to heating vessel called *kunde* or *kanti* and boiled in high temperature for 10-15 minutes. During this process, about 1/3<sup>rd</sup> milk is frequently taken out in *balti* and add back, the process referred as *saans marnae*. This process takes place for 3-5 times and is done to sterilize *balti*. The volume of milk reduces by

10-20% and consequently TSS increases to 16-18%. The color of milk becomes reddish brown. Continuous stirring must be done during boiling by use of *daadu* made of coconut and bamboo or of silver or other materials. Three phases can occur during boiling:

- If boiling is less, milk will be unsweet and thin consistency.
- If boiling is adequate, milk will be sweet and desirable consistency
- If over boiling is done, milk will be develop cooked flavor and *dahi* have grainy texture.

The explanation for these three phases while boiling milk in Nepalese indigenous *dahi* making can be correlated to yogurt milk. It is considered that insufficient heating will result in a weak-bodied yogurt, while excessive heating will lower gel strength and result in a grainy textured yogurt with a tendency towards syneresis. The phenomenon of grainy texture could be due to structural rearrangements following gelification. The continued aggregation of casein particles after the aggregation and gelation of whey proteins has been initiated may cause local stresses in the network, leading to localized fractures shortly after gel formation [12].

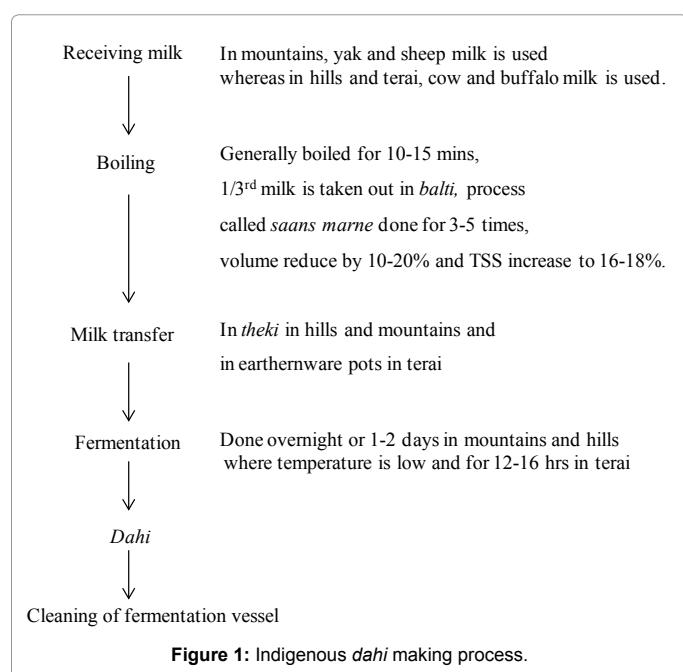
**Milk transfer:** The well boiled milk is transferred to hollow wooden vessel or container locally called as *theki* in boiling hot condition or alternately, cooled for 10-15 minutes. If transferred hot, lidding of *theki* with cap is not done for 10 minutes, else curd will be sour. Care should be taken not to contaminate with rice. This may lead to sour *dahi*. There is no addition of culture in *theki*. The microorganisms entrapped in cracks of *theki* acts as source of inoculums. After lidding, *theki* should be covered with cloth at top, the process called as *naato banne*. In terai region baked earthen container is used in which cooled inoculated (*Joran*) milk is transferred for fermentation.

**Fermentation:** The milk is fermented in the vessel for 12-16 hours in summer and 1-2 days in winter depending on altitude. In winter, the vessel especially *theki* is covered with warm cloth and/or kept near fireplace. Generally, in hills of Nepal, if fermentation is started in morning, *dahi* will be ready next morning. There is a belief milk must be fermented as least one night. The duration of fermentation depends on the season as well as on the geographical location of the place.

**Dahi:** After suitable time temperature fermentation, the obtained product is *dahi* having thick consistency and firm texture called *chakana chakana dahi* in *Nepali*. The prepared *dahi* has three distinct phases:

- Creamery layer on top
- Homogenous body of curd and the surface being sift and glossy
- Watery portion at bottom (though excess not desirable, not quite apparent when earthen pot is used).

**Cleaning of fermentation vessel:** Prepared *dahi* is consumed as such, sold in market or churned to prepare *ghee* and *mohi*. The fermentation vessel is cleaned with hot water and used for next batch. In case of *theki* if spoilage of *dahi* occurs (called *chokha* in *Nepali*), it is cleaned with the leaf of *bimiro* (*Citrus medica* L.) plant and hot water. Literature survey revealed that this plant reported for the antioxidant activity, antimicrobial activity and anti fungal activity. Phytochemical screening states that it contains fixed oils, volatile oils, and citric oxide and flavanone glycosides are abundant constituents of citrus leaves and fruits [13]. The medicinal value of this plant has also been described in Nepalese *Ayurveda* (Nepalese Traditional Medicine) [14].



## Results and Discussion

### Sensory quality of *dahi* and factors affecting it

Appearance, color, flavor, taste, texture and other impressions like syneresis and consistency make up the sensory quality of any fermented dairy foods including *dahi*. When asked about the sensory quality of *dahi* most of the respondents identified the following as the desirable characteristics:

**Appearance, color and form:** The *dahi* should be good set, has natural milk or caramelized color and has smooth and glossy surface.

**Odor:** It should be balance of sweet and sour (1:1).

**Taste:** The taste should be sweetish to sweet and sour.

**Texture:** Preference of most of the respondents was for smooth, glossy surface and solid texture *dahi* with no wheying off and good mouthfeel.

**Consistency:** *Dahi* should have firm and solid body and consistency quality.

**Eating quality:** *Dahi* should produce good mouthfeel. It should feel like a soft and sponge when pressed in tongue.

According to BIS [15] specifications for fermented milk product-*Dahi*, that it should have a pleasing flavor and a clean acid taste, devoid of undesirable flavor, should have firm and solid body and texture and be uniform with negligible whey separation. Other characteristics of a good quality *dahi* made from whole milk which has a cream layer on the top, the rest being made up of a homogenous body of curd and the surface being smooth and glossy, while the cut surface should be firm and free from cracks of gas bubbles and it should have a pleasant acid taste with sweetish aroma.

### Factors affecting appearance, form and color

Appearance, form and color are affected by color of milk, heating intensity of milk or added coloring materials. Caramelized color is obtained during excessive high temperature heating of the milk [16]. Appearance is also affected by duration of fermentation. Many respondents opined that *dahi* not fermented overnight or for adequate time and in proper temperature develops thin curd, high wheying off (called *jholayilo* in Nepali) and bad taste.

### Factors affecting flavor

Flavor is one of the most important properties of food products, and is an important factor determining its acceptability and preference. The percentage response of the respondents approving the factors having effect on the flavor of *dahi* is given in Table 2.

Most respondents opined milk plays significant role in flavor of *dahi*. Cheng [17] reported the sensory properties of dairy products depend largely on the relative balance of flavor compounds derived from fat, protein, or carbohydrate in the milk. Good quality product comes from good quality raw material. The fat content in milk determines quality of finished product. *Dahi* prepared from whole milk is preferred by most respondents. The respondents opined that best *dahi* comes from *daar theki*. Few respondents from terai region claimed *dahi* prepared in earthenware vessel more desirable and thick consistency than *dahi* prepared in *theki*. Almost all respondents agree on flavorful *dahi* comes from *daar theki*. The flavorful *dahi* prepared in *daar theki* can be generalized in same way as wine aged in oak barrel. Campbell et al. [18] reported impact of oak on wine flavor is derived primarily from

extraction of volatile aroma and flavor compounds from oak into wine. The characteristics of oak and *daar* wood are similar in many aspects.

The fermentation time and temperature affects *dahi* quality and flavor. One night fermented *dahi* in *theki* kept near fireplace or covered with cloth gives best quality *dahi*. One third respondents emphasized quality culture addition in development of consistent product whereas other believed in no need for addition of culture (especially *theki* users).

The odor and taste as a whole gave flavor which depended on the volatile constituents of milk [11] and those produced by dairy starter. Most flavor compounds in *dahi* are expected to be produced from lipolysis of milkfat and microbiological transformations of lactose and citrate into diacetyl and acetaldehyde. According to Cheng [17] more than 100 volatiles, including carbonyl compounds, alcohols, acids, esters, hydrocarbons, aromatic compounds, sulfur-containing compounds, and heterocyclic compounds, are found in yogurt at low to trace concentrations. Besides lactic acid, acetaldehyde, diacetyl, acetoin, acetone, and 2-butanone contribute most to the typical aroma and flavor of yogurt. Extended storage of yogurt causes off-flavor development, which is mainly attributed to the production of undesired aldehydes and fatty acids during lipid oxidation. Similar observations of off-flavor have been reported by all of the respondents in present study.

### Factors affecting texture

One of the most important sensorial attributes for *dahi* is texture, which could be assessed by sensory or instrumental analysis. Many of the factors were found to be responsible for the texture and micro structure of *dahi*. The respondents' response is presented in Table 3.

Milk total solids topped the list of factors followed by fat content, fermentation vessel; culture addition, fermentation time, temperature and manufacturing process were found notable. The respondents opined that the texture of *dahi* depended upon the times milk is heated on fire and volume reduction thereby increase in total solids. The higher the TSS of milk, better the texture of *dahi*.

One of the most important processing parameters affecting microstructure, texture, and rheology of *dahi* is heat treatment of milk. This is according to Lucey and Lee [19] when milk is heated at >70°C,

Particular	Percentage of respondents (n=236)
Milk	100
Fat Content	85.6
Fermentation Vessel	92.7
Fermentation Time	51.1
Fermentation Temperature	62.3
Culture Addition	33.5

Respondents were allowed multiple responses, percentages may exceed 100%.

Table 2: Factors influencing the flavor.

Particular	Percentage of Respondents (n=236)
Milk TSS	96.4
Fat Content	93.3
Culture Addition	45
Fermentation Vessel	87.6
Fermentation Time	37.9
Fermentation Temperature	24.6
Manufacturing Process	23.5

Respondents were allowed multiple responses, percentages may exceed 100%.

Table 3: Factors affecting texture.



the major whey proteins, such as,  $\beta$ -lactoglobulin, are denatured. During denaturation  $\beta$ -lactoglobulin interacts with the  $\kappa$ -casein on the casein micelle surface (and any soluble  $\kappa$ -casein molecules, i.e.  $\kappa$ -casein that dissociates from the micelle at high temperatures) by disulfide bridging, which results in increased gel firmness and viscosity

Many respondents opined *dahi* made of whole milk have better texture. As reported by De Ross [20] fat plays a major role in the determination of texture and flavor of complex food products and its quantitative impact was largely investigated in the past. The better texture might be due to better water holding capacity. Becker and Puhan observed that yogurt made from whole milk did not show any whey separation. An increase in WHC from 10% to 16% was also reported by Keogh and O'Keonedy in yogurt containing 5% fat compared to non-fat yogurt [12].

Forty five percent respondents believed addition of previous day culture in milk enhances better texture as it would have good set compared to non cultured added milk. But majority of respondents claimed better textured *dahi* in *theiki* without culture addition. This might be due to better temperature control and desirable microflora in *theiki*.

Texture of the curd depends mainly upon the rate of development of the acidity i.e. type of organisms present in the culture. The wide variation in the quality parameter of the curd can be attributed to the manufacturing conditions and type of organisms used [21]. The texture is always enhanced when a texturing (ie. EPS producing) starter is used. They also allow for the increasing smoothness (2 times) and improvement WHC (1.5 times higher in average) [12]. Katawal and Subba [1] in their research have also found milk and milk products having considerable fat content have influence on texture development and has preserved the eating and keeping quality.

Respondents' opined fermentor must be kept near fireplace or covered with clothes for maintaining optimum incubation temperature. Otherwise, *dahi* will not be fermented and bad textured. *Dahi* incubation temperature has marked effect on *dahi* texture. *Dahi* made at around 25-30°C will have more viscous, smoother and slimy appearance. Lucey et al. [22] who studied the microstructure of chemical and bacterial lactic curd, showed that gels made at 42°C appeared to be coarser and to have much less branches or cross-links, thinner strands, and larger pores in comparison to gels made at 30°C. The denser protein matrix observed at lower temperatures induces a better WHC and a lower permeability of the gel than obtained at higher temperatures.

### Factors affecting consistency

*Dahi* should have firm body and consistent quality. During the study, variation in consistency was observed. Variation in consistency among *dahi* of different region may be due to the variation in the strains of bacteria in the mixed culture and variation in the manufacturing techniques by different manufacturers. Additional material may also have influence the body and consistency score. It was reported by Gupta et al. [21] that addition of non-fat dry milk and vegetable oil to skim milk improves the body and consistency of prepared curd.

### Factors affecting eating quality

Eating quality might be understood as the total or overall sensory impression perceived from a food [1]. The response of respondents on the eating quality is presented in Table 4 and it is shown that sweetness, sourness, texture, color and fermentation vessel significantly affect the eating quality.

Particular	Percentage of respondents (n=236)
Sweetness	50
Sourness	50
Texture	95
Color (Yellow)	45
Fermentation Vessel	75

Respondents were allowed multiple responses, percentages may exceed 100%.

Table 4: Factors influencing eating quality.

Half of respondents liked sweet *dahi* whereas other half showed preference for sour type. Most respondents showed preference for *dahi* having sweet: sour=1:1 flavor. Ninety five percent of respondents opined texture of *dahi* as desirable quality. In terms of color, forty percent gave preference to colored (yellow from cow) *dahi* whereas other likes white *dahi*. Seventy seven percent respondents opined *daar theki*-fermented-*dahi* as first choice. In similar way seventy five percent respondents, all from terai preferred earthenware-pot-fermented *dahi* as their first choice. Rest has preference for *dahi* made in *theiki* of other woods, stainless steel vessel, paper or plastic cups.

### Occasions of production, use and marketing of *dahi*

Generally *dahi* is made at home for consumption by family, for sale in sweetmaker's shop or hotels and during religious, ritual, cultural occasions. *Dahi* is prepared at home also for the purpose of *ghee* and *mohi* making and for welcoming guests at home. *Dahi* is almost as essential in some religious and cultural occasions like *Swasthani Pooja*, *Satyanarayan Pooja*, *Saraswati pooja*, *Tihar*, *Dasain*, wedding, *Nwaran*, *Barakhi*, *Shraddha*, birthday, *Puran*, *Pashni* or as token of good omen. It is important item regarded as *argha* offered to Gods. *Dahi* is used as 'binder in *tika*'. It is used as *daun* in *selroti* preparation. *Dahi* is highly preferred during intestinal disorders like diarrhea as a source of probiotics. Almost all respondents prepared *dahi* in *Dasain*, *Tihar* and *Pooja/Shraddha*. Traders of Tarahara prepared *dahi* on regular basis for sale as well as on people's special demand in special occasions. Some traders were found to prepare *dahi* in large quantity during summer season because people preferred to consume *dahi* as such or as a refreshing nonalcoholic beverage and savory to beat hot days in summer. Sugar may or may not be added before consumption. It is also consumed after mixing it with rice or *chiura* (beaten rice) anytime and especially in Ashad 15 (*dhan diwas*, paddy transplantation day). This has further increased and popularized *dahi* throughout Nepal.

### Nutritional value of *dahi*

*Dahi* is one of the most important products in the family of fermented milks. Of the total quantity of milk converted into milk products, about 45% is used for *dahi* making in eastern Nepal. *Dahi* is reported to have better nutritive value than milk. All respondents agreed with this point of view. Though there is no increase in fat or protein content of milk during fermentation, however, the digestibility of *dahi* is more than that of milk. This fact has also been discussed by Gandhi and Natrajan [23].

Gandhi and Natrajan [23] reported that Calcium and Phosphorus content of *dahi* are more easily assimilated in the body as compared to milk. *Dahi* contains more vitamins, which is synthesized by specific lactic acid bacteria. During the curd formation, lactose of milk is converted to lactic acid. There is a breakdown of protein resulting an increase in the non-protein nitrogen. The fat globules coalesce and distribute themselves on the top. Physically during *dahi* formation, milk proteins are jellified under thin exudates and a clear serum on the curd is seen. The formation of consistently good quality *dahi* depends

upon the use of right type of starter cultures. As a result of metabolic activity of *dahi* starters, quantitative nutritive changes occur in milk during *dahi* making process. There are appreciable changes in mineral and vitamins contents of *dahi* depending on the type of organism used for fermentation. A mixed culture of *L. bulgaricus* and *Leuconostoc cremoris* decrease thiamine, riboflavin and nicotinic acid in milk during *dahi* fermentation. However, single culture of *L. lactis* and *L. cremoris* raised the thiamine concentration from 2-20% over that of milk. Similarly, riboflavin content of *dahi* made from whole buffalo milk is almost four fold that of skim milk *dahi*.

### Therapeutic value of *dahi*

All respondents opined Nepalese indigenous *dahi* having therapeutic properties. It has natural benefits and curative properties for different diseases. The diseases and percentage of response is shown in Table 5.

All respondents opined for cure of gastrointestinal diseases by consumption of *dahi* like chronic constipation, diarrhea, dysentery, chronic appendicitis and gastric ulcer. Twenty three percentage respondents stated its cure for hepatitis and jaundice, thirty six percentages for skin disorders like psoriasis and eczema, sixty percentages opined premature old age and decay could be prevented by taking sufficient curd in the daily diet. Similarly, more than ninety percent respondents believed *dahi* mixed with other suitable ingredient can be regarded as beauty enhancer. It can cure hair fall, dandruff and pimples. Very few respondents reported *dahi* as treatment of osteoporosis and insomnia. Half of respondents opined *dahi* as cure for cancer. Our findings on therapeutic properties are supported by Gandhi and Natrajan [23].

In the same way, 1/3<sup>rd</sup> of respondents believed that the use of *dahi* in the form of *mohi* is highly beneficial in the treatment of diabetes. They strongly recommended consuming *dahi/mohi* prepared in *daar theki* for diabetics. Semwal et al. [24] reported chemical constituents from the leaves of *daar* (*Boehmeria rugulosa*) with antidiabetic and antimicrobial activities.

### Storage of *dahi*

Normally *dahi* is not stored. It is consumed fresh and prepared as per demand during different occasions and festivals. However earthenware pot or *theke dahi* can remain in good condition for 3-4 days. The storage life is reported to extend by 6-7 days by the process called *thapuwa dahi* where milk addition at times into the fermentation vessel/container is done in a semi continuous mode. Generally evening or next morning milk (luke warm) is added to morning fermented *dahi*. *Dahi* will be ready the following day. Like many other milk products, *dahi* is prone to deterioration, especially at an ambient temperature, within a matter of days. Various microbial, enzymatic, or chemical reactions occurring within *dahi* during storage may alter its physical, chemical, and microbiological structure, causing deterioration or spoilage. Cheng [17] reported generation of volatile by-products leads to off-flavors and makes the product unsatisfactory for the tastes of consumers.

### Age and preference

The response to the question as who in the family like *dahi* most is shown in Table 6. It was found that the adult like to consume *dahi* very much. The children like *dahi* due to top creamery portion. Very old people liked it least which could be due to their weak health condition, feeling cold with *dahi* and hypersensitive reaction reactions. People avoid *dahi* during common cold, fever and pneumonia.

Disease	Percentage of Respondents (n=236)
Gastrointestinal	100
Hepatitis And Jaundice	23
Skin Disorders	36
Longevity	68
Cancer	46
Diabetes	75
Pimples	95
Hair Fall	92

Respondents were allowed multiple responses, percentages may exceed 100%.

Table 5: Therapeutic properties of *dahi*.

Particular	Percentage of Respondents (n=236)
Children	16
Adolscnt	37
Adult	46
All Members	39
Old	7
Very Old	3

Respondents were allowed multiple responses, percentages may exceed 100%.

Table 6: Respondents' liking for *dahi*.

### Conclusions

The present study clearly showed that Nepalese indigenous *dahi* is indispensable item of diet since immemorial. *Dahi* is prepared in special wood container called *theke* or in earthenware pots called *kantari*. There is no need to add starter culture in *theke*. Preparation method of indigenous *dahi* is unique in Nepal. Milk and culture quality and composition, heat treatment, fermentation vessel and duration affect sensory qualities of *dahi*. *Dahi* is essential in every religious and cultural occasion in Nepal which is nutritionally and therapeutically superior to milk. Storage life of *dahi* can be extended by a semi-continuous mode called *thapuwa dahi*.

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### References

- Katawal SB, Subba D (2008) A Survey Study on Technology of Sel-roti: A Traditional Food of Nepal. J Food Sci and Technol Nepal 4: 23-30.
- Tamime AY, Robinson RK (1999) Yoghurt: Science and Technology, 2nd (ed) Woodhead Publishing, Boca Raton F. L. New York, USA.
- Perdigon G, Alvarez S, Rachid M, Agüero G, Gobbato N (1995) Immune system stimulation by probiotics. J Dairy Sci 78: 1597-1606.
- El Zubeir IEM, Abdalla WM, El Owni OAO (2005) Chemical composition of fermented milk (roub and mish) in Sudan. J Food Control 16: 633-637.
- el Agamy EI, Ruppner R, Ismail A, Champagne CP, Assaf R (1992) Antibacterial and antiviral activity of camel milk protective proteins. J Dairy Res 59: 169-175.
- Kharel GP, Acharya PP, Rai BK (2010) Traditional Foods of Nepal. Highland Publications, Kathmandu, Nepal.
- Dewan S, Tamang JP (2007) Dominant lactic acid bacteria and their technological properties isolated from the Himalayan ethnic fermented milk products. Antonie Van Leeuwenhoek 92: 343-352.
- Bhandarkar PL, Wilkinson TS (1993) Methodology and Techniques of Social Research. 9th ed, Himalaya publishing House, Dehli.

9. Ott L, Larson FR, Mendenhall W (1981) *Statistics: A Tool for the Social Science*, 4th ed, PWS publishers, Boston.
10. Dahal B (2011) Indigenous fermented milk product using local old dahi.
11. Chowdhury NA, Paramanik K, Zaman W (2011) Study on the Quality Assessment of Curd (Dahi), Locally Available in Bangladesh Market. *World J Dairy and Food Sci* 6: 15-20.
12. Sodini I, Remeuf F, Haddad S, Corrieu G (2004) The relative effect of milk base, starter, and process on yogurt texture: a review. *Crit Rev Food Sci Nutr* 44: 113-137.
13. Manoj J, Pal RK (2011) In Vitro Anthelmintic Activity of Aqueous and Alcoholic Extracts of Citrus Medica Leaves. *Der Pharmacia Lettre*, 3: 396-399.
14. Bajracharya MB, Tillotson A, Caldecott T (2010) Review of Ayurvedic Medicines-Formulas.
15. Indian Standard Institution (1980) Specification for Dahi: IS: 9617, Manak Bhawan, New Delhi.
16. Munzur MM, Islam MN, Akther S, Islam MR (2004) Effect of Different Levels of Vegetable Oil for the Manufacture of Dahi from Skim Milk. *Asian-Aust J Anim Sci*, 17: 1019-1025.
17. Cheng H (2010) Volatile flavor compounds in yogurt: a review. *Crit Rev Food Sci Nutr* 50: 938-950.
18. Campbell JI, Pollnitz AP, Sefton MA, Herderich MJ, Pretorius IS (2006) Factors affecting the influence of oak chips on wine flavour. *J wine industry* 21: 38-42.
19. Lee WJ, Lucey JA (2010) Formation and Physical Properties of Yogurt. *Asian-Aust J Anim Sci* 23: 1127-1136.
20. de Roos KB (1997) How lipids influence food flavor. *Food Technol* 51: 60-62.
21. Gupta RC, Mann B, Joshi VK, Prasad DN (2000) Microbiological, chemical and ultrastructural characteristics of Misthi Doi (Sweetened dahi). *J Food Sci Technol* 37: 54-57.
22. Lucey JA, Tamehana M, Singh H, Munro PA (1998) A comparison of the formation, rheological properties and microstructure of acid skim milk gels made with a bacterial culture or glucono- $\delta$ -lactone. *Food Res Int* 31: 147-155.
23. Gandhi DN, Natrajan AM (2010) Preparation of a Good Quality Dahi (Curd) and Probiotic Milk Products. 1-31.
24. Semwal DK, Rawat U, Semwal R, Singh R, Krishan P, et al. (2009) Chemical constituents from the leaves of *Boehmeria rugulosa* with antidiabetic and antimicrobial activities. *J Asian Nat Prod Res* 11: 1045-1055.

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