

Production of Traditional Fermented Milk in Kenya (a Review)

by

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Abstract

Traditional fermented milk production and its consumption in Kenya is considered to be one of the oldest cultural and traditional practice among many Kenyans. The fermented soft cheese like product is preferred for its excellent flavor, delicious taste and health giving properties. The fermented product is produced by local people using locally available materials and ancient methods unique to the people themselves. Due to the ever growing population, the consumption of the fermented product has gained popularity among non-Kenyans and those Kenyans living in urban areas. The fermented product has also been an excellent source of useful dairy fermentation microorganisms for commercial and industrial purpose. The aim of this review is to give an outline of the production of traditional fermented milk in Kenya and draw an insight to its potential and investigate its compositional and microbiological characteristics.

Introduction

It would have been impossible for man to survive without the indigenous fermented foods for Millennia as fermentation are part of nature, they also preserve food, improve digestibility and enrich substrates with essential vitamins, proteins and amino acids. They are responsible for many of the diverse flavors and textures. Man's association with fermented milk stretches back thousand of years before Christian era, having its origins before the dawn of civilization. Kenyan traditional fermented milk is one of those products with long history. Fermented milk in Kenya has been produced and consumed by most of communities in the country, particularly the pastoralists

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who keep large herds of animals. Kenyans prefer a viscous product, fermented with mesophilic cultures producing diacetyl flavor and little CO₂ (Wango et al, 1992). Traditionally fermented milk differs in the type of milk and coagulation method used, and of course, in the species of resident microorganisms. The fact that they are traditionally produced, many fermented milk products which are only made in extremely restricted areas, and have not had their starter microorganisms adequately studied, is a cause of concern for the manufacture of new fermented milks in the future.

Milk production in Kenya

The total land mass in Kenya is 56.9 million hectares. Ten million hectares of this land is classified as high to medium potential land. About 60% of this land is devoted to crop and milk production. 42.1 million hectares, 80% of total land area in Kenya, is classified as having low potential and is extensively used for livestock production (Development plan 1994-1996). Dairy farming in Kenya is a major pre-occupation of its 25 million people. Types of dairy animals kept includes European breeds such as Friesian, Jersey, Arshire and Guernsey. Majority of herd reared comprises of cross breed between the European breeds and local Zebu. Common crosses includes Sahiwal and Nandi breed which are reared for milk production. Dairy farming in Kenya is concentrated in Rift Valley Province (Fig. 1). In most districts of Rift Valley, dairy farming is carried out on large farms of over 250 hectares. It is often associated with farming of cereals such as wheat, maize and barley. Average dairy herds on search farms vary in size but it is not less than 50 cows. In other districts, dairy farming is carried out in small farms where it competes with growing cash crops such as tea, coffee, and pyrethrum. Expansion of dairy farming in these farms is limited by the size of land.

Kenya produced 1.826 billion tons of milk in 1992. With the milk production growth rate of 2% per year, she is targeted to produce 1.976 billion tons of milk in 1996. Milk produced is processed into a number of products by dairy processing firms. The major milk processing firm in Kenya is Kenya Cooperative Creameries (K.C.C.). There are other processing firms which include Daramere Dairies, Brooke side Dairy, Kitida Cooperative among many others.

Traditionally fermented milk in Kenya.

Traditionally fermented milk refers to that milk product which is indigenous to the region of production and has been developed by the communities living in that region themselves. Traditionally fermented milk has long history and form an integral part of the culture, the word traditional does not mean 'ancient'. It rather indicates that the product is produced using old age techniques from locally available materials. Although documentary evidence is not available, it appears that preoccupation factors played a role in the emergence of traditional fermented milk in Kenya. Studies indicates that 53% of milk produced in cooler Kenyan highlands is consumed as fermented milk 'maziwa lala' (Shalo 1973). Production and consumption of fermented milk is a dairy undertaking in arid and semiarid areas of Kenya.

The major areas where fermented milk is still being produced and consumed include, Narok and

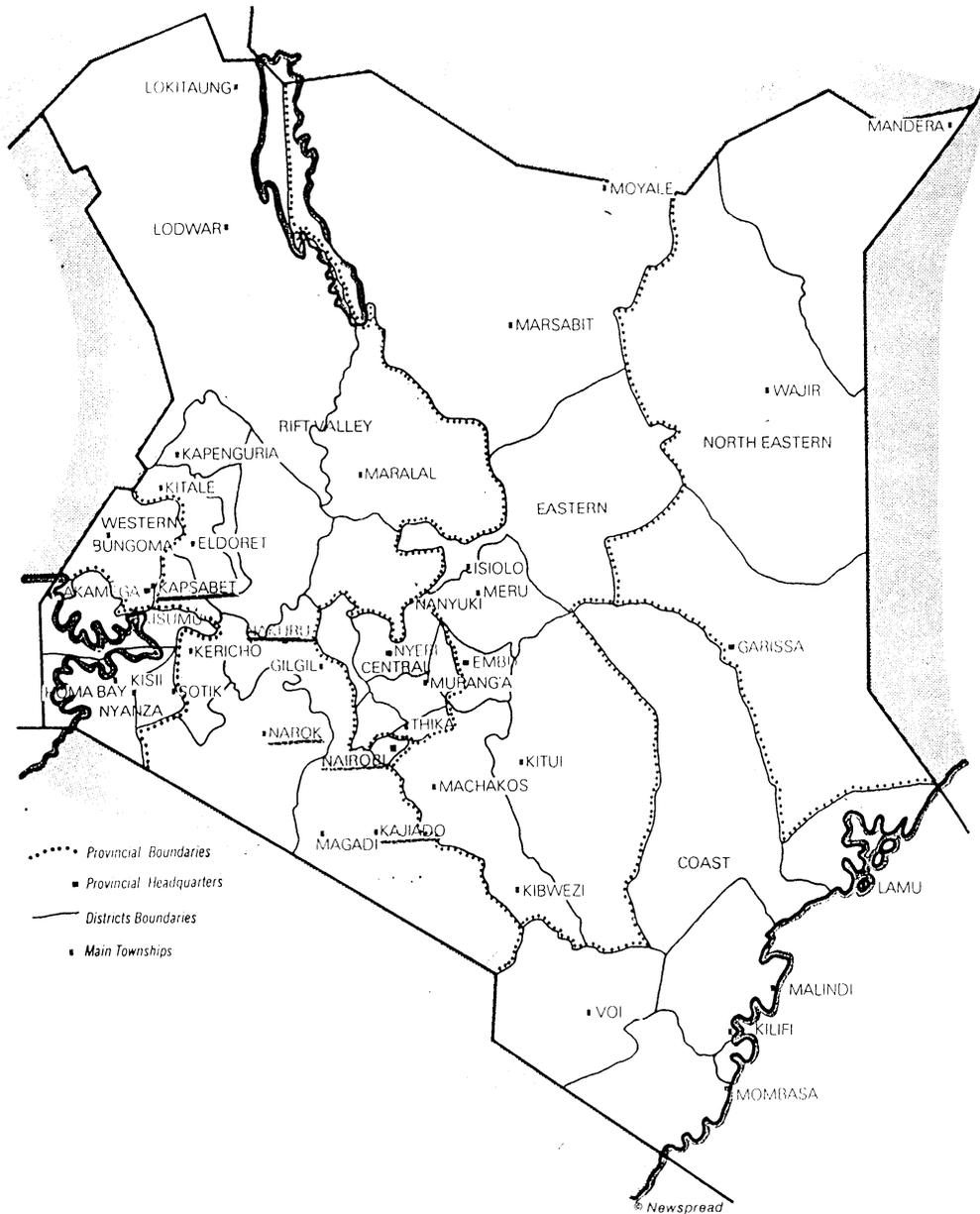


Fig. 1 . MAP OF KENYA

Kanjiado districts by the Maasai community, and Nandi, Elgeyo, and Marakwet districts by the Kalenjin community. Other districts include Turkana, Kitui, Machakos, Marsabit and Garissa among others. Consumption of fermented milk in these regions is a cultural habit that has been practiced since time in memorial.

Method of traditional fermented milk production in Kenya.

The following description is based on investigations carried out by the authors among the Kalenj in community living in Rift Valley, Kapsabet area indicated on the map (Fig. 1). The community is one of those communities in Kenya who extensively produce and consume the fermented milk product.

The fermented milk product is referred to as *mursik* in this area by Kalenj community. It is a major type of diet whose production and consumption constitutes more than half of the daily food consumption. On average, 500 ml of the product is consumed daily per person. It is very popular with adults especially men. It is commonly consumed after meals and sometimes together with other food preparations such as *ugali*, a maize meal which is a staple food in Kenya. The product is usually fed to breast feeding mothers and initiates. It is believed that when feeding on this product, one grows stronger and his or her immune system against common diseases is enhanced. Production of this fermented milk product is facilitated by availability of milk produced by the pastoralist Kalenj communities.

A gourd, specifically prepared for preparing *mursik* is washed with hot water with the aid of curved wood stick known as *sosiot*, obtained from palm branches. The gourd is then left outside for a few hours to dry. When the gourd is dry, it is rubbed inside with burning end of some chopped stick collectively called *itoik*. This chopped sticks are obtained from special trees namely, *chemaklitit* and *sinetwet*. They are cut and dried before use.

The rubbing effect makes the charcoal break inside. A specially dried stick called *Sosiot* obtained from palm branches is used to break the charcoal to finer particles. The main purposes of using the burnt stick are to improvement of flavor of *mursik*, pasteurization of the gourd and the coloring of the *mursik*. The bigger charcoal particles are removed using a special instrument similar to a fly whisk. This consists of a tail of a cow fitted with a small stick. Raw milk is then put into the gourd for 7-10 days. At the end of this period milk will have soured. It is then checked for whey formation. In presence of whey the outer curd is removed and whey drained off. The gourd is then refilled again with fresh milk and ripening continues. The gourd is frequently checked

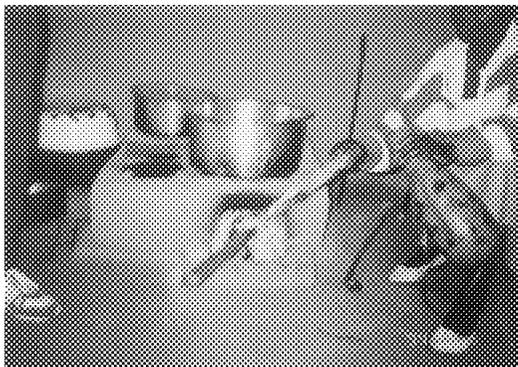


Fig. 2. Gourd preparation

ed within the first one month for whey formation. In case of any, it is drained off and the gourd refilled with fresh milk. After one month, whey formation stops. Under good production environmental conditions, i.e. temperature, and good hygiene the *mursik* can be ripened for up to 12 months. This is carried out in the same gourd at ambient temperatures. *Mursik* is consumed alone or with other foods like *Ugali* a major type of food consumed in Kenya. A longer fermentation time is preferred due to a notable improvement in products

ensory characteristics.

Starter characteristics of the traditional fermented milk product

Studies carried out on traditional fermented milk collected from Kanjiado, Narok and Nakuru district indicated that fermentation is spontaneously carried out by lactic acid bacteria (Miyamoto et al., 1986).

Characteristics of isolated species indicated that *Lb. plantarum* produced type DL-lactic acid, grows at 15 °C and 45 °C. Two strains of *Str. lactis* had characteristics which were partially similar to those of *Str. faecalis*. The strain identified as *Str. cremoris* differed from typical strain in that it could ferment a wide range of carbohydrates. Two strains of *L. euc. mesenteroides* produced D-lactic acid and were positive for dextran formation. In terms of properties of lactic acid bacteria isolated from the traditional fermented milk, the highest acidity produced by *Lb. plantarum* in skim milk containing 0.5% glucose during two weeks of incubation was 1.5% and that by *Lb. curvatus* was 1.34%. Some strains of *Lb. plantarum*, *Lb. casei* and *Lb. curvatus* were found to have relatively high aroma producing abilities. One strain of *Str. lactis* examined, *Str. lactis KM*, showed greater antimicrobial activity against both *S. aureus* and *B. subtilis* (Fig 4).

Studies carried out on lactic acid bacteria isolates from traditional fermented milk produced by Maasai in northern Tanzania indicates that, *Lc. lactis* ssp. *lactis* and *Lb. confusus* has the ability to inhibit growth of *Stap. aureus* and *E. coli* (Isono et al., 1994).

In terms of the proximate composition, unpublished research findings indicate that traditional fermented milk from Nandi District has high butter fat content, high protein content and high ash content than the commercially fermented milk product. Table 3 compares samples obtained from fermented milk in Nandi district. Samples 02, 03, and 04 were obtained from independently fermented product after one, two, and three weeks of incubation at room temperature, respectively. The studies indicate that the physical nature of the product is similar to that of fresh cheese. That is a product with a soft smooth textured consistency.



Fig. 3. Serving the fermented milk product

Table 1. Distribution of lactic acid bacteria isolated from traditional fermented milk.

Type of bacteria	% Occurrence
<i>Lb. curvatus</i>	24
<i>Lb. plantarum</i>	
<i>Str. cremoris</i>	33
<i>Str. faecium</i>	
<i>Str. lactis</i>	
<i>Leuc. dextranicum</i>	43
<i>Leuc. mesenteroides</i>	

Total plate count results indicate that the number of microorganisms fall within the range expected in cultured milk which is 10^6 - 10^9 per ml. Total solid content is high though no conventional standardization was done. This can be attributed partly to the treatment procedure of gourd with burnt stick which adds some solids to the product. Protein content is similar to that of full fat plain yogurt in Japan and slightly lower than that of full fat plain yogurt in Europe. Fat content is relatively higher compared to average fat content of fresh milk which is 3.3 %. Ash content is higher for sample 04 as compared to the other samples. There is noticeable increase in total plate count from samples 02 to 04. There is low titratable acidity in sample 02 and higher in samples 03 and 04.

Conclusion and recommendations

The most powerful means of obtaining useful dairy cultures is through screening the microorganisms from naturally occurring fermentation processes (Dick et al., 1993).

Fermented milk from Kenya is one of the product which has shown some strains of great industrial potential (Morita et al., 1992).

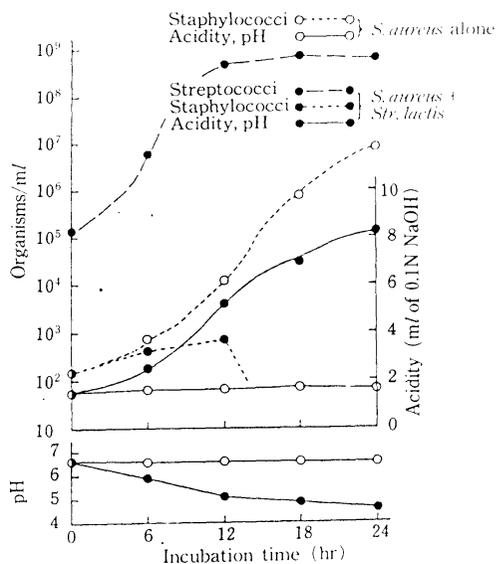


Fig. 4. Effect of *Streptococcus lactis* MK against the growth of *Staphylococcus aureus* I AM 1011 in 10% reconstituted skim milk. (MIYAMOTO et al., 1986)

Table 2. Composition characteristics of traditional fermented milk

Parameter / Sample	02	03	04	Ref. 1	Ref. 2
Total solids, %	19.03	23.72	26.85	8.0	-
Crude ash, %	0.52	0.63	0.94	0.8	0.8
Fat, %	4.50	3.45	3.30	3.0	3.8
Crude protein, %	3.37	3.16	3.28	3.2	3.8
Titratable acidity, %	0.27	1.22	0.90		
pH	4.30	4.20	4.50		
Total plate count, CFU / g	2.7×10^7	6.5×10^7	7.2×10^7		

NB: Ref. 1 Full fat plain yogurt in Japan.

Ref. 2 Full fat plain yogurt in Europe.

Screening of useful dairy fermentation cultures from fermented milk from Kenya, therefore need to be studied.

There are a number of therapeutic and nutritional properties associated with fermented milk. This could not be under-emphasized especially concerning with the health problems related to cardiovascular disorders, cancer and short life span among human beings. The biotechnological potential of traditional fermented milk is actually great. Production and consumption of fermented milk product in Kenya forms a crucial part of diet to many Kenyans and non Kenyans. There is, therefore, a need to exploit further the health value of this common and traditional product from Kenya.

Table 3. Sensory description of the traditional fermented milk.

Sample	Description
02	Mild acidic taste Slightly black in color, smooth texture, moderately viscous.
03	Milk acidic flavored taste, smooth texture, viscous. Slightly black in color.
04	Blackish in color, acidic taste, highly viscous. Highly flavored, smooth texture.

NB : Samples 02, 03, and 04 were obtained from product fermented for one, two and three weeks, respectively.

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