Chapter 4
Microbial Aspect of Lactic Acid Bacteria Isolated From Camel Milk

Dasel Wambua Mulwa Kaindi
https://orcid.org/0000-0003-1561-2408
University of Nairobi, Kenya

Patrick Murigu Kamau Njage
https://orcid.org/0000-0002-4364-5314
Technical University of Denmark, Denmark

ABSTRACT

Camel milk provides a common source of nutrition but also a potential rich source of beneficial, pathogenic, and potentially pathogenic microorganisms. This chapter reviews lactic acid and probiotic bacteria from camel milk, product innovation using such bacteria, and potential areas of improvement in technical as well as practical aspects of fermentation technologies. Lactic acid bacteria fermentation helps mitigate the impact of poor handling and storage conditions by enhancing shelf life and food safety. Traditionally-fermented sour milk products are culturally accepted and widely distributed worldwide with product-specific microbiota responsible for aroma, flavor, and texture. Knowledge of microbiota and predominant, technologically important microorganisms associated with camel milk is critical in developing products with enhanced quality and safety, as well as sustainable interventions for these products, including camel milk specific starter culture development. This chapter presents occurrence of LAB and probiotic bacteria in camel milk and technological aspects of camel dairy.

DOI: 10.4018/978-1-7998-1604-1.ch004

INTRODUCTION

The preparation of most traditional fermented dairy products was reviewed in detail by Food and Agricultural Organization (FAO, 1990) and will be discussed in details in Chapter 5. There is a wide diversity in the products depending on agricultural practices, animal husbandry, seasonality, agroecological zones, animal species, stage of commercialization or industrialization, food preferences and cultural practices. Same factors also influence the camel dairy microbiota. Fermented foods and beverages serve as a major component of diets in the world (Savadogo et al., 2004). This chapter presents the occurrence of LAB and probiotic bacteria in camel milk; developments in typing and characterization; a high technological potential provided by a rich diversity of organisms; traditional and modern camel milk fermentation practices as well as constraints and opportunities for further innovation. Knowledge of microbiome predominant, and technologically important microorganisms associated with camel milk is critical in developing products with enhanced quality and safety, as well as its importance in development of sustainable interventions for these products, including development of novel camel milk specific starter cultures.

LACTIC ACID FERMENTATION

Milk fermentation is a preservation process and occurs through the conversion of lactose into lactic acid with the use of lactic acid bacteria (LAB) and other microorganisms. The application of lactic acid fermentation to prolong the shelf life of food has existed for many generations (Djadouni & Kihal, 2012). LAB is the main microorganism involved in the fermentation of various products. They are a collection of functionally related organisms that are all fermentative, gram-positive, non-motile bacteria and generally have no functional catalase. LABs convert lactose and other sugars in milk to lactic acid (Rhee, Lee, & Lee, 2011). The process also leads to the development of aromatic substances, improved digestibility of proteins, development of sugar polymers, vitamins and useful enzymes (Shori & Baba, 2012). Some LABs produce antimicrobial substances and bacteriocins that inhibit the growth of pathogenic and spoilage microorganisms (Hernández et al., 2005). Lactic acid development leads to an acidic environment that suppresses the growth of undesirable pathogenic and spoilage bacteria (Ross, Desmond, Fitzgerald, & Stanton, 2005). This also plays an important role in food preservation and is considered an effective tool for food safety applications (Cotelo et al., 2013; Christoph, Gerber, et al., 2012; Christoph et al., 2017). During the early stages of fermentation, the growth of certain groups of microorganisms is high compared to others when the levels of lactic acid are still low. Some microorganisms can adapt to acidic conditions and therefore, continue to survive in the food. Some pathogens, for instance, *Escherichia coli* O157:H7, can survive the low acid condition of fermented products (Tamime & McNulty, 1999), leading to health risk towards the consumers.

Bacteria present in camel milk products are shown in Table 1. Most of the microorganisms involved in fermentations belong to LAB. In many occasions, fermentations of camel milk results in a wide variety of LAB populations in fermented foods such as *Streptococcus lactis, Lactobacillus casei, Streptococcus diacetylactis, Lactobacillus lactis, Leuconostoc cremoris, Lactobacillus bulgaricus* and *Lactobacillus acidophilus* (Lore, Mbugua, & Wangoh, 2005). The microflora plays a vital role in producing acid, texture, taste, and aroma of dairy and other fermented products (Leroy & De Vuyst, 2004).