Chapter 10
Effects of Industrial Processing Methods on Camel Milk Composition, Nutritional Value, and Health Properties

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ABSTRACT

Camel milk has a comparable gross composition with other milk sources including bovine milk with some minor differences in the molecular properties of proteins and fat. The limited amount of β-Lg and κ-Casein(CN) are involved in heat denaturation via formation of disulfide bridges in cow milk; their absence in camel milk result in different responses for heat treatment at different scale. Furthermore, differences between camel milk proteins compared to other milk resulted poor coagulation and reduce stability during processing of dairy products such as yogurt and cheese. The effect of different thermal processing methods on camel milk were discussed; however, high pressure processing (HPP) study on processing effect on camel milk is an area of research for more confirmation in-depth study. The industrial processing methods were found to effect important camel milk properties, nutritional values, and health properties compared to other animals including limiting bioactive proteins such as immunoglobulin, lactoferrin, lysozyme, and vitamins. This effect depends on the type of heat treatment applied.

INTRODUCTION

Camel milk has a comparable gross composition with other milk species including bovine milk. However, due to the unique molecular properties of these components (i.e. Fat and proteins) it is very challenging to implements the production process used for processing of other milk (Hailu et al., 2016a).

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These differences include rennetability or coagulation properties, heat stability, curd formation (Hailu et al., 2016b; Farah, 1986; Ramet, 2001). Heat treatment of milk is an essential step to render milk safe for human consumption and extend its shelf life (Chapter 3). Moreover, heat treatment is an integral part of production process of different products i.e. cheese, yogurt, powders (see Chapter 5). There are varied heat treatment methods depending on applied time-temperature combination. This is including low temperature long time pasteurization (LTLT), high temperature short time pasteurization (HTST), sterilization, thermization and Ultra High Temperature (UHT). Among all, HTST pasteurization and UHT are the most commonly used methods in dairy industry (Benabdelkamel, et al., 2017).

The heat stability of camel milk is different compared to bovine milk (Farah, 1986; Ramet, 2001); whereas camel milk reported to have some different properties from bovine milk including poor stability at high temperatures. This is attributed to the casein micelle or deficiency of β-lactoglobulin and κ-casein in camel milk (Al Haj & Al Kanhal, 2010). The addition of neither urea nor formaldehyde alone has no effect on HCT of camel's milk heat stability (Alhaj, Metwalli, & Ismail, 2011), therefore, heat treatment should be carefully optimized. On the other hand, proteins sedimentation could be the main problem for camel milk preservation (Farah et al., 2004) due to their poor stability. Similarly, the overall purpose of heat treatment applied to other milk sources would have the same effect; however, the deleterious outcomes for production of a specific milk product type is not documented yet. The scientific reports made on effects of different factors on industrial processing of camel milk is not much, therefore other milk sources are used to show the possible implications and these types of milk are specified each time whenever referred. This chapter aims to provide an overview on industrial processing methods and their effect on camel milk composition, nutritional value and health properties.

Thermization

Thermization is a mild heat treatment of milk. It is used to extend the quality of raw milk at farms especially camel milk with poor hygienic quality (see Chapter 3); or could be used when raw camel milk is held chilled for some time, before further processing. Ramet (1984) reported that lag phase of raw camel milk (four to six hours) is greater than that of cow milk (two to three hours). The content of antimicrobial factors (Chapter 7) which would make growing of microbes harder are a unique features of camel milk (El-Agamy, 1998; 2000). The aim of this treatment is to control the growth of psychrophilic and psychrotrophic bacteria. The thermization temperature will not bring an irreversible change to the proteins and keep milk properties similar to fresh milk.

These psychrotrophic bacteria if not deactivated may release heat-resistant proteases and lipases into the milk. The bacterial enzymes (lipase and protease) will not be totally inactivated during thermization or even during pasteurization and result in increased off-flavors in case milk is used for cheese, milk powders and UHT treatment. Conditions used for thermization are 57–68∘C for 15 s, followed by refrigeration. Thermized raw milk can be stored at a maximum temperature of 8°C for up to 3 days (IDF, 1984). This does not lead to full inactivation of all spoilage and pathogenic bacteria. Nowadays camel milk is produced and collected in small farms then sent directly to heat treatment without storage, hence thermization is not required. However, the increase in camel milk production and storage under cold temperature for few times at farms, lead to subjecting camel milk to thermization process as an essential stage. The bactericidal properties of camel milk might provide a substituting advantaged of thermization step; however, this may need further studies.

Related Content