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Food Proteins

Structure, Sources, and Applications

Edited by Mudasir Ahmad Malik
and Devinder Kaur

Food Proteins

With an awareness of the growing demand for inexpensive, nutritional, and functional proteins, this book provides an overview of various protein sources and their protein composition. It covers the behavior of proteins during processing and storage, as well as the potential applications of food proteins in different industries. It also features in-depth discussions of the chemical structure of food proteins, including how amino acid composition can determine nutritional qualities and functional properties, influencing the attributes of food products such as mouthfeel and flavor. Providing a comprehensive guide to the chemistry behind the proteins in food, this book is well suited for scientists and industry professionals seeking to develop their understanding of protein.

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1 Milk Proteins

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INTRODUCTION

"The whole, fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy milch animals, excluding that obtained within 15 days before or 5 days after calving" (De, 2008). The milk production in India in the year 2023–2024 was 239.3 million tonnes, in 2022–2023 was 230.6 million tonnes, and in 2021–2022 was 221.1 million tonnes, indicating an annual growth in milk production. Figure 1.1 shows the milk production in India since 1991 (National Dairy Development Board).

Since prehistoric times, humans have been known to ingest milk from both cattle (such as cows and buffalos) and non-cattle (such as goats and sheep) (Dunne et al., 2012, Evershed et al., 2008). Due to its extensive availability and high production quantities, cattle milk is the most consumed milk globally and is a convenient source of nutrition. People in poor nations and in regions where the climate is not conducive to dairy cattle's survival might benefit nutritionally from non-cattle milks. Goat milk also serves as an alternative for those suffering from cow milk intolerance (Faye &

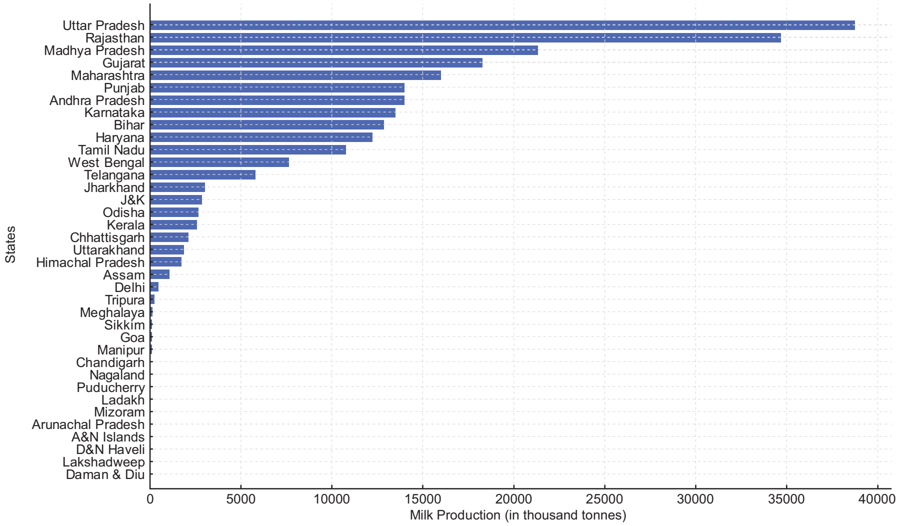

FIGURE 1.1 State-wise milk production.

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Konuspayeva, 2012, Park, 2017). Examples are horse milk in central Asia's steppe regions; yak milk on the Tibetan plateau; reindeer milk in northern Scandinavia; musk ox milk in the Arctic; lamb milk in Europe and the Mediterranean basin (including the Middle East); goat milk in Africa and southern Asia; and camel milk, also known as "the white gold of the desert," in Africa. There are no global figures on the production of milk from other dairy animals, including llamas, yaks, horses, donkeys, deer, and musk ox. Due to the unknown quantities that are either sold directly to locals by farmers or consumed locally at their homes, a large portion of non-cattle milk production goes unrecorded, particularly in developing nations. In non-cattle agricultural systems, the addition of milk as a product increases value and aids farmers in managing the volatile costs of wool, meat, and hair. In many regions across the world, the milking of buffalo, goats, sheep, and camels is well established, growing in popularity, and proving to be a lucrative enterprise for those who have already adopted it (Roy et al., 2020).

Consuming dairy and milk are commonly cited as a crucial component of a nutritious, well-balanced diet. It is the first food that mammals eat and gives them all the energy and nutrients they need for healthy growth and development, which is especially important for the building of bone mass (Pereira, 2014). Numerous elements pertaining to the individual animal or the animal's surroundings affect the composition of bovine milk. Milk composition is influenced by several factors, many of which are not fully understood. These factors include diet (Larsen et al., 2010), breed (Palladino et al., 2010), individual animal genetics (Soyeurt et al., 2008), lactation stage (Stoop et al., 2009), management (Coppa et al., 2013), and season (Heck et al., 2009). Several mechanisms underlie these effects (Schwendel et al., 2015).

COMPOSITION OF MILK FROM DIFFERENT SOURCES

Milk primarily consists of water, fats, proteins, lactose (carbohydrates), and minerals (Gantner et al., 2015). The concentration of milk from different sources is summarized in Table 1.1. The physical characteristics and nutritional profile of milk are influenced by the concentrations of these components, which differ between species. The composition of milk varies significantly due to several factors, including breed, lactation stage, milking interval, feed type, and climate (Claeys et al., 2014).

The previous research has thoroughly examined the variations in milk composition across different species. Milk composition differs significantly among species, but all milks share four main components: protein, fat, lactose, and minerals. Non-ruminant milks, such as those from horses and donkeys, resemble human milk more closely in terms of protein, lactose, and ash content than do milks from dairy cattle and other ruminants. Ruminant milks generally contain higher levels of protein and fat compared to human and non-ruminant milks (Table 1.1). Human milk is notable for its much greater concentration of oligosaccharides derived from lactose, which far exceeds that found in other species. Goat milk is also recognized for its relatively high oligosaccharide content, with a composition considered like that of human milk (Roy et al., 2020).