Chapter 8
Health-Improving and Disease-Preventing Potential of Camel Milk Against Chronic Diseases and Autism:
Camel Milk and Chronic Diseases

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ABSTRACT

Camel milk has been used as part of the human diet since ancient times. This chapter tries to elaborate the different aspects of nutraceutical functional properties of camel milk, focusing on the nutritional composition, presence of bioactive zoochemicals and peptides, antioxidant nutrients (vitamin C), and health rendering properties of this unique milk. Recent research has identified camel milk as a prophylactic and therapeutic functional food due to its noticeable content of essential macronutrients, namely bioactive functional proteins and peptides, along with its considerable content of essential micronutrients. Indeed, the presence of this unique mixture has shown to be promising contributors to the management and prevention of chronic diseases, such as cancer, diabetes, liver and kidney, metabolic syndrome, inflammatory bowel diseases in adults, and autism. In vivo, in vitro, and epidemiological and experimental studies were reviewed, and molecular mechanisms were highlighted for better understanding of the health-promoting, disease-preventing potential of camel milk.

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INTRODUCTION

Few past studies unraveled that camel milk (CM) treasures a plethora of considerable amounts of zoochemicals (compounds in animals that are believed to provide health benefits beyond the traditional nutrients that foods contain) and antioxidant vitamins such as C and E (Farah, 1993; Farah, Rettenmaier, & Atkins, 1992; Konuspayeva, Faye, & Loiseau, 2011), lactoferrins and lysosomes (El Sayed, Ruppanner, Ismail, Champagne, & Assaf, 1992; Konuspayeva, Faye, Loiseau, & Levieux, 2007), and immunoglobulins (Ebaid, Salem, Sayed, & Metwalli, 2011; El Sayed et al., 1992; Konuspayeva et al., 2007; Miniero et al., 2014) that may entail therapeutic potential. Several studies extensively reviewed and critically revised the significant therapeutic and prophylactic properties of CM, as a commonly and traditionally practiced medical intervention, and recently evident by modern research, with emphasis on anti-diabetic, antimicrobial and anti-inflammatory effects (Abdel Gader & Alhaider, 2016; Dubey, Lal, Mittal, & Kapur, 2015; Gizachew, Teha, Birhanu, & Nekemte, 2014; Hammam, 2019; Kalla, Manthani, & Keerthi, 2017; Khatoon & Najam, 2017; Mati et al., 2016; Mihic, Rainkie, Wilby, & Pawluk, 2016; Mirmiran, Ejtahed, Angoorani, Eslami, & Azizi, 2017; Mullaicharam, 2014; Niasari-Naslaji, Arabha, Atakpour, Salami, & Moosavi-Movahedi, 2012; C. Sharma & Singh, 2014; Shori, 2015; Yadav, Kumar, Priyadarshini, & Singh, 2015). Reports affirmed that the unique constitutes of CM in terms of the presence of a plethora of antioxidants, antiviral, antibacterial, antifungal, hypoglycemic, anti-tumor activity and anticancer properties, along with its ability to prevent aging and to affect autoimmune diseases (Al-Juboori, Mohammed, Rashid, Kurian, & El Refaey, 2013; Kula & Tegegne, 2016; Refaey, 2013; Sharma & Singh, 2014); all make camel milk a candidate functional and therapeutic food that deserves greater attention.

However, to the best of our knowledge, there is scarcity in the published research that gives explicit, comprehensive revision on the anti-cancer anti-inflammatory and anti-diabetic potentials of CM. Therefore, the current chapter tried to fill this gap and provide a comprehensive revision on the major research findings related to the effect of CM on the prevention, mitigation, and management of inflammation-related chronic diseases, namely cancer, diabetes, metabolic syndrome, and inflammatory bowel diseases.

CANCER

As part of the traditional medicine in the Middle East, CM has long been used in the prevention and treatment of numerous types of cancers (Korashy, Maayah, Abd-Allah, El-Kadi, & Alhaider, 2012), and people consume CM regularly as part of the common belief that it improves immunity against diseases and decreases the risk for cancer (Badawy, El-Magd, & Alsadrah, 2018). Some reports indicated that camel products, including both urine and milk, acquire anticancer effects (Al-Harbi et al., 1996; Al-Yousef et al., 2012; Mushref, 2006). This traditional application of CM could be found in ancient medicinal books that provide many quotes about the camel's benefits and nutraceutical values. Avicenna (980-1037 AD), the father of early modern medicine, stated the therapeutic uses for CM in treating diseases of the liver, spleen, kidney, cancer, and childhood diseases (Ibn-e-Sina, 2005; Zibaee et al., 2015).

Further, in traditional medicine for Arabs and Muslims, CM has long been used for remedial purposes, based on the fact that CM is mentioned in a praise context in the Holy Quran and Prophetic *Sunnah* (Saad, 2015). This belief in CM is reflected in the common conventional practice repeatedly reported