

Chapter 15

Lactoserum: As a Complete Nutraceutical

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ABSTRACT

Lactoserum, a byproduct of cheese industry, is rich in nutrients, but it is discharged directly into the environment. It has many human applications that promise to be a complete nutraceutical for the future generations. It is of high nutritive value and its products can be used as functional ingredients in food and pharmaceutical applications and as nutrients in dietary and health foods. They contain full spectrum of amino acids including essential and branched-chain amino acids which are important in tissue growth and repair. The other biological activities of lactoserum are antibiotic, anti-cancer, anti-toxin, immune-enhancer, and prebiotic (growth enhancement of gut microflora such as bifidobacteria). Lactoserum can thus be used as nutraceutical in various products like infant formulas, food supplements, cheese spreads, sports bars, and beverages to meet a variety of health goals for people of all ages, including animal feed.

INTRODUCTION

Lactoserum is a by-product of cheese or casein in the dairy industry and contains usually high levels of lactose, low levels of nitrogenous compounds, protein, salts, lactic acid and small amounts of vitamins and minerals. It is obtained by following

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Lactoserum

acid, heat or rennet driven coagulation (Kargi, & Ozmihci., 2006). Lactoserum, also known as cheese whey, is an opaque liquid, greenish yellow in colour with total solid content ranging in 6-6.5% w/v and biochemical oxygen demand (BOD) of at least 30,000.

Cheese whey is usually produced all over the world according to the traditional protocols and in small scale through denaturation of whey proteins but it is chiefly generated from ovine whey in the Mediterranean basin. About 9 kgs of whey are usually produced from 1 kg of cheese production (Zafar & Owais, 2005). It is well known that cheese whey is rich in nutrients but it is discharged directly into the environment that constitutes significant loss of protein and energy source. The BOD of whey varies from 30,000 to 50,000 mg/g depending upon the wastage of milk in the whey (Mukhopadhyay, Talukdar, Chatterjee, & Guha, 2003). There are mainly two types of cheese whey (lactoserum): Sweet whey and Acid whey.

Sweet whey is produced by precipitation of casein by proteolytic enzymes such as chymosine and pepsin or microbial enzymes produced from *Mucor miehei* and *M. pusillus*. It comes from the production of cheddar, Swiss and Italian varieties of cheese. It contains approximately 93% water and 6.35% solids, with about 76% of the solids being lactose (Delfour Jolles, Alais, & Jolles, 1965).

Acid whey is produced by precipitation of caseins during cheese making. It comes from soft cheese with cottage cheese as a predominant product. Precipitation is achieved by acidification not above pH 5.1. Acid whey is rich in minerals due to solubilization of colloidal calcium phosphate of casein micelles that occurs concomitantly with acidification. Its composition is similar to sweet whey except that it has higher lactic acid and ash contents (Delfour Jolles, Alais, & Jolles, 1965).

The composition of cheese whey depends on various factors like source of cheese (bovine, caprine or ovine), composition of cheese (i.e. breed, stage of lactation, feeding regime and type of cheese), ratio of whey to milk (if milk or cream is added to whey prior to manufacturing cheese) and technological practices or the manufacturing procedure followed (i.e. heat temperature, ripening temperature, time, batch vs. continuous processes and possible use of ultrafiltration) (Ong & Shah, 2009).

MICROBIOLOGY OF LACTOSERUM

The predominating microflora in cheese whey are *Lactococcus lactis* subsp. *cremoris*, *L. lactis* subsp. *lactis*, *Lactobacillus helveticus*, *Streptococcus thermophilus*, *Enterococcus faecium*, *Leuconostoc mesenteroides*, *Leuconostoc pseudomesenteroides*, *Lactobacillus plantarum*, *Lactobacillus pentosus*, *Lactobacillus paracasei*, *Lactobacillus plantarum*, *Enterococcus faecalis*,

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