Uses and properties of whey

Usos y propiedades del Lactosuero

Jonathan Hernández-Miranda a, Sergio Soto-Simental b, Aurora Quintero-Lira b, Javier Piloni-Martini b

Abstract:

Whey is a by-product of the dairy industry, which has a high nutritional value due to the presence of protein, lactose, vitamins and minerals that have nutritional functions of interest. Whey can be used directly as an ingredient in various products or it can be fractioned into its different components to be used for various purposes, thus given added value to this by-product, however the lack of information about its use has led producers to end up for discarding it, thus losing value nutritional components. Therefore this research offers a brief review of the uses and properties of whey.

Keywords:

Whey, whey protein, lactose, minerals, achievement, properties

Resumen:

El lactosuero es un subproducto de la industria láctea, el cual posee un alto valor nutritivo por la presencia de proteínas, lactosa, vitaminas y minerales que tienen funciones biológicas de interés. El lactosuero puede ser utilizado directamente como ingrediente en diversos productos o puede ser fraccionado en sus diferentes componentes, para utilizarlos con diversos objetivos, dando así un valor agregado a este subproducto, sin embargo la falta de información acerca de su aprovechamiento ha generado que productores terminen por desecharlo perdiendo con ello valiosos componentes nutritivos. Por lo cual la presente investigación ofrece una breve revisión de los usos y propiedades del lactosuero.

Palabras Clave:

Lactosuero, proteínas de lactosuero, lactosa, minerales, propiedades

Introduction

Whey is a by-product of dairy industry that comes of clotting milk and later casein removal, during cheese manufacturing [1,2,26]. It is categorized in two types of whey, sweet whey and acid whey, that differ in how milk is coagulates. The first is produced from cheeses coagulated with rennet (Chymosin protease) while the second is obtained from cheeses made by acid precipitation, adjusting pH to 4.6 by the action of lactobacillus, adding organic acids (lactic acid) or mineral acids such as hydrochloric or sulfuric [18,23]. This by-product is considered like a source of compounds of high nutritive valued, chemically contain 93-94% of water [22], that retain approximately the 55% of solids present in whole milk, including whey protein, most of it lactose, minerals like calcium and phosphorus, [12] vitamins soluble in water [3] such as C and vitamins from B complex like thiamine, riboflavin, pantothenic acid, pyridoxine, cobalamin, [4,19] also contain lactic and citric acid, compounds non-protein nitrogens such as urea or uric acid, [14] but this components are modified depending on the type of whey, as a consequence of the manufacturing process. In general acid whey has a low pH, low concentration of protein and lactose, but contains a higher amount of calcium, phosphorus and lactic acid compared to sweet whey. It is known that the manufacture of 1 Kg of cheese produce approximately 9 Kg of whey, making it, the most abundant product, that could be tapped for its nutrimental compounds, offering different ways to give added value. However, the lack of information had generates that sometimes this by-product is discarded without taking advantage of its nutritional value, therefore the principal

* Jonathan Hernandez-Miranda, Universidad Autónoma del Estado de Hidalgo, https://orcid.org/0000-0002-6363-3126, Email: he214820@uaeh.edu.mx

b Universidad Autónoma del Estado de Hidalgo, https://orcid.org/0000-0002-6923-0926, Email: sotos@uaeh.edu.mx

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aim of this work, is to provide information about of the different ways to advantage whey.

**Use of whey**

The application of whey can be divided in four basic ways: applying directly in some products, separation and application of whey components, use in biotechnological processing and partial processing what after use. [25] Therefore, as a consequence of its components, it is use directly in bakery, meat, confectionery, dairy products, flavoured, carbonated, probiotic and alcoholic beverages, increasing the nutritional value or acting as an emulsifier, gelling or foaming agent [9,12,19,22] in addition, the components of whey promote the multiplication of desirable microflora in the intestine tract. [20] As for it fractionation, from whey can be obtained lactose, whey proteins, free amino acids, vitamins and minerals useful to supplement or enrich other food products. The biotechnology industry takes advantage of the high lactose content to produce alcohol and lactic acid [15,21,23] whey has also been used as a culture medium to produce bacteriocins and enzymes, organic chemicals like, acetic, citric, propionic acid and glycerol, bioplastics have been manufactured, [18,23] and biofuels such as bioethanol and bio-hydrogen which are an alternative to fossil fuels. [14,16] Finally the partial processing of whey in concentrates and isolates of protein is one the main ways to take advance of whey, which has been the subject of scientific research, because is a complete source of proteins that is rich in aminoacids (AA) that containing sulfur and branched chains, [4] are recognized for their high nutrition value, high digestibility, rapid absorption and generation of AA in plasma, [5] these products consist of the main whey proteins, including beta lactoglobulin (β-LG), alpha lactoalumin (α-LA), bovine serum albumin (BSA), lactoferrin (Lf), immunoglobulins (Ig) and transforming growth factor, [15] these whey derivatives have been used as an ingredients in various food products such as ham, pickles, confectionery, cakes, infant formulas and sport beverages [3] and its used on the one hand is justified by its capacity as an emulsifying or stabilizing agent due to its high content of β-LG, which is the only protein fraction capable of forming fibers that give it this property, [11] together with this, β-LG has shown antihypertensive, anticarcinogenic, hypocholesterol and antimicrobial activity, [24] on the other hand, due to its easy digestion, biological and nutritional properties for health promotion and prevention of diseases, it has been used in manufacture of infant formulas. [6,7,27] These properties can be attributed to the presence of Lf that plays an important role in the chelation of metals and AA that carry free radicals, [13] however, it has been reported that in general the whey proteins present antibacterial, immunomodulatory and anti-inflammatory effects [10] in addition have an effect on the relief of fasting blood glucose and the elevation of body weight, it has been suggested that they may be useful in the management of diabetes. [13]

The AA release through hydrolysis, generating active peptides, is another way to take advantage of whey and the importance of these products, is a consequence of they have shown antioxidant effects by increasing the presence of glutathione (GSH) that reduces hydroperoxides in alcohols and peroxide in water through the oxidation of its reduce form [4] also the AA that make up the whey proteins have different functions in the body, for example, leucine has a key role in the regulation of the protein synthesis machinery [29] minimize the loss of muscle mass, which is attributed to the rapid digestion and absorption of proteins that generate an increase in plasma AA, [8] the AA that containing sulphur such as cysteine and methionine precursors of GSH have shown anticarcinogenic and antioxidant properties additionally improve the immune functions and branched-chain amino acids such as leucine, isoleucine and valine have a crucial role in metabolism, homeostasis of blood glucose and neural functions. [12,17] In conclusion the whey is a by-product with a high nutritive value and functional properties which has a wide industrial applications, from as an ingredient to increase the nutritional value of some products to being a means of production compounds of industrial interest. It also offers various alternatives for producers to generate economic benefits without loss of raw material.

**References**


