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Functional food relevance of whey protein: A review of recent findings and scopes ahead

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ABSTRACT

The prospecting for nutrients has catapulted whey protein to the forefront of the functional food sector. This protein, filtered from cheese whey, has been characterized to contain a plethora of healthy components such as essential amino acids, bioactive peptides, antioxidants and immunomopotentiators. Consequently, whey protein has been validated to confer radical scavenging, anti-inflammatory, antitumour, immunostimulatory, hypotensive, gut homeostasis, antiobesity, antidiabetic, muscle biosynthesis, osteoprotective and radioprotective roles. As the multifarious benefits of whey protein cumulate amidst the dramatic rise in metabolic and degenerative health issues, it seems imperative to harness their potential. This review presents the significant biological aspects of whey protein and its derivatives. Further, it rationalizes their incorporation in functional foods.

Contents

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1. Introduction

The instances of metabolic syndrome such as cancer, diabetes, obesity, and cardiac complications are rising in an alarming manner (Aude, Mego, & Mehta, 2004). Dietary intervention is increasingly deemed to be an effective strategy to control metabolic diseases (Ren et al., 2007). The importance of high protein-diet is cohesively recognized (Westerterp-Plantenga, Lemmens, & Westerterp, 2012). However, proteinaceous food sources are expensive (Brooks, Simpson, & Raubenheimer, 2010). The Recommended Dietary Allowance (RDA) of protein for optimal health may not be available from diet (Paddon-Jones & Leidy, 2014). The inadequate quality of protein begets many metabolic problems (Schönfeldt & Gibson Hall, 2012).

The above facts highlight the importance of searching for nutritive yet cheaper sources of proteins. In this scenario, a dairy industry by-product, whey holds immense significance. This supernatant left after coagulation of casein has been discovered to be an excellent source of food-grade protein (Graf, Egert, & Heer, 2011). Whey proteins constitute 15–20% of total milk proteins (Sindayikengera & Xia, 2006). The key components of whey protein have been characterized as β-lactoglobulins and α-lactoalbumins (Marshall, 2004). Beta-lactoglobulin-derived peptides have been characterized to possess immense functionalities (Power, Fernández, Norris, Riera, & FitzGerald, 2014). Glycomacropeptide is a peptide constituent of whey protein, derived from casein. The beneficial effects of this hydrophilic glycopeptide on satiety and phenylketonuria management have been validated (Neelima, Sharma, Rajput, & Mann, 2013). The functional multiplicity of this peptide is illustrated in Fig. 1. Other constituents of whey protein include immunoglobulins, serum albumins, and lactoferrin (Law & Leaver, 2000). Protein quality depends on its constituent amino acids and in this regard, whey protein is one of the highest standards. It is rich in essential, branched-chain amino acids (Devries & Phillips, 2015). The branched-chain amino acids include leucine, isoleucine, and valine and they play crucial roles in metabolism, blood glucose homeostasis and neural function (Joy et al., 2013). Leucine is known to regulate skeletal muscle protein synthesis (Rieu et al., 2007). Another essential amino acid, cysteine is the building block of glutathione, the dietary antioxidant (Micke, Beeh, & Buhl, 2002). It is vital for fighting oxidative stressors and preventing redox imbalance-caused diseases (Trachootham, Lu, Ogasawara, Nilsa, & Huang, 2008). As the biological benefits of whey proteins emerge, it seems important to keep track of them with a timely and updated literature review.

2. Physiological roles of whey proteins

Whey protein is a rich source of bioactive peptides which may play a role in the dietary management of chronic diseases. The biological efficacy of whey protein is a function of its processing technique. Whey proteins are generally marketed in three forms, such as whey protein concentrate, whey protein isolate and whey protein hydrolysate (Sousa et al., 2012). The concentrate has fat and lactose along with the quintessential proteins (29–89%) (Bounous, 2000); the isolate is made of 90% protein (Hayes & Cribb, 2008) and the hydrolysate is the semi-digested form of the protein (Kanda et al., 2013). The established and emerging applications of whey proteins are discussed in subsequent sections (Sousa et al., 2012).

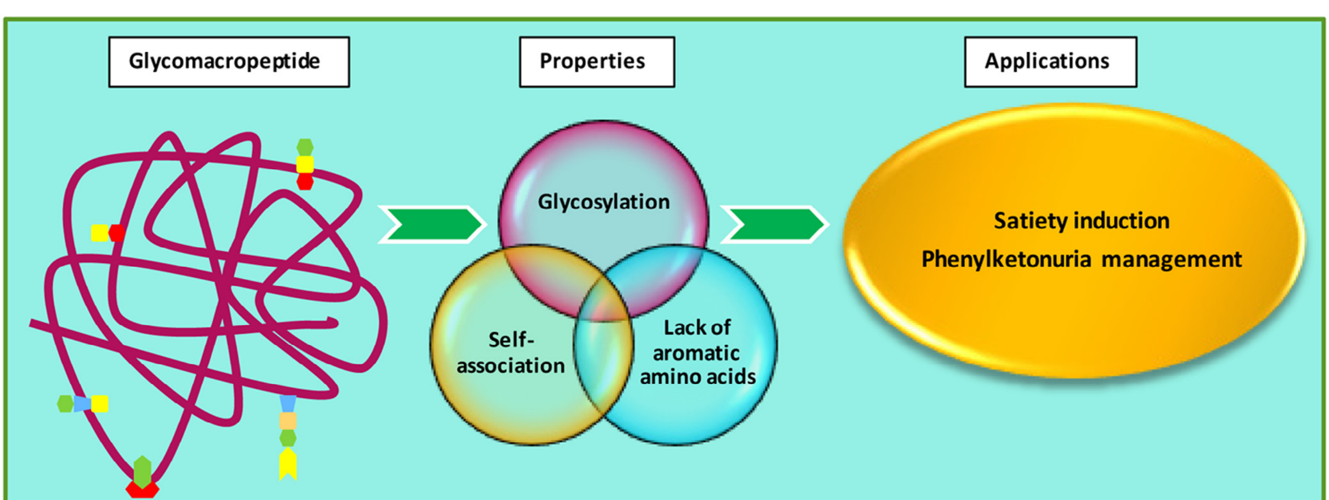

Fig. 1 – Biological roles of whey protein.