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Research article

WHEY PROTEIN HYDROLYSATES: TECHNO-FUNCTIONAL PERSPECTIVE

Sumaira H. Khan

Department of Food Technology, Islamic University of Science and Technology, Awantipora, Pulwama-192122, Kashmir, India (correspondence: e-mail: khansumaira84@gmail.com)

ABSTRACT: The paper deals with the techno-functional perspective of whey protein hydrolysates. Molecular changes occurring during protein hydrolysis result in modified techno-functional behavior of the hydrolysates compared to the intact protein such as altered solubility, viscosity, sensory properties, and emulsion and foam properties. It plays important role as an antioxidant to help increase body immune system. Whey components have ability to improve the host antioxidant defense and lower oxidant burden which is emerging as a premier contribution to population health. The utilization potential of whey and its derivates in many food products, including dairy products, nutritional beverages and prepared foods is highlighted.

Key words: Whey, protein, hydrolysates

INTRODUCTION

The growing attention of food industry to acquire innovative new products to address consumer interests has prompted much desired research on healthy foods. Whey protein hydrolysates are of great importance and much interest evoked in its role in nutritious and healthy foods. However, sporadic information is available on techno-functional properties of whey and its fractions. There is a need to develop novel technologies which include chromatographic and membrane separation so as to enrich active peptide fraction from hydrolysates of various pro-functional properties of whey protein hydrolysates. It is important to study the technological properties of active peptide fraction and to develop model food that contain these peptides and retain their activity for a longer period. Evidence continues to accumulate that whey contains a variety of factors and compounds capable of improving health and preventing disease. However, new information in the areas of probiotics, prebiotics and viral virulence indicate that there is great potential to produce healthful functional foods and cosmetics to reduce both infectious and chronic diseases. The new developments in whey protein research will ensure their continued growths that are emerging from the amalgamation of manufacturing advances and clinical science. It covers a wide range of health issues particularly immune system enhancement from concentrating lactoferrin. These advancements have potential for multifunctional benefits of whey supplementation and fortification. The present communication highlights the various techno-functional properties of whey protein hydrolysates, and identifies future research areas.

Whey protein hydrolysates

Techno-functional perspective of whey hydrolysates entails multifaceted aspects in view of their importance in food industry particularly in relation to human health. Whey protein is a mixture of globular proteins isolated commercially from the industrial cheese process waste whey. Whey is left over when milk coagulates, and contains everything that is soluble from milk. It is a 5% solution of lactose in water, with some minerals and lactalbumin. Whey protein is typically a mixture of β-lacto globulin (~65%), α-lactalbumin (~25%), and serum albumin (~8%), which are soluble in their native forms, independent of pH. The protein fraction in whey (approximately 10% of the total dry solids within whey) comprises four major protein fractions and six minor protein fractions.

The major protein fractions in whey are beta-lacto globulin, alpha-lactalbumin, bovine serum albumin and immunoglobulin's (Haug et al; 2007). Whey protein has been reported to possess anti-inflammatory or anti-cancer properties (Xiao et al; 2006). These effects on human health are of great significance and are currently being researched as a way of reducing disease risk, and as a possible supplementary treatment for several diseases (Krissansen, **2007).** Whey products offer numerous functional and nutritional properties that are valued by food manufacturers. For example, in dairy products, whey can replace the fat in low-fat products. It improves slicing, spreading, and melting characteristics in processed cheese. In baked goods, whey improves the crust color and enhances flavor. In processed meats, it improves moisture retention. Whey offers high-quality protein, calcium, and vitamins, which can be used to improve the nutritional content of many foods. In infant formula, whey creates a formula more similar to human milk and stimulates the growth of beneficial bacteria in the intestinal tract (Ha et al; 2003). The whey protein hydrolysates are designed to be applied to nutritional, diabetic and medical foods such as dry mixtures (i.e. milk shakes, soups, puddings, omelettes), drinks, nutritional bars, meal replacers and specialized food for sports nutrition, elderly people, diabetic preparations for weight-loss programs, and meal replacers for people having disorders of the digestive function of proteolytic enzymes that results is a complex mixture of peptides of different chain lengths together with free amino acids. Protein hydrolysates is a complex mixture of peptides of different chain lengths and free amino acids that are produced through heating with acid or by addition of proteolytic enzymes amino acids (Manninen, 2009). However several studies **have** shown that protein hydrolysates containing mostly di- and tripeptides are absorbed more rapidly than free form amino acids and much more rapidly than intact proteins (Di Pasquale, 1997). Oral intake of protein hydrolysates and amino acids in combination with carbohydrates can result in an insulin tropic effect as much as 100% greater than with the intake of carbohydrates. Whey protein hydrolysates (WPH) are typically produced from some type of purified protein source, mostly as WPC that has its protein chains hydrolyzed or broken. Two predominant hydrolyzing methods existing include (a) acid hydrolysis in the presence of increased temperatures or cool temperatures or (b) adding a cocktail. Chicon et al; (2009) suggest that hydrolysates improve heat stability comparable to those of the untreated WPI.

Whey components have the ability to improve the host antioxidant defenses and lower oxidant burden is emerging as a premier contribution to population health. Viral virulence is linked to passage of non-virulent forms through hosts with compromised antioxidant status. Researches repeatedly demonstrated that selenium and vitamin E will prevent viruses from converting to a virulent genotype. This effect is non-specific as it appears to be related to increased oxidant tone or poor ability to defend against oxidants, so that factors that act as antioxidants or that reduces biological oxidant generation are protective. Nutritionally, whey products provide active lactoferrin/metal-binding activities. Afforded by immunoglobulin's, enzymes (lysozyme, lactoperoxidase), lactoferrin,, isracidin or caseinomacropeptides, whey could also reduce oxidant burdens imposed by inflammation. Immunoglobulins are involved in the passive protection of the young and they resist degradation in the intestinal lumen. Lactoferricin, a peptide cleaved from lactoferrin by pepsin, exerts *in vitro* antibacterial effects against both bacteria and yeast, an effect that is linked to iron-binding activity. Lactoferricin also exhibits an antimicrobial activity that originates from a direct interaction with the surface of bacteria. Lactoferrin binds iron and provides the means for both stable iron delivery and scavenging of free iron that could catalyze oxidative reactions. Whey protein and lactoferrin are all good candidates for dietary inhibitors of oxidative stress even when dietary Vitamin E is low (Walzem, 1999). Whey protein hydrolysates known for moderate-high degree of hydrolysis and a high content of short peptides, in general, enjoy nutritional importance such as sports nutrition drinks, nutritional bars, and hypoallergenic infant formulas. Whey protein hydrolysates find use in a wide range of applications as they provide a number of benefits when compared to unhydrolysed whey protein concentrates / isolates. Whey protein hydrolysates, as a foaming agent in food industry, can be effectively utilized as less expensive alternative to egg white. Whey protein hydrolysates are well recognised for the beneficial impacts including improvement in heat stability, enhanced digestibility and absorption, improving the texture of nutritional bars and shelf-life , improvement of foaming and emulsification properties, reduction or elimination of the allergenicity of whey protein, creation of bioactive peptides that may provide health benefits, and improving the texture of beverages, yogurts and smoothes.

Future research scope

The future work is needed to establish in more detail the interfacial properties of hydrolysates obtained under high pressure and to characterize the functional peptides responsible for emulsifying activities. Antibody binding properties of whey protein hydrolysates obtained under high pressure merits adequate research focus. The peptides present retain enough capacity to efficiently form emulsion. Therefore, it should be noted that hydrolysis has negative impact on long-term emulsion and foam stability. As such, further step should be taken into consideration to establish the interfacial properties of hydrolysates obtained under high pressure and to characterize the functional peptides responsible for emulsifying activities.

Concluding remarks

Summing up, it may be said that the techno-functional properties of whey protein hydrolysates hold tremendous scope in the field of food technology. Various researches conducted on some aspects seem to be deficient and are of routine analytical nature. This state of **affairs** may be attributed to the fact that this is the emerging field which is yet to gain adequate recognition. In view of multifaceted applicability of whey hydrolysates, it is imperative to explore the research fields of investigation so that technologies are developed to exploit the knowledge for healthcare and development of food industry which would match global scenario and compete with Europe /western products

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