Bioactive properties of milk proteins in humans

The importance of the diet in human health has been recognized for centuries. Milk is the primary source of nutrients for infants. It provides a nutritionally balanced source of both macronutrients (proteins, fats and carbohydrates) and micronutrients (vitamins and minerals) for optimal growth and development. Milk and dairy products from animal sources have traditionally been an important component of Western diets in the adult and elderly population. However, more recently, the popularity of milk and dairy products is increasing worldwide due to their recognized nutritional benefits, convenience and taste.

The increased availability of energy-dense food in conjunction with physical inactivity in the general population has led to an increase in various health conditions such as obesity, cardiovascular disease and type 2 diabetes. However, in addition to providing energy and essential nutrients, food contains bioactive or physiologically active components which may beneficially modulate specific functions. Specifically, during the digestion of milk proteins, it is possible to release short fragments having a wide range of biological/health promoting activities, also called bioactive peptides. Bioactive peptides can also be produced industrially in a food-grade manner by microbial processing (fermentation) or by enzymatic digestion of milk proteins (to produce hydrolysates).

Consumption of milk and dairy products, as part of a balanced diet, is associated with enhanced health. Various meta-analyses indicate that dairy product consumption may have beneficial effects for weight management, high blood pressure, cardiovascular disease and type 2 diabetes. These beneficial effects may arise due to interactions between dairy components and various systems in the human body. Owing to their benefits as natural dietary ingredients, their lack of reported side-effects (as opposed to drugs) and low-cost, a growing number of scientific studies are underway to evaluate the potential health benefits of consuming dairy proteins and their hydrolysates. The aim of this review was to evaluate the scientific evidence (generated between 1985 and 2015) linking health enhancing effects in humans to milk protein intake. To date, there is a general lack of information in terms of the amount, stability and intestinal permeability of milk protein-derived bioactive peptides, therefore, the question remains whether these peptides are physiologically relevant to humans.

Positive effects on morphological modifications (e.g., increased muscle and reduced fat mass) along with serum glycemic and blood pressure regulation have been demonstrated in humans following milk protein consumption. However, the results are still inconclusive for other properties (i.e., antimicrobial, anti-inflammatory, anticancer and antioxidant activities). Interestingly, various processing regimes, such as heat treatments when applied to native bovine milk, have been shown to induce denaturation which may affect accessibility to digestive enzymes and as a consequence the release of bioactive peptides. Currently, there are a limited number of studies demonstrating a direct relationship between well characterized bioactive peptides and the mechanism(s) by which they modulate specific health targets. Overall, it was concluded that to date assessment of the role of bioactive peptides in humans appears to have been hampered by (1) the inadequate design of

human intervention studies (e.g., lack of relevant human controls and statistically underpowered intervention group sizes), (2) insufficiently characterized bioactive peptides (unknown peptide sequence) and (3) technological limitations to allow a detailed understanding of the mechanism(s) of action (e.g., difficulties with bioactive peptide detection and quantification in human fluids). Therefore, well designed human studies along with novel strategies for the identification of bioactive peptides are needed to support the food industry in the development of functional foods. This is a prerequisite for the granting of health claims which in turn will provide a competitive advantage for food companies supplying bioactive peptide-based functional foods/food ingredients.

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