Whey Based Bioactive Peptides Used in Animal Products

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Abstract
Bioactive peptides come out as a result of the hydrolysis of milk proteins and contain nutritional, functional and biological activities. Nowadays, the utilization of whey proteins to provide various features in the animal products such as meat and milk products and animal production has been increasing. In this compilation, after being introduced some general information about their common characteristics, bioactive peptides will be mentioned about their particularly recent usage in animal products.

Keywords: animal products, bioactive peptides, whey.

1. Introduction

The role of the proteins as physiologically active components in dietary has been increasing. Many proteins, existing naturally in foodstuff, demonstrate their physiological activity directly or after in vitro/in vivo enzymatic hydrolysis. During the recent years, the protein taken in diet has been understood to be a rich source of bioactive peptide [1].
A large number of plant or animal derived peptides having bioactive potential have been found and these peptides have mostly been isolated from milk derived products. These proteins having biological activity could be derived from animal sources such as milk, egg, meat and fish, or from plant sources such as soy or wheat [2]. Bioactive peptides were first reported by Mellander (1950), and today a great number of bioactive peptides, having opioids, immunomodulator, mineral binder, cholesterol lowering, anti- oxidative, anti- thrombotic, anti-hypertensive, anti-microbial and anti-cancerigen activities have been introduced [3, 4]. The usage of biological peptides in various animal products is the case and they are particularly used in the production of animal provender, and in the production of milk and meat products. Within the scope of this compilation, studies which were conducted on the usage of bioactive peptides in animal products will be reviewed.

2. Bioactive Peptides and Their Production:

Commonly, the main protein fractions of milk are caseins, α-lacto albumin, β-lacto globulin, immunoglobulin, lacto ferrine, protease- peptic fractions, and transferrin and serum albumin which are whey proteins. Of these proteins, bioactive peptides could come out during the gastro intestinal process. These peptides generally have various physiological effects on their hormone like characteristics [5]. Peptides known as bioactive are known as opioid and Angiotensin I-Peptides Having Converting Enzyme Inhibition Activity (ACE Inhibitor Bioactive Peptic). Most of the fragments of serum protein derived

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bioactive peptides; α-lactoforin, α-lactorfin, ß-lactorfins, ß-lactokinins, albutensin, α-laktalbumin and ß-lactoglobulin have been determined to have ACE inhibitor activity [6].

Opioid peptides could be defined as the peptides having morphine like characteristics [5], and performing positive effects on the nerve system [7, 8]. These peptides are β-casein (60.-70. fraction: β casomorfin), αs1-casein (90.-96. fraction: α-casomorfin), β-lactoglobulin (102.-105. fraction: β-lactorfin) ve α-lactalbumin (50.-53. fraction: α-lactorfin) sourced and the bioactive peptic performing the strongest opioid activity is β casomorfin [9]. Peptides having opioid activity have been determined to have effects on the regulation of the social behavior, in relieving the pain, in diminishing the gastrointestinal discharge rate, in the prevention of the diarrhea, in the regulation of amino acid transfer, and in the secretion of insulin and somatostatin hormones [3].

ACE inhibitor peptides increase the blood pressure transferring angiotensin I, exposed out of angiotensinogen, to the strong vasoconstrictors angiotensin II. In addition, ACE disintegrates the vasodilative bradykinin enzyme and stimulates the exposure of aldosterone in adrenal cortex. ACE inhibitor peptides regulate the blood pressure blocking these effects [10].

The most popular method for the production of bioactive peptides is the enzymatic hydrolysis. The enzymes used most for this purpose are pepsin, trypsin and chymotrypsin. In addition to these, alcalase, thermolisine, subtilisin and microbial origined proteolytic enzymes are also used. The enzymatic hydrolysis of the bioactive peptides could be from food proteins, the formation related with the microbial activity in the fermented foods, and the temperature used during the processing of the food are the formations of bioactive peptides through protein hydrolysis as a result of the effects of alkali or acid conditions. Membrane filtration techniques are successfully used in enriching the specific peptic fractions [3, 8, 11, 12].

B-Lactoglobulin (β-Lg) is a protein having the highest rate (58%) in whey proteins and first studied in 1934. β-Lg plays a role in the transfer of the passive immunity in the newborns and in the regulation of the phosphor metabolism in the mammary gland. Besides, it can function as fatty acid or lipid binding protein as well. β-LG and lactoferrin, rich in sulfuric amino acids, are stated to be more effective than total serum proteins in the prevention of colon cancer. α-Lactalbumin (α-La) makes up approximately the 2-5% of the skimmed milk proteins. α- La develops the immune system and diminishes the risks for some cancer types. Immunoglobulins (Ig) are the smallest fraction of the milk proteins existing in whey exposed as a result of the cow milk cheese production and also colostrums. This group of the whey proteins, named as minor compounds in most cases, strengthens the immune system in adults, while it provides the passive immunity in juveniles. They also increase the resistance of humans against infections and their rates are higher in colostrums. Proteoz-pepton fractions make up roundly 3 % of the milk proteins and almost 20% of the whey proteins. Lactoferrin, whose function is to carry iron in blood serum, is an iron-binding Glico-protein. It is produced in the mucosal epithelial cells of various mammals such as humans, cows, goats, horses, dogs and some rodent animals. The studies carried out justifies that lactoferrin displays anti microbial, anti viral, and anti fungal effects. The bio activity of lactoferrin stems from its iron binding characteristics. It behaves like an antibiotic. It can perform both bactericidal and bacteria- static effect against many micro organisms. Lactoperoxidase (LPO) is an oxydoreductors secreted in milk and provides the protection of gastro intestinal systems of the mammary gland during the lactation and of the newborns against pathogen micro organisms. The existence of LPO in the cattle was reported by various studies. Glycomacropeptide (GMP), also known as caseinomacropeptide, is a glicophosphopeptide and is produced as a result of the hydrolytic activity of the chymosin enzyme over the κ-casein during the cheese production and makes up 10-20% of the whey proteins. It was also determined that GMP functions as pre-biotic and fosters the development of bifid bacteria of the probiotic bacteria [13, 14].

Apart from their so-called characteristics, whey proteins have functional characteristics such as increasing consistency, strengthening the gel formation, forming the emulsion, keeping water and preventing serum separation, and have been used in so many food products to improve the sensory and textural properties and to increase durability [15, 16].

3. Bioactive Peptides in Animal Products:

Addition to animal provender:

More than half of the whey produced is used in animal feeding as an additive in Western countries. 0.05% fat, 0.13% protein and 0.09% casein increase were determined in the milk of the cows fed with whey, and it was also observed that when the milk, obtained from these animals, was used in cheese making, yeasting and clotting happened in a short time. This is given to animals as mixed with grains [17, 18].

Cheese Making:
Mysost, Ricotta and cottage cheeses are made from whey. The cottage cheese consumed extensively in our country is made by boiling and then straining the whey. Mysost cheese is made by heating and thickening the whey. Ricotta cheese is made by adding sour whey and by precipitating the proteins after mixing the whey with milk and heat at 90°C. It is advised to use whey protein concentrator in cheese production. Adding this into the tank milk where the cheese is to be made will decrease the amount of the necessary ferment and the cheese quality will rise [19, 20].

Yoghurt Production:
For the purpose of increasing the dry matter of the yoghurt, PAS protein concentrators or PAS powder could be used with skimmed milk powder successfully at 1-2% rate. Whey protein concentrator and whey powder are used to give a harder structure to the yoghurt, to be able to decrease the water release, and to give it a different aroma. It was reported that de-natured whey protein concentration is used in making yoghurt and although this yoghurt shows a different taste, it has the same characteristics with the yoghurt made from fatty milk in view of the amounts of viscosity, acidity and acetaldehyde [21, 22, 23].

Butter Production:
The fat rate of the whey formed during cheese production in cheese making centers displays differences according the technologies employed. If the fat rate is under 0.2%, it is not economical to produce butter from this whey. Using cream separators, it is possible to make separation till 0.05% fat remains in the whey. The cream obtained in this way, is turned into butter after being heated and added acid [23].

Ice-Cream Production:
Whey concentrator obtained with ion exchangers and ultra-filtration techniques could be added into the ice cream mixture instead of ¼ of the skimmed milk powder. In the UK, it is rumored that de-mineralized whey powder and concentrator are used in ice cream [23].

Usage in Drinking Milk:
The taste weakness in dietary drinking milk prepared from low-fat milk due to the low fat rate could be eliminated and increased by adding whey protein. Again, in order to provide a similarity between cow milk and mother milk, lactose and whey protein addition is employed [20, 24].

Usage in the Meat Industry:
Fresh whey proteins provided with yeast are used in the production of various salami and sausages as additives at maximum 2% rate in amount. They could successfully be used at certain levels in de-mineralized PAS powder, concentrators and de-natured lactalbumine meat and emulsion meat products. In other processes like frankfurter, chicken meat and fish, PAS is reported to be able to be used around 5, 5% [19, 23, 25, 26].

4. Conclusions

Milk, meat and pulse, occupying a significant place in human nutrition, attract attention due to their high protein contents. Peptides, provided from the proteins existing in these foods through enzymatic or microbial hydrolysis perform so many activities beneficial to human health and have been used in many milk and animal products. However, similar applications should be carried out in different food sectors and the results should be determined in a detailed way. Bioactive peptides are foreseen to be able to be produced more widely in a near future.

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