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Biochemical Taste Parameters in Meat and Sea Products

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ABSTRACT

Flavour of meat or sea products is generally thought to consist of the volatile components sensed in the nose, both through the nostrils and from inside the mouth. Taste results from the combination of basic flavors (sweet, sour, bitter, salt and umami). The flavors and aromas associated with meat and sea foods are generally those that develop during heating and cooking. Animal products such as meat and sea foods have very complex composition and definition of their quality are very complicated. Different food components have different tastes. Sweet flavor in meat or sea products is derived from sugars, amino acids and organic acids. Carbohydrates generally taste sweet. Fats have little taste, but contribute mouth feel and carry odorants. Lipids have an effect on flavor perception, stability and generation. In this review, it was aimed to inform basic flavor parameters of animal products such as meat and sea foods.

Key words: Biochemical taste parameters, meat, sea food

INTRODUCTION

Taste results from the combination of basic flavors (sweet, sour, bitter, salt and umami) derived from water-soluble compounds and odor derived from a myriad of substances present in the food product from the onset or derived via various reactions. The flavors and aromas associated with meat and sea foods are generally those that develop during heating and cooking. When water-soluble substances derived from precursor compounds dissolve in the saliva, they bind to the taste buds and stimulate a response that is perceived in the brain. Odor occurs when volatile compounds bind to receptors in the olfactory bulb behind the nasal cavity and stimulate a response. Both flavor and odor release depend on the matrix in which they are embedded, therefore, texture has a tertiary effect on both because it modulates when they are available to be perceived. However, the function of the taste senses is not clearly understood (Lawless and Heymann, 1998).

Animal products have very complex composition and definition of their quality is very complicated. Recently, researchers focused on biochemical taste parameters of animal products (Cimen *et al*., 2009; Yildirim and Cimen, 2009; Bayril *et al*., 2010; Tekelioglu *et al*., 2010). According to Hofmann (1990) product quality is consisted of hygienic, nutritive and sensory aspects (at first colour, texture, tenderness, softness and flavour). The product quality is also influenced by the technological factors (Beriain *et al*., 2003). Meisinger and Miler (1998) divided quality properties into two groups: visual and edible quality properties or palatability. These authors defined that visual characteristics of quality are influenced by: water holding capacity or loss of juice, colour, intramuscular lipids and glow. In this review, it was aimed to inform basic flavor parameters of animal products such as meat and sea foods.

The effect of carbohydrate, fat and protein on taste: Different food constituents have different tastes. Sweet flavor in meat is derived from sugars, amino acids and organic acids. Carbohydrates generally taste sweet. Fats have little taste, but contribute mouth feel and carry odorants. Amino acids have the most variation in taste and the effect of amino acids and peptides on food taste has been researched extensively. According to Kirimura and Shimizu (1969) arginine is bitter and slightly sweet, serine is sweet with some sour and umami, glutamic acid is sour and umami and alanine is sweet with slight umami. Generally amino acids have more than one taste character, but can still be divided into three basic groups: sweet amino acids, sour and umami-like amino acids and bitter amino acids. Except for the bitter ones, most amino acids have two or three tastes. Peptides are generally not as strong tasting as amino acids. Some amino acids are the dominant contributors of taste in a foodstuff while others intensify taste or add to mouth feel. Lipids have an effect on flavor perception, stability and generation. A flavor substance may be hydrophilic or lipophilic. When a food contains little or no lipids, a high concentration of lipophilic compounds will be in the air above the food, since, it cannot bind to lipids in the food. If lipid content of a food is higher, most of the lipophilic flavorants will be bound to lipids in the food and the concentration in the air above the food is much lower. The headspace concentration of hydrophilic flavorants is not affected as much by the lipid content. Studies have shown that an increase in fat content results in a decrease of flavor strength and changes the flavor pattern. Flavor release in the mouth from the lipid phase of foods is slower than from the water phase, so the maximum flavor intensity is perceived later than that of hydrophilic flavorants. Lipids in food also affect the stability of flavors (De Roos, 1997).

MEAT AND BIOCHEMICAL TASTE PARAMETERS

Beef: A wide array of taste-active volatiles occurs in beef (Shahidi, 1994). Beef taste, which develops when heat is applied, depends on the amounts and proportions of precursor compounds present. Meat is composed of water, proteins, lipids, carbohydrates, minerals and vitamins. Of these, proteins, lipids and carbohydrates play primary roles in taste development because they include numerous compounds which are capable of developing into important taste precursors when heated (Spanier and Miller, 1993; Mottram, 1998). The compounds that elicit various tastes and odors have different thresholds for perception. Sweet taste in meat is derived from sugars, amino acids and organic acids. Sour flavors arise from amino acids coupled with organic acids. Inorganic salts and sodium salts of glutamate and aspartate generate saltiness. Bitterness is likely due to hypoxanthine, anserine and carnosine as well as some amino acids (MacLeod, 1994).

Mutton: Lamb and mutton fats contain both species-related taste components and high levels of saturated fatty acids (Cramer, 1983); mutton taste also generally increases with age (Field *et al.*, 1983). Researchers agree that meaty aroma comes from the lean portion of meat while species-specific flavors originate in orare deposited in the fat portion (Pearson *et al.*, 1973). Reduction of mutton flavor in processed meats has been achieved by reducing mutton fat to a level of 10% or less in processed products (Wenham, 1974), using spices (Baliga and Madaiah, 1971) or smoking and curing (Ogmundsson and Adalsteinsson, 1979). The concentrations of pH were also lower for mutton than fish meat. The pH concentrations close to neutral of meat from fish may be advantage for eating quality (Kayim, 2010; Kayim and Can, 2010).

Sensory panelists liked the taste better when lean mutton was included in meat patties, frankfurters or jerky. Jerky and frankfurters containing trimmed mutton were equal to the all-beef products in taste acceptability (Bartholomew and Osuala, 1986).

Fish meat and sea products: Off odours and flavours in fish or sea products arise from contamination from metabolites, from the spoilage of protein, or from oxidation products of the oil itself. Fish flavors are mainly characterized by the volatile compounds in fish. Olafsdottir and Fleurence (1998) present a good review on the main groups of fish odors. These are species related fresh fish odor, microbial spoilage odor, oxidized odor, environmentally derived odor and processing odor. The last is not of interest when dealing with fresh fish, but is relevant for example in ripening of herring and anchovies. When stored, iced fish results primarily in bacterial spoilage deterioration. In frozen fatty fish, where bacterial spoilage is arrested, the principal changes in flavor and odor result from alteration in lipid components. The fresh fish odor is prevalent during the first few days after catching. After that oxidation products and microbial metabolites dominate the aroma of fish. The compounds associated with fresh fish flavors are mostly 6-, 8- and 9-carbon aldehydes, ketones and alcohols derived from the unsaturated fatty acids characteristic of fish by lipoxygenase activities. Six carbon compounds (hexanal, trans-2-hexenal, cis-3-hexenal) provide green plant-like aromas. They are connected to freshwater fish and are usually not found in saltwater species. Eight carbon compounds (1-octen-3- ol, 1-octen-3-one, 1-cis-5-octadien-3-ol, 1-cis-5-octadien-3-one) seem to occur in most types of fish and seafood and contribute heavy plant-like odors and metallic-like flavors. Oxidation of meat lipids damages both odor and flavor of fresh, cooked, stored (refrigerated or frozen) or reheated meat resulting in rancid and/or warmed over flavor. Freezing and storage of frozen fish may furnish favorable conditions for alterations in muscle structure, muscle proteins and lipids and textural properties in general. These changes are related to alterations in the sensory attributes of frozen fish and may affect their market (Mackie, 1993).

Formation and growth of ice crystals during freezing and storage of sea products may cause lysis of organelles and disintegration of membranes. Enzymes that are released from organelles and/or membranes may be more active than in the bound state (Hultin, 1985). The release of dehydrogenases from mitochondria might influence the redox potential of tissues and the release of lipases from lysosomes may cause more rapid breakdown of lipids (Shewfelt, 1981). The damage of organelles due to freezing and during storage can be studied by the activities of enzymes in muscle tissue fluids, enzymes that in fresh tissue are retained in intracellular organelles. The activity of the mitochondrial enzyme β-hydroxy-acyl-coenzyme A- dehydrogenase (β-HADH) has been regarded as a measure of the damage caused in mitochondria by various freezing and thawing treatments of meat and sea products (Makri *et al*., 2007).

Lipids that are liberated from the disintegrated membranes could be subjected to faster hydrolytic or oxidative reactions. The secondary oxidation products of lipids influence directly the taste or interact with proteins and cause off colours. The changes in lipids during storage of frozen fish can be detected by a variety of chemical tests including free fatty acids content, peroxide value, conjugated dines, thiobarbituric reactive substances etc. (Shenouda, 1980).

The physical, chemical, bio-chemical and sensory properties of frozen stored fish species have been studied for several decades because of their economic importance. However, little information is available on the quality of frozen stored bivalve molluscs that comprise a significant marine resource.

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