CURRENT STATUS OF MEAT FLAVOR

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Meat flavor consists of the basic tastes, including the “umami” taste, and hundreds of odiferous volatiles. Of more than 1,000 flavor volatiles identified in meat, only a few have “meaty” aromas. The precursors of most meaty volatiles include cysteine and the reducing sugars which react via the browning reaction (BR). Two volatiles, 2-methyl-3-furanthiol and bis(2-methyl-3-furyl) disulfide, identified in beef, chicken, pork and tuna, are recognized as meat flavor impact compounds. The cooking methods also affect the types of meat volatiles formed with a large number of pyrazines being formed during grilling and frying. Also, the unsaturated fatty acids of cell phospholipids, after oxidation, react with BR products to form different volatiles, some of which may contribute to meat species flavor differences. However, precursors or volatile compounds present in raw meat from different species also contribute to these flavor differences.

1. INTRODUCTION

The flavor of cooked meat is dependent upon many factors including the following: (a) the types and levels of nonvolatile taste-active compounds present in the meat, (b) the types and concentrations of meat precursors that form volatile components upon cooking and (c) the method of cooking/processing. The basic tastes of meat include sweet, sour, salty, bitter and the “umami” or savory taste. The volatiles formed during cooking are responsible for the different meat flavors and over 1,000 volatiles have been identified in the cooked meats (Shahidi, 1994). The different cooking/processing methods, boiling or stewing, roasting, broiling, frying or thermally processing (canning), also affect the flavor of each type of meat cooked by altering the types and concentrations of volatiles produced.

2. BASIC MEAT TASTE

Nonvolatile components such as sugars (ribose, glucose and fructose) and amino acids (glycine, alanine, serine, threonine, lysine, cysteine, methionine, asparagine, glutamine, proline and hydroxyproline) contribute a slight sweetness to the meat (MacLeod,
Different amino acids (aspartic acid, glutamic acid, histidine and arginine), and naturally occurring organic acids (sucinic, lactic, inosinic, ortho-phosphoric and pyrrolidione carboxylic acids) provide sourness to meat. Meat saltiness is mainly due to inorganic salts and salts of glutamate and aspartate, while several components contribute bitterness to the meat. Bitter components in meat include hypoxanthine, carnosine, anserine, other peptides, and L-amino acids (histidine, arginine, lysine, methionine, valine, leucine, isoleucine, phenylalanine, tryptophan, tyrosine, asparagine and glutamine).

Other taste-active components in meat also include those that are responsible for the umami taste: glutamic acid and its sodium salt (MSG), 5'-inosine monophosphate (IMP), 5'-guanosine monophosphate (GMP) and certain peptides. The umami taste has a characteristic savory quality with glutamate being its most important contributor (MacLeod, 1994). One difference between beef flavor and that of pork and chicken is that beef has a lower perceived umami taste probably due to a lower concentration of glutamate in beef than in pork or chicken (Kato and Nishimura, 1987; Kawamura, 1990).

Besides providing taste, MSG, IMP and to a lesser extent, GMP, have flavor-enhancing properties. The 5'-ribonucleotides have strong flavor potentiating effects individually, but also act synergistically with glutamic acid or MSG to enhance meaty, brothy, MSG-like, mouthfilling, dry and astringent qualities in meat while suppressing sulfurous and hydrolyzed vegetable protein (HVP) notes (Kuninaka, 1981). Both MSG, IMP and GMP lose their activity with any change or degradation of chemical structure during cooking of meat.

3. MEAT AROMA COMPONENTS

Meat flavor or aroma is developed from interactions of nonvolatile precursors: amino acids, peptides, reducing sugars, vitamins, nucleotides and unsaturated fatty acids, during cooking. These interactions produce volatile products that result in unique meaty aromas that differ among meat types (mutton, beef, pork, poultry and fish). According to Shahidi (1994) the volatiles identified in cooked meats include most types of organic compounds: hydrocarbons, alcohols, aldehydes, carboxylic acids, esters, lactones, ethers, heterocyclic constituents (furans, pyridines, pyrroles, oxazoles and oxazolines, thiazoles and thiazolines, and thiophenes) and other sulfur- as well as halogen-containing components.

Many meat volatiles are formed via Maillard reactions where reducing sugars react with α-amino acids to give Amadori and Heyns intermediates. These intermediates can dehydrate to form furfural or hydroxymethyl-5-furfural from pentoses and hexoses, respectively, or rearrange to form reductones and dehydroreductones. These latter compounds can react with ammonia or hydrogen sulfide to give different heterocyclic compounds (furanes, pyranones, pyrroles and thiophenes); degrade into a variety of components such as hydroxyacetone, cyclotene, hydroxyacetyl, or acetoin; or undergo retro-aldolization to form aldehydes such as glyoxal, pyruvaldehyde, glycolaldehyde, or glyceraldehyde. The reductones and dehydroreductones can react with amino acids via the Strecker degradation to give aldehydes and α-aminoketones. For example, as shown in Figure 1, a dicarbonyl compound reacts with methionine to give a Schiff base, which upon losing carbon dioxide and being hydrolyzed, forms the aminoketone and methional. Methional, which has a cooked potato aroma, has been identified by Gasser and Grosch (1988) as having a relatively high flavor dilution factor in cooked beef aroma. Components with high flavor dilution factors are considered important to that particular flavor (MacLeod, 1994).