Chapter 9 / Loss of Senses with Age

Loss of Taste, Smell, and Other Senses with Age

Effects of Medication

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1. INTRODUCTION

There is an increasing awareness of the potential for maintaining functional status and quality of life to very old age. Integral to that aim is retaining the function of the senses, which are vital for learning, interacting, taking pleasure from the outside world, and overall health. All sensory modalities (including taste, smell, vision, hearing, and touch) undergo age-related declines, although the time of onset and degree of loss for a particular sensory modality varies among individuals. Many changes in the senses are not an inevitable consequence of aging, but rather are influenced by such factors as disease, medication use, and environmental factors including nutrition. Current research aims to better understand the mechanisms of age-related sensory losses and to develop methods that compensate for these changes so that the elderly can maximize their remaining abilities.

This chapter provides an overview of the decrements in taste, smell, vision, hearing, and touch in elderly persons, as well as how these sensory changes impact nutritional status. The role of medications in these losses will be addressed. In addition, the relationship of nutritional factors to sensory health are examined.

2. CHEMOSENSORY LOSSES WITH AGE

Alterations in taste and smell occur with advancing age, and this can lead to poor appetite (1), inappropriate food choices (2), and/or lower nutrient intake (3). Decreased appetite is one cause of lower energy consumption in the elderly (4–6), which can ultimately impact protein and micronutrient status and may induce subclinical deficiencies that directly affect health status (4,5,7). Loss of appetite is of special concern for elderly with critical illnesses who are at a higher risk to develop protein-energy malnutrition, as well as micronutrient deficiencies (8).
Taste and smell affect appetite, food choices, and nutrient intake in the following ways. First, these chemosensory (e.g., taste and smell) signals initiate cephalic phase responses including salivary, gastric, pancreatic, and intestinal secretions that prepare the body to digest food (9,10). Second, taste and smell provide sensory information that allows us to detect and discriminate among foods in the face of fluctuating nutritional requirements. This is accomplished in part by changes in the activity in taste neurons in response to physiological needs (11–14). Third, taste and smell sensations enable us to select a nutritious diet. Learned associations between the taste and smell of a food and its postingestive effects (10,15) allow an individual to modulate food intake in anticipation of its nutritional consequences. That is, taste sensations serve as an indicator of a food’s nutritional value. Fourth, taste and smell signals play a role in initiating, sustaining, and terminating ingestion, and thus influence the quantity of food that is eaten and the size of meals (10). Fifth, taste and smell sensations induce feelings of satiety and are primary reinforcers of eating (10,16,17). Thus, impairments of taste and smell can alter food choices and intake and subsequently exacerbate disease states, impair nutritional status and immunity, and produce weight loss (16,18).

2.1. Taste Losses with Age

2.1.1. Physiology of the Taste System

In order to understand the perceptual changes in taste with age, it is helpful to describe the anatomy and physiology of the taste system. Taste sensations occur when chemicals in foods and beverages contact taste cells in the oral cavity that are clustered into buds scattered on the dorsal surface of the tongue, the soft palate, pharynx, larynx, epiglottis, uvula, and first third of the esophagus (16,19,20). Taste receptor-like cells have even been identified in the lining of the stomach and intestines (21). Taste buds are structures that consist of 50–100 specialized cells arranged somewhat like segments in a tangerine. Taste cells replicate constantly with a turnover time of approx 10–10.5 d. This continuous renewal renders the sense of taste vulnerable to nutritional deficiencies that impair reproduction of taste cells (16,18).

Taste buds on the tongue are found in elevated structures called papillae. Papillae on the anterior two thirds of the tongue are called fungiform papillae and usually contain 1–18 taste buds. Foliate papillae consist of folds arranged vertically on the posterior lateral sides of the tongue. Taste cells in foliate papillae are especially sensitive to sour tastes. Circumvallate papillae, which are surrounded by “moats,” are located on the posterior third of the tongue arranged in a V-shaped form pointing caudally. Biochemical components in taste cells transduce taste signals related to quality (e.g., salty), as well as intensity. These components include sodium channels, potassium channels, and two second messenger systems, the adenylate cyclase system and the phosphatidylinositol system (22,23).

Taste signals are transmitted from taste receptor cells to the medulla in the brain stem along three cranial nerves (17,20). Taste buds located on the anterior two-thirds of the tongue are innervated by one branch of the seventh cranial nerve (the chorda tympani nerve). Another branch of the seventh cranial nerve (the greater superficial petrosal nerve) innervates most of the taste buds on the soft palate. The remaining taste buds located on the soft palate are innervated by a branch of the ninth cranial nerve (the deep petrosal branch). Taste buds on the posterior third of the tongue are innervated by the