

Incidence of Taste Disorder and Umami Taste Disorder among the Japanese Elderly and Youth

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Abstract

The incidence of taste disorder has increased among both the elderly and the young in Japan. The loss of taste sensation not only affects the quality of life, but can also cause weight loss and health problems, particularly among the elderly. Taste disorder among the elderly has been attributed to side effects of medication, malnutrition (including zinc deficiency), systemic diseases, and oral diseases. We found that salivation was significantly decreased in elderly patients with taste disorder, but was normal in all elderly subjects with normal taste perception thresholds. This suggests that hyposalivation is closely related to taste disorder among the elderly. However, the cause of taste disorder among the young is unclear. In addition, we found that some elderly patients complained of loss of only umami taste sensation, whereas the other four basic taste sensations (sweet, salty, sour, bitter) were normal. Patients with loss of umami taste sensation were all over 65 years old, and they all complained of appetite and weight loss, resulting in poor general health.

In this article, we surveyed the prevalence of taste disorder in Japan and discussed the causes of taste disorder.

Keywords: Taste disorder; Umami taste disorder; Hyposalivation.

Introduction

The enjoyment of food is one of the greatest sources of pleasure in a human being's life. For food to be palatable, it is necessary that one be sensitive to taste. Loss of adequate gustatory function may induce poor appetite, reduced dietary intake and weight loss, particularly in the elderly. Together with the increase in elderly population, the number of patients suffering from taste disorder has also increased in Japan. In our clinical treatment of taste disorder patients, we found that some elderly patients complained of losing only the perception of umami taste (a synonym for a sensation of savory or broth-like flavor), whereas the other four basic taste sensations (sweet, salty, sour, bitter) were normal. All patients with loss of perception of umami taste fell into poor general health conditions because of appetite and weight loss. Thus, umami taste sensitivity seems to be important for the maintenance of good health. This article focuses on the incidence of taste disorder in the Japanese population, including the young generation, from the clinical point of view.



Figure 1: Filter disc test for assessment of taste disorder.

Each taste solution (sweet, salty, sour, and bitter) was administered to the subjects at five concentrations. For this test, the lowest concentration of each solution that a patient can detect and recognize is determined. A score of 3 or less indicates normal taste sensitivity, a score of 4 indicates a slight taste disorder, and a score of 5 indicates an intermediate taste disorder. The subject who cannot perceive level-5 of a taste solution is assessed as having a severe taste disorder.

Survey of Subjects Suffering from Taste Disorder in Japan

The filter disc test [1] is widely used in Japan to assess taste sensitivity (Figure 1). In this test, a filter soaked with a taste-inducing chemical solution is placed on specific areas of the tongue and oral cavity. Generally, the lowest concentration of each of the four basic tastes (sweet, salty, sour, and bitter) that a patient can detect and recognize is determined. Each taste solution is administered at five concentration levels, from the lowest (level-1) to the highest (level-5). Scores of 3 or less indicate normal taste sensitivity, a score of 4 indicates a slight taste disorder, and a score of 5 indicates an intermediate taste disorder. The subjects who cannot perceive a level-5 taste solution are assessed as having a severe taste disorder. A patient may also be asked to compare the tastes of different chemicals or to note whether the intensity of a taste increases when the chemical concentration is increased. The specific areas for clinical assessment of taste sensitivity are the tip of the tongue (innervated by the chorda tympani nerve), the posterior of the tongue (the glossopharyngeal nerve area), and the soft palate (the greater superficial petrosal nerve area) (Figure 2). These nerves are known as taste sensory nerves, and they innervate specific anatomical locations. Taste buds consisting of taste receptor cells are also located in the larynx, pharynx, and epiglottis; however, these areas are not analyzed in clinical settings because their locations pose technical challenges.

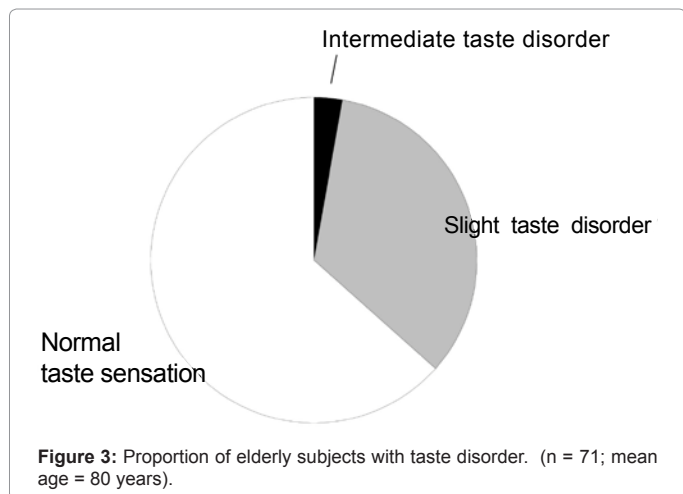
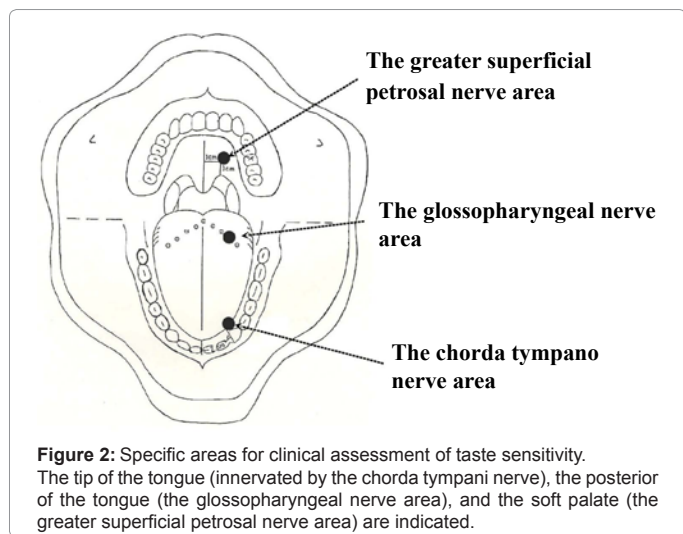
We previously surveyed the prevalence of taste disorder in elderly

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Received May 03, 2012; Accepted June 21, 2012; Published June 26, 2012

Citation: Sasano T, Satoh-Kuriwada S, Kaneta N, Shoji N, Kawai M, et al. (2012) Incidence of Taste Disorder and Umami Taste Disorder among the Japanese Elderly and Youth. J Nutr Food Sci S10:002. doi:10.4172/2155-9600.S10-002

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subjects to elucidate the relationship between aging and taste sensitivity [2]. The subjects included 71 elderly people (male: n = 19, female: n = 52), 65 to 94 years of age (mean = 80 years), in four different homes for senior citizens, with daily meals arranged by a nutritionist. After informed consent was obtained from each subject, the thresholds of the four basic tastes (sweet, salty, sour, and bitter) were measured using the filter paper disc method. Of the 71 subjects, 26 (36.6%) demonstrated slight to intermediate taste disorder, determined as a high threshold for taste sensitivity (Figure 3). Only 5 (19.2%) of the 26 subjects with taste disorder noticed a subjective decrease in taste sensitivity.

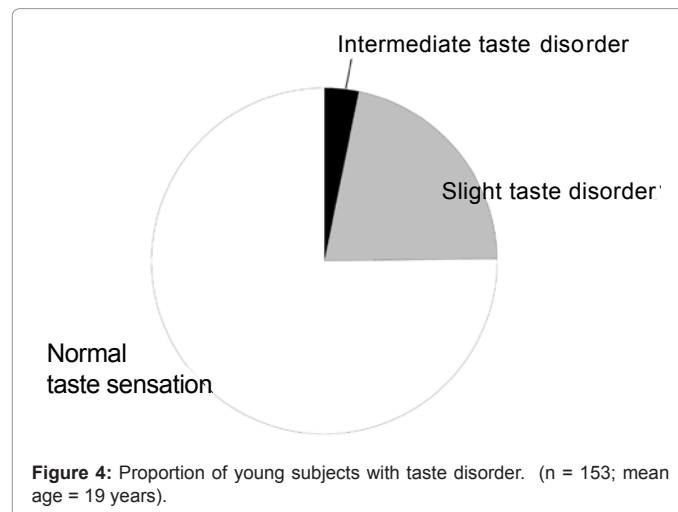
We also surveyed the prevalence of taste disorder in Japanese youth, because there have been some reports in the Japanese mass media of an increase in the incidence of taste disorder among the young [3]. The subjects of our study were 153 freshmen (first-year students) of our dental school who agreed to participate (male = 103, female = 50; age range 18 to 31 years old, mean = 19.1 years). The taste sensitivity test was carried out using the filter paper disc method. Of the 153 subjects, 38 (24.8%) were assessed as having a slight to intermediate taste disorder (Figure 4). Only 5 (7.9%) of the 38 subjects with taste disorder noticed a subjective decrease in taste sensitivity. Thus, the occurrence of taste disorder is common not only among the elderly but also among the

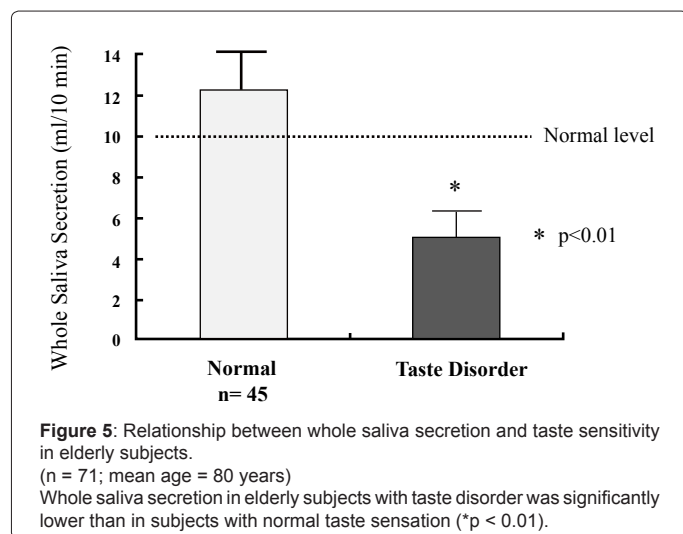
young in Japan. Many of the subjects with measurable taste disorder were unaware of their own taste dysfunction.

Causes of Taste Disorder

Taste sensory changes associated with advancing age may arise from alterations that are part of the normal physiological aging, or they may occur in response to secondary influences, such as the side effects of drugs or the effects of some diseases including periodontal disease/oral infections, nervous disorders including cerebral infarction, nutritional impairment, and endocrine disorders [4,5]. Some drugs may impact taste sensitivity by directly stimulating taste receptors, not only altering the normal transduction process and cellular functions, but also altering the salivary flow [6-8]. The reduction of salivary flow in the elderly seems to generally correlate with a decline in taste perception, and could be a result of the high prevalence of systemic diseases and consequent drug treatments [9,10]. Most drugs prescribed for the elderly, including remedies for stomach and bowel disorders, antihypertensives, muscarinic blockers, antihistamines, and antidepressants, reduce salivary flow as a side effect [11-14].

The cause of taste disorder among the young is unclear. The Japanese mass media speculated that it was a consequence of lifestyle changes, such as the reversal of nighttime and daytime sleep patterns, frequent use of the Internet, and reduced sleep. Some journalists also reported that poor eating habits in terms of nutrition and meal regularity are the cause of taste disorder among the young. Indeed, in young Japanese, changes in eating habits, such as skipping breakfast and frequently having convenience store foods (e.g., frozen meals or snack foods), might cause systemic diseases including taste disorder. At present, however, there have been few epidemiological studies regarding the relationship between taste disorders, lifestyle changes and eating habits in the young population. We recently reported that taste disorder among the young is not correlated with chronic systemic diseases or medication, salivary flow rate, or lifestyle (i.e., stress, reversed night and day activities, daily use of the Internet, sleep duration, or daily use of perfume), but rather is related to eating habits [3]. In detail, (1) subjects who skipped breakfast were more frequently assessed as having taste disorder, (2) subjects with taste disorder ate fish, shellfish, seaweed or bean products, such as tofu, less frequently than their normal counterparts, (3) subjects with taste disorder tended to pay less attention to a nutritionally balanced diet than normal subjects, (4) there was no correlation between the occurrence of taste disorder and





eating convenience store food, dieting, or fast food eating frequency, and (5) symptoms of anemia and/or weight loss were more frequent in the subjects with taste disorder than in normal subjects. Consequently, we concluded that guidance regarding nutritional elements that should be in the daily diet is necessary to help the young stay healthy [15].

Taste Sensation and Salivary Secretion

Saliva is essential for oral functions such as speech, mastication, swallowing, and taste sensation. We surveyed the patients who visited our hospital with complaints of oral dryness owing to decreased saliva secretion. These patients also suffered from secondary symptoms such as difficulty speaking and swallowing, masticatory disturbance, mucosal pain, and taste disorder. The patients' symptoms were relieved following increased salivation [16]. Thus, these results demonstrate that saliva is necessary to maintain proper oral function. Furthermore, saliva contains digestive enzymes (amylase and lipase) that initiate the digestion of starch and lipids. Saliva also contains antibacterial, antiviral, and antifungal agents that balance the oral bacterial flora and inhibit the bacterial colonization of oral tissues [17]. The epidermal and transforming growth factors found in saliva promote tissue growth [18], differentiation, and wound healing [19]. Small proteins, IgA, defensins, cytokines, hormones, mucins, and other components in saliva are thought to play a role in innate immunity and defense of the oral mucosa [20]. Therefore, the decline (or absence) of salivation often causes infection, resulting in characteristic stomatitis, which may predispose to the destruction of taste receptors.

We previously investigated the relationship between salivary flow rate and taste perception threshold in the elderly to determine whether hyposalivation influences taste disorder [2]. The subjects were the same as described in (Figure 3). Salivary flow rate was measured using the gum test, in which saliva secreted following gum chewing was collected for 10 min. This method is widely used to clinically assess oral dryness [21]. As shown in (Figure 5), whole saliva secretion among subjects with taste disorder was significantly lower than in subjects with normal taste perception thresholds (>10 mL/10 min). There were no significant differences in whole saliva secretion by gender or age among the subjects with taste disorder [2]. This suggests that hyposalivation is closely related to taste disorder in the elderly, which is consistent with the finding that taste disorder is frequently observed in radiation-induced xerostomia [21]. Furthermore, Matsuo et al. reported an elevated taste

threshold and reduced taste nerve response after surgical removal of the submandibular and sublingual glands [22]. Consequently, we conclude that salivation is essential for normal taste function, and we consider that a treatment for hyposalivation may be an effective remedy for taste disorder [16].

Umami Taste Disorder

In our taste clinics, we sometimes meet elderly patients with taste disorder who complain of persistent impaired umami taste, although the other four basic taste sensations (sweet, salty, sour, and bitter) are normal, or have improved in the recovery process [23,24]. As a consequence, such patients say, "I can recognize tastes, but I cannot feel umami, so I have no appetite because foods don't taste good." Unfortunately, patients with impaired umami taste perception are diagnosed as having normal taste sensation during clinical examinations because they show normal threshold scores for the four basic taste tests. Currently there is no clinical test for umami taste, although the other four basic tastes have been widely used in quantitative and qualitative taste sensitivity tests, as described above. Thus, we have recently developed a new method to clinically assess the umami taste sensitivity using a filter paper disc with sodium glutamate (MSG).

Patients who complained of the loss of only umami taste sensation, while having normal sensation of the other four basic tastes (sweet, salty, sour, bitter) were all over 65 years old, and they all complained of appetite and weight loss, resulting in poor general health. After treatment, their umami taste threshold recovered, and they gained back their appetite and weight [25].

In conclusion, taste sensation, particularly for umami taste, brings not only an enjoyable life but also contributes to good overall health.

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This article was originally published in a special issue, **Nutrition and Human Health: Health Benefits of Umami Taste in Asian Cuisine** handled by Editor(s). Dr. Hisayuki Uneyama, Ajinomoto Co., Inc., Japan.