Taste Disorders: Hypogeusia, Ageusia, and Dysgeusia

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Abstract

Taste is a large part of our everyday lives and is commonly taken for granted. Damage or dysfunction to the taste system, such as damage to structures or dysfunction in the taste pathway could be detrimental to people’s quality of life and nutritional intake. This literature review looks into the etiology, assessment process, and treatment of each category of taste dysfunctions: Hypogeusia, Ageusia, and Dysgeusia. The commonly linked disorder of burning mouth syndrome is also researched for a better connection to the three taste dysfunctions. New techniques to further knowledge on the subject are proposed as well as more preventative precautions.
Introduction

It is estimated that over two million Americans suffer from a chemosensory dysfunction. Chemosensation involves receptors that are responsive to chemical stimuli. Chemosensation includes the senses taste and smell (Karita, Harada, Yoshida & Kokaze, 2012). This paper focuses on the taste, or gustatory, side of chemosensory dysfunction. Disorders related to taste abnormalities include ageusia, which refers to the lack of taste, hypogeusia, which refers to a diminished taste acuity, and dysgeusia, which refers to an unpleasant, obnoxious or perverted taste (Walker, 1990).

Pathway

The gustatory system is complex. It includes reception, transduction, propagation, and perception of a chemical tasting or odorants. Each of these processes require a specific, and effective operation of numerous mechanisms (Ksouda, Affès, Hammami, Sahnoun, Atheymen, Hammami & Zeghal, 2011). PET scans of the human brain have revealed the specific structures involved in taste sensation. These structures include: the thalamus, insular cortex, anterior cingulated gyrus, parahippocampal gyrus, lingual gyrus, caudate nucleus, and temporal gyri (Mattes, Cowart, Schiavo, Arnold, Garrison, Kare & Lowry, 1990). Taste perception is located at the level of the taste buds, which locate the taste receptors, and are located at different points of the oral cavity (Felix, Tomita, Pereira, Cordeiro, Carleti, Barros & Cabrel, 2009). When a tastant enters the mouth it is diffused through the tongue, pallet, epiglottis, pharynx, and larynx. Tastants such as sweet and bitter are activated through g-protein coupled receptors, while tastants such as salty and sour act on specific ion channels. The electrical signals for taste are then sent to the central nervous system through the cranial nerves VII, IX, and X (Caldas, Facundes, Cunha, Balata, Lean & da Silva, 2013). The anatomy of the central taste pathway and the secondary projections fibers, that allow the sensation of taste in humans, is not well understood. There is,
however, knowledge of three main areas in which signals pass through: the nucleus tractus solitary (NTS) located in the medulla oblongata, the ventral posteromedial nucleus (VPM) of the thalamus, and the central trigeminal tract at the level of the pons or midbrain (CTT) (Tsivgoulis, Ioannis, Vadikolias, Galetta & Piperidou, 2011). Cranial Nerve VII contributes to two taste areas: the superior salivary nucleus and the gustatory nucleus. These areas supply sensory fibers, connected to the taste buds on the anterior two thirds of the tongue, with sensory information (Walker, 1990). The solitary tract, which involves the central tegmental tract to the medial VPM nucleus, is the first relay in taste sensation. Taste information is then relayed to the primary taste cortex in the frontal operculum and insular cortex finally reaching the secondary cortical taste area in the orbitofrontal cortex (Kim, Song, Jeong, Choi & Na, 2007). Due to the complexities of the gustatory system assessment of dysfunction within the system can be difficult.

Assessment

To assess taste disorders, the process of chemogustometry is used, but because taste is a chemical sense and is closely related to smell, testing for taste, alone, is difficult due to the need to simply narrow down subject perception to objective taste components (Naik & Claussen, 2010). Taste sensitivity is most commonly tested through two different procedures: electroguatometric and a form of a filter disk test. Electroguatometric testing uses electrical stimulation in specific areas of the oral mucosa where taste receptors are located. This method allows for the evaluation of quantitative taste sensitivity but cannot be applied to qualitative assessment of different tastants. Electroguatometric testing is more commonly used to evaluate taste disruptions due to nerve dysfunctions in the sensory pathway. Filter disk tests consist of filtered paper soaked in chemical solutions that correspond with one of the five tastants. The filtered disk is then placed in specific areas of the tongue and oral cavity. The lowest
concentrations of each basic taste should be detectable. This type of testing allows for the evaluation of both quantitative and qualitative taste sensitivity (Sasano, Satoh-Kuriwada, Shoji, Sekine-Hayakawa, Kawai & Uneyama, 2010). In a variation of the filter disk test, there is a three-drop method in which four tastants are used. Each tastant is dropped onto the subject’s tongue three times at different concentration, all of which should be detectable. Then the subject verifies whether they perceived the tastant or not. This test is used often used due to its cost efficiency and its high test and retest reliability (Hsiao & Li, 2007). When assessing for taste disorders, test results can be plotted onto a pentagon chart shown in Figure 1. A pentagon chart has been viewed as the easiest way to assess taste disorders and includes the basic chemical stimuli of sweet, salty, sour, and bitter that are always tested for. When these tastants are tested, their level of concentration and the level at which the subject can identify them are plotted upon this chart allowing physicians to easily read and assess the taste dysfunction (Naik & Claussen, 2010). Along with the assessment of taste dysfunctions in an objective way, there are often forms of assessment to gain subjective insight to the subjects’ mood, experience, and how the disorder may affect their daily life. In some cases patients can fill out a questionnaire to verbally explain the sensations they are experiencing and also to describe their personal daily routines such as their food frequency and nutrimental intake (Karita, et al., 2012). In other scenarios patients’ moods are evaluated and categorized into a five-point scale to compute for anxiety, depression, anger, fatigue, and confusion. These different types of assessment allow physicians to evaluate patients’ quality of life (Hummel, Frasneli, Gerber & Hummel, 2007). Quality of life is often an effect of taste disorders but research has also found that quality of life may also be a contributor to taste disorders. Psychological factors such as mood can change thresholds of the four basic tastes. The release of neurotransmitters from different mood states effect taste sensitivity
TASTE DISORDERS

(Hummel, et al., 2007). It has been reported that when normal serotonin and noradrenaline levels are disrupted, as they typically are in patients suffering from depression and anxiety, they have an impact of taste disorders. Those who suffer from depression usually have a decreased sensitivity to all tastes and those who suffer from panic disorders have a decreased sensitivity to bitter tastants (Heath, T., Melichar, J., Nutt, D., & Donaldson, L, 2006).

**Etiologies**

Chemosensory dysfunctions have multiply etiologies: psychogenic, systemic, oral, and neurological pathologies, however, pharmaceuticals are the most common cause of taste disturbances (Ksouda, et al., 2011). Taste disorders can be cause by various occurrences, the most common being, viral infections, glossitis, trauma to nerves, tumors, vascular causes affecting the neural pathway, neuropathies and iatrogenic. It has also been observed that many people who go though chemotherapy have a significant decrease in their gustatory functions during, and up to three months, after treatment. Overall taste sensitivity is diminished with age (Naik & Claussen, 2010). Causes have been linked to saliva in many cases due to components in saliva that can stimulate taste receptors and change taste sensitivity by chemical interaction (Sasano, et al., 2010). Pharmaceuticals’ chemical structures can disrupt several components that are key for taste. For example, pharmaceuticals may destroy mitosis in receptor cell replication, block the apical ion channels on a taste buds as a diuretic, it could lead to candida overgrowth on the tongue surface. Immunosuppressant and steroids are examples of the type of pharmaceuticals that can lead to taste disturbances (Ksouda, et al., 2011). Others causes of taste disorders can include viral infections, tumors, lesions associated with the taste pathways, head trauma, radiation therapy, epilepsy, psychiatric disorders and hypothyroidism. Also, some drugs have side effects that directly impact taste sensitivity or cause hyposalivation, thereby resulting in a
TASTE DISORDERS

decrease of taste sensitivity (Sasano, et al., 2010). A simple solution to taste disorders caused by habitually use or abuse drugs is to reduce or stop use of the drug. Once use of drugs is reduced or stopped completely the symptoms of the disorder are typically reduced (Femiano, Lanz, Buonaiuto, Gombos & Cirillo, 2008). More specifically, cranial nerve VII is connected to the anterior two thirds of the tongue and the sublingual salivary gland and can be linked to the cause taste disorders due to different surgical issues (Walker, 1990). It has been reported that middle ear surgery could cause taste disorders. The chorda tympani pathway runs through the middle ear and is vulnerable to injury by chronic inflammatory processes or middle ear surgery. Due to the fact that parasympathetic chorda tympani fibers are responsible for the basal secretomotor innervation of these glands; consequently, a diminished salivary flow rate and xerostomia (chronic dry mouth), have been reported after middle-ear surgery which may be the underlying factor of middle ear surgery putting patients at a higher risk of developing a taste disorder (Guinand, Just, Stow, Van & Landis, 2010). Some reports have suggested that a portion of the gustatory fibers cross and ascend in the ML before synapsing in the thalamus and a lesion to these fibers may cause taste disturbances (Tsivgoulis, Loannis, Vadikolias, Galetta & Piperidou, 2011). It has also been suggested that damage due to the lingual branch of the glossopharyngeal nerve and excessive excision of soft palate leads to severe damage of the palatal taste nerve and may be a cause of taste disturbances after palatopharyngeal surgery (Hsiao & Li, 2007). Another factor that can cause taste disorders is the exposure to chemicals, whether they are industrial or household. Commonly, those who experience the taste disorders due to acute toxin exposure are easier to diagnose and assess due to the immediate symptom onset but those who have chronic exposure to toxins and gradually experience symptoms of a taste disorder are harder to diagnose due to the repeated chemical exposure (Smith, Davidson & Murphy, 2009).
Quality of life

In general over five percent of the population has some olfactory or gustatory disorder, although most people do not even complain about it. In some cases, however, these symptoms can cause mood changes leading to decreased appetite, ingestion of spoiled food, body odor, or sexual dysfunction, lack of awareness of dangerous toxins, and thus a decrease in the quality of life (Ribas & Duffau, 2012). To assess the quality of life of those who suffer from taste disturbance a profile of mood state (POMS) questionnaire is used (Hummel, et al., 2007).

Maintenance of quality of life is very important especially for those who undergo surgery, chemotherapy, or radiation therapy. It is important to understand that patients, who suffer from alterations of taste, although not a lethal side effect, can lose pleasure of eating which is a major part of quality of life (Imai, Soeda, Komine, Otsuka & Shibata). Our taste perception is important for giving our body warning signs of possible toxic intake. Having a taste disorder can change eating habits, impact pleasure association, and disrupt the nutritional status of individuals. There may also be a reduction in the alert to risky situation that compromise the quality of life (Caldas, et al., 2013).

The treatment of taste disorders is difficult and dominantly depends on accurate assessment of the cause and type of taste disorder (Sasano, et al., 2010). This paper reviews literature on the topic hypogeusia, ageusia, and dysguesia covering the causes, assessment, and treatment of each.

Section I: Hypogeusia

Hypogeusia is a category of taste disorder in which those who suffer show symptoms of a decreased ability to taste difference in foods (Naik & Claussen, 2010). The causes surrounding
hypogeusia are related to socioeconomic level, alcohol and drug use, and certain surgeries. Diagnostic tests are usually performed using a filter paper test and treatment is still experimental.

In regards to hypogeusia, one sole cause has not been found, but it is most common among those of middle level education. Due to their educational level their socioeconomic level is usually lower and their jobs have higher health risks within the work place. Also, due to the lower pay, that often accompanies a lower socioeconomic job, it does not allow for the healthy living conditions in which they are exposed to harmful toxins and chemicals, which may also be a large contributor of hypogeusia (Caldas, et al., 2013). Along with and related to socioeconomic causes, hypogeusia has been correlated with those who receive a laryngectomy. Hypogeusia occurs in approximately 80% of laryngectomy patients. During the surgery disruption of airflow in the respiratory tract and changes to the epithelial structure of the nasal mucosa contribute to the cause of hypogeusia. Those who receive a laryngectomy are correlated with patients who are, again, of low education. They are also, usually, frequent smokers and have a history of a high alcohol intake, both of which cause damage to the taste buds and could be an underlying factor to the cause of hypogeusia. Another cause of hypogeusia could be the mere aging process. Out of 71 elderly subjects 36% reported symptoms of hypogeusia. This may be due to a correlation between hyposalivation and hypogeusia that suggest proper salivation prevents the occurrence of hypoguesia, an due to the reduction of proper salivation with age hypogeusia may be a factor of getting older. (Sasano, et al., 2010). Another surgery that has been connected to hypoguesia has been ear surgery involving the chorda tympani. Of the 45 patients that underwent ear surgery of the chorda tympani, 53% reported symptoms of hypogeusia. It was also reported that males were more sensitive to taste alterations than women. An interesting outcome of the surgery in relation to hypogeusia was only half of the tongue was experiencing the taste alterations in those who
suffered. It was reported that the side of the tongue opposite that of the chronic otitis media did not experience any alterations (Felix, et al., 2009).

The diagnosis of hypogeusia is standard in the fact that a filter paper test is used. Four different tastants are distributed to patients at different concentrations. The patients’ ability to detect the different tastants, and each of their concentrations, allows for better discrimination of the degree of taste alteration (Sasano, et al., 2010).

Treatment of hypogeusia can consist of treating hyposalivation but the treatment that diminishes hyposalivation can have several aversive effects such as palpitations, sweating, nausea, diarrhea, and dizziness in older patients. A surgical way to help diminish hypogeusia is to remove either submandibular or sublingual glands that cause a reduction of the taste nerve and increase taste threshold. Through this treatment it is seen that proper salivation is necessary for normal taste functioning. A new study is looking into the use of umami as a relief of hypogeusia. This technique is still being experimented with but would allow a relief of the taste abnormality without the adverse side effects that come with medication or surgery and is stemmed from the theory that umami may have a higher threshold compared to the other four tastants, salt, sweet, sour, bitter (Sasano, et al., 2010).

Hypogeusia causes are mainly socioeconomic correlated. Those who are of the lower socioeconomic level are using exposed to toxins within their work place and their homes. Those how are lower socioeconomic level are also correlated to lower education levels that are also correlated to higher alcohol and drug. Those who smoke are correlated to the need to have a laynectomy. Hypogeusia also seems to be an outcome of age. All the factors correlated with low socioeconomic status can also contribute to speeding up the aging process, which could be another contributor to hypogeusia. Another diagnostic test that would be interesting to use is one
that measures the level of saliva. This could measure how toxins, drugs, alcohol, or even age, is effects the level of taste through salivation. In the aspect of treatment, the best solution could be increased knowledge of the subject and increase preventative measures. Work places that expose employees to harmful toxins should make masks available and mandatory. The government should enforce policies to better improve environments surrounding lower socioeconomic homes. Other preventative measures should be enforced such as stopping the use or greatly reducing the use of drugs and alcohol. The more knowledge the public is provided with the better they can prevent themselves from becoming exposed to possible causes of hypogeusia.

Section II: Ageusia

Ageusia is a category of taste disorder in which those who suffer show symptoms of an absence of taste all together. Causes of ageusia are not well known but seem to be connected to damage done to the cortex and central pathways and drug use. It is also speculated that specific surgeries and drugs can be a contributor to the cause of ageusia. Diagnosis of ageusia is rare due to its symptoms not being pronounced in some humans. Treatment of ageusia is still under research but in most cases symptoms can be decreased by the termination drug use.

Complete ageusia is exceptionally rare. In many cases patients who cannot taste suffer from a combination of taste and smell disorders, but the loss of taste in a clinical entity is extremely rare and little research has been able to be done due to this fact (Naik & Claussen, 2010).

Due to the rarity of aguesia, the causes of ageusia cannot be simply narrowed down. The causes range from surgery accidents to medications. Ageusia can be explained in some situations, however, as a consequence to damage done to the cortex and central pathways that are responsible for taste (Ribas & Duffau, 2012). Ageusia can also be caused by the use of
medications, in particular; one medication that has been found to correlate with ageusia is clopidogrel. Clopidogrel is a new thienopyidine derivative and is used as a secondary preventative in patients with atherosclerosis, coronary artery disease, and those who suffer from ischemic attacks (Ksouda, et al., 2011). Further research has been done to investigate stroke patients with ageusia. Those who have suffered from a stroke experience ageusia, usually, contralateral and this particular form of ageusia is thought to be due to gustatory fibers that ascend contralateral into the cerebral hemisphere from the thalamus to the cerebral cortex via the posterior part of the cronæ reigate. This would better explain why in some cases ageusia only effects part of the tongue (Kim, et al., 2007). It has also been reported that those who suffer from chronic middle ear inflammations report symptoms of ageusia and it has been found this may be due to the reduction in gustatory sensations in their anterior two-thirds of the tongue (Felix, et al., 2009). Another disorder, burning mouth syndrome (BMS), seems to correlate with ageusia, in that 60% of those who suffer from BMS also report suffering from ageusia (Femiano, Gombos, Esposito, Nunziata & Scully, 2006).

Ageusia is rarely diagnosed because, in many cases, those who suffer never report symptoms. It is believed that this is due to the sectorial gustatory sensitivity and because complete ageusia is so rare it is not well diagnosed. If patients do suffer from partial ageusia they would still have the ability to taste food just not at the same intensity they might if they did not suffer from ageusia at all (Felix, et al., 2009).

For those who do suffer from ageusia and are diagnosed report having a decrease in appetite. In terms of ageusia as a side effect to Clopidogrel, it is not life threatening but can severely affect patients’ quality of life. It does however lead to continual looping effect in which patients have a loss of appetite, lose weight, and require discontinuation of said drug, which then
leads to a higher risk of atherosclerosis, coronary artery disease, and ischemic attacks (Ksouda, et al., 2011).

Treatment for ageusia is still being researched but due to the rarity of diagnosis of the disorder not much can be looked into. As of right now the best solution to the disorder are the options of discontinuing a causal drug use (Ksouda, et al., 2011).

Ageusia seems to be most correlated with damage or disruption to cranial nerves related to taste. The rarity of full aguesia makes diagnostics difficult but if further education was available to those who undergo surgeries that may cause ageusia, then partial ageusia may become more readily assessed due to more patients knowing what symptoms to aware of. Another possibility is to do more routine check ups for those that undergo surgery or take medications linked with partial ageusia. Treatment seems to be a difficult part of ageusia since few suffer from full ageusia and only lose the ability to taste on specific regions of the tongue. If more routine checkups are implicated then specific regions of patients’ tongues can be tested to narrow down the causes of ageusia. Dietary counseling should also be put into place so that those who suffer from ageusia learn to have a better relationship with their food and improve their quality of life.

**Section III: Dysgeusia**

Dysgeusia is a category of taste disorder in which those who suffer describe the presence of a metallic, foul, or rancid taste in their mouth without any physiological causes (Naik & Claussen, 2010). Also, many patients who suffer from dysgeusia report a spontaneous bitter taste when eating sweet items (Hsiao & Li, 2007). The cause of dysgeusia has been linked to cancer patients receiving chemotherapy and radiation therapy. Causes are also related to specific drug use and correlated with socioeconomic levels. Diagnostic testing for dysgeusia are most
commonly performed through a filtered disk process. Treatment for dysgeusia ranges from the onset of menopause and decreased levels of estrogen to long-term dietary counseling.

There have been several factors found to be a cause of dysgeusia but the most common causes are chemo and radiation therapy. It is estimated that over all 50-75% of cancer patients are affected by dysgeusia. The rate of dysgeusia is strongly correlated with the accumulation of radiation therapy sessions (Mosel, Bauer, Lynch & Hwang, 2011). In more relation to cancer, chemotherapeutic drugs such as cisplatin, doxorubicin, 5-fluorouracil (5-FU), docetaxel, and paclitacel cause dysgeusia (Imai, et al.). Dysgeusia in chemotherapy patients can be explained through neurological damage done to the cranial nerves: VII, IX, and X, taste buds, and mucosal damage (Imai, et al.). Frequently cancer patients are victims of dysgeusia due to the direct injury to the mucosal epithelium, nerves, taste buds, or olfactory receptors. Patients who are healthy can regenerate these cells quickly, but due to the exposure to radiation and chemotherapy, cancer patients suffer the consequences of the damage and in turn suffer from dysgeusia. Medications can also cause dysgeusia, such as vorinostate, which led to a metallic taste and an extreme saltiness of foods. Other medications include CTCL agent, romidepsin, HDAC, and inhibitory HDAC. Other causes may be due to infections of the mouth from bacterial, fungal, and viral agents (Mosel, et al, 2011). As seen with hypogeusia, those with lower education and lower socioeconomic ranking are at higher risk for developing dysgeusia due to their jobs. Due to the exposure of ammonia, wood dust, chromium, and hydrocarbon solvent mixtures of many construction and factory workers their risk is high. Also, common chemicals such as those from hairdressing, chemotherapy, gasoline, and intranasal zinc have been shown to cause dysgeusia (Smith, et al., 2009). Other causes of dysgeusia have been linked to diabetic neuropathy (Ishimaru, Hatanaka, Miwa & Furukawa, 2001), and patients who receive drug therapy of
Fluorouracil (5FU) (Imai, et al.). It has also been noted that the progression of dysgeusia could be caused by the continuous stimulation of bitter taste receptors causing the receptors to become desensitized and making the bitter threshold higher (Ishimaru, et al., 2001).

Diagnosis for dysgeusia, in cancer patients, is performed through a filter disk test in which the paper is soaked in NaCl solutions of different concentrations. (Guinand, et al., 2010). As an effect of dysgeusia on quality of life, patients have a substantial amount of weight loss and a reduction of nutrient intake. This is due to the rancid taste they may experience while eating or the lack of hunger due to a constant unpleasant taste experience, even with the absence of food (Karita, et al., 2012).

It’s been observed that dysgeusia can be reduced after the onset of menopause due to a drop of estrogen in the hormonal system (Femiano, et al., 2008). In many cancer patient cases, Zinc consumption improves the symptoms of dysgeusia caused by radiation (Imai, et al.). Other drugs have also been reported to manage the side effect of dygeusia caused by radiation and the distortion of the mucosa. These drugs include antibiotics or analgesics (Mosel, et al., 2011). In other cases, such as dysgeusia caused by bilateral middle ear operations and damage to the chorda tympani, symptoms fade and resolve on their own after a few months (Guinand, et al., 2010).

The most effective treatment for long-term dysgeusia, however, has been dietary counseling. Through this form of treatment patients learn steps to create a more pleasant relationship with food. Patients are advised to drink an abundant amount of water, chew slowly, and to switch between foods to prevent their taste receptors from adapting (Mosel, et al., 2011).

Dysgeusia is most correlated with those who receive chemo or radiation therapy, which may cause damage to the oral mucosa and taste buds. An interesting test to add to the diagnostic
process for dysgeusia would be a taste bud count. Due to the occasional fade or resolution of
dysgeusia after a few months allows us to infer dysgeusia may be caused by problem with taste
bud turn over rate, in which the taste buds are not regenerating at a normal rate and therefore
causing taste disruptions. It has been identified that a decrease in estrogen is correlated to
lessening symptoms of dysgeusia. It has also been seen that zinc and antibiotics can be used to
heal the oral mucosa and possible help regenerate taste buds decreasing the symptoms of
dysgeusia. Seeing as chemo and radiation therapy are necessary, the best form of treatment is
dietary counseling in which patient’s learn to live with the disturbances but find techniques to
minimize the effects they have on their quality of life.

Discussion

Each category, hypogeusia, ageusia, and dysgeusia, of taste disorders, is unique and
complex but many of them have overlapping factors, such as socioeconomic causes, effects on the quality of life, and a disorder called burning mouth syndrome (BMS).

For each of the three taste disorders socioeconomic levels seem to be correlated to the causes of the disorder. Those who are of a lower socioeconomic level typically work and live in environments that are filled with toxins that contribute to damage of the taste pathway and structures. Lower education is also correlated to lower socioeconomic levels, which are often correlated to higher drug and alcohol use that also contribute to damage of the taste system.

Another commonality between all three of the taste disorders is the reduction in quality of life. Individuals who suffer from any of the three disorders have to learn a new relationship with food and learn how to better balance their nutrition. Eating for those with a taste disturbance is no longer enjoyable but more of a necessary task. For many this can lead to a depressive state that can further cause complications to their disorder.
Burning mouth syndrome has also been studied to be a large contributor to taste disorders and is even thought to be responsible for alterations of taste (Femiano, et al., 2008). BMS is even more closely related to dysgeusia. BMS is both pain related and due to sensitivity of the tongue (Sun, Wu, Wang, Lin, Chen & Chiang, 2013). The burning sensation felt by those who suffer from the dysfunction, have been described the pain to be as though they have burned their mouth on a hot liquid or food (Femiano, et al., 2008). There are three different categories of symptoms of BMS. The first of which are the classical symptoms of BMS (Gurvits & Tan, 2013). Those who are affected are pain free but suffer from burning sensations that develops by late morning and gradually increased though out the day until the peak of pain sensation is reached by the evening. This category of BMS is usually linked to poor nutrition or diabetes mellitus. Then there are those who suffered from continuous symptoms of BMS through the entirety of the day. This category is usually caused by psychological disorders such as depression and panic disorders. The third category contains those who suffer from intermittent symptoms, experiencing pain free periods during the day and other periods painful. This category is usually the outcome of allergic reactions to the environment or from medications (Sun, Wu, Wang, Lin, Chen & Chiang, 2013).

There is little known on the causes of BMS but majority of the time it affects women (7:1) (Femiano, et al. 2006), and even more commonly, women middle aged or older (Sun, et al., 2013). Those who are postmenopausal are at an even higher risk to suffer from BMS (Nasri, Teixeira, Okada, Formigoni, Heir & Siqueira, 2007). It is hypothesized that women to be more commonly affected by BMS when are overly sensitive or under mental or physical stress. It is thought that the main cause of BMS is psychogenic and is even more closely related to depression (Hummel, et al., 2007). There has not been much found on the cause of BMS from a
physiological standpoint but there does seem to be a correlation with thyroid dysfunction (Femiano, et al., 2006), and trigeminal nerve degeneration (Sun, et al., 2013). Dysgeusia, interestingly, is a criterion for the diagnosis of BMS (Gurvits & Tan, 2013).

To diagnose BMS several types of procedures have to be implicated such as the use of an elecrogustomery, whole mouth gustatory testing, and magneto encephalography. The equipment for diagnosis is expensive and is not practical for routine evaluations and is why BMS is rarely clinically diagnosed (Imai, et al.). Not only is the equipment and procedure for diagnosis of BMS expensive and difficult, for a correct diagnosis a careful history of the patient is necessary, along with physical examination and laboratory analysis (Gurvits & Tan, 2013). There are two categories of diagnosis for BMS, primary and secondary BMS. Primary BMS refers to symptoms of the first category in which the symptoms are idiopathic and are caused organically and can most likely be identified by neuropathological causes. Secondary BMS are refers to symptoms of the third category of symptoms in which the cause is most likely due to psychological factors (Sun, et al., 2013).

Burning mouth syndrome has a large impact on the quality. Those who suffer from BMS describe having psychological symptoms of anxiety and depression due to their gustatory disturbances (Femiano, et al., 2008). BMS can even cause a change in patients’ personality traits. This is thought to be due to the disruption of their taste and eating habits in which they become deprived and are more vulnerable to behavioral changes (Sun, et al., 2013). Unfortunately, treatment of BMS is difficult and tedious due to the underlying medical conditions and behavioral feedback (Gurvits & Tan, 2013). It has been found that the most effective form of treatment for BMS, so far is psychotherapy, with the use of drug therapy. The use of alpha lipoic acid, clonazepam, and other antidepressants seem to relieve symptoms that accompany BMS and
in turn can help relive some of the symptoms it causes in the three taste disorders. Alpha lipoic acids are both fat-and water-soluble allowing them to work throughout the body and help regenerate antioxidants. Clonazepam is a type of benzodiazepine used to enhance the neurotransmitter GABA and reduce anxiety. Other antidepressants work to regulate other neurotransmitters all of which help to restore normal taste function (Gurvits & Tan, 2013). Along with the elimination of local systemic, or psychological factors present in BMS patients, the introduction of vitamin supplements help reduce the symptoms of BMS (Mosel, et al., 2011).

The percentages of those who have reported chemosensory dysfunction is low, but that does not mean these dysfunctions do not matter. As indicated, many more may suffer from taste disorders without realization, and the effects these disorders have an impact on patients’ quality of life. Overall the complexity of the gustatory system and the connections it has to other chemosensory senses can create a difficult diagnosis for taste disorders. This in turn can make treatment difficult, but that does not mean it is impossible to help those who suffer. In future research it would be interesting to look at the rate at which treatments work and how long they seem to last. It would also be interesting to look at an overall connection between each of the disorders to narrow down common denominators such as specific drug use and their pathways along with specific surgeries that disrupt the same pathways. Due to the difficulties in testing for taste disorders there is not much information, but with the advancement in technology and the ability to better pinpoint causes in the taste pathway, more information is being produced. With this information causes, diagnosis, and treatment will become easier and more help can be put into place to improve those who suffers quality of life.


Figure 1. Claussen’s 5-Komponent-Chemo-Gustometry (C5KCG) Chart