Taste Testing in a Pediatric Case of Congenital Aglossia

Franziska Valent1, Long Wang1, Betty McMicken2, Cheryl Rock1

1Department of Family and Consumer Sciences, California State University, Long Beach, CA 90840
2Department of Communications Sciences and Disorders, Chapman University, Orange, CA 92866

ABSTRACT

Congenital aglossia (CA) is a rare inborn condition characterized by the complete absence of the tongue. This study aimed to determine gustatory function in a pediatric female subject with CA. The study was built on previous research on taste discrimination of a 44-year-old female subject with isolated congenital aglossia (ICA) and anecdotal reports of individuals with CA possessing the ability to discern taste stimuli.

In this randomized, double-blinded, controlled trial, a total of 78 samples were presented to an 11-year-old female subject with CA in the presence of her parents. Triplicate samples of sucrose (sweet), citric acid (sour), sodium chloride (salty), caffeine (bitter), and monosodium glutamate (umami) solutions at five concentration levels each were tested, in addition to three water samples. Stimuli solution concentrations ranged from 0.5 M to 5.0x10^-3 M for sweet, 3.2x10^-4 M to 2.0x10^-3 M for sour, 0.1 M to 1.0x10^-3 M for salty, 1.0x10^-4 M to 1.0x10^-3 M for bitter, and 1.0x10^-4 M to 1.0x10^-3 M for umami. Data was analyzed using SPSS 22. The recorded responses were used to develop contingency tables and descriptive statistics were run to determine percentage of accurate stimuli identification and frequency of substitutions. Correct identification was set at a threshold value of 33.33% accuracy (two out of three). Cross-tabulations of taste identification accuracy versus actual taste, stimuli concentration, and presentation order were developed and tested for statistically significant association (p≤0.05) using chi-square testing.

Out of the five stimuli, sour and umami were correctly identified by the participant. Umami was accurately identified 100% of the time at 5.0x10^-3 M and sour 66.66% of the time at 1.6x10^-3 M. Correct identification threshold criteria were not met for sweet, salty, and bitter samples at any concentration. Statistically significant association could not be determined between taste identification accuracy and particular taste [X^2(5)=7.674, p=0.175]. Individual stimuli concentration levels (sweet p=0.645; sour p=0.558; salty p=0.484; umami p=0.461), or presentation order [X^2(5)=55.000, p<0.001] were found to be significant. The most commonly recorded substitution was bitter as sour (n=5), followed by bitter as salty (n=4).

This study supports previous findings indicating that sour is one of the stimuli that may be accurately identified by a person with CA, though at a lower threshold than previously found in the ICA trial or in persons without CA. This study also indicated accurate taste discrimination of umami stimuli, a new finding compared to the previous trial. As with sour, umami identification occurred at a lower threshold than for stimuli without CA. These lower discrimination thresholds, as well as the misidentification of the sweet, salty, and bitter stimuli, may indicate possible gustatory dysfunction among individuals with CA compared to persons born with a tongue.

MATERIALS & METHODS

The tongue is the primary organ for taste detection and discrimination. Additional areas with potential gustatory function include the back of the tongue, the soft palate, and the throat. The five basic stimuli are sweet, sour, salty, bitter, and umami. Difficulties tasting are associated with decreased appetite, food enjoyment, and ultimately food intake. Taste difficulties have frequently been associated with malnutrition, especially in elderly patients. Thus, adequate gustatory function may affect nutritional status and overall quality of life.

Congenital aglossia (CA) is a very rare inborn condition characterized by the complete absence of the tongue. Congenital aglossia may present with other developmental malformations such as jaw and facial anomalies, deafness, and sinus inversus. However, cases of isolated congenital aglossia (ICA) in which absence of the tongue is the only detected anomaly are also known and have been documented.

This study seeks to further investigate the taste function of individuals with CA. While previous reports on taste function in this population exist, few specifically tested the abilities and limitations of taste detection.

SUMMARY & CONCLUSIONS

- Sour and umami were correctly identified using threshold criteria of 66.67% (two out of three).
- Citric acid (sour) was correctly identified at the second concentration level: 0.00016 M
- Normal taste threshold for citric acid: 0.00007 M
- MSG (umami) was correctly identified at the second concentration level: 0.005 M
- Normal taste threshold for MSG: 0.0005 M
- NaCl (salty), sucrose (sweet), and caffeine (bitter) were not correctly identified at any concentration.
- The most common substitution was sour for bitter (n=5), followed by salty for bitter (n=4).
- Statistically significant relationship could not be determined between taste identification accuracy and:
  - Individual stimuli concentration levels (sweet p=0.645; sour p=0.558; salty p=0.484; umami p=0.461).
  - Presentation order [X^2(5)=55.000, p<0.001].
- Correct identification of sour and umami at higher concentration thresholds than normal, as well as lack of identification of sweet, salty, and bitter stimuli may indicate lack of taste sensitivity in a person with CA.
- 100% accurate taste identification of MSG at 0.005 M may indicate heightened sensitivity to umami taste.

Impaired gustatory function contributes to decreased appetite, suboptimal/inadequate dietary intake, and puts people at increased risk for malnutrition. Congenital aglossia is a rare condition that allows us to investigate what is still possible in speech, swallowing and taste without the tongue. Findings from studies on taste discrimination in people with CA may shed light on mechanisms of taste discrimination and potentially provide new directions of diagnosis and rehabilitation in people with altered taste, such as head-and-neck cancer patients with total or partial glossectomy and radiation, Alzheimer’s patients, patients with autism, and the aging population.

REFERENCES


FOR MORE INFORMATION

Please contact fhvalent@gmail.com for more information about this project.