"The Liking of Bitter Foods was Associated with an Increased Liking for Sweet and Salty Foods in Females With and Without a Diagnosis of Breast Cancer."

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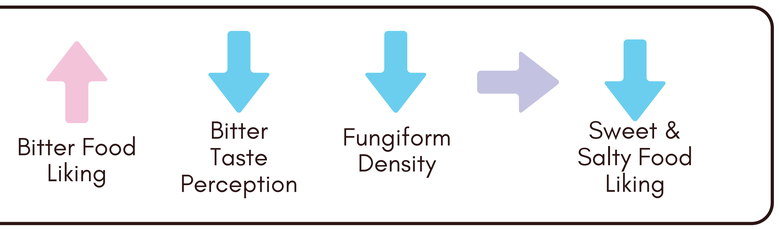
Introduction

- Differences in taste perception can significantly influence food preferences and nutritional status[1]
- Bitter taste is detected by a class of G-protein coupled receptors (GPCRs) known as bitter taste receptor type 2 (TAS2Rs)[1]
- Thought to have evolved as a defense against toxic or poisonous substances[1]
- Bitter taste perception is influenced by multiple genes, wide range of sensitivity in individuals[4]
- Fungiform papillae (FP) density directly correlates with bitter taste sensitivity, as it determines the number of taste buds present[4]
- FP density has been shown to decrease as Body Mass Index (BMI) increases[4]
- FP density has shown correlation with sweet taste mechanisms[3]
- Age, menopause status, smoking, dry mouth, allergies, and ethnicity can all impact taste perception[2]
- Females exhibit a lower threshold for bitterness[1]
- TAS2Rs receptors have also been identified on cancer cells, though function remains unclear[5]
- Cancer has been shown to change the structure of tastebuds[5]

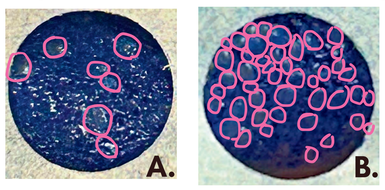
Hypothesis



Methods

- 40 female participants with and without a self-reported breast cancer diagnosis
- Bitter taste perception assessed with bitter test strips
  - Control - plain paper
  - Phenylthiocarbamide (PTC)
    - Ranked no taste, some taste, strong taste
- FP density counted by dying anterior tongue with blue food dye and counting papillae in a defined region
- Food preference questionnaire
  - Categories were sweet, salty, fat, and bitter
  - 0 (never tried) to 5 (like a lot) scoring system
- Participants divided into Bitter "Likers" and Bitter "Dislikers" based on a median split analysis of the bitter liking composite score

Figure 1. Method of Finding Fungiform Papillae



FP do not uptake the blue food dye. FP have been circled in a contrasting color. Letter A represents a non-taster (less than 15 FP) and letter B represents a supertaster (more than 30 FP)

Example images of the tongue to show fungiform papillae from research students (not study participants), taken with an iPhone 14.

Results

Table 1. Participant Demographics

	ALL participants n=39	*Dislike Bitter n=20*	*Like Bitter n=19*	*p-value (p<0.05)**
Age, y	60.0 ± 3.11	61.0 ± 4.2	58.9 ± 4.7	p=0.746
Race, % (n)				p=.2351
Black or African American	20.0 (8)	30.0 (6)	10.5 (2)	
White	80.0 (31)	70.0 (14)	89.5 (17)	
Anthropometrics				
Normal, % (n)	30.1 (12)	25.0 (5)	36.8 (7)	p=0.662
Overweight, % (n)	25.6 (10)	25.0 (5)	26.3 (5)	
Obese, % (n)	43.6 (17)	50.0 (10)	36.8 (7)	
Smoking/Vaping status				p>0.999
Never, % (n)	76.9 (30)	75.0 (15)	78.9 (15)	
Previously, % (n)	15.4 (6)	15.0 (3)	15.8 (3)	
Currently, % (n)	7.7 (3)	10.0 (2)	5.3 (1)	
Breast Cancer Diagnosis				
Diagnosed % (n)	46.2 (18)	55.0 (11)	36.8 (7)	p=0.341
Bitter Taste Status (PTC)				p>0.999
Non-taster, % (n)	43.6 (17)	45.0 (9)	42.1 (8)	
Taster, % (n)	56.4 (22)	55.0 (11)	57.9 (11)	
Fungiform Density	23.9 ± 10.6	24.3 ± 7.8	21.6 ± 13.0	p=0.440
Other factors				
Currently taking antibiotics, % (n)	7.7 (3)	5.0 (1)	10.5 (2)	p=0.605
Currently taking allergy meds, % (n)	30.8 (12)	35.0 (7)	26.3 (5)	p=0.731
Diagnosis of dry mouth, % (n)	20.5 (8)	20.0 (4)	26.3 (5)	p>0.999
Routine dental cleanings, % (n)	92.3 (36)	90.0 (18)	94.7 (18)	p>0.999

Values are means ± SDs unless otherwise indicated. * Indicates significant differences between participants that like and dislike bitter. Analyzed with either a between subjects t-test or a Fisher's Exact Test.

Figure 2. Bitter Taste Preference and Taste Preference Score

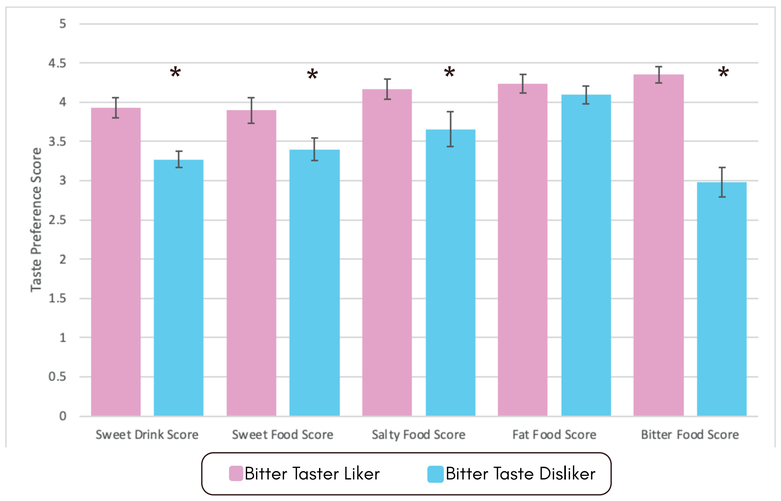


Figure 3. Correlation of Bitter Score and Sweet Score

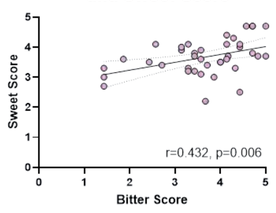


Figure 4. Correlation of Bitter Score and Salty Score

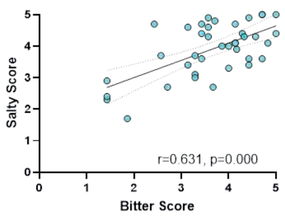
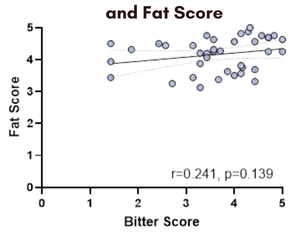
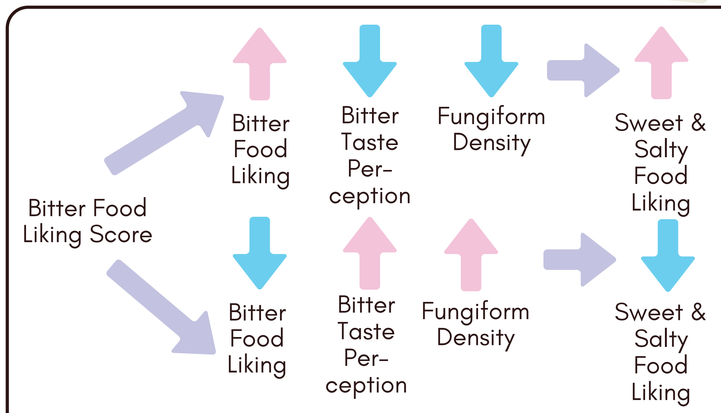


Figure 5. Correlation of Bitter Score and Fat Score



Discussion



Bitter Likers had higher scores for sweet drinks, sweet foods and salty drinks than Bitter Dislikers.

Bitter Likers might have a broader acceptance of intense flavors, like sweeter or saltier foods due to their lower fungiform papillae density. Since they have less areas for taste buds, the sensations of sweet and salty could also be lowered. On the other hand, bitter Dislikers may have heightened taste sensitivity, which could lead salty and sweet foods to taste unpleasant.

Breast cancer diagnosis, BMI, FP density, and age did not differ between Bitter Likers and Dislikers.

Liking responses did not account for food preparation methods, which can alter bitterness.

Self-reported preferences may be subject to bias or influenced by recent exposure.

Self-reported height and weight may lead to inaccurate BMI.

Conclusion

This study examined the relationship between bitter taste preference and the preference for other food types in women with and without a breast cancer diagnosis. Our hypothesis was not supported: bitter Likers had a higher liking for sweet drinks, sweet foods and salty foods. Understanding this relationship may help women make healthier dietary choices based on their taste preferences. Further research is needed to explore how cancer treatments, such as chemotherapy, affect long-term taste perception and food preference.

References

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