“Bitter Taste Sensitivity as a Potential Predictor of Postoperative Nausea and Vomiting in Breast Reconstruction Patients Following Breast Cancer Diagnosis”

LSU Health NEW ORLEANS

School of Medicine

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Introduction

- Bitter taste is detected by bitter taste receptor type 2 (TAS2Rs), a class of G-protein coupled receptors (GPCRs).[1]
- Bitter taste is thought to have evolved as a defense against toxic or poisonous substances.[1]
- Bitter taste perception varies widely among individuals and is influenced by multiple genes.[3]
- Higher fungiform papillae (FP) density is associated with greater bitter taste sensitivity due to an increased number of taste buds.[3]
- Taste perception is influenced by age, menopausal status, smoking, xerostomia (dry mouth), allergies, ethnicity, and sex.[2]
- Cancer has been shown to alter taste bud structure, potentially affecting taste perception.[4]
- Postoperative nausea and vomiting (PONV) is one of the most common postoperative complications and is commonly associated with anesthesia and postoperative opioid use.[6]

Table 1. Risk Factors Associated with PONV[10]

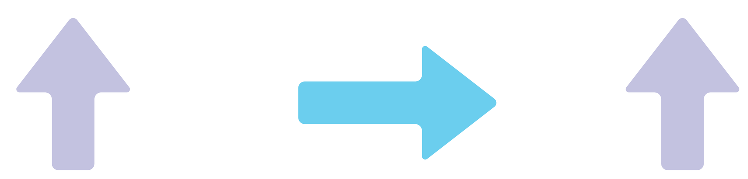
Prevalence of Risk Factors	
Female	82%
Non-smoker	81%
Previous PONV or motion sickness	55%
Anticipated post-op opiates	78%

Table 2. PONV Risk with Number of Risk Factors[10]

Baseline Risk Score (APFEL Score)	
# of Risk Factors	Baseline PONV Risk
0	10%
1	20%
2	40%
3	60%
4	80%

- PONV highly associated with endocrine and reproductive surgeries, including women who have had breast cancer and breast cancer treatment[9]
- Previous studies have reported associations between bitter taste perception and nausea-related conditions, although findings have been inconsistent:
  - Greater bitter taste acuity associated with increased motion sickness.[5]
  - Non-tasters reported to have higher rates of nausea and motion sickness.[8]
  - Non-tasters more likely to experience Hyperemesis gravidarum.[7]
- **The relationship between bitter taste perception and PONV remains unclear.**
- **This study investigated the association between bitter taste sensitivity and PONV in women diagnosed with breast cancer.**

Hypothesis



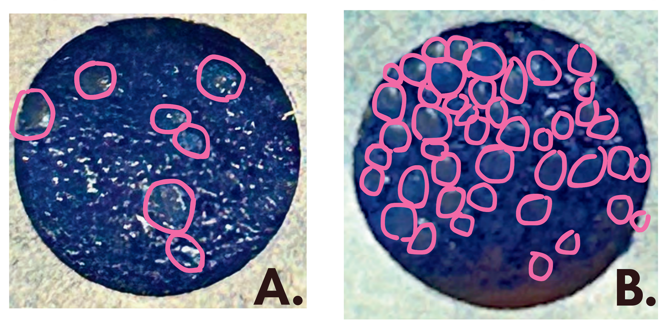
Bitter Taste Perception

Incidence of PONV

Methods

- 70 female participants with a self-reported breast cancer diagnosis
- Bitter taste perception assessed with bitter test strips
  - Control - plain paper
  - Phenylthiocarbamide (PTC)
  - Sodium benzoate
  - Thiourea
    - 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 (dislike a lot) to 5 (like a lot) scoring system
- Surgical nurse questionnaire
  - Medications administered; report of PONV

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 3. Participant Demographics

Characteristic	Super taster (n=17)	Medium taster (n=35)	Non-taster (n=18)
Participant characteristics			
Age (years) mean ± SD	56.9 ± 8.7	53.6 ± 11.4	53.4 ± 8.8
Race, White, % (n)	88.2% (15)	91.4% (32)	94.4% (17)
Menopause status, % (n)			
Premenopausal	5.9% (1)	8.6% (3)	16.7% (3)
Perimenopausal	11.8% (2)	25.7% (9)	16.7% (3)
Postmenopausal	82.4% (14)	65.7% (23)	61.1% (11)
Smoking status, % (n)			
Never	94.1% (16)	91.4% (32)	77.8% (14)
Former	5.9% (1)	8.6% (3)	5.6% (1)
Current	0.0% (0)	0.0% (0)	11.1% (2)
Most recent breast cancer diagnosis, % (n)			
2026	11.8% (2)	2.9% (1)	11.1% (2)
2025	29.4% (5)	28.6% (10)	44.4% (8)
2024	17.6% (3)	20.0% (7)	22.2% (4)
2023	5.9% (1)	8.6% (3)	0.0% (0)
2022	17.6% (3)	5.7% (2)	11.1% (2)
2021	11.8% (2)	5.7% (2)	0.0% (0)
2020 or earlier	5.9% (1)	28.6% (10)	11.1% (2)
Underwent chemotherapy, % (n)			
	17.6% (3)	54.3% (19)	44.4% (8)
Taste liking survey score, mean ± SD			
Sweet score	3.7 ± 0.6	3.6 ± 0.6	3.6 ± 0.8
Salty score	3.8 ± 0.7	3.8 ± 0.9	4.0 ± 0.7
Fat score	3.8 ± 0.6	3.7 ± 0.7	3.9 ± 0.9
Bitter score	3.5 ± 0.9	4.0 ± 0.8	3.6 ± 1.0
Bitter tastant detection, any taste			
PTC, % (n)	100.0% (17)	100.0% (35)	0.0% (0)
Sodium benzoate, % (n)	82.4% (14)	71.4% (25)	50.0% (9)
Thiourea, % (n)	94.1% (16)	91.4% (32)	55.6% (10)
FP density, median ± SD			
	35.1 ± 4.8	16.9 ± 5.5	17.8 ± 12.4

Note: Taster category assessed by ability to taste PTC and FP density.

Table 4. Surgical and Perioperative Characteristics of Study Participants

Characteristic	Super Tasters (n=17)	Medium Tasters (n=35)	Non-Tasters (n=18)
Preoperative			
History (Hx) of Motion Sickness, % (n)	40.0% (6)	58.6% (17)	69.2% (9)
Hx of PONV, % (n)	40.0% (6)	51.7% (15)	46.2% (6)
Scopolamine Patch, % (n)	86.7% (13)	62.1% (18)	84.6% (11)
Aponvie, % (n)	20.0% (3)	24.1% (7)	23.1% (3)
Intraoperative (IO)			
Anesthesia Duration, %, (n)			
Under 4 hours (h)	0.0% (0)	11.4% (4)	0.0% (0)
4-6 h	35.3% (6)	34.3% (12)	38.9% (7)
7+ h	52.9% (9)	34.3% (12)	38.9% (7)
Total Intravenous Anesthesia, % (n)	0.0% (0)	2.9% (1)	5.6% (1)
Volatile Anesthetic, % (n)	88.2% (15)	80.0% (28)	72.2% (13)
Received IO Antiemetics, % (n)	100% (15)	100% (29)	100% (14)
Received IO Opioids, % (n)	100% (15)	100% (29)	100% (14)
Postoperative			
PONV Present, % (n)	5.9% (1)	11.4% (4)	11.1% (2)
PONV Intensity (1-5), Mean	0.07	0.31	0.21
Received Postoperative Antiemetics, % (n)	5.9% (1)	11.4% (4)	11.1% (2)

Note: Percentages were calculated using available data; denominators may vary because of missing perioperative records.

Figure 14. No significance (NS) in Hx of motion sickness

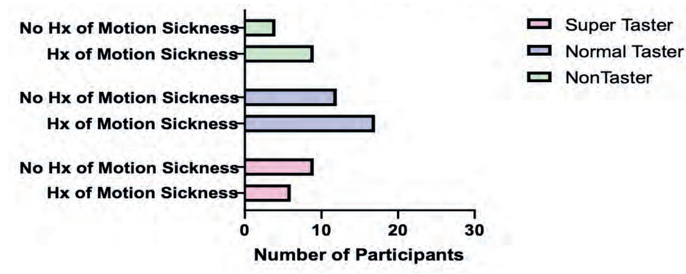


Figure 15. NS in Hx of PONV

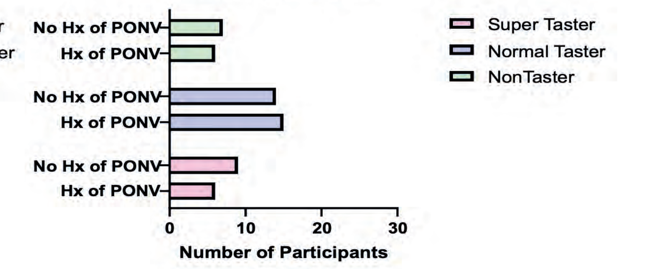


Figure 16. NS in incidence of PONV

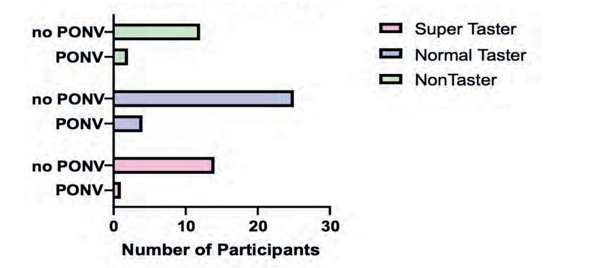


Figure 3. Super Tasters (ST) had higher BMI than NonTasters (NonT)

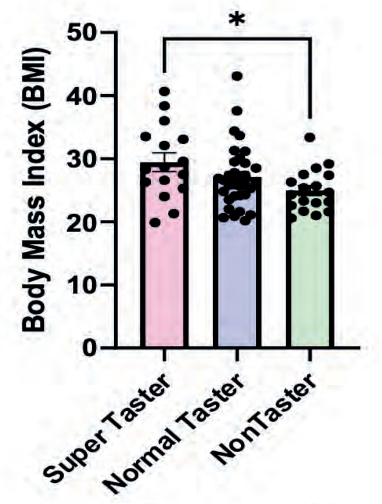


Figure 4. ST had more Fungiform Papillae than Normal Tasters & NonT

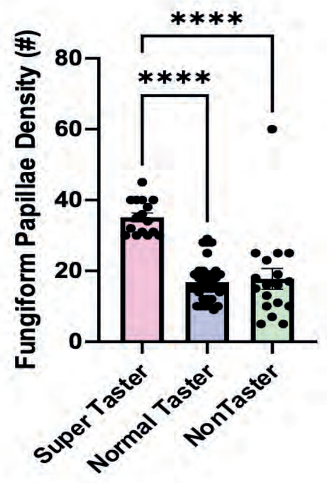


Figure 5. Taster Status did not affect Sweet Liking

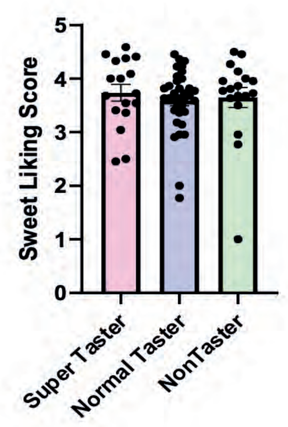


Figure 6. Taster Status did not affect Bitter Liking

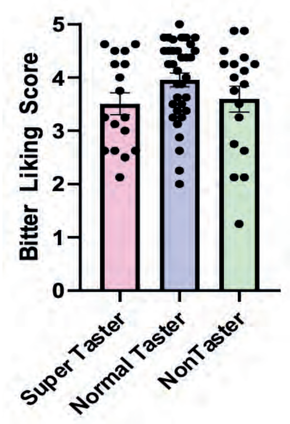


Figure 7. Taster Status did not affect Salty Liking

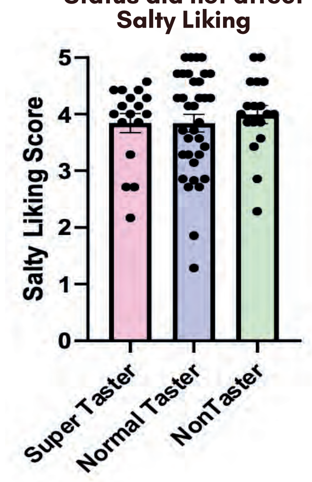
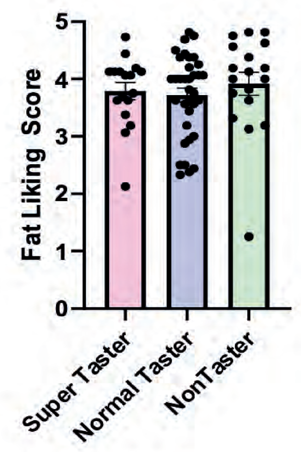


Figure 8. Taster Status did not affect Fat Liking



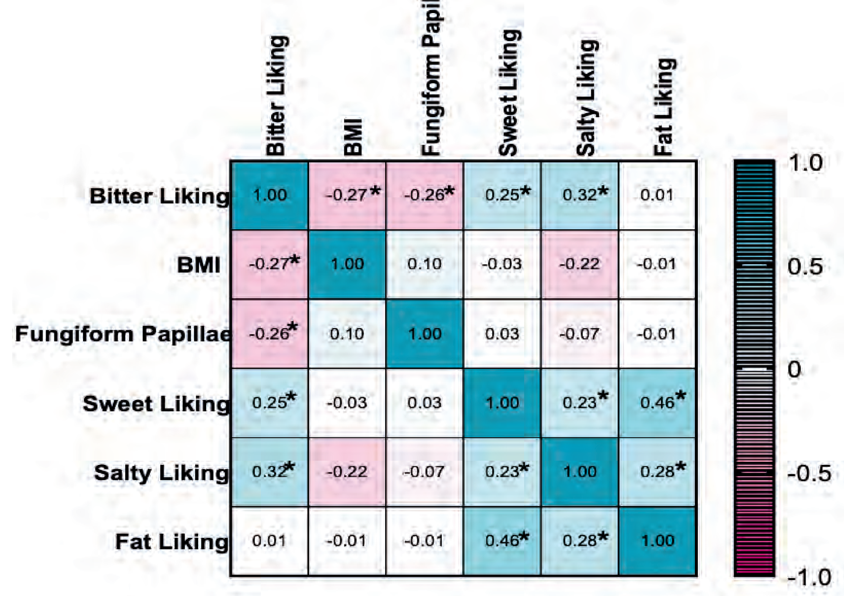


Figure 9. Correlations among BMI, FP Density and Food Liking Scores

Figure 10. Significant Negative Correlation Between BMI and Normal Tasters

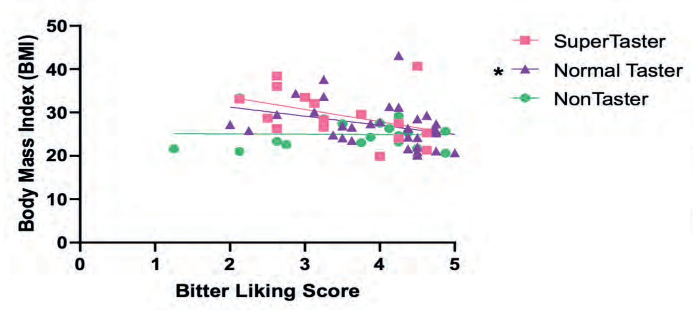


Figure 11. Significant Positive Correlation Between Sweet Liking Score and Normal Tasters

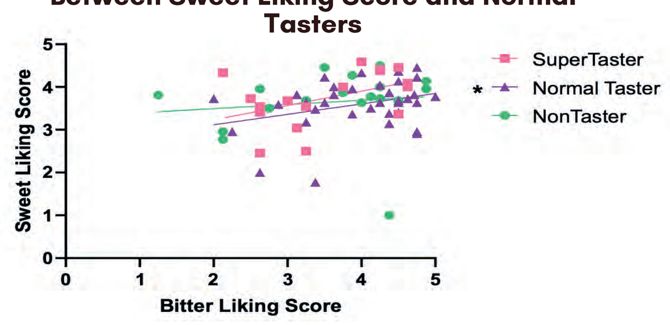


Figure 12. Correlation of Salty and Bitter Liking Scores

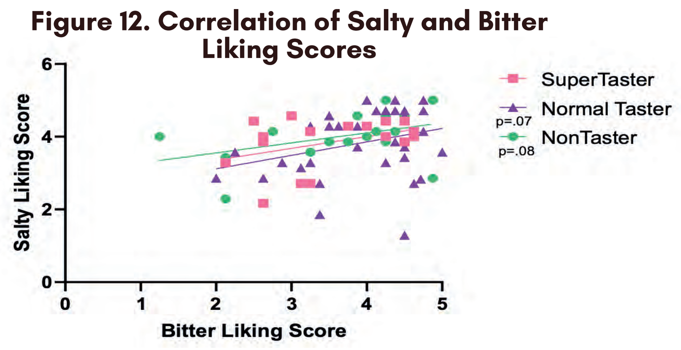
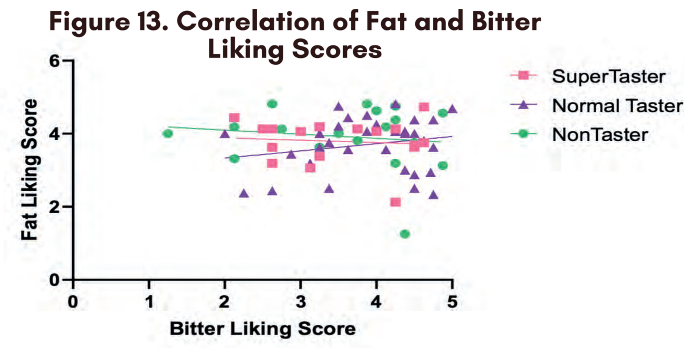


Figure 13. Correlation of Fat and Bitter Liking Scores



Discussion

- No significant effect of taster status on PONV incidence was observed, likely due to the routine use of prophylactic antiemetics (e.g., scopolamine, Aponvie, ondansetron) in this high-risk surgical population.
- The widespread use of these medications likely reduced the overall incidence of PONV, potentially limiting the ability to detect differences in PONV susceptibility between taste phenotype groups.
- Although no relationship between taste phenotype and PONV was identified, several significant associations between taste measures, food preferences, and BMI were observed.
- Bitter liking score was negatively correlated with BMI.
- Bitter liking score was negatively correlated with fungiform papillae density, suggesting that greater taste sensitivity may be associated with lower preference for bitter foods.
- Bitter liking score was positively correlated with both sweet liking score and salty liking score.
- Among normal tasters, bitter liking score was negatively correlated with BMI and positively correlated with sweet liking score.
- Super tasters exhibited significantly higher BMI than non-tasters, consistent with previous research.
- Super tasters also exhibited significantly greater fungiform papillae density than medium tasters and non-tasters, supporting the validity of the study's taste phenotype classification.
- This study represents a single breast reconstruction clinic and may not be generalizable to the broader patient population.

Future Directions

- Although bitter taste phenotype was not associated with PONV incidence in this cohort, the routine use of prophylactic antiemetics and the low overall incidence of PONV may have masked potential differences in PONV susceptibility between taste phenotype groups.
- Established relationships with BMI and fungiform papillae density were confirmed, supporting the validity of the study's taste phenotype classification.
- Additional analyses will evaluate the effects of anesthesia duration, anesthesia type, and perioperative antiemetic regimens on PONV outcomes.
- Future studies with larger, multi-center cohorts and greater variability in antiemetic prophylaxis should further investigate the relationships among bitter taste phenotype, chemotherapy exposure, time since breast cancer diagnosis, and PONV risk.

References

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