Original Article

Sweet taste sensitivity among pregnant women at different stages of pregnancy

Sensibilidade gustativa ao gosto doce em gestantes em diferentes períodos da gestação

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ABSTRACT

Objective: to investigate sweet taste detection thresholds in pregnant women at different gestational periods. **Methods:** this cross-sectional, analytical and epidemiological study was conducted at Family Health Units. We included 109 pregnant women aged 18 years or older, in any trimester of pregnancy. The sweet taste detection threshold was assessed in a whole-mouth taste test. Participants also completed a structured questionnaire on personal, demographic, socioeconomic, and health characteristics, and their weight and height were measured. **Results:** the average threshold values studied were 2.83 g/L in the first and second trimesters and 1.41 g/L in the third trimester, remaining stable across gestational periods. Sweet taste detection thresholds differed according to household arrangement: pregnant women living alone or with friends had a significantly higher threshold index, indicating lower sweet taste sensitivity. **Conclusion:** the sweet taste detection threshold remained stable throughout pregnancy, and household arrangement may influence sweet taste sensitivity. **Contributions to practice:** identifying altered sweet taste sensitivity throughout pregnancy can inform interventions to promote healthy eating behaviors.

Descriptors: Taste Threshold; Pregnancy; Taste Disorders.

RESUMO

Objetivo: investigar o limiar de detecção ao gosto doce em gestantes em diferentes períodos gestacionais. **Métodos:** estudo epidemiológico, analítico e transversal, realizado em Unidades de Saúde da Família. Participaram 109 gestantes com idade acima de 18 anos, em qualquer trimestre gestacional. O limiar gustativo ao gosto doce foi avaliado por meio de um teste de análise sensorial do tipo estímulo da boca toda. As participantes também responderam a um questionário estruturado com informações pessoais, demográficas, socioeconômicas e de saúde, além de terem peso e altura aferidos. **Resultados:** as médias do limiar estudado foram de 2,83 g/L no primeiro e segundo trimestres, e 1,41 g/L no terceiro trimestre, mantendo-se estável entre os períodos gestacionais. Observou-se diferença no limiar de detecção em função do arranjo familiar, gestantes que residiam sozinhas ou com amigos apresentaram um aumento significativo no índice limiar, indicando menor sensibilidade ao gosto doce. **Conclusão:** observou-se que o limiar de detecção ao gosto doce se manteve estável ao longo da gestação e o tipo de arranjo familiar pode influenciar a sensibilidade ao gosto doce. **Contribuições para a prática:** identificar alterações na sensibilidade gustativa ao gosto doce ao longo da gestação pode subsidiar intervenções voltadas à promoção de comportamentos alimentares saudáveis.

Descritores: Limiar Gustativo; Gravidez; Distúrbios do Paladar.

Introduction

Taste sensitivity, particularly to sweet taste, strongly influences eating behavior because it is closely linked to carbohydrate intake and the activation of brain reward mechanisms[1]. The taste detection threshold, defined as the lowest concentration of a substance the gustatory system can detect, is widely used to assess sensory perception in different physiological and clinical contexts[2].

Sweet taste is especially relevant because it shapes food preferences and directly affects energy metabolism. Sweet taste sensitivity can be influenced by physiological factors, such as hormonal fluctuations, as well as environmental and pathological conditions[3]. In specific populations, altered taste thresholds may reflect altered regulation of food intake and contribute to adverse nutritional and metabolic outcomes[4].

Among the methods for measuring taste sensitivity, the whole-mouth taste test is widely used. It was developed according to internationally standardized criteria, such as those of the American Society for Testing and Materials (ASTM) and the International Organization for Standardization (ISO) 13301. This procedure is characterized by its simplicity, low cost, good reproducibility, and applicability across different population groups. In addition, it shows consistent performance when compared with other approaches used to assess gustatory function, such as electrogustometry[5].

Changes in sweet taste perception have been documented in several populations. For example, individuals with type 2 diabetes mellitus show elevated sweet detection and recognition thresholds, indicating reduced sweet taste sensitivity[6-7]; users of antidepressants, particularly tricyclics, present sweet-specific hypogeusia[8]; and individuals with autism spectrum disorder exhibit atypical gustatory sensory reactivity and lower preference for sweet taste[9]. These conditions share a reduction in sweet taste sensitivity, which may favor higher sugar intake and exacerbate metabolic disorders. However, important gaps remain regarding this phenomenon in pregnant women, a group that is physiologically susceptible to marked hormonal and metabolic changes.

Pregnancy is divided into three trimesters, each with distinct physiological characteristics, and can directly affect sensory perception and food preferences. Throughout pregnancy, substantial hormonal changes may modify taste sensitivity, shaping food choices and, consequently, maternal and fetal nutritional status[10]. Understanding these changes can inform more individualized and effective dietary counseling strategies during prenatal care.

Therefore, this study aims to investigate sweet taste detection thresholds in pregnant women at different gestational periods.

Methods

Type of study

This was a cross-sectional analytical epidemiological study conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Study setting and period

We conducted the study in the first half of 2024 at Family Health Units in the municipalities of Itajuípe, Canavieiras, and Poções, located in southern and southwestern Bahia, Brazil. In each municipality, four Family Health Units were randomly selected. These municipalities were chosen for logistical feasibility and ease of access for the research team.

Population

The study included pregnant women aged 18 years or older, in any trimester of pregnancy. We used non-probability sampling, and recruitment took place over four weeks through invitations distributed by Family Health Unit teams during prenatal visits. The

invitations described the study objectives, inclusion and exclusion criteria, and the scheduling of the first meeting with the researchers.

At the first meeting, we explained the study objectives, potential risks and benefits, and the time required for participation. We then presented the Informed Consent Form (ICF). Pregnant women who agreed to participate had their contact information recorded so we could schedule data collection, which was later carried out at the same Family Health Unit where they were receiving prenatal care.

Inclusion and exclusion criteria

Inclusion criteria were willingness to take part in at least one study procedure and to sign the ICF. We excluded pregnant women who smoked, had a cold, had diabetes or hypertension, used antidepressant medications, wore dentures, or had oral conditions that could interfere with taste perception.

We invited 233 pregnant women across all participating units. In total, 120 attended for data collection. After applying the eligibility criteria, 117 were considered eligible. During data collection, 8 women withdrew, resulting in a final sample of 109 participants.

Study variables and instruments

Interviews and tests were conducted individually in private rooms at Family Health Units. The independent variable was gestational trimester. The main outcome was the sweet taste detection threshold, and additional variables included socioeconomic factors.

We assessed the sweet taste detection threshold using a whole-mouth taste test, following the ASTM method, equivalent to ISO 13301:2002, with adaptations[8]. The test used a three-alternative forced-choice (3-AFC) procedure, in which samples were presented in sets of three (triads) in ascending sucrose concentrations and offered to participants one at a time. The sucrose solutions had the following concentrations: 0.0550 g/100 mL, 0.1000 g/100 mL, 0.2000 g/100 mL, 0.4000 g/100 mL, 0.8000 g/100 mL, and 1.6000 g/100 mL.

Each participant received three samples per set: one test sample (with varying sucrose concentration) and two control samples (mineral water). Using a response form, participants were asked to identify the sample they perceived as different. The test was conducted with instructions to taste the samples from left to right and then record the code of the sample they judged to be distinct.

The test comprised six rounds. Participants were instructed to rinse their mouth or drink water between rounds to clear residual taste. A disposable cup was provided so they could discard the solutions if they chose to expectorate after tasting the samples.

Samples were served at room temperature in 50 mL plastic cups labeled with three-digit codes. Sample preparation was carried out in the Food Technology Laboratory of the State University of Southwest Bahia, using mineral water as the solvent and sucrose as the solute, both measured on a SHIMADZU AUW220D analytical balance. The solutions were then stored in previously sanitized containers and kept at room temperature until testing.

Data analysis was based on each participant's threshold index, defined as the mean of the highest concentration that was not detected and the next higher concentration, expressed in $\log_{10}$ units, according to the following equation: $A_i = \mathrm{Log}\,[(L)_i] = \mathrm{Log}\,[(C_o)] + \mathrm{Log}\,[(C_+)] + 0)/2$.

C_o is the highest concentration not detected/recognized by the taster, and C+ is the lowest concentration detected/recognized by taster "i." The individual threshold for that participant was then given by $L_i = 10A_i$. After determining each participant's individual threshold, we calculated the geometric mean of the Li values for each group.

Participants completed a structured questionnaire developed by the research team, which collected demographic, socioeconomic, and health information. Health-related items addressed engagement in physical activity, history of COVID-19, loss of smell and/or

taste, medication use, presence of chronic noncommunicable diseases, nausea during pregnancy, and gestational period.

We measured weight and height and obtained pre-pregnancy weight from Family Health Unit records. Weight was measured on a calibrated digital scale (capacity up to 150 kg) with the participant standing and wearing light clothing. Height was measured with a portable stadiometer (20–210 cm) with the participant barefoot, in the appropriate anatomical position (Frankfurt plane). Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared (BMI = weight/height^2).

Data analysis

We computed descriptive statistics (measures of central tendency and dispersion). Variable distributions were tested for normality using the Shapiro–Wilk test from the stats package (version 4.4.0)[11]. Because all variables showed non-normal distributions ($\rho < 0.05$), we used nonparametric tests.

To compare two independent groups, we used the Mann–Whitney test. For comparisons involving three or more independent groups, we applied the Kruskal–Wallis test followed by Dunn's post hoc test with Bonferroni correction, implemented with the Fisheries Stock Analysis (FSA) package, (version 0.9.6)[11-12].

Associations between variables were examined using Spearman correlation. We report correlation coefficients (ρ) and corresponding p-values, adopting a 5% significance level ($\alpha = 0.05$).

We generated graphs with the ggplot2 package (version 3.5.1) and managed and organized the data with the dplyr package (version 1.1.4)[13]. Results are presented in tables and figures, highlighting descriptive statistics, p-values from hypothesis tests, and correlation coefficients.

All statistical analyses were carried out in R, version 4.4.0, using the RStudio interface (version 2024.9.0.375)[11].

Ethical considerations

Data collection respected participants' ethical, political, and religious beliefs, in accordance with National Health Council Resolution No. 466, dated December 12, 2012. The study was approved by the Research Ethics Committee of the State University of Southwest Bahia (Certificate of Presentation for Ethical Consideration [CAAE] 58910322.3.0000.0055; opinion No. 5.530.892/2022).

Results

A total of 109 pregnant women participated in the study, with a mean age of 25.83 years (± 6.98). We assessed sweet taste sensitivity using a rapid method for determining the threshold index. Figure 1 shows the number of pregnant women in each trimester who detected sucrose in the test solutions. A trial was considered correct when the participant detected sucrose in the solution.
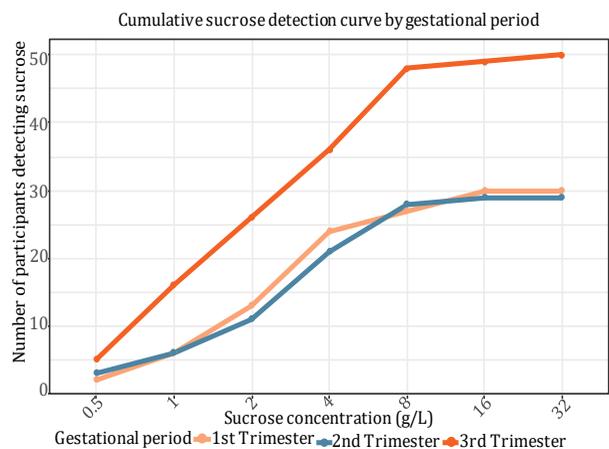

Cumulative sucrose detection curve by gestational period

Figure 1 – Correct responses per session, by gestational trimester. Itajuípe, Bahia, Brazil, 2025

We summarized sweet taste detection threshold indices by sociodemographic and health variables, which together capture the main findings of this study (Table 1).

Table 1 – Detection threshold index by sociodemographic and health variables. Itajuípe, Bahia, Brazil, 2025

Variable	n (%)	Threshold index (median; Q1-Q3)	p-value
Type of housing			0.574*
Owned	65 (59.6)	2.83 (0.71–5.66)	
Rented	28 (25.7)	2.83 (1.41–4.24)	
Provided (no rent)	16 (14.7)	2.12 (0.53–4.24)	
Lives with			0.055*
Parents	18 (16.5)	1.41 (0.71–2.83)	
Husband	84 (77.1)	2.83 (1.41–5.66)	
Alone or with friends	6 (6.4)	5.66 (0.71–11.31)	
Race			0.524*
White	13 (11.9)	2.83 (1.41–2.83)	
Black	51 (46.8)	2.83 (0.71–5.66)	
Brown	39 (35.8)	1.41 (1.41–2.83)	
Other	6 (5.5)	4.24 (1.41–5.66)	
Household income (minimum wages)			0.575*
Up to 1	78 (71.6)	2.83 (0.71–2.83)	
> 1	31 (28.4)	2.83 (1.41–5.66)	
Gestational period (trimester)			0.460*
First and second	59 (54.1)	2.83 (1.41–2.83)	
Third	50 (45.9)	1.41 (0.71–5.66)	
Marital status			0.629*
With partner	85 (78.0)	2.83 (1.41–5.66)	
Without partner	24 (22.0)	2.12 (0.70–2.83)	
Type of family			0.978*
Nuclear	58 (53.2)	2.83 (0.71–5.66)	
Extended	26 (23.8)	2.83 (1.41–2.83)	
Childless couples	14 (12.8)	2.83 (1.41–2.83)	
Single-parent families	11 (10.1)	2.83 (0.71–5.66)	
Physical activity			0.250†
No	86 (78.9)	2.83 (0.71–2.83)	
Yes	23 (21.1)	2.83 (1.41–5.66)	
History of COVID-19			0.536†
No	84 (77.1)	2.83 (0.71–5.66)	
Yes	25 (22.9)	1.41 (1.41–2.83)	
Loss of smell/taste			0.497*
None	91 (84.3)	2.83 (0.71–5.66)	
Taste	4 (3.7)	4.24 (1.77–5.66)	
Taste and smell	13 (12.0)	1.41 (1.41–2.83)	
Medication use			0.928†
No	26 (23.8)	2.83 (1.41–2.83)	
Yes	83 (76.1)	2.83 (0.71–5.66)	
Nausea			0.459†
No	46 (42.2)	1.41 (0.71–5.66)	
Yes	63 (57.8)	2.83 (1.41–5.66)	
Person responsible for food			0.570*
Herself	84 (77.1)	2.83 (1.41–5.66)	
Others	25 (22.0)	2.12 (0.71–2.83)	

*Kruskal–Wallis test; †Mann–Whitney test

The Spearman correlation between pre-pregnancy BMI and the sweet taste detection threshold index was not statistically significant ($\rho = -0.061$; $p = 0.530$), suggesting no meaningful association between these variables.

We then fitted a generalized additive model including variables that showed statistically significant associations in the Spearman correlation analysis, namely household arrangement and the sweet taste detection threshold index; these results are presented in Table 2.

Table 2 – Results of the generalized additive model for the detection threshold index. Itajuípe, Bahia, Brazil, 2025

Variable	Coefficients (β)	Standard error	t-value	p-value
Intercept	1.7678	0.7136	2.477	0.014*
Lives with husband	1.3216	0.7863	1.681	0.095
Lives alone or with friends	5.1013	1.3485	3.783	<0.001*

*Statistical significance, p<0.05

Discussion

Our results showed no statistically significant differences in sweet taste sensitivity across gestational trimesters. This lack of statistical significance may be partly explained by the relatively small sample size, which limited the statistical power to detect true differences. Studies with small samples yield larger standard errors, reducing the precision of estimates and the likelihood of identifying meaningful effects[14]. In this study, difficulties accessing the target population, limited participation, and the long time required to test each participant constrained the final number of women assessed.

However, women in the third trimester were more likely to correctly identify the low-concentration sucrose solution, and the median values suggest greater sweet taste sensitivity late in pregnancy.

Studies using similar methods to assess sweet taste have reported comparable threshold index values in other populations. In these studies, patients with type

2 diabetes mellitus[6-7], users of antidepressant medications[8], and regular alcohol consumers[15] had higher threshold indices than their respective control groups, indicating that certain health conditions and substance use can raise sweet taste detection thresholds.

Changes in taste during pregnancy are frequently reported[10,16]. These alterations have been attributed to hormone receptors in taste buds, which respond to the hormonal fluctuations typical of pregnancy, as well as to physiological changes such as weight gain and variations in immune response[16].

In this study, 56% of women in the first trimester reported preferring the solution with the highest sucrose concentration—that is, the sweetest sample. This finding is consistent with a case–control study in which 30% of pregnant women reported altered taste, with an increased preference for sweet flavors[16]. This pattern may lead to higher sugar intake, which is particularly concerning in pregnancy because it increases the risk of gestational diabetes—a condition associated with complications such as fetal macrosomia, delivery difficulties, and a higher risk of later metabolic disease[17].

Regarding medication use, the drugs most frequently reported were ferrous sulfate and folic acid. Evidence indicates that ferrous salts can cause adverse effects such as a metallic taste in the mouth[18-19]. In this study, however, women who reported medication use and those who did not had similar medians for the sweet taste detection threshold.

We also examined nausea, which was reported by a large proportion of participants. Even so, there was no statistically significant difference in the sweet taste detection threshold index between women with and without nausea, although the median was lower among those who reported nausea. This finding contrasts with previous studies, which suggest that nausea and vomiting during pregnancy are associated with reduced taste sensitivity and altered perception of basic tastes, including sweet taste[20-21].

Pregnant women with nausea tend to have lower sweet taste detection thresholds and altered tolerance for basic tastes, with sweet taste often better accepted[20-21]. The discrepancy between those findings and ours may be partly explained by the relatively small sample size, which may have limited our ability to detect a true association with adequate statistical power.

A key finding of this study was the association between household arrangement and the sweet taste detection threshold index. The generalized additive model showed that women living with their parents had lower sweet taste sensitivity and were used as the reference group. Women living with a husband had, on average, higher threshold indices, although this difference was not statistically significant. In contrast, women living alone or with friends had significantly higher threshold indices, indicating lower sweet taste sensitivity; in this group, higher sucrose concentrations in the test solutions were required for detection.

These findings suggest that household arrangement may influence sweet taste perception, possibly by reflecting eating habits and sensory experiences shaped within the home environment. Taste development and the formation of food preferences largely occur during childhood and adolescence and are strongly influenced by the family context[22]. Thus, changes in living arrangements, such as moving to live alone, may alter eating patterns and potentially increase the intake of sweet foods.

Our results highlight the importance of educational and nutritional interventions beginning in childhood to promote healthy, sustainable eating practices, especially during physiologically sensitive periods such as pregnancy. The support and shared eating habits of household members can be key determinants of a healthy, balanced diet and help prevent maternal and fetal metabolic disorders[16].

Family involvement in health promotion initiatives may also improve pregnant women's adherence to nutritional guidance during pregnancy and the postpartum period. Understanding this influence can inform the development of more integrated pub-

lic policies that are responsive to the social context of pregnant women[22].

However, the statistical model explained only 10.3% of the variance in the threshold index, indicating that other contextual factors not explored in this study are likely involved.

Finally, adequate, balanced nutrition during pregnancy is essential for fetal growth and development[16]. Taste sensitivity in this period can directly shape pregnant women's food choices[10,23], and understanding these changes can inform the development of individualized, evidence-based nutritional strategies to better meet maternal and fetal needs.

Study limitations

A key limitation of this study was the small sample size and potential selection bias, which may have reduced the statistical power to detect significant differences between groups. These limitations stemmed from difficulties accessing the target population, the long time required for individual data collection, and the study's limited scope to three municipalities. Such factors limit the generalizability of the findings and should be considered when interpreting the results, underscoring the need for future studies with larger samples and broader population coverage.

Contributions to practice

The findings of this study have important implications for health care practice, particularly for nutritional care and prenatal follow-up of pregnant women. Identifying changes in sweet taste sensitivity throughout pregnancy can inform targeted interventions to promote healthy eating behaviors. These insights are especially relevant for preventing adverse nutritional outcomes, such as excessive gestational weight gain and gestational diabetes mellitus. In this regard, understanding sweet taste perception can help health professionals design educational strategies and individualized care plans during prenatal care.

Conclusion

The sweet taste detection threshold index remained stable across the different trimesters of pregnancy, with no statistically significant differences between gestational periods. However, household arrangement may influence sweet taste sensitivity: pregnant women living alone or with friends showed lower sweet taste sensitivity, suggesting that psychosocial factors may shape eating behavior during pregnancy.

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Authors' contributions

Study conception and design: **Matos TB, Cunha SS**. Data analysis and interpretation: **Matos TB, Ferreira CGS**. Drafting of the manuscript or critical revision of the manuscript for important intellectual content: **Matos TB, Brazil JM, Braga JMS, Faria LA, Milagres MP**. Final approval of the version to be published and responsibility for all aspects of the manuscript to ensure the accuracy and integrity of any part of the work: **Matos TB, Milagres MP**.

Data availability

The authors state that all data are fully available in this article.

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