The assessment of sensitivity to phenylthiocarbamide in teachers of a private college

A avaliação da sensibilidade à feniltiocarbamida em docentes de uma faculdade privada

La evaluación de la sensibilidad a la feniltiocarbamida en profesores de un colegio privado

Jéssica Ferreira Bezerra Marques[1], José de Souza Soares[2], Rosana Regina de Saldanha[3], Walquiria Lene dos Santos[4]

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1. Faculdade de Ciências e Educação Sena Aires. Valparaiso de Goias, Goias, Brazil.
https://orcid.org/0000-0001-8541-4760

2. Faculdade de Ciências e Educação Sena Aires. Valparaiso de Goias, Goias, Brazil.
https://orcid.org/0000-0002-2884-9466

3. Faculdade de Ciências e Educação Sena Aires. Valparaiso de Goias, Goias, Brazil.
https://orcid.org/0000-0002-9627-6268

4. Faculdade de Ciências e Educação Sena Aires. Valparaiso de Goias, Goias, Brazil.
https://orcid.org/0000-0001-6489-5243

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RESUMO

Objetivo: avaliar a sensibilidade gustativa a proteína PTC nos docentes de uma faculdade privada de Goiás, associando esta sensibilidade gustativa à ingestão de alimentos que contém essa substância, hábitos socioculturais e alimentares. **Método:** A avaliação da sensibilidade ao composto PTC (Feniltiocarbamida) ocorreu junto a 40 docentes de uma faculdade privada do estado de Goiás após administração oral de uma gota da solução de concentração 0,01% do composto, seguida pela aplicação do questionário para avaliar à substância testada. Os dados foram analisados no programa EpiInfo versão 7.2.3.0. Para se verificar a associação entre a sensibilidade gustativa ao PTC e as variáveis dependentes. utilizou-se os testes do qui-quadrado ou o teste exato de Fisher. **Resultados:** Observou-se que 65% dos docentes recrutados apresentam sensibilidade ao PTC. De 40 participantes, 47,5% eram do sexo feminino e 52,5% do sexo masculino. A população era da faixa etária entre 24 e 62 anos. Após a administração da solução do composto PTC (0,01%), a sensibilidade ao sabor amargo foi a mais relatada. Não houve associação entre a sensibilidade gustativa ao PTC e as variáveis estudadas. **Conclusão:** A inclusão na dieta de alimentos considerados saudáveis, associados ao sabor amargo, pode também ser influenciada pelo grau de sensibilidade e tolerância à esses alimentos.

Descritores: Feniltiocarbamida; Sensibilidade; Docentes

ABSTRACT

Objective: to evaluate the taste sensitivity to PTC protein in the teachers of a private college in Goiás, associating this taste sensitivity to the ingestion of foods that contain this substance, socio-cultural and eating habits. **Method:** The sensitivity assessment to the compound PTC (Phenylthiocarbamide) occurred with 40 teachers from a private college in the state of Goiás after oral administration of a drop of the 0.01% concentration solution of the compound, followed by the application of the questionnaire to evaluate the tested substance. The data were fulfilled using the EpiInfo program version 7.2.3.0. To verify an association between taste sensitivity to PTC and as dependent dependents. chi-square tests or Fisher's exact test are used. **Results:** It was observed that 65% of the recruited professors are sensitive to PTC. Of the 40 participants, 47.5% were female and 52.5% male. The population was between 24 and 62 years old. After administration of the PTC compound solution (0.01%), sensitivity to bitter taste was the most reported. There was no association between taste sensitivity to PTC and the variables studied. **Conclusion:** The inclusion in the diet of foods considered considered, associated with the bitter taste, can also be influenced by the degree of sensitivity and tolerance to these foods.

Descriptors: Phenylthiocarbamide; Sensitivity; Faculty.

RESUMEN

Objetivo: evaluar la sensibilidad gustativa a la proteína PTC en los profesores de un colegio privado de Goiás, asociando esta sensibilidad gustativa a la ingestión de alimentos que contienen esta sustancia, hábitos socioculturales y alimentarios. Método: La evaluación de sensibilidad al compuesto PTC (Feniltiocarbamida) se realizó con 40 profesores de un colegio privado en el estado de Goiás luego de la administración oral de una gota de la solución de concentración al 0.01% del compuesto, seguida de la aplicación del cuestionario para evaluar la sustancia probada. Los datos se cumplieron utilizando el programa EpiInfo versión 7.2.3.0. Verificar una asociación entre la sensibilidad gustativa a PTC y como dependientes dependientes. Se utilizan pruebas de chi-cuadrado o la prueba exacta de Fisher. Resultados: Se observó que el 65% de los profesores reclutados son sensibles al PTC. De los 40 participantes, el 47,5% eran mujeres y el 52,5% hombres. La población tenía entre 24 y 62 años. Después de la administración de la solución del compuesto PTC (0,01%), la sensibilidad al sabor amargo fue la más notificada. No hubo asociación entre la sensibilidad gustativa al PTC y las variables estudiadas. Conclusión: La inclusión en la dieta de los alimentos considerados considerados, asociados al sabor amargo, también puede estar influenciada por el grado de sensibilidad y tolerancia a estos alimentos.

Descriptores: Feniltiocarbamida; Sensibilidad; Facultad.

Introduction

Sensitivity to PTC (phenylthiocarbamide) is an example of classic Mendelian inheritance. This character is controlled by a dominant (S) allele that determines sensitivity to PTC and a recessive allele (s), not sensitive to PTC. Phenylthiocarbamide has in its structure a thiocyanate molecule (N-C = S), which is found in vegetables of the Cruciferae or Brassicaceae family, such as broccoli, cabbage, Brussels sprouts, cauliflower, watercress and cabbage, among others.[1]

Bitter taste is a variable characteristic, and its genetic basis was identified 75 years ago, through a series of studies on individual responses to phenylthiocarbamide (PTC). PTC and propylthiouracil-related compounds (PROP) are members of the thiourea and designates a thiocyanate molecule. Although PTC and PROP do not occur naturally in food, they stimulate the bitter taste in some, so they are used in studies to assess the relationship between genetics and the perception of bitter taste.[2]

Since unpleasant taste is often the main criterion for food rejection, individuals sensitive to phenylthiocarbamide tend to reject foods that contain this substance. This can directly influence the adoption of unhealthy eating habits, which can result in damage to the health of these individuals, since a diet rich in fruits and vegetables is known to be responsible for reducing the risk of developing chronic, cardiovascular diseases, obesity and cancer.[3]

The sensitivity test to phenylthiocarbamide is commonly used in educational institutions as a resource to relate concepts of Genetics to the daily lives of students and teachers. The present work will aim to evaluate the taste sensitivity to PTC protein with the professors of a private institution, associating it with the intake of foods that contain this substance, smoking habits and alcoholism.

The objective of this study was to evaluate the taste sensitivity to PTC protein in the teachers of a private college in Goiás, associating this taste sensitivity to the ingestion of foods that contain this substance, socio-cultural and eating habits.

Method

The data were analyzed using the EpiInfo program version 7.2.3.0, and a descriptive analysis was initially performed. Chi-square tests or the Fisher's exact test. Individuals who reported having a cold or having a disease that affected their taste were excluded from the analysis. All tests were bilateral and variables associated with a p-value <0.05 were considered associated.

The PTC test consists of trying a solution composed of water and the aforementioned protein, phenylthiocarbamide, commonly found in vegetables that are part of a healthy diet.[1] The participation of the research was conditioned to the signing of a consent form obtained freely and spontaneously, after the explanation of the research and pertinent clarifications. This work was submitted to the FACESA Human Research Ethics Committee and approved under number 3,771,495. The data collection was carried out in the months of March, April and May 2019, in the IES living spaces. The assessment of sensitivity to the PTC compound (Phenylthiocarbamide) after oral administration of a drop of the 0.01% concentration solution of the compound, followed by the application of the questionnaire to assess the tested substance. Subsequently, an anonymous questionnaire was filled in with information such as age, sex, smoking habit, recent infections if the individual perceived the taste of phenylthiocarbamide. The questionnaire also presented several foods containing phenylthiocarbamide and the participants indicated which ones they liked, and did not like. This information is necessary since researchers try to relate it to the perception of the protein.

Results

For assessing taste sensitivity to PTC (Table 1) with food intake containing this substance, eating habits, smoking, alcohol consumption and coffee consumption, in addition to demographic characteristics, the chi-square test or the exact test was applied Fisher, according to the characteristics of the variables studied, with no association between taste sensitivity to PTC and the variables studied.

Table 1- Assessment of taste sensitivity to PTC. Goiás, 2020.

	Sensitive (n=24)		**Insensitive (n=14)**		**p**	**OR**	**CI95%**
	n	**%**	**n**	**%**			
Sex							
Female	**8**	**33,3**	**8**	**57,1**	0,27	0,37	0,09-1,45
Male	**16**	**66,7**	**6**	**42,9**			
Perception of consumption							
Fat							
Little/Medium	21	**87,5**	14	**100,0**	0,43	0,37	0,01-3,32
Very much	3	**12,5**	0	**0,0**			
Sugar							
Little/Medium	22	**91,7**	12	**85,7**	0,60	1,80	0,17-19,18
Very much	2	**8,3**	2	**14,3**			
Salt							
Little/Medium	22	**91,7**	12	**85,7**	0,60	1,80	0,17-19,18
Very much	2	**8,3**	2	**14,3**			
Vegetables							
Little/Medium	14	**58,3**	7	**50,0**	0,63	1,30	0,35-5,46
Very much	10	**41,7**	7	**50,0**			

Habits							
Tabaco							
Yes	2	**8,3**	1	**7,7**	1,00	1,09	0,08-13,3
No	22	**91,7**	12	**92,3**			
Álcool							
Yes	13	**54,2**	7	**50,0**	1,00	1,18	0,31-4,42
No	11	**45,8**	7	**50,0**			
Café							
Consume	18	**75,0**	13	**92,9**	0,22	0,23	0,02-2,15
Does not consume	6	**25,0**	1	**7,1**			
Foods							
Cabbage							
Consume	22	**91,7**	13	**92,9**	1,00	0,84	0,06-10,27
Does not consume	2	**8,3**	1	**7,1**			
Broccoli							
Consume	23	**95,8**	14	**100,0**	1,00	-	-
Does not consume	1	**4,2**	0	**0,0**			
Red wine							
Consume	13	**54,2**	10	**71,4**	0,32	0,47	0,11-1,93
Does not consume	11	**45,8**	4	**28,6**			
Green tea							
Consume	10	**41,7**	7	**50,0**	0,73	0,71	0,18-2,68
Does not consume	14	**58,3**	7	**50,0**			
Beer							
Consume	16	**66,7**	7	**50,0**	0,49	2,00	0,51-7,70
Does not consume	8	**33,3**	7	**50,0**			
Cauliflower							
Consume	18	**75,0**	14	**100,0**	0,06	-	-
Does not consume	6	**25,0**	0	**0,0**			
Cabbage							
Consume	21	**87,5**	11	**78,6**	0,64	1,90	0,32-11,08
Does not consume	3	**12,5**	3	**21,4**			
Chili							
Consume	18	**75,0**	13	**92,9**	0,22	0,23	0,02-2,15
Does not consume	6	**25,0**	1	**7,1**			
Turnip							
Consume	10	**41,7**	5	**35,7**	1,00	1,28	0,32-5,01
Does not consume	14	**58,3**	9	**64,3**			
Radish							
Consume	15	**62,5**	6	**42,9**	0,31	2,22	0,58-8,51
Does not consume	9	**37,5**	8	**57,1**			
Cress							
Consume	16	**66,7**	12	**85,7**	0,26	0,33	0,05-1,86
Does not consume	8	**33,3**	2	**14,3**			
Cheese							
Consume	23	**95,8**	13	**92,9**	10,00	1,76	0,10-30,71
Does not consume	1	**4,2**	1	**7,1**			

FACESA's professors participated in this research, out of 40 participants, 47.5% (n = 19) were female and 52.5% (n = 21) male. The population was between 24 and 62 years old. The sensitivity test to phenylthiocarbamide (PTC) revealed that 65% of the individuals were sensitive (n = 26), it was also found that 15% (n = 14) of the participants were insensitive. After administering the solution of the PTC compound (0.01%) to the participants, the perception of the flavor reported by the teachers was recorded. Sensitivity to bitter taste was the most reported. Information on the assessment of sensitivity to the PTC compound in participating teachers is shown in Figure 1.

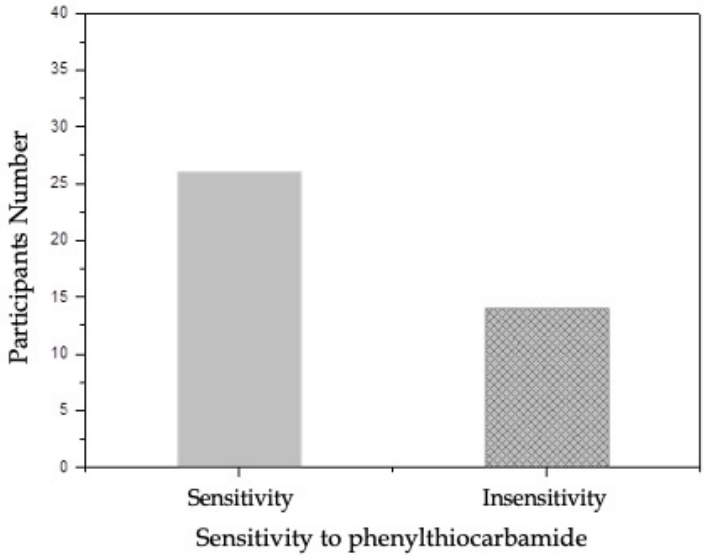

Figure 1- Distribution of FACESA professors regarding sensitivity to phenylthiocarbamide (PTC). Goiás, 2020.

We also observed that the majority, regardless of gender, consumed alcoholic beverages. As for cigarette consumption, it was found that only a minority of participants reported having a smoking habit. It was also investigated whether the participants considered maintaining a healthy diet and 62.5% said yes and 37.5% said they did not consider maintaining healthy eating habits. When it was assessed whether the participant had the flu or had a disease that could influence his taste, it was found that 95% said no (Figure 2).

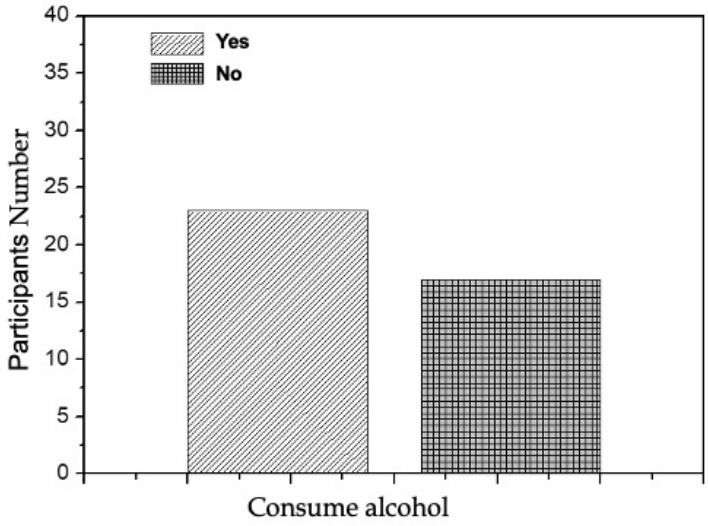

Figure 2- Distribution of FACESA professors regarding alcohol consumption. Goiás, 2020.

Figure 3 shows the declared responses for the applied questionnaire. Regarding the consumption of fatty foods, it was observed, in general, that the items "medium" and "little" were the most marked. In the analysis of the answers "sugar consumption" it was possible to observe a low declared consumption, the most marked. The most declared item for the consumption of salt was "little". Regarding the consumption of vegetables, the items "very" and "average" stand out with an average frequency.

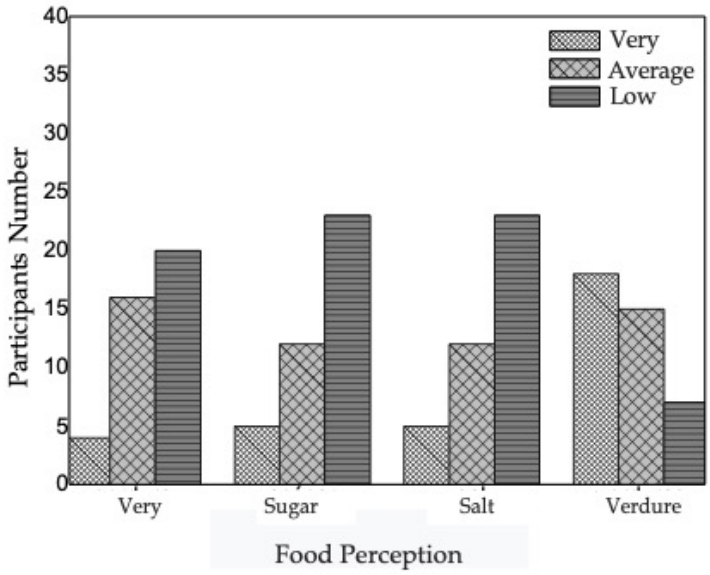

Figure 3- Representative of the responses to the perception of consumption referring to fat, sugar, salt and vegetables that the participants reported in a questionnaire. Goiás, 2020**.**

Regarding the eating habits mentioned in a questionnaire to participants for the purpose of investigating the consumption of food in PTC, high percentages of individuals who reported consuming in relation to those who do not consume were obtained. With regard to vegetables, as for vegetables, there was no relevant difference between those who reported consuming and those

who did not. As for drinks, there was a significantly higher number of individuals who reported consuming red wine and coffee, compared to those who reported not consuming and in relation to other drinks mentioned in the questionnaire, there was no significant difference between those who consumed and those who did not. As for cheese, most participants reported consuming it (Figure 4).

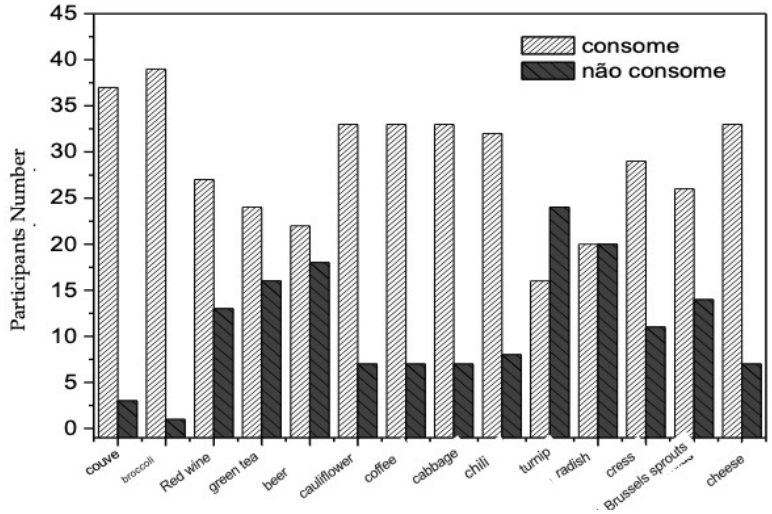

Figure 4- Percentage of rejection of foods containing or not phenylthiocarbamide (PTC) Manifestation of taste (G) or dislike (NG) of vegetables rich in phenylthiocarbamide. Goiás, 2020.

Discussion

The results indicated that of 40 participating teachers, 47.5% were female and 52.5% male, aged between 24 and 62 years. It was found that 65% of teachers were able to taste phenylthiocarbamide (PTC), and 15% did not feel the presence of phenylthiocarbamide (PTC) (Figure 1). Regarding food preference, questionnaires were applied to choose teachers' foods, which are described as having the phenylthiocarbamide substance (PTC), such as: broccoli, cabbage, cauliflower, watercress, cheese and coffee.

As for the consumption of bitter foods, there was no significant difference related to the results regarding the sensitivity of the substance of Pheniltiocarbamide, as people can suffer cultural pressure and lie in the questionnaires related to food.

As for sensitivity to phenylthiocarbamide was associated with sex, there was a significant difference only for males. This study contradicts that presented by4 since studies claim that women tend to be more sensitive to PTC than men and that sex hormones have a great influence on this sensitivity. The study by Bartoshuk and colleagues also showed different results that showed a prevalence of females in sensitivity to phenylthiocarbamide, because women tend to have a high density of fungiform papillae.[5-6] In addition, it also contradicts the studies by Duffy and collaborators[6], in which no differences were found between the sexes. However, it is worth mentioning again that the reduced sample may be affecting this result. This demonstrated that only 3 participants reported smoking.

The impact of alcohol and tobacco consumption on the health of individuals is already well established, however the impact of this behavior on the modification and development of inappropriate eating habits due to loss of taste sensitivity, still raises great debate.[7-8] In relation to smokers sensitive to phenylthiocarbamide, the result demonstrated that, although studies prove the harmful effect of nicotine on the taste buds9, this does not apply to all smokers, and only one participant (6.7%) - smoker - did not feel the bitterness of phenylthiocarbamide, which corroborates studies that contradict this hypothesis.[10]

This sensory difficulty may occur due to changes in the shape, number and vascularization of the taste buds, due to the action of the components present in tobacco and alcohol, which would influence the ability to detect and perceive taste. Bitter foods, therefore, rich in phenylthiocarbamide, contain important vitamins and are protective against disease. Dastan and collaborators relate this result to the fact that individuals not sensitive to PTC have a less refined taste and less selective to other flavors when compared to individuals sensitive to PTC. This is because individuals sensitive to PTC need a smaller amount to taste such a flavor. A non-sensitive person, on the other hand, tends to need more of a certain food to taste the same, eating more and also preferring fattier sweet and salty foods.[11]

In this study, a total of 23 people confirmed the use of alcohol in their daily lives. Kang, Cho and Yurn[12] observed that people who used to use alcoholic beverages were less sensitive or insensitive when compared to individuals sensitive to PTC. However, it was also observed in studies by Pandolf[13-14], that even individuals with greater sensitivity to bitter tasting consume bitter foods and beverages, influenced by the cultural factor. This occurs mainly with men in relation to drinks such as liquor, red wine, among others. The authors also claimed that the search for healthier habits tends to make these people more sensitive to consume foods such as vegetables that are more bitter despite their high degree.

The gene encoding the PTC receptor protein is TAS2R38 located on the long arm of chromosome 7 (7q35-q36), and contains about 1,002 base pairs (bp) in its coding region.[16,18] This gene belongs to the family of receptors for bitter TAS2R, presenting five allelic forms, in which the recessive form is associated with non-perceptions of bitter. Thus, individuals who are insensitive have homozygous recessive (tt) genotypes. The other four allelic forms (T1, T2, T3 and T4) determine a variable expressiveness between individuals is associated with genetic polymorphism. Molecular analyzes of the TAS2R38 gene showed that mutations in this gene result in polymorphism in the receptors encoded by it. These variations are associated with differences in the perception of PTC classifying individuals as sensitive, insensitive and insensitive.[15-17] The non-relationship between sensitivity to PTC and the listed foods contradicts data that state that the more sensitive the individual to phenylthiocarbamide is, the greater his tendency to reject foods containing this protein.[19-20]

However, it is possible that this relationship was not observed in the present study due to the small number of the sample population. In this work, it was possible to observe the curiosity of the participants in understanding why some felt the bitter taste and others did not. In this context, this interest of the participants proves the purpose of the practice, which besides promoting interaction and instigating them to understand how the theory is applied in daily life, awakened the critical sense and facilitated the understanding of the conceptual bases involved in this dynamic.

Conclusion

In this study, we verified the sensitivity to the PTC compound in teachers of a private higher education institution. It was observed that most participants were sensitive to the bitter taste that the compound promotes. Eating habits are directly influenced by the sensitivity to flavors, consequently the inclusion in the diet of foods considered healthy, associated with the bitter taste, can also be influenced by the degree of sensitivity and tolerance to these foods. Emphasize that the information provided in the responses to the questionnaires may have been influenced by pressure from society and the media and may not correspond to actual eating habits.

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Correspondent Authot
Jéssica Ferreira Bezerra Marques
Acre St. ZIP: 72876-241. Chacaras Anhanguera, Valparaiso de Goias, Goias, Brazil.
jhessyka28@gmail.com