SENSORY PERCEPTION EVALUATION OF SALTY TASTE IN HIPERTENSIVE PEOPLE

AVALIAÇÃO DA PERCEPÇÃO SENSORIAL AO GOSTO SALGADO EM PESSOAS HIPERTENSAS EVALUACIÓN DE LA PERCEPCIÓN SENSORIAL AL GUSTO SALADO EN PERSONAS HIPERTENSAS

Joelton Rocha Gomes¹, Evely Rocha Lima², Jamille Marinho Brazil³, Daniel de Melo Silva⁴, Gisele Bonfim Pereira⁵, Thaciany Paula Marques Alves⁶, Maria Patricia Milagres⁷

ABSTRACT

Objective: to evaluate gustatory perception of salty taste in people with systemic arterial hypertension. **Method:** this is a quantitative, descriptive and cross-sectional study of individuals diagnosed with arterial hypertension, characterizing the test group, and non-hypertensive individuals, defining the control group. This study was carried out in the second half of 2017. The whole mouth stimulus test for the salty taste was performed in order to evaluate the taste threshold. The Mann-Whitney test at 5% probability was used to compare unpaired mean data. The analyzes were studied in the Statistical Package for the Social Sciences, presenting the results in figure and table form. **Results:** it was observed that in the first and second sections, containing the lowest concentrations of NaCl, 0.09 g / L and 0.18 g / L, respectively, 54% of the control group was able to detect salty taste, higher than that of the test group (18.82%). Conclusion: it was observed that the taste threshold for salty taste was higher in hypertensive individuals when compared to normotensive individuals. **Descriptors:** Chronic Disease; Palate; Food Behavior; Sensory Threshold; Threshold; Hypertension.

RESUMO

Objetivo: avaliar a percepção gustativa ao gosto salgado em pessoas com hipertensão arterial sistêmica. **Método:** trata-se de um estudo quantitativo, descritivo e transversal, realizado com indivíduos diagnosticados com hipertensão arterial, caracterizando o grupo teste, e com indivíduos não hipertensos, definindo o grupo controle. Realizou-se este estudo no segundo semestre de 2017. Executou-se o teste de estímulo da boca toda para o gosto salgado a fim de avaliar o limiar gustativo. Utilizou-se, para a comparação entre as médias de dados não pareados, o teste de Mann-Whitney a 5% de probabilidade. Estudaram-se as análises no *Statistical Package for the Social Sciences*, apresentando os resultados em forma de figura e tabela. **Resultados:** observou-se que, na primeira e segunda seções, que continham as menores concentrações de NaCl, 0,09 g/L e 0,18 g/L, respectivamente, 54% do grupo controle conseguiu detectar o gosto salgado, resultado muito maior que o do grupo teste (18,82%). **Conclusão:** notou-se que o limiar gustativo para o gosto salgado foi maior nos indivíduos hipertensos quando comparados aos indivíduos normotensos. **Descritores:** Doença Crônica; Paladar; Comportamento Alimentar; Limiar Sensorial; Limiar Gustativo; Hipertensão.

RESUMEN

Objetivo: evaluar la percepción gustativa del gusto salado en personas con hipertensión arterial sistêmica. **Método:** se trata de un estudio cuantitativo, descriptivo y transversal, realizado con individuos diagnosticados con hipertensión arterial, caracterizando el grupo test, y con individuos no hipertensos, definiendo el grupo control. Se realizó este estudio en el segundo semestre de 2017. Se ejecutó la prueba de estímulo de la boca entera para el gusto salado a fin de evaluar el umbral gustativo. Se utilizó, para la comparación entre los promedios de datos no pareados, la prueba de Mann-Whitney al 5% de probabilidad. Se estudiaron los análisis en el *Statistical Package for the Social Sciences*, presentando los resultados en forma de figura y tabla. **Resultados:** se observó que, en la primera y segunda secciones, que contenían las menores concentraciones de NaCl, 0,09 g / L y 0,18 g / L, respectivamente, el 54% del grupo control logró detectar el gusto salado, mayor que el del grupo de prueba (18,82%). **Conclusión:** se notó que el umbral gustativo para el gusto salado fue mayor en los individuos hipertensos cuando comparados a los individuos normotensos. **Descritores:** Enfermedad Crónica; El Gusto; Comportamiento Alimenticio; Umbral Sensorial; Umbral Gustativo; Hipertensión.

³Master (PhD student), State University of the Southwest of Bahia / UESB. Jequié (BA), Brazil. Email: jamillemarinho@hotmail.com ORCID iD: <https://orcid.org/0000-0002-1834-4544>; ^{4,7}PhDs, University of the Southwest of Bahia / UESB. Jequié (BA), Brazil. Email: dms366@bol.com.br ORCID iD: <https://orcid.org/0000-0003-1949-1594>; mpmilagres@yahoo.com.br ORCID iD: <https://orcid.org/0000-0002-4845-5624>; ^{5,6}Pharmacy students, State University of the Southwest of Bahia / UESB. Jequié (BA), Brazil. Email: gibpereira@hotmail.com ORCID iD: <https://orcid.org/0000-0001-5774-130X>; Email: thacy.marques@outlook.com ORCID iD: <https://orcid.org/0000-0001-8276-2284>

INTRODUCTION

Systemic arterial hypertension (SAH) is known to account for approximately 9.4 million deaths worldwide, according to data from the World Health Organization (WHO).¹ Brazil was ranked in 2015 as the sixth country with higher occurrence of HAS-related deaths.² According to the Brazilian Society of Cardiology³, hypertension is prevalent in about 36 million Brazilians and is present in more than 60% of the elderly. Several factors and conditions are listed as possible causes for hypertension: obesity; age; sex; sedentary habits, alcoholics and smokers; genetics; ethnicity and food choices.³

In this sense, the role of food choices as a conditioning factor in health is highlighted, since healthy eating habits are directly related to the prevention of chronic non-communicable diseases (CNCDs).⁴ It is thus argued that the food choices process may be a risk factor for the development of CNCDs, since there is a direct relationship between preferences for foods rich in saturated fatty acids, trans fat, sugars and sodium and these diseases.⁵

For this reason, research is conducted to relate dietary choices and the development of CNCDs. An association between health education and sodium consumption was evaluated as an example in a study carried out in Switzerland with workers, in which it was observed that the mean salt intake was higher in the hypertensive participants when compared to normotensive participants.⁶

In a study carried out in Brazil with the urban population of Vitória (ES), after a study of salt intake and urinary sodium / potassium ratio, a high sodium intake was observed in the study population. It was also observed a high prevalence of hypertension at the study site, evidencing that high sodium intake is directly related to the development of hypertension.⁷

In this way, it is related the process of food choices to health conditions, the need to know the determining factors of this process. It is scored, according to Estima et al.⁸, that the process of food choices encompasses psychological and sociocultural factors, especially biological, economic and food supply / availability. It is stated⁹ that age, sex, the media, as well as product-related information such as brand, price, label and health claim, can also determine food choices.

In this context, the role of sensorial aspects is highlighted, since they are

considered as one of the main determinants in this process⁸. Sensory properties include the intrinsic aspects of food, such as taste, odor, taste, appearance, texture and others, which are evaluated by the senses, such as smell, taste, sight and touch.¹⁰

It is observed, then, from the influence of the taste on the food choices that this sensorial sense allows, to the individual, to select the foods that they like to him; thus, the salty taste in food is a predictor of food choices. It is known that individuals with a high salty taste threshold, that is, a low gustatory sensitivity for this taste, tend to ingest a greater amount of salt in order to identify the taste in the food¹¹, which may be responsible for the development or aggravation of SAH.¹²⁻⁴

Due to the importance of the evaluation of the threshold index for taste as a diagnosis of gustatory conditions, several types of sensorial analyzes to evaluate the gustatory threshold, such as electrogustometry, impregnated disk and whole mouth stimulation, are identified.¹⁵

It is pointed out that the whole mouth stimulation method, besides the low cost, has, as an advantage, the stimulation of a greater number of taste buds in the oral cavity, which allows the individual to discriminate the stimuli that are received. The threshold test is divided into sections; in each one, a solution of sodium chloride and two water samples are presented to the participants, and a different sample is required. The concentration of sodium chloride in each section is increased until the participant is able to differentiate the sodium chloride solution from the water samples. The detection threshold is defined as the minimum concentration that allows the participant to differentiate the sample containing the substance from samples containing only water.¹⁵

The threshold index is used in studies to evaluate dietary choices and the relation to some health conditions,¹⁵⁻²⁴ for example, in the evaluation of the taste threshold for sweet and the relation with Diabetes Mellitus type 2,¹⁶ the determination of gustatory threshold for sweet and salty alcoholics and non-alcoholics¹⁷ and the evaluation between the use of antidepressants and changes in gustatory sensitivity.¹⁸ Destacam-se os estudos que têm analisado a relação entre o índice limiar para salgado e a HAS.^{15,22,24}

It is observed, in studies, that hypertensive patients present a higher salivary threshold index than the normotensive ones.^{15,24} It is noticed in other studies, that hypertensive patients using antihypertensive drugs had a

lower sensitivity to salty taste compared to healthy subjects.²²⁻³ It was also observed,²⁴ that the threshold index for the detection and recognition of hypertensive patients is higher than those of their normotensive and normotensive relatives without family ties.

However, in spite of the number of published articles that deal with the evaluation of gustatory sensitivity comparing hypertensive and normotensive individuals, most of them have inconsistencies in the exclusion factors, constituting a bias for the results found. It is known that diseases such as Diabetes Mellitus type 2,¹⁶ upper airway obstruction,²¹ smoking habits¹¹ and alcoholics¹⁷, besides the use of antidepressant drugs¹⁸ and the age range²⁰ may lead to alteration of gustatory sensitivity.

OBJECTIVE

- To evaluate gustatory perception of salty taste, in people with systemic arterial hypertension.

METHOD

This is a quantitative, descriptive and cross-sectional study, carried out in the second half of 2017, at the Basic Health Unit Sebastião Azevedo and at the campus of the State University of the Southwest of Bahia (UESB), in the municipality of Jequié, Bahia. It is reported that the study sample was non-random, composed of 150 individuals, aged between 18 and 60 years, of both sexes, which was divided into two groups: test group and control group.

Each group was composed of 75 individuals, and the group consisted of individuals with a diagnosis of SAH, attended at the Sebastião Azevedo Basic Health Unit, and the control group was composed of UESB students and staff not diagnosed with SAH.

Exclusion criteria included individuals of both groups: smokers, pregnant women, individuals with colds, febrile, who presented with some complication in the oral cavity, the use of dental prostheses or who had consumed alcoholic beverages in a minimum period of 96 hours before the tests were performed.

The sensitivity test was used to evaluate the gustatory sensitivity for the determination of the threshold index of detection to the salty taste, using the methodology described in the Brazilian standard²⁵ and International Organization for Standardization²⁶.

The gustatory threshold was measured using the rapid detection method, where each subject performed six series of 3-AFC sensory tests (i.e. 3-Alternative Forced Choice). The

concentrations of NaCl were increased in increasing concentrations in a continuous and monodic manner, respecting the following values: 0.09; 0.18; 0.36; 0.72; 1.5 and 3.0 g / NaCl, values also adopted by Silva et al.¹⁷.

The samples were prepared and standardized in the UESB Food Technology Laboratory, with mineral water and NaCl, quantified using the analytical balance SHIMADDZU AUW220D and then packed in plastic containers at room temperature and under the light.

For the statistical analysis, the equation for the determination of the threshold of each individual was applied to then, also, to apply another equation to obtain the average threshold of the two groups, calculating the geometric mean of the threshold values.

The Kolmogorov-Smirnov normality test was used to compare the mean threshold index between the test and control groups; then the unmatched data comparison test, Mann-Whitney, adopting the significance level of 5%. It is added that the analyzes were carried out in the software Statistical Package for the Social Sciences (SPSS), version 21, licensed.

The study was based on the ethical requirements of the study, according to the legal precepts contained in Resolution No. 466/2012 of the National Health Council. The research project was approved by the Ethics and Research Committee of the State University of the Southwest of Bahia (UESB) under the Certificate of Presentation for Ethical Appraisal (CAAE) n. 46718615.0.0000.0055 and the favorable opinion n. 1.251.287.

RESULTS

The study population was composed of 75 hypertensive volunteers, of whom 52% (n = 39) met the inclusion criteria and 48% (n = 36) were excluded (Table 1).

Table 1. Percentage of individuals who did not meet the inclusion criteria. Jequié (BA), Brazil, 2017.

Exclusions	Hipertense (test group, n=75)	
	n	%
Flu	18	24%
Sore throat	5	7%
Diabetes	5	7%
Use of dental prosthesis	4	5%
Smoker	2	3%
Lesions in the oral cavity	1	1%
Use of alcoholic beverages	1	1%

It was found that in the test group, 76% declared themselves female and 34% were male; the hypertensive population was composed of 34% of the individuals declared to be male and 76% of the female. The following characteristics were pointed out for the majority of the hypertensive ones: 55% declared themselves mulattoes; 64% did not have completed High School; 72% had a monthly income of less than three minimum wages and 61% had a predilection for salty foods. Among the favorite foods are rice and beans (36%), salads, fruits and vegetables (38%), meat (33%), pasta (18%), breads and cake (12%). It was noted that all patients used some medication regularly for the treatment of hypertension, and 42% used the

combination of an angiotensin-enzyme inhibitor with a diuretic.

It is observed that the normotensive population was also composed of 75 individuals, who did not have a diagnosis of SAH and met the inclusion criteria. It was found that 65% were female and 35% male.

It is perceived that, in the first and second sections, the lowest concentrations of NaCl - 0.09 g / L and 0.18 g / L were observed in the first and second sections, L, respectively, that 54% of the control group was able to detect salty taste, a result much higher than that of the test group (18.82%) (Figure 1).

Figure 1. Percentage of hits per section. Jequié (BA), Brazil, 2017. — control group — test group

Individual detection thresholds were obtained by means of the geometric mean between the highest undetected concentration and the lowest concentration detected by hypertensive and normotensive individuals. It was verified, through the gustative sensitivity analysis, that the mean threshold of the test group was 1.09 ± 0.68 g/L, while that of the control group was 0.20 ± 0.08 g/L.

he Mann-Whitney test at 5% probability revealed that there is a statistically significant difference ($p < 0.05$) between the mean threshold index for salty taste, when comparing the hypertensive group and the

normotensive group, being that the test group has a higher threshold for the salty taste, which shows that this group needs a greater quantity of salt to be able to identify the salty taste in food. It should be noted that a significant statistical correlation between the gustatory threshold for salty and factors such as sex, income, skin color, schooling, medication used, taste and preference food were not observed.

DISCUSSION

In this study, we observed the difficulty of the hypertensive group in identifying the saline solution in the first sections, that is,

those with the lowest concentration of salt. It is thus demonstrated that hypertensives are less able to detect salty stimuli at low concentrations than normotensive ones, by means of the rapid detection method in a growing series of solutions presented, indicating a reduction of gustatory sensitivity to salty taste by test group.

It is pointed out in this context that the findings of this study are in agreement with those found in a study²² with 100 hypertensive patients, through the triangular-type whole-mouth stimulus method and with five sections of increasing NaCl concentration, which observed that hypertensive patients taking Captopril and Atenolol are less sensitive to salty stimuli than healthy people, noting also that sex and age are associated with reduced sensitivity by hypertensive individuals ($p < 0.05$); however, the authors did not exclude alcoholics, people with Diabetes Mellitus, nor the elderly, and these groups present changes in gustatory sensitivity.^{16-7,20}

However, it is observed in another study,²³ with 84 hypertensive patients, by means of the whole-mouth stimulus method, with four sections of increasing concentration of NaCl, that hypertensive patients undergoing therapy with hypotensive drugs, such as converting enzyme inhibitors of angiotensin I, diuretics, calcium channel blockers and beta-blockers, are less sensitive to salty taste than normotensive ones ($p < 0.05$). It should be noted, however, that the authors did not exclude patients with dental prostheses or alcoholics, knowing that these factors alter gustative sensitivity.^{15,17}

This leads to a research bias, since it is not known if the loss of gustatory sensitivity is actually influenced by hypertension or other factors that were not excluded in the research, such as people with Diabetes Mellitus, alcoholics, users of dental prosthesis, etc. It is suggested, therefore, that a research with more concise exclusion factors may indicate the actual condition of gustatory sensitivity of hypertensive individuals. The importance of taste threshold values for salty in the hypertensive group found in this study is highlighted.

The results of this study show a statistically significant difference ($p < 0.05$) between the mean threshold index for salty taste when comparing the hypertensive and normotensive groups. In a study by Olayemi et al.,²⁴ using the whole mouth stimulus method, hypertensive patients had a higher threshold for salty taste, noting that the detection threshold for hypertensive patients (1.167 g / L)) was higher than their normotensive

relatives. It was also reported that normotensive individuals with a family history of hypertension had a higher detection threshold ($p < 0.01$) compared to normotensive controls.

It is emphasized that several authors report the reduction of taste sensitivity to salty taste, related to habits and attitudes, such as: the use of antihypertensives,²²⁻³ the use of antidepressants,¹⁸ smoking habits¹⁹ and alcoholics,¹⁷ the obstruction of the pathways Diabetes mellitus type 2¹⁸ and age.²⁰

In this perspective, among the studies that observed the loss of gustatory sensitivity to salty taste, those that used the same methodology of this research and exclusion factors similar to those used in this study stand out. In a survey¹⁷ with alcoholics, a mean saline taste threshold was found in 0.34 g / L salt;¹⁸ in a study with antidepressant users, threshold values of 0.53 g / L salt.

It is pointed out that the values found by the authors mentioned above are lower than the result of this research, showing that, among alcoholics, users of antidepressive and hypertensive drugs, the latter are the most affected in terms of reduction of taste sensitivity to salty taste. It is noteworthy that this comparison was only possible in this study due to adjustments of the exclusion factors, which allowed the best comparison with the surveys of alcoholics and users of antidepressant drugs.

It has been observed that the reduction of taste sensitivity to salty taste by hypertensive individuals may influence them in their food choices, since they tend to have difficulties in perceiving the salty taste in foods with small concentrations of sodium chloride, which leads them to ingest more salt in an attempt to perceive this taste.

It should be noted that a higher intake of salt may lead to an increase in blood pressure,²⁷⁻⁹ thus constituting a risk factor for the development of several pathologies,³⁻⁴ besides making antihypertensive therapy difficult.

It is also noted that this reduction of gustative sensitivity can make it difficult to control the consumption of salt in foods by hypertensive individuals, since they may perceive that they are ingesting little salt because they do not taste salty when, In fact, this lack of perception is linked to the reduction of sensitivity and not to the amount of salt in the food. It is important to note the importance of using the gustatory sensitivity test in the diagnosis and treatment of hypertension.

CONCLUSION

It was allowed by this study to identify that the taste threshold for salty taste is higher in hypertensive individuals (test group) when compared to normotensive individuals (control group). It is emphasized that the elevated taste threshold for the test group may interfere with the increase in NaCl consumption in order to improve food palatability.

Exacerbated NaCl consumption is associated with increased blood pressure levels, a fact that contributes directly to the pathophysiology of hypertension. Therefore, it is concluded that it is important to carry out food education activities in Basic Health Units in order to guide individuals on other ways to improve food palatability without the indiscriminate use of NaCl.

The importance of the development of new studies relating the reduction of gustative sensitivity with hypertensive individuals, as well as the mechanisms by which the reduction is given. As a limitation of this study, the size of the population is highlighted, suggesting that an expanded study with a larger population.

REFERENCES

1. World Health Organization. Raised blood pressure. [Internet]. Geneva: WHO; 2017 [cited 2017 Oct 04]. Available from: http://www.who.int/gho/ncd/risk_factors/bl_ood_pressure_prevalence_text/en/
2. Sociedade Brasileira de Hipertensão. Taxa de morte por hipertensão arterial cresceu 13,2% na última década. [Internet]. São Paulo: SBH; 2017 [cited 2017 Oct 04]. Available from: <http://www.sbh.org.br/geral/noticias.asp?id=486>
3. Sociedade Brasileira de Cardiologia. VI Diretrizes Brasileira de Hipertensão Arterial. Arq Bras Cardiol [Internet]. 2016 Sept [cited 2017 Oct 04];107(3 Suppl 3):1. Available from: http://publicacoes.cardiol.br/2014/diretrizes/2016/05_HIPERTENSAO_ARTERIAL.pdf
4. Jansen L, Roodenburg AJ. The use of food composition data in the Choices International Programme. Food chem. 2016 Feb 15;193:196-202. Doi: 10.1016/j.foodchem.2015.06.082
5. Menezes EW, Lopes TV, Mazzini ER, Dan MC, Godoy C, Giuntini EB. Application of Choices criteria in Brazil: Impact on nutrient intake and adequacy of food products in relation to compounds associated to the risk of non-transmissible chronic diseases. Food Chem. 2013 Oct 1;140(3):547-52. Doi: [10.1016/j.foodchem.2013.02.031](https://doi.org/10.1016/j.foodchem.2013.02.031)
6. Luta X, Hayoz S, Krause CG, Sommerhalder K, Roos E, Strazzullo P, Beer-Borst S. The relationship of health/food literacy and salt awareness to daily sodium and potassium intake among a workplace population in Switzerland. Nutr Metab Cardiovasc Dis. 2018 Mar 1;28(3):270-7. Doi: [10.1016/j.numecd.2017.10.028](https://doi.org/10.1016/j.numecd.2017.10.028)
7. Molina B, Del Carmen M, Cunha RDS, Herkenhoff LF, Mill JG. Hypertension and salt intake in an urban population. Rev Saúde Pública. 2003 Oct;37(6):743-50. Doi: <http://dx.doi.org/10.1590/S0034-89102003000600009>
8. Estima CDCP, Philippi ST, Alvarenga MDS. Fatores determinantes de consumo alimentar: por que os indivíduos comem o que comem? Rev Bras Nutr Clín. 2009 Nov; 24(4):263-8. Uri: producao.usp.br/handle/BDPI/14114
9. Jomori MM, Proença RPC, Calvo MCM. Determinantes de escolha alimentar. Food choice factors. Rev Nutr. 2008 Jan/Feb; 21(1):63-73. Doi: [10.1590/S1415-52732008000100007](https://doi.org/10.1590/S1415-52732008000100007)
10. Brazil JM, Milagres MP, Lima ER, Pinto CF, Santos G, Brandão WB, et al. Healthy food and its influence on consumption: Explicit and implicit attitudes. Int Arch Med. 2016 Sept 15;9. Doi: [10.3823/2108](https://doi.org/10.3823/2108).
11. Piovesana PD, Sampaio KD, Gallani MC. Association between taste sensitivity and self-reported and objective measures of salt intake among hypertensive and normotensive individuals. ISRN Nutr. 2012 Oct 24;2013. Doi: [10.5402/2013/301213](https://doi.org/10.5402/2013/301213)
12. Vollmer WM, Sacks FM, Ard J, Appel LJ, Bray GA, Simons-Morton DG, et al. Effects of diet and sodium intake on blood pressure: subgroup analysis of the DASH-sodium trial. Ann Inter Med. 2001 Dec;135(12):1019-28. Doi: [10.7326/0003-4819-135-12-200112180-00005](https://doi.org/10.7326/0003-4819-135-12-200112180-00005)
13. Arguelles J, Diaz JJ, Malaga I, Perillan C, Costales M, Vijande M. Sodium taste threshold in children and its relationship to blood pressure. Braz J Med Biol Res. 2007 May; 40(5):721-6. Doi: [10.1590/S0100-879X2007000500017](https://doi.org/10.1590/S0100-879X2007000500017)
14. Mente A, O'Donnell MJ, Rangarajan S, McQueen MJ, Poirier P, Wielgosz A, et al. Association of urinary sodium and potassium excretion with blood pressure. N Engl J Med. 2014 Aug;371(7):601-11. Doi: [10.1056/NEJMoa1311989](https://doi.org/10.1056/NEJMoa1311989)
15. Piovesana PM, Gallani MCBJ, Sampaio KL. Review: Methodologies for the analysis of taste sensitivity to salt. Braz J Food Technol. 2012 Sept; 15(3):182-90. Doi: [10.1590/S1981-67232012005000013](https://doi.org/10.1590/S1981-67232012005000013)

16. Dias VR, Brazil JM, Almeida JAR, Silva CS, Milagres MP. Evaluation of the sensory perception of sweet taste in people with Diabetes Mellitus type 2. *Rev RENE* [Internet]. 2016 July/Aug [cited 2017 out 04];17(4):483-9. Doi:
17. Silva CS, Dias VR, Almeida JA, Brazil JM, Santos RA, Milagres MP. Effect of heavy consumption of alcoholic beverages on the perception of sweet and salty taste. *Alcohol Alcohol*. 2015 Oct 13;51(3):302-6. Doi: [10.1093/alcalc/agt116](https://doi.org/10.1093/alcalc/agt116)
18. Almeida JAR, Brazil JM, Matos TB, Silva LA, Milagres MP. Study of the alteration of gustatory perception in users of antidepressant drugs. *Mundo Saúde*. 2017 Apr; 41(2):170-9. Doi: [10.15343/0104-7809.20174102170179](https://doi.org/10.15343/0104-7809.20174102170179)
19. Spritzer N. Limiares gustativos ao sal em hipertensos. *Arq Bras Cardiol*. 1985 Mar;44(3):151-5.
20. Mojet J, Christ-Hazelhof E, Heidema J. Taste perception with age: generic or specific losses in threshold sensitivity to the five basic tastes?. *Chem Senses*. 2001 Sept;26(7):854-60. Doi: [10.1093/chemse/26.7.845](https://doi.org/10.1093/chemse/26.7.845)
21. Pellegrini G, Vasconcelos RBV, Dias ICG. The perception of salty taste in subjects with or with no nasal obstruction. *Rev CEFAC* [Internet]. 2005 July/Sept [cited 2017 Oct 04];7(3):311-7. Available from: <http://www.redalyc.org/html/1693/169320510006/>
22. Amen FM. Salty taste threshold in hypertensive patients taking certain types of anti-hypertensive medication compare to healthy individuals. *J Interdiscipl Med Dent Sci*. 2015 July; 3(184):2. Doi: [10.4172/2376-032X.1000184](https://doi.org/10.4172/2376-032X.1000184)
23. Suliburska J, Duda G, Pupek-Musialik D. The influence of hypotensive drugs on the taste sensitivity in patients with primary hypertension. *Acta Pol Pharm*. 2012 Jan/Feb;69(1):121-7. PMID: [22574515](https://pubmed.ncbi.nlm.nih.gov/22574515/)
24. Olayemi SO, Mabadeje AF. Comparative study of salt taste threshold of hypertensives, their normotensive relatives and non-relatives. *Niger Postgrad Med J*. 2003 June;10:96-8. PMID: [14567044](https://pubmed.ncbi.nlm.nih.gov/14567044/)
25. Associação Brasileira de Normas Técnicas. NBR 12806: Análise sensorial de alimentos e bebidas-terminologia. Rio de Janeiro: ABNT; 1993.
26. International Organization for Standardization. ISO 13301: 2018. Sensory analysis. Methodology. General guidance for measuring odour, flavour and taste detection thresholds by a three-alternative forced-choice (3-AFC) procedure. In: ISO

- International Standard. N° 13301/International Organization for Standardization [Internet]. Geneva: ISO; 2002 [cited 2018 June 15]. Available from: <https://www.iso.org/standard/68901.html>
27. Karppanen H, Mervaala E. Sodium intake and hypertension. *Prog Cardiovasc Dis*. 2006 Sept/Oct;49(2):59-75. Doi: [10.1016/j.pcad.2006.07.001](https://doi.org/10.1016/j.pcad.2006.07.001)
28. Graudal NA, Hubeck-Graudal T, Jürgens G. Effects of low-sodium diet vs. high-sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride. *Cochrane Database Syst Rev*; 2012 Oct 1;25(1):CD004022.. Doi: [10.1016/j.pcad.2006.07.001](https://doi.org/10.1016/j.pcad.2006.07.001)
29. O'donnell M, Mente A, Rangarajan S, McQueen MJ, Wang X, Liu L, et al. Urinary sodium and potassium excretion, mortality, and cardiovascular events. *N Engl J Med*. 2014 Aug 14;(371):612-623. Doi: [10.1056/NEJMoa1311889](https://doi.org/10.1056/NEJMoa1311889)
30. Yarmolinsky DA, Zuker CS, Ryba NJ. Common sense about taste: from mammals to insects. *Cell*. 2009 Oct 16;139(2):234-244. Doi: [10.1016/j.cell.2009.10.001](https://doi.org/10.1016/j.cell.2009.10.001)

Submission: 2018/05/23

Accepted: 2019/01/11

Publishing: 2019/02/01

Corresponding Address

Evely Rocha Lima

Rua Nossa Senhora do Perpétuo Socorro, 203

Bairro Jequiezinho

CEP: 45208-097 – Jequié (BA), Brazil