

Evaluation of Taste Perception of Oncological Patients: Relationship with Personal and Clinical Variables and Comparison with a Control Group

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Avaliação da Percepção do Paladar de Pacientes Oncológicos: Relação com Variáveis Pessoais e Clínicas e Comparação com um Grupo Controle

Evaluación de la Percepción del Sabor de Pacientes Oncológicos: Relación con Variables Personales y Clínicas y Comparación con un Grupo de Control

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ABSTRACT

Introduction: Antineoplastic treatment can cause side effects that impair the patients' food intake and nutritional status. **Objective:** To evaluate the taste perception in patients undergoing cancer treatment, to relate it to personal and clinical variables and to compare with taste perception in healthy individuals. **Method:** Cross-sectional study with 50 individuals undergoing cancer treatment and another 50 individuals in the control group. To assess taste perception, participants received food samples and were asked about sweet, bitter, salty and sour flavors. The intensity of the flavor was assessed using a scale from 1 to 5. **Results:** Patients undergoing cancer treatment perceived the flavors of the following foods more strongly: *dulce de leite* (4.48±1.0 vs. 3.78±0.9; p<0.05), guava (4.10±1.0 vs. 3.52±0.9; p<0.05), lemon juice (4.42±0.9 vs. 2.86±1.0; p<0.05), passion fruit juice (3.76±1.2 vs. 2.56±1.0; p<0.05) and coffee (4.42±0.8 vs. 3.14±0.9; p<0.05). The foods: cassava starch, natural yogurt, arugula and chicory were perceived with less intensity when compared to the control group. Among the four flavor categories evaluated, the foods in the salty group were the ones that least differed in terms of the taste perception and sour and bitter foods were perceived more distinctly between the groups. **Conclusion:** The present study is pioneer in evaluating the taste perception using food, instead of standardized solutions, and through this technique, significant differences were identified in the intensity of taste perception of individuals undergoing cancer treatment.

Key words: Neoplasms; Medical Oncology; Antineoplastic Agents/adverse effects; Taste; Dysgeusia.

RESUMO

Introdução: O tratamento antineoplásico pode causar efeitos colaterais que prejudicam a ingestão alimentar e o estado nutricional dos pacientes. **Objetivo:** Avaliar a percepção do paladar de pacientes em tratamento oncológico, relacioná-la com as variáveis pessoais e clínicas e compará-la com a percepção do paladar de indivíduos saudáveis. **Método:** Trata-se de um estudo transversal com 50 indivíduos em tratamento oncológico e outros 50 indivíduos do grupo controle. Para avaliar a percepção do paladar, os participantes receberam amostras de alimentos e foram questionados quanto aos sabores doce, amargo, salgado e azedo. A intensidade do sabor foi avaliada por meio de uma escala de 1 a 5. **Resultados:** Os pacientes em tratamento oncológico perceberam os sabores dos seguintes alimentos de maneira mais acentuada: doce de leite (4,48±1,0 vs. 3,78±0,9; p<0,05), goiabada (4,10±1,0 vs. 3,52±0,9; p<0,05), suco de limão (4,42±0,9 vs. 2,86±1,0; p<0,05), suco de maracujá (3,76±1,2 vs. 2,56±1,0; p<0,05) e café (4,42±0,8 vs. 3,14±0,9; p<0,05). Já os alimentos: biscoito de polvilho, iogurte natural, rúcula e chicória foram percebidos com menor intensidade quando comparados ao grupo controle. Entre as quatro categorias de sabor avaliadas, os alimentos do grupo salgado foram os que menos se diferenciaram quanto à percepção do paladar e os alimentos azedos e amargos foram percebidos de forma mais distinta entre os grupos. **Conclusão:** O presente estudo é pioneiro em avaliar a percepção do paladar utilizando alimentos, ao invés de soluções padronizadas; e, por meio dessa técnica, identificaram-se diferenças significativas na intensidade da percepção do paladar dos indivíduos em tratamento oncológico.

Palavras-chave: Neoplasias; Oncologia; Antineoplásicos/efeitos adversos; Paladar; Disgeusia.

RESUMEN

Introducción: El tratamiento antineoplásico puede causar efectos secundarios que perjudican la ingesta de alimentos y el estado nutricional de los pacientes. **Objetivo:** Evaluar la percepción del gusto en pacientes sometidos a tratamiento contra el cáncer, relacionarlo con variables personales y clínicas y compararlo con la percepción del gusto en individuos sanos. **Método:** Este es un estudio transversal con 50 individuos en tratamiento contra el cáncer y otros 50 individuos en el grupo de control. Para evaluar la percepción del sabor, los participantes recibieron las muestras de alimentos y se les preguntó sobre los sabores dulces, amargos, salados y agrios. La intensidad del sabor se evaluó usando una escala del 1 al 5. **Resultados:** Los pacientes en tratamiento contra el cáncer percibieron los sabores de los siguientes alimentos con más fuerza: dulce de leche (4,48±1,0 vs. 3,78±0,9; p<0,05), guayaba (4,10±1,0 vs. 3,52±0,9; p<0,05), jugo de limón (4,42±0,9 vs. 2,86±1,0; p<0,05), jugo de maracujá (3,76±1,2 vs. 2,56±1,0; p<0,05) y café (4,42±0,8 vs. 3,14±0,9; p<0,05). Los alimentos: galletas de almidón, yogur, rúcula y achicoria se percibieron con menos intensidad en comparación con el grupo de control. Entre los sabores, los alimentos salados fueron los que menos diferían y los alimentos amargos y amargos se percibieron más claramente entre los grupos. **Conclusión:** El presente estudio es pionero en evaluar la percepción del gusto utilizando alimentos, en lugar de soluciones estandarizadas, y identificó diferencias significativas en la intensidad de la percepción del gusto en individuos en tratamiento contra el cáncer.

Palabras clave: Neoplasias; Oncología Médica; Antineoplásicos/efectos adversos; Gusto; Disgeusia.

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INTRODUCTION

Every year, nearly 12.7 billion persons are diagnosed with cancer. Estimates indicate that until 2030, 1.7 million new cases of the disease in Latin America and Caribbean will occur¹. In Brazil, the projection for each year of the triennium 2020-2022 is 625 thousand new cases of malignant neoplasms².

Cancer is the abnormal growth of cells and due to this, it is called malignant neoplasm too. Said cell growth can partially or fully evade the organism control, invading tissues and organs and causing aggressive effects³ to the patient. It is a NCD – non-communicable disease whose epidemiologic evolution is associated to factors like urbanization process, industrialization, alcoholic beverages use, physical inactivity, inappropriate nourishment, tobacco use and other environmental factors⁴.

Malignant neoplasms treatment are surgery, radiotherapy, and chemotherapy whether associated or not. While surgery consists in the excision of the tumor mass, radiotherapy is a method capable of eliminating tumor cells through ionizing radiation applied directly at the tumor site. Chemotherapy is a modality of treatment involving the use of cytotoxic substances administered intravenously and can be classified according to its finality⁵. Further to the objective of reaching malignant cells, chemotherapy affects normal cells too and causes several side effects compromising the patient quality of life as nausea, vomit, alopecia, esophagus lesion, hydroelectrolytic imbalance and taste change. The later known as dysgeusia affects patient's food intake and collaborates for the deterioration of the nutritional status^{6,7}.

It is known that cancer affects older persons mostly, a period of life where the nutritional status can be fragile due to taste perception changes^{8,9} too. The decline of taste papillae and even digestive enzymes eventually increase dysgeusia and compromise food intake⁹. However, not only older ill individuals suffer with dysgeusia.

Investigators suggest different mechanisms that can influence the taste perception of the patient in oncologic treatment, starting with the inflammation characterized by cytokines that modify not only the taste, but olfactory sensitiveness. The disorder of the nutrient zinc is also indicated as facilitator of taste decrease, and xerostomia as well, which is the reduction of salivation provoked by the oncologic treatment too. The antineoplastic measures in themselves lead to cell apoptosis and contribute to this condition¹⁰.

Acknowledging that all these causes of dysgeusia will impact the food intake, investigators have been studying the taste of oncologic patients. Pugnaroni et

al.¹¹ investigated the change of perception of the flavors salty, sweet, sour, and bitter using solutions in different concentrations. The authors concluded that there was significant difference in taste perception among the group of oncologic patients and control group¹¹.

So far, studies investigating with the food itself and not basic flavors solutions are unknown. Therefore, the current study has the objective of evaluating the perception of patients' taste in oncologic treatment, associate it with clinical and anthropometric variables and compare with taste perception of healthy individuals.

METHOD

This study was conducted with patients in oncologic treatment at the Cancer Hospital of the Franca "Santa Casa de Misericórdia" Complex from August to December 2019, upon the Institutional Review Board approval number CAAE 17466319.8.0000.5438 and registered at the Brazilian clinical trial registry RBR-94857q.

Intervention study with 50 individuals enrolled who met the following inclusion criteria: age equal or older than 18 years, in oncologic treatment, able to feed orally who signed the Informed Consent Form (ICF), agreeing to join the study. The exclusion criteria were: tobacco users or neoplasm in head and neck.

The control group consisted of other 50 individuals enrolled among the study's sponsoring university after verbal invitation. The inclusion criteria were: healthy, non-smokers individuals who signed the Informed Consent Form. The exclusion criterion for this group was limited to tobacco use. These individuals were enrolled after the intervention with the oncologic patients in order to pair the groups regarding the characteristics of gender and age.

The established number of participants was meant to reach more significant results, since it would not be possible to select patients with only one type of neoplasm or using one medication alone to homogenize the sample.

In the first meeting with the investigator the oncologic patients were given a food questionnaire which helped to know the former and current nourishment habits, preference of food consistency, aversions, and intolerances. Clinical data as medical diagnosis, type of neoplasm, medications and time of treatment were gathered from the medical chart. In addition to the clinical data, an anthropometric evaluation was carried out with weight, height, and calf (CC), waist and arm circumference (AC).

Once the study population was described, the intervention in the chemotherapy room of the service was initiated. The patients were asked initially to mouth wash with water twice to clean the oral cavity. Next, they received food samples and were asked about the perception

of flavors sweet, bitter, salty, and sour (in that order). For this, 5 grams or 5 mL of three food of each one of the four flavors were used. The sweet food were: dulce *de leche* (1), guava paste (2) and honey (3); the bitter: arugula (1), chicory (2) and coffee (3); the salty: salty cracker (1), starch biscuit (2) and pitless olive (3); and sour: lemon juice (1), passion fruit juice (2) and whole natural yogurt (3). The investigators chosen the foods, considering they are part of the Brazilian population feeding culture and easily accessible.

The intensity of taste was evaluated through a non-validated scale from 1 to 5, being 1 the minimum intensity and 5, the maximum intensity. In-between the evaluation of each sample, water wash mouth was performed with the purpose of not tarnishing the perception of the taste of the next food. Control group underwent the same intervention.

Descriptive statistics was performed through values of mean and standard deviation. Komogorov-Smirnov test was used for the normality of the data. The test t of Student was utilized to verify the difference between the two study groups. The analysis of variance (ANOVA) with Bonferroni *post hoc* was used to identify differences of the scale of intensity among three foods of the same group. SPSS version 20 and level of significance of $p < 0.05$ were used for all the analyzes.

RESULTS

50 patients in oncologic treatment and 50 healthy individuals formed the control group joined the study. The mean age of the study participants was 57.8 ± 12.0 years for oncologic patients and 58.1 ± 12.6 for control group.

Among the individuals in oncologic treatment, breast cancer was predominant in women and large intestine in men. All of them were in chemotherapy and ten submitted to radiotherapy too in sites other than head and neck. There was no association between the tumor site and antineoplastic treatments with taste perception.

The other personal and nutritional characteristics of the participants are shown in Table 1.

Statistical difference between individuals in oncologic treatment and control group was found for the variables: Body Mass Index – BMI (25.9 ± 4.5 vs. 28.1 ± 5.6 ; $p < 0.05$), CC (34.0 ± 3.5 vs. 37.8 ± 4.2 ; $p < 0.01$) and AC (28.0 ± 3.6 vs. 31.8 ± 4.8 ; $p < 0.01$). However, there was no association among the variables of nutritional status and perception of taste of patients in oncologic treatment.

Table 2 shows the intensity of taste patients and control group perceived in each food.

Among the four categories of flavor evaluated, the salty food group had less differences regarding taste

perception, while sour and bitter food were perceived more differently between control group and patients in oncologic treatment.

Of the 12 food tasted, the patients in oncologic treatment evaluated the flavor of ten at the highest intensity possible.

When the differences were evaluated among food of the same category, the control group perceived the sweet flavor of honey significantly more intense than the sweet flavor of the dulce *de leche* and guava paste. This did not occur with the group of patients in treatment, that is, the oncologic patients did not feel the difference of intensity of the flavor sweet among honey, dulce *de leche* and guava paste.

Both groups perceived differently the intensity of salty flavor of salty cracker, starch biscuit and olives, the latter was felt as the saltier.

Sour food group was the only one with statistically significant difference in the perception of taste among the two groups and for all the comparisons, the control group concluded yogurt was the sourer food and the patients in treatment, as the least sour. Curiously, among the bitter group, the control group classified coffee as the less bitter and oncologic patients, the bitterest.

DISCUSSION

The present study concluded that most of the oncologic patients in treatment were females and, in this group, breast cancer was the most frequent neoplasm. These data corroborate the estimate published by the National Cancer Institute José Alencar Gomes da Silva (INCA), showing that breast cancer continues to be the most frequent in women².

For males, the findings of this study are opposed to the national estimates, showing prostate cancer as the most frequent in men. The present study revealed that colorectal cancer presented the highest incidence in men, the second most common site, with preview of 41 thousand new cases per year². According to the International Agency for Research on Cancer (IARC)¹², in 2020, more than 1.1 million new cases of colorectal cancer and more than 740 thousand new cases of rectal cancer are anticipated. This institution's projections for 2040 suggest that these figures will increase 60% approximately, which demonstrates the magnitude of this public health problem¹².

Regarding anthropometric evaluation, BMI showed that most of the oncologic patients were overweight in the present study. Miranda et al.¹³, while evaluating a similar population of the oncologic patient of the current survey found higher rate of overweight according to BMI classification in comparison with undernourishment¹³.

Table 1. Demographic and Nutritional Characteristics of the population. Franca (SP), 2019

Variable	Patients (n=50)		Control (n=50)		Total (n=100)	
	N	%	N	%	N	%
Gender						
Female	35	70	35	70	70	70
Male	15	30	15	30	30	30
Age						
29 to 40 years	6	12	6	12	12	12
41 to 59 years	21	42	21	46	42	42
60 to 70 years	14	28	13	22	27	27
71 to 85 years	9	18	10	20	19	19
BMI Adult						
Low weight	2	4	0	0	2	2
Eutrophy	9	18	7	14	16	16
Overweight	16	32	20	40	36	36
BMI Older Adult						
Low weight	5	10	2	4	7	7
Eutrophy	10	20	8	16	18	18
Overweight	8	16	13	26	21	21
AC						
Without risk	19	38	27	54	46	46
With risk	29	58	20	40	49	49
Not classified	2	4	3	6	5	5
CC						
Normal	38	76	47	94	85	85
Abnormal	12	24	3	6	15	15

Captions: BMI: Body Mass Index; AC: Arm Circumference; CC: Calf circumference.

Table 2. Mean and standard deviation values of the intensity of the study patients' perception of sweet, bitter, salty, and sour tastes (n=50). Franca (SP), 2019

Food group	Patients (n=50)	Control (n=50)
Sweet		
1 Dulce de leite	4.48±1.0	3.78±0.9*
2 Guava paste	4.10±1.0	3.52±0.9 ^a
3 Honey	4.40±0.9	4.32±0.8 ^{b c}
Bitter		
1 Arugula	3.64±1.3	4.46±0.9*
2 Chicory	3.00±1.1 ^a	3.86±1.0 ^a
3 Coffee without sugar	4.42±0.8 ^{b c}	3.14±0.9 ^{b c}
Salty		
1 Salty cracker	3.00±1.2	3.42±1.4
2 Starch biscuit	2.46±1.1	3.18±1.0*
3 Olives	4.22±1.1 ^{b c}	4.54±0.9 ^{b c}
Sour		
1 Lemmon juice	4.42±0.9	2.86±1.0*
2 Passion fruit juice	3.76±1.2 ^a	2.56±1.0*
3 Natural yogurt	3.48±1.2 ^b	4.49±0.7 ^{b c}

Note: Difference between patients and control: *p<0.05. Differences within the same group in relation to intensity of taste of the food group sweet, bitter, salty and sour: 1 vs. 2: ^a p<0.05; 1 vs. 3: ^b p<0.05; 2 vs. 3: ^c p<0.05.

This result appears to reflect the status of other individuals of the country and of the control group. According to Vigitel¹⁴ data published in 2020 through a telephone investigation conducted by the Ministry of Health, overweight in Brazil reached 55.4% in 2019.

Regardless of the overweight noticed, the parameters evaluating the lean body mass as AC and CC were inappropriate for some patients of this study, especially when compared to control group. Nutritional inappropriateness, it is worth mentioning, was even greater in older individuals in both groups and this can be associated to muscle depletion of senility itself. Investigators affirmed that, even before depletion occurs, ageing-related loss of muscle mass, called dynapenia is already in place and associates to negative outcomes as functional decline and death¹⁵.

In a multicenter study with individuals in oncologic treatment in more than 42 hospitals in Brazil, scholars stratified them per age range and found that the older had more odds of undernourishment. The study showed yet that gastrointestinal symptoms resulting from treatment side effects were also more frequent in individuals older than 50 years, especially lack of appetite¹⁶.

It is known that side effects of antineoplastic treatment collaborated for the deterioration of the nutritional status, further to the catabolism produced by the disease itself.

Regarding dysgeusia, it can damage the patient's food acceptance during oncologic treatment¹⁰.

The patients in oncologic treatment in the present study perceived the taste of the following food more intensely: *dulce de leite*, guava paste, lemon juice, passion fruit juice and coffee.

Oncologic patients perceived sweet food more intensely, further to being evaluated more uniformly when compared to control group where the intensity of sweet food of the samples had higher variation. Other scholars had already reported the most intense perception chemotherapy patients have of sweet taste. The authors noticed that sweet flavor was significantly perceived at higher level in an investigation using five different intensities of basic flavors, sweet, sour and umami. They showed still that this difference impacted the energetic and nutritional intake of the patients negatively¹⁷.

The patients of the present study perceived starchy biscuit, natural yogurt, arugula, and chicory less intensely when compared to control group.

Two of the salty foods, the salty cracker and the starch biscuit were the only most oncologic patients did not classify with more intense flavor. This result was similar in the control group and may be associated to the taste adapted to high use of sodium. Data of the National Health Survey of 2013¹⁸ showed that the Brazilian population mean sodium intake was over 9 grams per day, exceeding WHO – World Health Organization upper limit¹⁹. In addition, these are processed food Brazilians are increasingly and constantly using²⁰.

In a study that evaluated the acceptance of preparations of patients in cancer treatment, none reported feeling salty flavor while tasting one of the recipes⁷, reinforcing that the taste of these individuals may be actually used to more salty taste similar to other Brazilians.

Among sour and bitter, two foods stood out for presenting totally opposed results among the patients and control groups. While control group classified natural yogurt as the sourest food and sugarless coffee as less bitter, oncologic patients reported the opposite.

The more bitter perception of coffee the patients reported concurs with the findings of a study with oncologic patients whose aim was to evaluate the loss of sensitiveness of taste for the bitter flavor utilizing coffee too. The authors found more sensitiveness for this flavor when compared with sweet and umami²¹.

This study is pioneer in evaluating the perception of taste through food samples. Such characteristic is positive for bringing new elements for the study of dysgeusia in oncologic patients, however, has limitations for not investigating other variables that can impact the perception of taste of these individuals concomitantly

and the interference of the neoplasm site and time of treatment. The lack of standardized tools for the evaluation of taste was another important limitation of the present study.

The authors who evaluated the sensorial alterations of taste and smell before and during the treatment of patients with lung cancer noticed that not only the intensity, but also the characteristics of these changes can modify during the treatment. The investigators affirmed yet that the patients experience these changes individually and their impact depend too of other symptoms, side effects and general life conditions²².

CONCLUSION

The current study identified significant differences in the intensity of the perception of taste in healthy individuals and in oncologic treatment. The tastes perceived with more intensity were sweet, while salty foods were perceived with less intensity. Sour and bitter food were noticed with opposed intensity among patients and individuals of the control group and no association between the clinical and anthropometric variables and the perception of taste was found.

Studies evaluating taste changes in patients in oncologic treatment to minimize the adverse effects of dysgeusia and promote more pleasure and satisfaction while eating to collaborate to the preservation of the nutritional status should be encouraged.

CONTRIBUTIONS

All the authors contributed for the conception and/or study design, collection, analysis and interpretation of the data, wording and critical review and approved the final version to be published.

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DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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