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Food preferences and aversions of patients undergoing chemotherapy, radiotherapy and/or hematopoietic stem cell transplantation

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SUMMARY

Background & aims: This longitudinal, qualitative, descriptive, and exploratory study aimed to identify and understand the food preferences and aversions arising from hematopoietic stem cell transplantation (HSCT), chemotherapy, and/or radiotherapy treatment.

Methods: An open and individual interview was carried out with patients diagnosed with hematological diseases or cancer, submitted to HSCT, chemotherapy, and/or radiotherapy treatment. The participants answered the following questions: "Have you experienced any changes in taste since the beginning of radiotherapy/chemotherapy?"; "Have you experienced any strange taste in your mouth, aversion or preference for a certain food that did not exist before the beginning of radiotherapy/chemotherapy?" The software IRAMUTEQ (R Interface for Multidimensional Analysis of Texts and Questionnaires) version 0.7 alpha 2 was used for textual analysis, with similarity analysis and word cloud.

Results: One hundred and forty six patients were included in the study, 50% (n = 73) female and 73% (n = 50) elderly. The main words reported by the participants in regards to food aversions were "meat", "beef" and "chicken", which are related to dysphagia. Regarding food preferences, the most mentioned words were "fruits", "juices" and "soups", whose consumption was associated with an improvement in gastrointestinal symptoms, especially nausea.

Conclusion: Adjustments in the diet plan based on this information can contribute to a better acceptance of the diet, and clinical and nutritional prognosis.

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1. Introduction

Several factors influence the sensation of taste and the consequent development of food preferences and aversions, such as the use of spices in food preparation, age, diseases such as diabetes and megaloblastic anemia, some medications, inflammatory process, and genetic variations in taste receptors [1–4]. In hospitalized patients, the association of these factors with gastrointestinal symptoms contribute to a change in caloric and protein intake, with a

consequent risk of malnutrition, sarcopenia, and worse prognosis [5–7].

Regarding patients undergoing chemotherapy, radiotherapy, and hematopoietic stem cell transplantation (HSCT), the food preferences and aversions can be determined by psychological stress, pain caused by the tumor and side effects of chemotherapy, radiotherapy, and/or immunosuppressants with repercussion on the gastrointestinal tract [8–10]. Medical treatment can also cause damage to the taste buds and changes in the expression of taste genes, with consequent dysgeusia, ageusia, and metallic or bitter taste [11,12].

Literature data on food preferences and aversions in patients undergoing cancer treatment are based on the quantification of food intake and food remains [5,12]. However, the food consumed

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may not reflect food preferences and aversions since their selection of these foods can be influenced by psychological, genetic, social, and nutritional guidelines factors, provided to individuals aiming at improving symptoms or assisting in the treatment [13]. Thus, an active listening of individuals, with reports and perceptions about food choices, would allow a better understanding of food preferences and aversions, eliminating these biases.

Therefore, the aim of this study is to identify and understand the food preferences and aversions due to HSCT, chemotherapy and/or radiotherapy treatment through the reports and perception of hospitalized patients.

2. Materials and methods

2.1. Sample and research environment

This is a longitudinal, qualitative, descriptive, and exploratory study. The intentional sampling strategy was used. Individuals of both sexes, aged over 20 years, submitted to HSCT, chemotherapy and/or radiotherapy treatment in the three months preceding the research were included.

Participants were admitted to a public or private hospital in Belo Horizonte, Minas Gerais, Brazil, evaluated and daily followed up through the length of hospital stay by properly trained nutritionists, from February to June 2018, and from February to June 2019. The information was recorded on a physical or electronic medical record and then collected for this study. Individuals whose medical records do not present information about food preferences and aversions were excluded from the study, as well as those in palliative care.

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involved in the research were approved by the Human Research Ethics Committees of the Federal University of Viçosa and the Federal University of Minas Gerais (CAAE: 81971618.6.0000.5126; CAAE: 90996418.2.00 00.5153). Data were collected from medical records, so that, it was not necessary to apply the Informed Consent Form.

2.2. Data collection

During the assessment and daily nutritional follow up, an open and individual interview was carried out at the bedside, in a quiet environment and without external noise, with the presence or absence of a companion, according to the patient's desire. The reason for the interview was explained to the participants and they answered daily through the hospital stay, the following questions: "Have you experienced any changes in taste since the beginning of radiotherapy/chemotherapy?"; "Have you experienced any strange taste in your mouth, aversion or preference for a certain food that did not exist before the beginning of radiotherapy/chemotherapy?". Active listening was performed with a maximum of 10 min and the transcription of the information was transcribed in the participant's medical records.

2.3. Statistical analysis

The Consolidated Criteria for Reporting Qualitative Research (COREQ) recommendations for explicit and comprehensive reports of qualitative studies were followed [14].

Data organization and content analysis followed the sequential steps proposed by Bardin (1977), which are: pre-analytical phase, in which the individual's report were organized; exploration of the material, where the data were clustered into two categories (food preferences and food aversions); treatment of results, inference and interpretation [15,16].

The full transcription and double typing of the information present in the physical and electronic medical report were carried out, and to preserve the identity of the participants they were identified according to the number of service and medical record.

The software IRAMUTEQ (R Interface for Multidimensional Analysis of Texts and Questionnaires) version 0.7 alpha 2 was used for textual analysis, with similarity analysis and word cloud. Quantitative analysis was performed using the software SPSS version 20.0 to characterize the sample and compare aversions and food preferences with gastrointestinal symptoms using the chi-square test.

3. Results

One hundred and forty-six patients were included in the study. Among the participants, 50% (n = 73) were female and 73% (n = 50) were elderly. Regarding skin color, 58.9% of the individuals (n = 86) declared themselves to be white, 28.8% (n = 42) brown and 12.3% (n = 18) black. Only 1 individual was illiterate. Among those evaluated, 36.3% (n = 53) had incomplete primary education and 6.8% (n = 10) completed. High school was not completed by 2.1% (n = 3) of the sample and completed by 32.2% (n = 47). With regard to higher education, 2.7% (n = 4) of the research participants did not complete it, and 19.2% (n = 28) completed it. Regarding marital status, 52.1% (n = 76) individuals reported being married, 25.3% (n = 37) being single, 13% (n = 19) were widowed and 9.6% (n = 14) divorced.

The median age was 59 years (IQR: 47–69) and the length of hospital stay was 15 days (IQR: 7–31), with 17.5% (n = 25) progressing to death. Most patients were admitted to the public hospital (67.1%), declared themselves to be white (58.9%) and were married (52.1%). Regarding clinical conditions, 63.7% (n = 93) of the patients were diagnosed with hematological diseases, 11.6% (n = 17) with gastrointestinal tract cancer, and 24.7% (n = 36) with other types of cancer. In regards to treatment, most of the patients (82.2%) underwent chemotherapy (Table 1).

Regarding gastrointestinal symptoms, 26% (n = 38) of the patients had constipation at some point during hospitalization, 8.2% (n = 12) diarrhea, 6.2% (n = 9) vomiting, 13% (n = 19) nausea, 47.9% (n = 70) dysgeusia/ageusia, 6.8% (n = 10) mucositis, 18.5% (n = 27) dysphagia, 18.5% (n = 27) complained pain to chew or swallow food and 56.2% (n = 82) reported dry mouth.

Individuals were asked daily about food preferences and aversions during the application of food records/24 h recall. All patients invited to participate agreed to answer the questions. In all, we obtained 840 responses, a median of 3 (IQR: 1–7) per hospitalized person. The analysis of the patient's reports allowed the identification of the main food preferences and aversions. Some participants also reported their experience with food and main factors related to changes in taste.

Table 1
Clinical and sociodemographic characteristics of the sample (n = 146).

Variable	n	%
Treatment		
Chemotherapy	120	82.2
Chemotherapy and radiotherapy	5	3.4
Radiotherapy	5	3.4
Hematopoietic stem cell transplantation	10	6.9
Chemotherapy and surgery	5	3.4
Chemotherapy, radiotherapy and surgery	1	0.7

Variables expressed in absolute and relative frequency.

3.1. Food aversion

The words “meat”, “beef” and “chicken” were mentioned more frequently when it came to food aversions (Fig. 1). The word “meat”, encompassing pork, beef, and chicken was mentioned 47 times, followed by “chicken” [25], “beef” [22], and “beans” [19].

In qualitative analyze the main causes of meat exclusion were related to swallowing difficulties (dysphagia) reported by patients. The chi-square test also showed a significant difference in aversion to some type of meat between individuals who had or did not have dysphagia ($p = 0.027$), as well as dysgeusia or ageusia ($p = 0.00$). Only one participant associated food aversion with nausea caused by the smell of the preparations, and one with the fear that these foods “feed the cancer”:

“I have an aversion to beef and chicken, because it forms something like a dough in my mouth and it is difficult to swallow” (N105).

“I have an aversion to beef, chicken and pork, because it forms something like a wad in my mouth and it is difficult to swallow” (N128).

“I have an aversion to rice and beans, as well as beef, chicken and pork, because when I eat them, it seems like the meat is itching my mouth” (N167).

“I do not eat beef or chicken, because I was told that these foods feed cancer” (N55).

“In the first three days of chemotherapy I had aversion to beef, chicken and pork, because their smell made me sick” (N197).

The words “sweet” and “food” were mentioned seven times each, the second being followed by the adjectives “seasoned” (mentioned three times), and “salt” (also mentioned three times), and “salt food” was said by individuals as a way of referring to preparations served at lunch and dinner, especially rice (mentioned 14 times) and beans (mentioned 19 times). Regarding seasoning, the participants reported aversions to foods that included pepper, a large amount of salt and garlic, and the second being due to the strong smell exhaled when the thermal dishes were opened.

“I have an aversion to food too seasoned and with strong spices, like pepper” (N169).

“Sweet” and “milk” were also mentioned seven times each, the milk being associated with gastrointestinal symptoms, such as nausea and excessive flatulence.

“I have an aversion to milk, because it tastes sour in my stomach and makes me want to vomit (...)” (N135).



Fig. 1. Word cloud of food aversions reported by patients undergoing chemotherapy, radiotherapy and/or HSCT.

3.2. Food preferences

The words “fruit” and “soup” were mentioned more frequently (16 and 15 times, respectively) when it came to food preferences, followed by “food” [10], which was followed by the adjectives “cold” [6], “fried” [4], “acid” [3], “pasty” [3] and “sweet” [4]. The word “juice” was mentioned nine times, as well as “nausea” (Fig. 2).

The chi-square test do not showed a significant difference in foods preferences with the presence of gastrointestinal symptoms at the time of nutritional assessment. The participants were not asked about the reasons for food preferences and aversions. However, the majority requested that their favorite foods to be included in the menu and justified this choice, often related to the improvement of gastrointestinal symptoms. This fact can be observed in the similarity tree, where “nausea” presented in the participants’ speech was one of the central lexical items (Fig. 3).

In regards to this symptom, it was observed in the patients’ reports during the initial interview and in the requests for diet adjustments that the improvement in nausea and heartburn were related to a preparation popularly known in Brazil as “captain”, often prepared without salt, sugar or spices.

“I like to eat cornmeal porridge without salt and sugar, which is known as “captain. Do you know what it is? You make a cornmeal dumpling with water, like a dough, and then throw it in the boiling water and let it cook until it becomes a thin porridge” (N155).

Acid, salty and bitter/sour foods were also associated with an improvement of this symptom:

“I like to drink sour juices, because they improve nausea” (N002).

“I prefer sour fruits or sour fruit juices, such as passion fruit, lemon, pineapple and orange, and with ice because it improves nausea” (N134).

“I prefer jelly, crackers, sparkling water and salted pumpkin seeds, because salt improves nausea” (N115).

“I prefer natural fruit juices, lettuce and tomato salad with lemon and Coke, because they improve nausea and thirst” (N008).

“I like vegetables, especially broccoli, watercress and chayote” (N165).

Food preferences were also related to the improvement of other symptoms, such as early satiety, inappetence, xerostomia (dry mouth) and odynophagia.

“I prefer soups and broths, because they are easier to swallow and accept, because I feel full” (N01).

“I like to eat soup with a lot of broth, because it improves nausea, and I also like to eat bitter foods, such as scarlet eggplant and



Fig. 2. Word cloud of food preferences reported by patients undergoing chemotherapy, radiotherapy and/or HSCT.

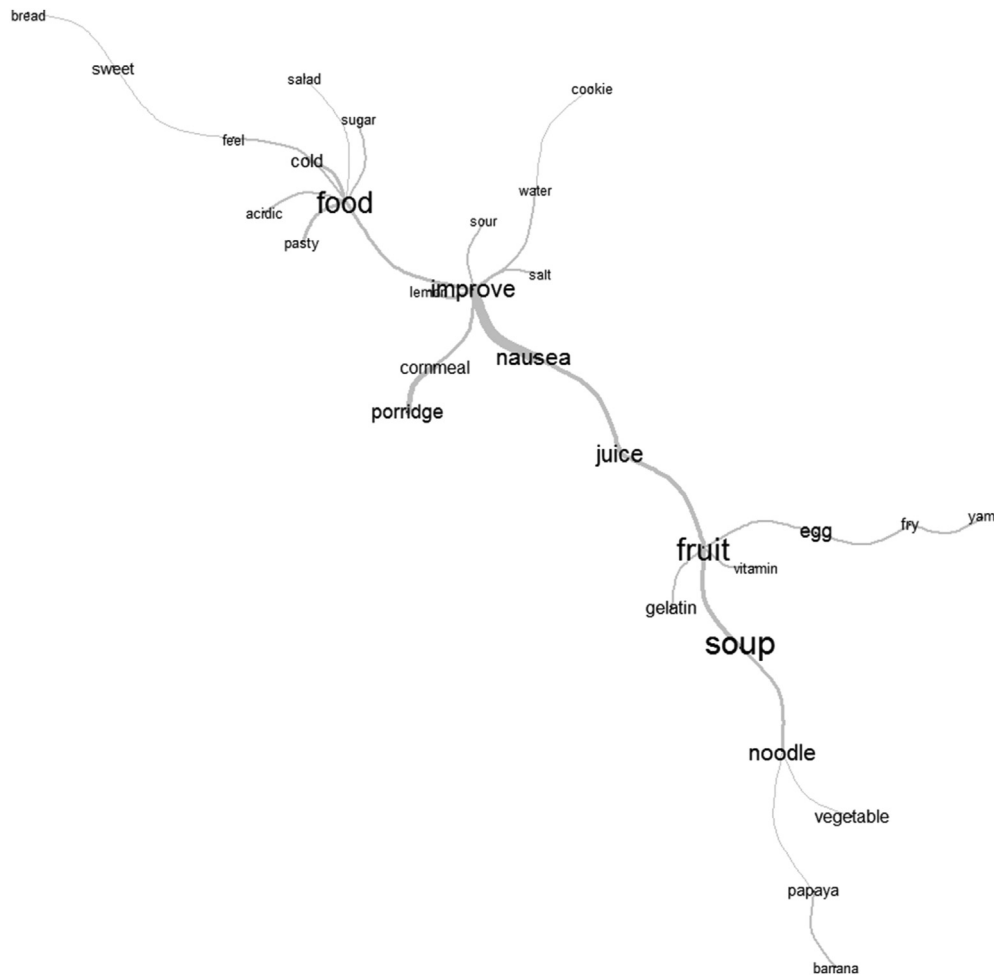


Fig. 3. Similarity tree of food preferences reported by patients undergoing chemotherapy, radiotherapy and/or HSCT.

chicory, because they improve my appetite, and I also like to eat cornmeal porridge without salt and sugar" (N153).

"I prefer to eat yogurt and starch biscuit, because they improve diarrhea. I also prefer soups and broths because of the pain to swallow" (N105).

"I prefer cold and icy liquids, because of the oropharyngeal candidiasis" (N187).

"I prefer jelly, because I can swallow it without chewing" (N169).

4. Discussion

In the present study, it was observed that gastrointestinal symptoms, one of the main side effects of the treatment of hematological diseases or cancer, influence food preferences and aversion, since the participants noticed that some types of food might prevent or relieve the symptoms. Quantitative and qualitative analyzes found similar results in relation to gastrointestinal symptoms associated with food aversions. However, the same did not happen with food preferences. This finding can be justified by the fact that the first analysis considered only the presence of gastrointestinal symptoms at the time of nutritional assessment, and not food consumption for their prevention. In addition, we observed in the speech of patients that past experiences, in other

hospitalizations or other cycles of chemotherapy/radiotherapy, also influence the food selection in the current hospitalization, with a focus on the prevention of symptoms. Preferences for juices, soups, pasty and icy foods were reported, which are indicated in case of nausea, dry mouth and mucositis [17]. Galindo et al. (2017) found similar results in their study with cancer patients, identifying a prevalence of changes in appetite of 61.7%, the main complaints being anorexia and early satiety [18].

Marinho et al. (2017) also observed the preference for fruits and fruit juices in their study with women with breast cancer undergoing chemotherapy [19]. A possible explanation for these preferences is due to the presence of vitamin B6 (pyridoxine) in these foods, which can help to improve nausea and vomiting. Studies on this topic that were carried out with pregnant women, pointed out that vitamin B6, present in antiemetic drugs, as well as in vegetables and fruits, such as spinach and bananas, acts in the synthesis of neurotransmitters, whose deficiency can induce nausea and vomiting symptoms [20–23].

Some patients reported a preference for sour, bitter, and citrus foods, such as vegetables, brassicas, lemon and orange juice. These foods stimulate the release of gastrointestinal and pancreatic secretions that assist in the digestion process, preventing or improving nausea and early satiety [24].

Animal protein-based food was the greatest aversion to the participants. Similar results were found in the study by Prockmann et al. (2015), who evaluated food rejection for 32 individuals with

lymphoma and leukemia, undergoing chemotherapy cycles, with meat (beef, pork, chicken and fish) accepted by 63% of the participants [5]. A possible explanation for this aversion would be the alterations in the gene expression of the taste receptors caused by radiotherapy and chemotherapy. In another study with 21 patients undergoing chemotherapy for head and neck cancer, Tsutsumi et al. (2016), observed the influence of treatment on the temporary reduction in messenger RNA (mRNA) levels of type 1 number 1 and 3 taste receptors (T1R1/T1R3), with consequent reduction in perception of the umami flavor [25]. This may justify the aversion to meat and the reason why some patients reported not being able to eat this food, because it formed something like a “wad” or a “dough” in the mouth [26]. Another possible explanation would be xerostomia (dry mouth), since saliva contributes to the beginning of the digestion process and the consequent interaction of nutrients with taste receptors [3].

Surprisingly, the aversion to chicken was mentioned more often than beef. In practice, it was observed that since it is a meat with less economic expenditure and fat content, it is offered more frequently in the hospital environment, with consequent complaints by patients of the monotony of the menu, however varied they may be forms of presentation and preparation. Furthermore, because it has a lower fat content, chicken is a drier meat, another complaint that has been heard in practice, what makes swallowing difficult, especially in those patients with xerostomia.

Despite the aversion to meat becoming a concern of inadequate protein intake, the insertion in the diet plan of vegetable protein-based food, such as soybeans, legume, seeds and whole grains allows this adaptation [27]. The latest survey (2019) carried out by Vigitel (Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey) pointed to a worsening of time in the consumption of beans, with only 59.7% of respondents consuming this food in 5 or more days of the week. However, knowledge of hospital gastronomy, with the development of different recipes with legumes, can contribute to adherence to the proposed diet [28].

Some hospitals adopt the neutropenic diet as protocol for preventing infections in patients with neutropenia resulting from immunosuppressive treatment [29,30]. Although there is no standardization regarding this diet, most institutions do not include raw fruits and vegetables, due to the risk of contamination by pathogens. However, these foods are odorless and sources of micronutrients that assist in the recovery process. Raw fruits and juices make up the main food preferences reported by the patients in the present study, being associated with the improvement of gastrointestinal symptoms, which can impact the best clinical prognosis. In addition, it is worth mentioning that the increase in the consumption of fruits and vegetables has been observed since 2006 in the Brazilian population [28].

Recent evidence does not support the benefits of the neutropenic diet in reducing infections and mortality, but demonstrate that it would increase not only the risk of infections, but also of graft-versus-host disease (GvHD) and changes in hematopoiesis, which can be justified by the use of antibiotics and reduced intake of polysaccharides present in fruits and vegetables, with consequent dysbiosis [31–34].

This is the first study to assess food preferences and aversions through reports of patients undergoing chemotherapy, radiotherapy and/or HSCT. Mechanism were adopted to guarantee the quality and reliability of the information, avoiding bias. COREQ recommendations [14] were followed and carried out by professionals with practical experiences in nutritional support for this group of patients, which allowed the identification of patients' perceptions, who deserved to be explored and the establishment of the best way to approach them, with a guiding, clear question that was easy to understand. Thus, the

present study provides support for health professionals to update their therapeutic plans, develop menus and eating plans, consistent with food preferences and aversions commonly presented by patients undergoing HSCT, chemotherapy and/or radiotherapy treatment, thus contributing to a better quality of life, nutritional status, response to treatment, and clinical prognosis [11,35].

The present study aimed to evaluate the presence of food preferences and aversions in individuals hospitalized for cancer treatment, regardless of the medication used or the location of the tumor. A limitation was the analysis of the presence of food preferences and aversions throughout the entire hospitalization, without relating the appearance of these preferences and aversions to the length of stay and the treatment phase.

5. Conclusion

The gastrointestinal symptoms influence food preferences and aversions of patients undergoing hematopoietic stem cell transplantation (HSCT), chemotherapy and/or radiotherapy treatment. Meat was reported as the main food aversion, and the food preferences were fruits, juices and soups. The elaboration of a personalized food plan, which prioritizes the supply of the most preferred foods and that substitute meat with foods with similar nutritional value, can contribute to a better acceptance of the diet and quality of life, positively influencing the response to treatment and clinical prognosis.

Statement of authorship

JVH collected and analyzed the data, interpreted the results, and wrote the article. The first author and LOP developed the research project and together with CAO and BSF collected the data. COBR and HHMH contributed to the design of the project, analysis and interpretation of the data, COBR being responsible for the research. All authors performed a critical review of the relevant intellectual content, approved the final version of the present work and agree to assume responsibility for all aspects of the work.

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Declaration of competing interest

The corresponding author states, on behalf of all authors, that there is no conflict of interest.

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