



Taste Alteration in Cancer Patients Receiving Chemotherapy: A Cross-Sectional Study

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OBJECTIVE

This study aimed to investigate nutrition in cancer patients, chemotherapy-induced taste alterations and the factors affecting these taste alterations.

METHODS

This study was planned as a cross-sectional study. Patients who had received chemotherapy at least once and had been on chemotherapy for the last 7-10 days (n=112) were included in this study. The data were collected using the Patient-Generated Subjective Global Assessment, the National Cancer Institute's Common Terminology Criteria for Adverse Events and the Chemotherapy-induced Taste Alteration Scale (CiTAS).

RESULTS

The CiTAS score was higher in female cancer patients. Patients with nausea 2.19 (SD=1.00) and vomiting 3.13 (SD=1.21) had higher scores on the taste disorder subscale of the CiTAS, while patients with vomiting 3.00 (SD=1.42) had higher scores on the general taste alterations subscale (p<0.05). Patients with constipation received high scores on the subscales of reduction in intake of the basic tastes, taste disorder, and general taste alterations 2.50 (SD=1.27) (p<0.05). Patients with a lack of appetite obtained high scores on the subscales of reduction in the intake of the basic tastes, taste disorder, phantoguesia, parageusia, and general taste alterations 2.64 (SD=1.29) (p<0.05). Mild malnutrition was observed in 24.6% of the patients.

CONCLUSION

This study revealed that taste alteration was higher in female and early-stage patients and more severe in patients with nausea, vomiting, constipation, and mucositis. Taste alteration was found to be greater in patients with poor nutritional status.

Keywords: Chemotherapy; dysgeusia; mucositis; nutrition; symptoms.

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Introduction

Taste alteration is a common side effect in patients receiving systemic chemotherapy.[1] Taste alteration is observed in 55 to 67% of the patients receiving chemotherapy but is mostly ignored as a symptom. Many

chemotherapy drugs commonly used in the treatment of cancer, such as taxane, platinum, adriamycin, and metabolites, cause taste alteration.[2,3]

Chemotherapy-induced taste alterations in cancer patients primarily affect food choice and cause a reduction in food intake. Inadequate food intake regarding

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content and amount causes malnutrition.[1,4,5] Patients with terminal cancer who experienced taste alteration were reported to have lower energy intake and experienced higher weight loss than the patients without taste alteration. Moreover, weight loss, a decrease in muscle mass, and malnutrition intensify chemotherapy-induced symptoms and negatively affect patient outcomes, quality of life, and survival rates.[6,7] In a review of symptoms experienced by cancer patients and their effects on nutrition, chemotherapy-induced taste alterations are reported to reduce caloric intake and cause weight loss leading to protein and vitamin deprivation.[8] Chemotherapy-induced taste alteration results in a decrease in food intake, thus causing weight loss and malnutrition.[9] Two independent studies indicated that chemotherapy-induced taste alteration caused changes in the taste perceptions of sweet, salty, sour and umami tastes, leading to loss of appetite in patients.[10,11]

The unpleasant alteration of taste sensation experienced by patients receiving chemotherapy decreases the quality of their lives.[12] For health care professionals to be able to provide adequate counselling about the taste alteration experienced by their patients, it is necessary to well define the characteristics of this symptom and other related situations. More evidence-based information is required in this regard.[13] The number of studies in Turkey that evaluate chemotherapy-induced taste alteration and nutritional status of cancer patients and related factors is limited. This study was planned to investigate chemotherapy-induced taste alteration in cancer patients and to investigate the factors affecting this side-effect.

Materials and Methods

Participants and Procedure

This study was planned as a cross-sectional study. Patients who were over 18 years old, were literate in Turkish, had received chemotherapy at least once, had been on chemotherapy for the last 7-10 days, and reported taste alteration after receiving chemotherapy was enrolled in this study. However, patients receiving head and neck radiotherapy were not included in this study. The research data were collected from 122 patients who met the research inclusion criteria. After receiving information on the patients who agreed to participate in this study, the data were collected in one session using the face-to-face interview method, between January and June 2016.

Data Collection and Measurements

The research data were collected using the Patient Characteristics Identification Form and the Patient-Generated Subjective Global Assessment (PG-SGA). Oral mucositis was evaluated using the National Cancer Institute's Common Terminology Criteria for Adverse Events version 4.03 (NCI-CTCAE v4.03) and the Chemotherapy-induced Taste Alteration Scale (CiTAS). The form describing patient characteristics consisted of two parts. The first part included patients' sociodemographic characteristics, such as age, gender, marital status, educational status, and income status. The second part consisted of questions regarding cancer patient characteristics, such as the type of cancer, duration of diagnosis, presence or absence of metastasis, chemotherapy regimen, and the number of cures.

The Patient-Generated Subjective Global Assessment (PG-SGA) was used to assess the nutritional status and symptoms of patients. The SGA was completed as described by Detsky et al. (1987), and the scored PG-SGA was completed as described by Ottery (1996). Each patient was classified as well-nourished (SGA A), moderately nourished, or suspected of being malnourished (SGA B) or severely malnourished (SGA C).[14,15] Questions about the symptoms of nausea, vomiting, diarrhea, constipation, lack of appetite, and fatigue that affect patient nutrition were included in the scale.

The National Cancer Institute's Common Terminology Criteria for Adverse Events version 4.03 (NCI-CTCAE v4.03) was used in evaluating oral mucositis. According to this, oral mucositis was scored between grade 0 (none) - grade 5 (death).[16]

The Chemotherapy-induced Taste Alteration Scale (CiTAS) with 18 items and four sub-dimensions was developed by Kano and Kanda.[17] Sözeri and Kutlütürkan (2014) conducted Turkish validity and reliability studies for the scale.[18] The CiTAS is a 5-point Likert type scale. The scale consists of four subscales. The subscale of reduction in intake of basic tastes (2-6 items) is used to assess individuals' perceptions for bitter, sweet, salty, sour, and umami tastes. The taste disorder subscale (13-18 items) evaluates the relationship between changes in taste sensation and nausea/vomiting, change in the sense of smell, difficulty in eating hot food/fatty food/meat, and loss of appetite. The phantogeusia and parageusia subscales (10-12 items) are used to evaluate individuals' phantogeusia and parageusia experiences. The general taste alteration subscale (1, 7-9 items) assesses ageusia, cacogeusia and hypogeusia in patients. The scores obtained from the subscales instead of the total scale score are used in evaluating

the scores received from the scale. The scores obtained from the subscales are calculated by adding the scores received from the subscale items in question and then dividing the obtained total score with the total number of items. The maximum and minimum scores for the subscales are 5 and 1, respectively. An increase in scores on the scale indicates an increase in the severity of the individual's taste alteration and disorder.[17,18] In this study, Cronbach's alpha values for the subscales were found to be 0.86, 0.82, 0.94, and 0.88, respectively.

Data Analysis

Data analysis was performed using SPSS Version 22.0 (IBM Corporation, New York, USA). The Kolmogorov-Smirnov test was used to evaluate the normal distribution of data. Number, percentage, mean, and standard deviation were used for descriptive statistics. Independent samples t-test and one-way ANOVA were used to find out the differences between scale mean scores of independent variables and a p-value <0.05 was considered statistically significant.

Results

Patient Characteristics and Clinical Features

The mean age of the participants in this study was 53.51 (SD=14.15) and 50.8% of them were male, 82.8% were married, 43.4% were primary school graduates, 75.4% were unemployed, and 51.6% had a steady income. In addition, the cancer diagnoses of the patients were breast cancer (24.6%), lung cancer (19.7%) and head and neck cancer (19.7%). The mean duration of the diagnosis was 19.05±26.30 months; 68% of the diagnosis time was one year or less, 77% of the patients had no metastasis, and 41% and 34.4% of the patients were receiving platinum and taxane chemotherapy drugs, respectively. The mean number of chemotherapy cures received by the patients was 3.83 (SD=2.93) and 45.9% of the patients received two chemotherapy cures (Table 1).

The mean body mass index of the patients was 25.97 (SD=4.68), and 43.4% of them were in the range of 18.5 kg/m²-24.95 kg/m². Evaluation of the deterioration of oral mucosa of the patients showed that only 7.4% had grade 1 mucositis, 93.4% did not smoke cigarettes, and 86.1% performed oral care. The nutritional status of patients was assessed according to the SGA evaluation; 75.4% of the patients were well-nourished, while 24.6% were moderately nourished or suspected of being malnourished (Table 1). Chemotherapy-induced symptoms were recorded in 55.7% of the patients, and their

Table 1 Sociodemographic and disease characteristics of cancer patients

Characteristics (n=122)	n (%)	Mean±SD
Age		53.51(14.15)
Under 40	19 (15.6)	
40-59	57 (46.7)	
60 and over	46 (37.7)	
Gender		
Female	60 (49.2)	
Male	62 (50.8)	
Marital status		
Married	101 (82.8)	
Single	21 (17.2)	
Education		
Primary school	53 (43.4)	
Secondary school	32 (26.2)	
University	37 (30.4)	
Working status		
Employed	30 (24.6)	
Unemployed	92 (75.4)	
Monthly income-expense		
Balanced	63 (51.6)	
Partially balanced	35 (28.7)	
Unbalanced	24 (19.7)	
Disease characteristics	n (%)	Mean (SD)
Cancer diagnosis		
Breast	30 (24.6)	
Lung	24 (19.7)	
GIS	16 (13.1)	
Head and neck	24 (19.7)	
Gynecological	7 (5.7)	
Testicular-prostate	8 (6.5)	
Other*	7 (5.7)	
Diagnosis time (years)		19.05 (26.30)
≤1	83 (68.0)	
1-5	29 (23.8)	
6 years and over	10 (8.2)	
Metastasis		
Yes	94 (77.0)	
No	28 (23.0)	
Chemotherapy drugs		
Taxane	42 (34.4)	
Adriamycin	16 (13.1)	
Platinum	50 (41.0)	
Metabolites	11 (9.0)	
Other	3 (2.5)	
Number of chemotherapy cycles		3.83(2.93)
2	56 (45.9)	
3	19 (15.6)	
4	20 (16.4)	
5 and over	27 (22.1)	

nutritional status was affected by nausea (23%), vomiting (4.9%), diarrhea (12.3%), constipation (22.1%), and inappetence (20.5%) (Table 2).

Table 2 Nutritional and symptom status of patients

Features (n=122)	n	%
Nutrition PG-SGA		
A	92	75.4
B	30	24.6
BMI (kg*m ²)		
≤24.9	57	46.8
25-29.9	42	34.4
≥30	23	18.8
Oral mucositis		
Grade 0	113	92.6
Grade 1	9	7.4
Smoker		
Yes	8	6.6
No	114	93.4
Alcohol use		
Yes	3	2.5
No	119	97.5
Oral care		
Yes	105	86.1
No	17	13.9
Symptoms nausea		
Yes	28	23.0
No	94	77.0
Vomiting		
Yes	6	4.9
No	116	95.1
Diarrhea		
Yes	15	12.3
No	107	87.7
Constipation		
Yes	27	22.1
No	95	77.9
Lack of appetite		
Yes	25	20.5
No	97	79.5

A: Well-nourished; B: Moderately or suspected of being malnourished;
*Unknown Primer (5), Sarkom (2).

Characteristics of Taste Alteration

The CiTAS mean scores of the participant cancer patients did not vary based on gender and age ($p>0.05$), but the CiTAS mean scores of female patients were higher than those of male patients. The CiTAS mean score on the taste alteration-induced discomfort subscale received by patients without metastatic cancer (2.19 ± 0.99) was found to be higher compared to the score of the patients with metastasis (1.81 ± 0.82). The CiTAS mean scores on the taste disorder subscale (assessing the relationship between changes in taste sensation and nausea-vomiting, change in smell sensation, difficulty in hot food/fatty food/meat consump-

tion, and loss of appetite) were significantly different between patients with and without metastatic cancer ($p<0.05$). However, the CiTAS mean scores did not vary significantly concerning the type of their chemotherapy regimen ($p>0.05$) (Table 3).

Taste Alteration and Symptoms

No statistically significant differences were found between the CiTAS mean scores of the patients with and without diarrhea and fatigue symptoms ($p>0.05$). The mean score of patients with nausea on the second subscale (taste disorder) of the CiTAS was found to be significantly higher than the score of the patients without nausea. The mean scores of patients with vomiting on the second (taste disorder) and fourth (general taste alterations) subscales of the CiTAS were found to be higher than of those without vomiting ($p<0.05$). The mean scores of patients with constipation on the first (reduction in intake of basic tastes), second (taste disorder) and fourth (general taste alterations) subscales of the CiTAS were found to be higher than of the patients without constipation ($p<0.05$). The mean scores of the patients with lack of appetite on the first (reduction in intake of basic tastes) ($p=0.015$), second (taste disorder) ($p<0.001$), third (phantogeusia and parageusia) ($p<0.001$), and fourth (general taste alterations) ($p<0.001$) subscales of the CiTAS were found to be higher than of those without lack of appetite (Table 4).

Taste Alteration and Mucositis

The mean scores of the patients with oral mucositis on the first (reduction in intake of basic tastes), second (taste disorder), third (phantogeusia and parageusia), and fourth (general taste alterations) subscales of the CiTAS were found to be higher than the patients without oral mucositis; however, only the difference in the second subscale was statistically significant ($p=0.028$) (Table 4).

Taste Alteration and Nutrition

The mean scores of the patients with mild malnutrition on the first (reduction in intake of basic tastes), second (taste disorder), third (phantogeusia and parageusia), and fourth (general taste alterations) subscales of the CiTAS were found to be higher than those of well-nourished patients ($p<0.001$) (Table 4).

Discussion

Treatment-induced taste alteration in cancer patients is also affected by individual and clinical characteristics of the individuals. In the present study, female pa-

Table 3 Differences in the taste scale mean scores by sociodemographic and disease characteristics of cancer patients receiving chemotherapy

	Decline in Basic Taste Mean (SD)	Discomfort Mean (SD)	Phantogeusia and Parageusia Mean (SD)	General Taste Alterations Mean (SD)
Gender				
Female	1.58 (0.82)	1.95 (0.92)	1.93 (1.18)	2.07 (1.19)
Male	1.54 (0.91)	1.84 (0.83)	1.63 (1.05)	1.86 (1.07)
t/P-Value	0.220/0.826	0.717/0.475	1.474/0.143	1.067/0.288
Age				
40 and under	1.48 (0.58)	1.48 (0.78)	1.91 (1.05)	1.86 (0.83)
41-59	1.50 (0.80)	1.50 (0.92)	1.76 (1.15)	1.96 (1.05)
60 and over	1.66 (1.03)	1.66 (0.85)	1.76 (1.14)	2.01 (1.25)
F/P-Value	0.560/0.573	0.787/0.458	0.138/0.871	0.122/0.885
BMI((kg*m ²)				
≤24.9	1.42 (0.73)	1.86 (0.86)	1.68 (1.03)	1.78 (0.96)
25-29.9	1.59 (0.92)	1.83 (0.80)	1.82 (1.24)	2.07 (1.25)
≥30	1.84 (1.02)	2.11 (1.03)	1.97 (1.13)	2.20 (1.06)
F/P-Value	1.976/0.143	0.866/0.423	0.565/0.570	1.517/0.223
Cancer diagnosis				
Breast	1.54 (0.85)	2.10 (1.01)	1.98 (1.23)	2.10 (1.17)
Lung	1.52 (0.94)	1.76 (0.76)	1.97 (1.21)	2.12 (1.13)
GIS	1.42 (0.71)	1.83 (0.67)	1.61 (1.11)	1.71 (0.82)
Head and neck	1.80 (0.72)	2.00 (0.56)	1.90 (0.87)	2.67 (0.89)
Gynecological	1.47 (0.67)	1.47 (0.81)	1.29 (0.45)	1.65 (1.14)
Testicular-prostate	1.54 (0.78)	1.85 (1.01)	1.33 (0.57)	1.32 (0.37)
Other	1.66 (1.03)	2.25 (1.31)	1.33 (0.81)	1.62 (0.97)
F/P-Value	0.300/0.952	0.727/0.649	0.896/0.513	1.311/0.251
Diagnosis time				
≤1 year	1.56 (0.92)	1.99 (0.94)	1.85 (1.18)	1.98 (1.11)
1-5 years	1.62 (0.76)	1.65 (0.54)	1.52 (0.88)	1.96 (1.10)
6 years and over	1.40 (0.69)	1.80 (0.98)	1.96 (1.25)	1.80 (1.03)
F/P-Value	0.236/0.790	1.729/0.182	1.045/0.355	0.129/0.879
Chemotherapy				
Taxane	1.50 (0.77)	1.84 (0.81)	1.57 (0.98)	1.92 (1.12)
Adriamycin	1.68 (0.85)	2.33 (1.16)	2.39 (1.34)	2.25 (1.02)
Platinum	1.58 (1.00)	1.89 (0.85)	1.81 (1.20)	1.97 (1.16)
Metabolites	1.56 (0.71)	1.53 (0.63)	1.63 (0.80)	1.65 (0.67)
F/P Value	0.156/0.960	F=1.536/0.196	1.650/0.166	0.500/0.736
Metastasis				
Yes	1.58 (0.91)	1.81 (0.82)	1.75 (1.10)	1.95 (1.13)
No	14.9 (0.72)	2.19 (0.99)	1.90 (1.19)	2 (0.97)
t/P-Value	0.479/0.632	-2.017/0.043	-0.630/0.530	-0.179/0.858

t= student t-test; F= ANOVA; SD= Standard Deviation.

tients were found to have higher mean scores for taste alterations, such as phantogeusia, parageusia, ageusia, cacogeusia, and hypogeusia. In a study involving patients with solid tumors, no statistically significant difference was found between taste alterations of male and female patients, but female experienced taste alteration twice as much as male patients.[5] Many studies

showed that female cancer patients experienced more taste alteration.[13,19] The taxane chemotherapy regimen was reported to cause taste deterioration in female breast cancer patients.[3] Other previous studies with patients receiving chemotherapy found that female patients experienced more taste deterioration.[2,20,21] However, some studies reported no difference in taste

Table 4 Differences in the taste scale mean scores by symptom status of cancer patients receiving chemotherapy

Symptom	Decline in Basic Taste Mean (SD)	Discomfort Mean (SD)	Phantogeusia and Parageusia Mean (SD)	General Taste Alterations Mean (SD)
Nausea				
Yes	1.59 (1.03)	2.19 (1.00)	2.08 (1.27)	2.08 (1.18)
No	1.55 (0.81)	1.81 (0.82)	1.69 (1.06)	1.93 (1.07)
t/P-Value	0.211/0.833	2.017/0.044	-1.598/0.113	-0.669/0.505
Vomiting				
Yes	1.80 (1.23)	3.13 (1.21)	2.61 (1.42)	3.00 (1.42)
No	1.55 (0.85)	1.83 (0.81)	1.74 (1.09)	1.91 (1.05)
t/P Value	0.685/0.495	3.727/<0.001	-1.858/0.066	2.409/0.017
Diarrhea				
Yes	1.34 (0.63)	1.97 (0.78)	1.48 (0.60)	2.08 (1.01)
No	1.59 (0.89)	1.88 (0.89)	1.82 (1.17)	1.95 (1.1)
t/P-Value	-1.025/0.307	-0.364/0.200	1.096/0.717	-0.436/0.694
Constipation				
Yes	2.00 (1.10)	2.22 (1.90)	2.22 (1.35)	2.50 (1.27)
No	1.43 (1.43)	1.80 (0.85)	1.66 (1.02)	1.81 (0.99)
t/P-Value	-3.119/0.002	2.236/0.027	-2.318/0.022	2.624/0.003
Lack of appetite				
Yes	1.93 (1.11)	2.58 (0.98)	2.48 (1.52)	2.64 (1.29)
No	1.46 (0.77)	1.72 (0.76)	1.60 (0.92)	1.79 (0.97)
t/P-Value	-2.458/0.015	-4.704/0.001	-3.621/0.001	-3.602 /0.001
Nutritional status (PG-SGA)				
A	1.38 (0.68)	1.64 (0.68)	1.57 (0.96)	1.70 (0.91)
B	2.10 (1.13)	2.67 (0.97)	2.44 (1.33)	2.78 (1.22)
t/P-Value	-4.209/0.001	-6.393/0.001	-3.810/0.001	-5.161/0.001
Oral mucositis				
Grade 0	1.54 (0.87)	1.85 (0.84)	1.74 (1.07)	1.92 (1.08)
Grade 1	1.75 (0.87)	2.51 (0.87)	2.25 (1.12)	2.52 (1.96)
t/P-Value	-0.691/0.0491	-2.230/0.028	-1.312/0.192	-1.602/0.112

t= student t-test; SD= Standard Deviation.

sensation between genders.[5,7] Although the reason for the difference in taste alterations by gender is not clearly known, female patients are more sensitive to taste alterations than men.[21,22]

In this study, taste alteration did not vary by age. In a study examining taste alteration in cancer patients after receiving six cures of chemotherapy application, taste alteration was found to be more frequent in young patients. Another study reported that female and young patients experienced more frequent taste alterations.[13]

Taste Alteration and Clinical Features

The present study showed that diagnosis and chemotherapy regimen did not cause significant variations in patient taste alteration. The mean scores of the patients

without metastatic cancer (patients who were in the early stage) on the taste disorder subscale of the CiTAS (which assesses the relationship between changes in taste sensation and nausea-vomiting, change in smell sensation, difficulty in hot food/fatty food/meat consumption, and loss of appetite) were higher than the patients with metastatic cancer. This result suggests that early-stage patients were more susceptible to taste alteration. Previous studies showed variable results compared with the present study. A study on lung cancer patients reported no relationship between taste alteration and cancer type, stage, treatment type and duration.[13] A survey of the patients with different cancer diagnoses showed that most patients experienced taste alteration at the beginning of chemotherapy, and that breast cancer patients experienced more frequent

taste alteration.[2] A study with 184 patients receiving chemotherapy reported that taste alteration was independent of diagnosis and disease history.[23] Moreover, breast and colorectal cancer patients experienced taste alteration; there was no difference between diagnoses regarding symptoms.[14] Patients with breast and gynecological cancer did not show significant differences in taste alteration based on the diagnosis.[4]

Taste Alteration and Symptoms

Chemotherapy-induced nausea is a significant problem in clinical settings, and approximately 50% of the patients experience this disturbing symptom.[24] In the present study, patients with nausea showed a higher taste disorder level than patients without nausea. The mean scores of the patients with vomiting on the general taste alteration and taste disorder subscales were higher than the patients without vomiting. The mean scores of the patients with inappetence on the subscales of taste disorder, phantogeusia and parageusia, and general taste alterations were higher compared with the patients without lack of appetite. Taste alteration may cause loss of appetite, food aversion and intake reduction, and increase the risk of malnutrition.[3] Patients with dysgeusia were reported to have higher nausea and vomiting scores and lower quality of life.[12] Another study reported that taste alteration and vomiting/nausea were related.[2]

In the present study, patients with constipation received higher mean scores on the subscales of reduction in the intake of basic tastes, taste disorder, and general taste alterations than the patients without constipation. The basic tastes subscale and taste disorder subscale evaluate the relationship between changes in taste sensation and nausea-vomiting, change in the sense of smell, difficulty in eating hot food/fatty food/meat, and loss of appetite. High mean scores based on these scales are anticipated in cancer patients, in addition to the accompanying constipation symptoms. Taste alteration was reported to cause loss of appetite. Constipation was reported to be the most common gastrointestinal symptom in terminal stage cancer patients with poor appetite.[25,26]

In the present study, patients had oral mucositis at grade 0 and 1, and patients with oral mucositis of grade 1 had a higher taste disorder level and experienced general taste alterations. Chemotherapy-induced oral mucositis causes deterioration of taste receptors.[1] Patients with oral mucositis are more likely to experience overall taste alterations, and to encounter problems, such as nausea and vomiting, changes in the sense of

smell, difficulty in eating hot food/fatty food/meat, and loss of appetite, due to these alterations. Taste alterations, such as chemotherapy-induced oral mucositis, were found to be related to dysgeusia.[1,27] The present study showed higher taste alterations in patients with nausea, vomiting, loss of appetite and mucositis, corroborating previous studies.

Taste Alteration and Nutrition

In the present study, the mean scores of the patients with mild malnutrition in all subscales of the CiTAS were found to be higher than the patients with good nutritional status. Patients experiencing the taste and smell alterations have been found to have a higher risk of malnutrition, and the taste and smell alterations have also been associated with oral dryness, feeling full quickly, and fatigue.[5] Patients with small extracellular lung cancer, and receiving cisplatin and paclitaxel chemotherapy, reported a loss of appetite with bitterness and unpleasant taste in the mouth[28] The present study corroborates previous studies that indicate a loss of appetite and reduction in food intake in cancer patients who experienced taste alteration.[1,29]

Limitations

The most significant limitation of this study is that the research data have been collected and evaluated using patients' own statements. The empowerment of this evaluation requires experimental measures of taste perception and identification. Another limitation of this study is that this study has been conducted with patients with different diagnoses and different chemotherapy regimens. Due to the various side effects of chemotherapy drugs, studies should be conducted on patients undergoing the same type of chemotherapy and over longer time intervals to strengthen clinical outcomes associated with taste alteration.

Conclusion

This study revealed that taste alteration was higher in female and early-stage patients and more severe in patients with nausea, vomiting, constipation and mucositis. Taste alteration was greater in patients with poor nutritional status. Therefore, continuous evaluation of the chemotherapy-induced taste alterations in cancer patients in oncology clinics, and preventive interventions for symptoms, such as nausea, vomiting, constipation and mucositis, affecting taste alteration might reduce taste alteration in patients and increase the quality of their lives. In consultations with patients

and their relatives in oncology clinics, taste alterations should be considered in the formulation of nutrition programs and preparation of foods for patients.

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