Original Article

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Taste Alteration in Patients Receiving Chemotherapy

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ABSTRACT

Objective: This study is aimed to determine factors that affect conditions of patients receiving chemotherapy in terms of experienced taste alteration.

Materials and Methods: In this descriptive study, 184 patients receiving chemotherapy were included in the sample. Data were collected during the period of December 2013 to May 2014 using "Patient Characteristics Identification Form" and "Chemotherapy-induced Taste Alteration Scale (CiTAS)." The data were analyzed using SPSS 20 (SPSS Inc., Chicago IL, USA) statistical software in terms of number, percentage, Mann-Whitney U test, and Kruskal-Wallis H test.

Results: The mean age of the patients was 55.5±11.8 and 57.1% of them were female. The clinical diagnosis of the patients were most frequently breast cancer (n=46), colorectal cancer (n=45), and lung cancer (n=25). Furthermore, 37.5% of the patients were in clinical stage II; 15.8% of the patients received paclitaxel+herceptin and 14.1% received gemcitabine+cisplatin chemotherapy protocols. Data demonstrated significant differences in mean scores ($p<0.05$) taken from "Decline in Basic Taste" and "Phantogeusia and Parageusia" subscales with patients with or without xerostomia. There were significant differences in the average scores of the subscales between those with and without a sore mouth "Discomfort" and "General taste alterations" ($p<0.05$).

Conclusion: It has been established that patients receiving chemotherapy experience substantial alteration in taste by exposure of different subscales of CiTAS. Analysis of scores collected from different subscales of CiTAS with respect to sociodemographic and pathological differences showed that patients with xerostomia and sore mouth experienced more severe taste alterations.

Keywords: Chemotherapy, taste alteration, nursing

Introduction

Taste alteration is a frequently encountered situation in patients receiving chemotherapy. The rate of incidence of taste alterations varies among patients (1). According to the study by Bernhardson et al., which was conducted with a total of 518 patients diagnosed with different types of cancer, the rate of incidence was 67% (2). The rate of taste alterations in breast cancer patients ranges between 55% and 84% (3, 4). In another study conducted on patients receiving chemotherapy for treatment of breast and gynecological cancers, 16% of the breast cancer patients experienced severe taste alteration, 12.6% experienced moderate taste alteration, and 22% experienced mild taste alteration, whereas 7% of the gynecological cancer patients experienced severe taste alteration, 12.4% patients experienced moderate taste alteration, and 22.5% experienced mild taste alteration due to the chemotherapy (5). The following are the taste alterations observed in the patients:

Hypogeusia: decline in taste sensitivity,

Ageusia: complete lack of taste functions of the tongue,

Parageusia: perversion of the sense of taste,

Cacogeusia: unpleasant taste that does not originate from food or beverage,

Phantogeusia (taste hallucination): continuous abnormal taste in the mouth, usually bitter or metallic, and

Hypergeusia: increase in taste sensitivity (6-8).

Taste alterations frequently encountered in patients receiving chemotherapy have physiological, psychological, and social influences on these individuals. These effects reduce the life quality of the patients (1, 2, 9-11). The taste alteration, adversely affecting the life quality of individuals, should be evaluated in a comprehensive manner for effective and appropriate management of the symptoms. For this purpose, there are many objective and subjective methods available for clinical use (8). The objective methods include all mouth taste test, regional

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taste test, taste recognition test, chemical gustometry, electrogustometry, filter paper disc method, positron emission tomography, and magnetic resonance. The etiology of taste alterations, the condition of experiencing alterations in basic tastes, and the level of taste alteration are determined by these methods (8, 11, 12). In the subjective evaluation of taste alterations, Common Terminology Criteria for Adverse Event v4.0 and Scale of Subjective Total Taste Acuity are used. These subjective evaluation tools evaluate the intensity of taste alteration and their effects on the individual partially (11, 13, 14). The decline in basic taste, general taste alterations, phantogeusia and parageusia, and disorder and taste subscales of the patients are more comprehensively evaluated by "Chemotherapy-induced Taste Alteration Scale (CiTAS)" developed by Kano and Kanda. CiTAS is an easy-to-use and practical measurement tool that does not require too much time. Information obtained using CiTAS can make great contributions to the training/consultancy roles of the nurses regarding symptom controls.

Materials and Methods

The aim of this study is to determine factors that affect conditions of patients receiving chemotherapy in terms of experienced taste alteration. The study was conducted on a total of 184 patients receiving chemotherapy at a university hospital hematology clinic and outpatient chemotherapy unit during the period of December 2013 to May 2014. Written permission was obtained from the Gazi University Medical Faculty Institutional Review Board. The sample selection criteria of the study: age ≥18 years, illiterate, conscious and receiving chemotherapy 7-10 days before the study, experiencing chemotherapy inducted taste alteration, and voluntary participation. Patients receiving radiotherapy with chemotherapy were excluded. "Patient Characteristics Identification Form" and CiTAS were used to obtain the data.

Data collection process: The patients were informed regarding the study before chemotherapy, and their consent was obtained. The data regarding Patient Characteristics Identification Form was obtained by the researcher. CiTAS was filled out by the patients by considering the previous week. The time spent for each data collection tool was 20-25 min.

Patient Characteristics Identification Form comprises 22 questions regarding sociodemographic characteristics and habits of the patients in addition to the disease and treatment.

CiTAS, which is a scale with 18 items and 5 subscales, was developed by Kano and Kanda in 2013. CiTAS is a 5-point Likert-type scale.

1st Subscale (2nd-6th items) Decline in Basic Taste: The condition of sensing the bitter, sweet, salty, sour, and umami taste by individuals is assessed.

2nd Subscale (13th-18th items) Discomfort: The relationship between taste alterations and nausea-vomiting, experiencing alterations in the sense of smell, having difficulty eating hot/oily/meat, and reduced appetite is assessed.

3rd Subscale (10th-12th items) Phantogeusia and Parageusia: The condition of individuals based on their experiences of phantogeusia and parageusia are assessed.

4th Subscale (1st, 7th-9th items) General taste alterations: The condition of individuals regarding their experiences of ageusia, cacogeusia, and hypogeusia is assessed (8).

For the assessment of the scale, scores received from each subscale are evaluated rather than the total score received from the entire scale. The subscale scores are obtained by dividing the number of the items into the sum of scores of those items. The maximum score is 5 points, whereas the minimum score is 1 point that can be received from subscales. The increase in the score shows that the intensity of taste alterations and discomfort are also increased (8).

Statistical analysis

The data obtained were analyzed by SPSS 20 (SPSS Inc., Chicago IL, USA) software package. In the analysis of the data, number and percentage tests were used, whereas Mann-Whitney U test was used for comparisons and Kruskal-Wallis H test was used for comparisons conducted with at least three groups. The relationship between variables was analyzed by Spearman correlation analysis. The significance level was determined as $p<0.05$.

Results

The mean age of the patients was 55.5±11.8 years (minimum=18, maximum=76, n=184); 57.1% of the patients were female. The mean age of female patients was 53.8±12.2 years, whereas it was 57.8±10.8 for male patients. Furthermore, 25% of the patients were diagnosed with breast cancer, whereas 22.8% were diagnosed with colorectal cancer and 13.6% were diagnosed with lung cancer. Moreover, 37.5% of the 37.5% of the patients were in clinical stage II. Chemotherapy protocols were as follows: 15.8% received paclitaxel+herceptin; 14.1% received gemsitabin+cisplatin; and 13.6% received fluorouracil, calcium folinate, irinotecan, and bevacizumab. Moreover, 65.8% of the patients had previously received chemotherapy, whereas 33.7% had been diagnosed with diseases other than cancer; 64.7% received some other drugs in addition to chemotherapy. The percentage of smokers during treatment was 6.2%, whereas the percentage of drinkers was 9.8%; 53.3% of the patients brushed their teeth for oral care, and 40.2% complained about mouth sores and 59.2% had reported to experience xerostomia (Table 1).

In the analysis results conducted on the basis of sociodemographic and disease characteristics of the subscale scores obtained from CiTAS, taste alterations were more frequently observed in patients who also experienced sores in the mouth along with xerostomia. There was no significant difference between other variables (age, sex, any other disease diagnosed, receiving drugs other than those for chemotherapy, smoking/oral care habits, diagnosis, stage, and treatment protocol) and average scores obtained from CiTAS subscales (Table 2, 3).

Discussion and Conclusions

Chemotherapy-induced taste alteration is a frequently encountered problem (8). In this study intended to determine the factors affecting chemotherapy-induced taste alteration, age groups/sex variables had no significant effect on subscales of CiTAS. Sensory functions weaken along with the age; one of these senses is the sense of taste (15). Imami et al. determined the ratio of experiencing chemotherapy-induced taste alteration as 75% in patients who were ≥70 years old, higher than that in any other age group (16). Schiffman et al. (17) stated that the sense of taste rarely disappears (ageusia) in the elderly, and the cases of hypogeusia and dysgeusia are encountered more often. In addition, taste perception concentration for sensing the sweet, salty, sour, and bitter tastes reduces as an individual becomes older (17). In this study, it has been shown that sex has no significant effect on the average scores obtained from subscales of CiTAS. However, according to sev-

Table 1. Patient sociodemographic characteristics, habits, and disease/treatment characteristics (n=184)

Characteristics	Number	%
Age groups (year)		
18-40	20	10.9
41-50	33	17.9
51-60	65	35.3
61 and over	66	35.9
Gender		
Female	105	57.1
Male	79	42.9
Diagnosis		
Lymphoma	20	10.9
Multiple myeloma	19	10.3
Breast Cancer	46	25.0
Lung Cancer	25	13.6
Colorectal Cancer	42	22.8
Over Cancer	13	7.1
Pancreatic Cancer	6	3.3
Other*	13	7
Clinical Stage		
I	20	10.9
II	69	37.5
III	53	28.8
IV	42	22.8
Treatment Protocol		
Paclitaxel, herceptin	29	15.8
Fluorouracil, calcium folinate, irinotecan, bevacizumab	25	13.6
Paclitaxel	19	10.3
Gemcitabine, cisplatin	26	14.1
Carboplatin, paclitaxel	15	8.2
Cyclophosphamide, bortezomib, dexamethasone	11	6.0
Fluorouracil, calcium folinate, oxaliplatin	13	7.1
Rituximab, cyclophosphamide, doxorubicin, vincristine, prednol	12	6.5
Doxorubicin, bleomycin, vinblastine, dacarbazine	8	4.3
Other**	26	14.1
Habits		
Cigarette		
Non-smoker	96	52.2
Former smoker	76	41.3
Smoker	12	6.5
Alcohol		
Does not Drink	166	90.2
Used to Drink, but quitted	18	9.8
Oral Care		
Brushing teeth	98	53.3
Rinsing mouth with water	27	14.7

Mouthwash	19	10.3
Brushing teeth+Mouthwash	40	21.7

* Malignant neoplasm of brain (n=3), prostate cancer (n=1), bladder cancer (n=2), testicular cancer (n=3), gastric cancer (n=2), and nasopharyngeal cancer (n=2).

** Fluorouracil+calcium folinate (n=5), ifosfamide+gemcitabine+vinorelbine (n=4), irinotecan+cetuximab (n=4), gemcitabine+bevacizumab (n=3), cisplatin+docetaxel (n=2), docetaxel (n=2), bleomycin+etoposide+cisplatin (n=2), brentuximab+cyclophosphamide+procarbazine+prednisone (n=2), topotecan (n=1), and cisplatin+doxorubicin (n=1).

eral studies, female patients experience more chemotherapy-induced taste alteration than male patients (2, 18).

The average scores of patients diagnosed with some other diseases, obtained from subscales of "Decline in basic taste" and "Discomfort," were higher than the average scores of those not having any other disease. In the study by Jensen at al., the percentage of patients experiencing chemotherapy-induced taste alteration was 84%; 24% of the patients had allergic diseases, whereas 13% had muscle/joint ache and 7% had hypertension (4).

In our study, the average scores of patients taking drugs in addition to chemotherapy, obtained from subscales of CiTAS, were higher than those who did not take any other drugs. In another study, the percentage of patients who had to take some other drugs in addition to chemotherapy was 33%. The percentage of the patients experiencing chemotherapy-induced taste alteration was determined as 84%; however, the effect of taking other drugs on the taste alteration was not evaluated (4). On the other hand, in the literature, drugs that cause taste alteration include antibiotics, analgesics, antihypertensives, antidepressants, anticonvulsants, bronchodilators, muscle relaxants, psychopharmacological, antiepileptics, and mouthwashes (9, 19-21). Some diseases accompanying cancer and drugs used for treatment of these diseases may cause taste alterations by affecting the sense of taste.

In this study, although not statistically significant, the average scores of non-smoking patients obtained from subscales of "Decline in basic taste" and "Discomfort" were higher than those of smoking patients. On the other hand, the average scores of non-smoking patients obtained from subscales of "Phantogeusia and Parageusia" and "General taste alterations" were higher than those of smoking patients. However, in the study by Zabernigg et al., which was conducted on chemotherapy-induced taste alteration, statistically significant difference was observed between smoking and non-smoking patients in terms of experiencing taste alteration (22).

In our study, the oral care habits of patients did not affect subscales of CiTAS. The scores of patients engaged in oral care by brushing teeth+mouthwash obtained from subscales of "Decline in basic taste," "Discomfort," and "General taste alterations" and their total scores of CiTAS were found to be higher than scores of other groups. In the subscale of "Phantogeusia and Parageusia," the score of the group stating that "I rinse my mouth with mouthwash" was higher than score of other groups. The alcohol in mouthwash used in oral care causes oral mucosa irritation, taste alterations, and tissue healing delay (23).

In our study, the average scores of patients experiencing xerostomia, obtained from subscales of "Decline in basic taste" and "Phantogeusia and Parageusia," were found to be higher than the scores of those who did not experience xerostomia. However, the average scores of patients with mouth sores, obtained from subscales of "Discomfort" and "General taste alterations," were higher than scores of those without mouth sores. In the study of Jensen et al., which was conducted to evaluate oral mucosal lesions, microbial changes, and taste alterations occurring in patients diagnosed with breast cancer and receiving adjuvant chemotherapy, there was no relationship between chemotherapy-induced taste alterations experienced by the patients and salivary flow rate and xerostomia (4). However, it is also known that saliva is important for regular functioning of the sense of taste and stimulation of taste receptors. Oral mucositis is considered as a reason causing chemotherapy-induced taste alteration. The changes occurring in mucosa are developed depending on stimulation of taste receptors and changes occurring in dissolving of taste molecules (21). It is believed that the changes occurring in the oral mucosa may affect the sense of taste either directly or indirectly.

In our study, it was also observed that diagnosis and disease stages of the patients have no effect on subscales of CiTAS. According to the study by Kano and Kanda, who investigated the chemotherapy-induced taste alterations, 29% of the patients were diagnosed with breast cancer and 23% were diagnosed with colorectal (8). However, disease and diagnosis stages of the patients were not compared with their taste alterations. According to a study by Gamper et al. on patients (n=109) receiving chemotherapy for treatment of breast and gynecological cancers, 16% of the breast cancer patients experienced severe taste alteration, whereas 12.6% of these patients experienced moderate taste alteration and 22% experienced mild taste alteration, and 7% of the gynecological cancer patients experienced severe taste alteration, whereas 12.4% experienced moderate taste alteration and 22.5% experienced mild taste alteration due to the chemotherapy (5). Considering the literature, the chemotherapy protocol received by the patients rather than clinical diagnosis and disease stages affect taste alterations experienced by the patients.

In our study, the average scores of patients taking gemcitabine and cisplatin, obtained from subscale of "Decline in basic taste," was found to be higher, whereas the average scores of patients taking "Doxorubicin, bleomycin, vinblastine, and dacarbazine" protocol, obtained from the subscales of "Phantogeusia and Parageusia," "Discomfort," and "General taste alterations," were higher than the scores of other groups. According to the study by Kano and Kanda, all their study patients experienced chemotherapy-induced taste alteration. The most common chemotherapy protocols received by the patients are paclitaxel (19%) and folinic acid+fluorouracil+oxaliplatin (12%) (8). According to another study conducted by Bernhardson et al., the chemotherapy protocols received by patients experiencing 75% taste alterations include cyclophosphamide+fluorouracil+epirubicin (14%), paclitaxel+docetaxel (14%), and fluorouracil+calcium folinate+oxaliplatin (13%) (2). The major chemotherapeutic agents causing phantogeusia are cyclophosphamide, doxorubicin, fluorouracil, methotrexate, and cisplatin (4). However, cisplatin and doxorubicin lead to more severe phantogeusia (1).

In our study, according to the subscales of CiTAS, patients experience taste alterations. Considering correlations between all subscales and variables depending on disease, treatment, and demographic charac-

Table 2. Patient sociodemographic characteristics and CiTAS scores depending on habits

Sociodemographic characteristics and habits	n (%)	Decline in Basic Taste Mean±SD	Phantogeusia and Parageusia Mean±SD	Discomfort Mean±SD	General taste alterations Mean±SD
Age groups (year)					
18–40	20 (10.9)	1.7±1.0	2.9±0.9	2.8±1.2	2.7±1.0
41–50	33 (17.9)	1.7±1.0	2.5±1.0	2.7±1.2	2.5±0.9
51–60	65 (35.3)	1.7±1.0	2.6±1.0	2.8±1.2	2.9±1.0
61 and over	66 (35.9)	1.8±1.0	2.7±0.9	2.6±1.3	2.7±1.1
		H=1.02 p=0.794	H=2.36 p=0.499	H=0.99 p=0.802	H=2.22 p=0.526
Gender					
Female	105 (57.1)	1.8±1.1	2.8±1.2	2.8±1.0	2.8±1.1
Male	79 (42.9)	1.7±1.0	2.7±1.3	2.5±1.0	2.8±1.1
		U=4125 p=0.947	U=3982.5 p=0.642	U=3520 p=0.078	U=4017 p=0.714
Diagnosed with another disease					
Yes	62 (33.7)	2.0±1.1	2.6±1.0	2.8±1.3	2.7±1.0
No	122 (66.3)	1.7±1.0	2.7±1.0	2.7±1.3	2.8±1.1
		U=3187 p=0.071	U=3320 p=0.175	U=3598 p=0.588	U=3609.5 p=0.612
Receiving drugs other than chemotherapy					
Yes	119 (64.7)	1.8±1.1	2.7±1.0	2.8±1.3	2.9±1.1
No	65 (35.3)	1.7±0.9	2.7±1.0	2.6±1.2	2.6±1.1
		U=3735.5 p=0.691	U=3834 p=0.922	U=3377.5 p=0.153	U=3379 p=0.156
Cigarette					
Non-smoker	96 (52.2)	1.8±1.1	2.7±1.0	2.8±1.4	2.9±1.0
Former Smoker	76 (41.3)	1.7±1.0	2.6±1.0	2.7±1.2	2.7±1.1
Smoker	12 (6.5)	2.0±1.0	2.6±1.0	3.1±1.1	2.7±1.3
		H=1.195 p=0.549	H=0.654 p=0.721	H=1.415 p=0.492	H=1.491 p=0.474
Oral Care					
Brushing teeth	98 (53.3)	1.7±1.0	2.6±0.9	2.7±1.3	2.7±1.1
Rinsing mouth with water	27 (14.7)	1.7±0.8	2.7±0.9	2.6±1.4	2.9±1.3
Mouthwash	19 (10.3)	2.0±1.3	3.0±1.2	2.7±1.3	2.7±1.1
Brushing teeth+Mouthwash	40 (21.7)	2.0±1.2	2.6±1.0	3.1±1.3	3.0±1.0
		H=4.82 p=0.184	H=1.29 p=0.729	H=2.79 p=0.424	H=3.16 p=0.366
Sore Mouth					
Yes	74 (40.2)	2.0±1.2	2.8±1.0	3.1±1.2	3.0±1.1
No	110 (59.8)	1.7±0.9	2.6±1.0	2.5±1.2	2.6±1.1
		U=3590 p=0.159	U=3555.5 p=0.145	U=3006 **p=0.002**	U=3239 **p=0.018**
Xerostomia					
Yes	109 (59.2)	1.9±1.1	2.8±1.0	2.9±1.3	2.9±1.1
No	75 (40.8)	1.6±0.9	2.5±0.9	2.6±1.3	2.6±1.0
		U=3255 **p=0.014**	U=3227.5 **p=0.015**	U=3593.5 p=0.162	U=3432 p=0.064

Table 3. Patient CiTAS scores depending on the disease and treatment characteristics

Disease and treatment characteristics	n (%)	Decline in Basic Taste Mean±SD	Phantogeusia and Parageusia Mean±SD	Discomfort Mean±SD	General taste alterations Mean±SD
Diagnosis					
Lymphoma	20 (10.9)	1.7±0.9	2.7±1.0	2.7±1.0	2.6±1.1
Multiple myeloma	19 (10.3)	1.4±0.3	2.1±0.8	2.6±1.1	2.4±0.9
Breast cancer	46 (25.0)	1.8±1.0	2.5±1.0	2.7±1.3	2.6±1.0
Lung cancer	25 (13.6)	1.9±1.1	2.8±0.9	2.9±1.2	2.9±1.1
Colorectal cancer	42 (22.8)	1.6±0.9	2.8±0.8	2.4±1.1	2.8±1.0
Over cancer	13 (7.1)	1.6±0.9	3.1±1.1	2.9±1.4	2.9±1.1
Pancreatic cancer	6 (3.3)	1.7±1.2	2.7±0.8	3.2±1.7	3.2±1.0
Other*	13 (7)	2.1±1.4	2.5±0.9	2.9±1.4	2.9±1.2
		H=2.6 p=0.919	H=10.9 p=0.143	H=3.9 p=0.784	H=5.4 p=0.605
Clinical Stage					
I	20 (10.9)	1.5±0.7	2.7±0.9	2.6±1.3	2.8±1.2
II	69 (37.5)	1.6±0.9	2.6±0.9	2.5±1.2	2.8±1.0
III	53 (28.8)	1.8±1.1	2.6±1.0	2.9±1.1	2.6±1.0
IV	42 (22.8)	2.0±1.1	2.8±0.9	2.9±1.4	2.9±1.1
		H=3.26 p=0.352	H=1.28 p=0.732	H=3.95 p=0.265	H=2.65 p=0.448
Treatment Protocol					
Paclitaxel+herceptin	29	1.7±0.9	2.3±0.8	2.9±1.2	2.6±1.0
Fluorouracil+calcium folinate+irinotecan. bevacizumab	25	1.7±1.1	2.9±0.8	2.5±1.2	3.0±1.1
Paclitaxel	19	1.8±1.1	2.6±1.1	2.6±1.4	2.7±0.9
Gemcitabine+cisplatin	26	2.2±1.3	2.8±1.0	2.9±1.4	2.9±1.2
Carboplatin+paclitaxel	15	1.9±1.0	2.6±0.8	2.8±1.4	2.6±1.2
Cyclophosphamide+ bortezomib+dexamethasone	11	1.4±0.4	2.0±0.8	2.7±1.2	2.2±0.8
Fluorouracil+calcium folinate+oxaliplatin	13	1.2±0.4	2.5±0.9	2.4±1.2	2.6±1.1
Rituximab+Cyclophosphamide+ doxorubicin+vincristine+prednol	12	1.7±0.9	2.3±0.9	2.6±1.2	2.5±1.0
Doxorubicin+bleomycin+ vinblastine+dacarbazine	8	1.7±0.9	3.2±1.2	3.3±0.8	3.2±1.2
Other*	26	1.7±1.0	2.8±1.0	2.6±1.2	3.0±1.0
		H=5.103 p=0.825	H=12.737 p=0.174	H=5.782 p=0.761	H=8.957 p=0.441

teristics, xerostomia and mouth sores cause taste alteration in majority of the cases. To elucidate changeable/unchangeable risk factors for experiencing taste alteration in patients receiving cancer treatment, more descriptive and randomized controlled studies are required.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gazi University Medical Faculty Institutional Review Board.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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