

The CiTAS scale for evaluating taste alteration induced by chemotherapy: state of the art on its clinical use

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Abstract. *Background:* Cancer is the leading cause of death worldwide. Of the various therapeutic approaches, chemotherapy is the most widely used treatment. Among the various side effects associated with this treatment, taste alterations (TAs) have received little attention, even though they have a serious impact on the nutritional aspect and quality of life (QoL) of patients. TAs concern 75% of the patients receiving chemotherapy, and this figure is still considered to be underestimated because could be due both to inadequate attention and to the absence of specific subjective tools able to fully evaluate TAs in patients undergoing chemotherapy. *Methods:* A review by querying CINAHL, PubMed, Scopus and Google Scholar databases about the current status of use of the CiTAS self-evaluation scale, was performed. *Results:* From critical reading of the selected reports, it can be said that until now CiTAS has not been used to a large extent for evaluating taste, even at a late stage in patients undergoing chemotherapy. However, the results and the selected reports seem to indicate hope for its wider use. *Conclusions:* In literature, CITAS scale has been used on very heterogeneous populations and not adequately studied in specific care settings, its use within controlled trials could implement its spread. Correct and subjective evaluation of TAs would allow the planning of specific and personalized interventions aimed at providing adequate nutrition to support the maintenance and/or achievement of a correct body mass index. All this could contribute significantly to a better perception of QoL in patients undergoing chemotherapy. (www.actabiomedica.it)

Key words: taste alteration, cancer patients, chemotherapy effect, nutrition, CiTAS scale

Introduction

According to the World Health Organisation (WHO), cancer is among the leading causes of death (1-3); in 2018, 9.6 million deaths from cancer are expected (2). In particular, in Europe, there are about 4,229,662 new cases of cancer (2). Despite new therapeutic approaches such as immunotherapy (4), treatments available today against cancer include surgery, chemotherapy and radiation therapy (5). Chemotherapy is often used in the treatment of such diseases. These treatments are effective against cancer cells but

also attack the physiological development of normal cells (6, 7).

The adverse effects of these therapies necessary for the treatment of cancers are now well known (5, 8, 9). The QoL of such patients is increasingly considered as a fundamental outcome of the therapeutic process (10-12). Strategies to reduce adverse events in the treatment of cancer diseases have recently been the subject of greater attention (13). Patients undergoing these treatments perceive various symptoms that may affect completion of the treatment course and their quality of life (QoL), both during and after treatment

(14-17). Chemotherapy can cause adverse effects that have a negative impact on nutritional status, such as anorexia, changes in taste and smell, aversion to food, nausea and vomiting, mucositis, constipation, diarrhea and early satiety (18). Research initially focused on the gastrointestinal consequences of cancers and their treatments (19), leaving aside other aspects such as taste alterations (TAs). TAs are the most distressing side effect with a serious impact on the nutritional aspect and QoL of patients and have received little attention from healthcare professionals (5). Taste is an important sensation that serves to evaluate the nutritional content of food, support oral intake and prevent the ingestion of potentially toxic substances. Patients with loss of taste have worse outcomes than those who have not lost their sense of taste and have been able to maintain food intake and nutritional support (20). TAs affect 75% of patients undergoing chemotherapy, and are still considered to be underestimated (19), despite their impact on the QoL of patients undergoing this treatment appearing to be increasingly known (7, 21, 22). This underestimation could be due both to inadequate attention and to the absence of specific subjective tools (6) able to fully evaluate TAs in patients undergoing chemotherapy. The CiTAS scale (23) is a tool for immediate and easy use (6).

The CiTAS original version (KANO) is a self-administered questionnaire composed of 18 items evaluated on a five-point Likert-type scale and divided into three dimensions:

- 1) quantitative changes in the perception of flavours (hypogeusia and ageusia),
- 2) qualitative changes in the perception of flavours (heterogeusia, cacogeusia) and
- 3) problems related to nutrition (difficulty in eating hot or fat foods).

Using a Likert scale 1-5 (where 1 = no difficulty or absence of the disturbance and 5 = maximum difficulty or disturbance), CiTAS evaluates the 4 dimensions of gustatory disturbances: intensity of taste, discomfort, phantogeusia and parageusia, and general alterations of taste. CiTAS can help in the planning of specific nursing interventions, providing adequate nutrition to support the maintenance and/or achievement of a correct body mass index. This can contribute to a better perception of QoL and to coping better with the side

effects of chemotherapy (6). Through this mini-review we wanted to investigate the state of the art about use of the CiTAS scale for the evaluation of TAs in cancer patients undergoing treatment with chemotherapeutic drugs.

Materials and Methods

The review process was conducted in the following steps: identification of the research problem, bibliographic research, data evaluation, data analysis and finally presentation of the summary of results. The research was conducted using the CINAHL, PubMed, Scopus and Google Scholar databases. The MeSH search terms included, "Chemotherapy-induced Taste Alteration Scale", "CiTAS", "Cancer Patients, Taste alteration", "Taste disorder" and "Chemotherapy" were combined with each other. The formulation of search terms/keywords and research on electronic databases was performed in collaboration to ensure greater validity and reduce biases in conducting research. Our research included articles in English published between January 2008 and December 2018. The limitations used were: human population, English language, publications in the last 10 years and scientific articles. Studies regarding patients of paediatric and neonatal age and validation studies were excluded. Only studies that met the previously described bibliographic search criteria were considered and only primary studies were included. Abstracts were evaluated according to the inclusion and exclusion criteria described below in order to determine whether or not to continue search and retrieval of full texts. Naturally, the same studies present on several databases were evaluated only once. All the full texts were in turn evaluated on the basis of the general and specific inclusion/exclusion criteria below to identify those eligible for review. Bibliographic research was conducted from May 3, 2018 to December 31, 2018. Research of articles and their analysis was conducted independently by three researchers.. For selection criteria, articles from national and international scientific literature whose title and content contained at least one of the keywords or a link to them were included. Selection was made after careful reading of the abstract and the complete article (Table 1).

Table 1. Selection criteria

Database	Key words	Search strings	Results
PubMed	Chemotherapy-induced taste alteration scale, Taste alteration OR Taste disorder, Chemotherapy	(chemotherapy-induced[All Fields] AND (“dysgeusia”[MeSH Terms] OR “dysgeusia”[All Fields] OR (“taste”[All Fields] AND “alteration”[All Fields]) OR “taste alteration”[All Fields]) AND (“weights and measures”[MeSH Terms] OR (“weights”[All Fields] AND “measures”[All Fields]) OR “weights and measures”[All Fields] OR “scale”[All Fields])) AND (“dysgeusia”[MeSH Terms] OR “dysgeusia”[All Fields] OR (“taste”[All Fields] AND “alteration”[All Fields]) OR “taste alteration”[All Fields]) OR (“disease”[MeSH Terms] OR “disease”[All Fields] OR “disorder”[All Fields])) AND (“drug therapy”[Subheading] OR (“drug”[All Fields] AND “therapy”[All Fields]) OR “drug therapy”[All Fields] OR “chemotherapy”[All Fields] OR “drug therapy”[MeSH Terms] OR (“drug”[All Fields] AND “therapy”[All Fields]) OR “chemotherapy”[All Fields])	4
CINAHL		Chemotherapy-induced Taste Alteration Scale OR CiTAS AND cancer patients AND (taste disorders or taste alterations)	6
Scopus		(ALL (chemotherapy-induced AND taste AND alteration AND scale) AND TITLE-ABS-KEY (cancer AND patients) AND TITLE-ABS-KEY (taste AND disorder) OR TITLE-ABS-KEY (taste AND alteration) AND TITLE-ABS-KEY (chemotherapy))	16
Google scholar		Chemotherapy-induced Taste Alteration Scale +CiTAS +cancer patients +taste alteration or disorder	15

Results

CiTAS has been used until now to evaluate taste alterations even at a late stage in patients undergoing chemotherapy. One study investigated these alterations and radiotherapy (Table 2). In particular, the articles considered for our study are described in Table 2. The descriptive-correlational study by Antony and Pavithran (5) in India was aimed at determining taste alterations and their possible relationship with the Quality of Life of patients undergoing chemotherapy. The study was conducted on 100 patients, aged between 20 and 65, who underwent at least 3 cycles of chemotherapy treatment, through convenience sampling. The CiTAS scale was used to evaluate the taste status of participating patients. All patients enrolled had taste alteration: 10% of the severe sample, and 50% of the entire moderate sample. Such taste alterations showed a negative correlation with the Quality of Life, highlighting how an increase in taste alteration

is related to a worse Quality of Life. The 2015 Sozeri study (7) aimed to determine the factors influencing taste alteration induced by chemotherapy, based on the subscales of the CiTAS instrument. Conducted on 184 patients undergoing chemotherapy treatment enrolled at the Haematology Unit of a university structure, its results showed how gender and age were variables that did not influence any CiTAS subscale. On the contrary, the most severe taste alterations were found in patients with xerostomia and a sore mouth. A study with the same objective is that of Rea et al.(24) conducted on 152 patients undergoing chemotherapy. Here, instead, females - like patients with phantoegusia and paraegusia - seem to experience this type of alteration more. The preliminary study by Simeone et al. (25), which investigates taste alterations in young and elderly patients undergoing chemotherapy treatment confirms that elderly subjects over 70 years of age have a taste alteration induced by chemotherapeutic drugs greater than any other group of patients with ages that differ

from theirs. The aim of the multicentric observational study by Guillari et al. (19), conducted on 92 women recruited through convenience sampling, is to describe the qualitative taste alterations in women undergoing chemotherapy. The results show how phantogeusia and parageusia were more present than in the other CiTAS classes. Furthermore, in the sample of women considered, a reduction in appetite and an absence of salivation showed a strong negative correlation with all CiTAS subscales. The 2017 cross-sectional study by Sato et al. (26), conducted on 91 patients, evaluated the prevalence of taste alterations and the predictive factors of these taste disorders at a late stage in patients who had survived allogeneic hematopoietic cell transplantation. Taste disorders were observed in almost half of the patients investigated. The most frequent form of taste disturbances at a late stage was reduced appetite. Almost all taste disturbances were mild in their severity. The taste disturbances investigated could return to normal levels after 1 year from transplantation. Among patients more than 1 year after HCT, chronic oral GVHD was significantly associated with an increased risk of phantogeusia and parageusia, whereas that among patients less than 1 year after HCT it was not. Immunosuppressive treatment did not affect any taste disturbance in patients either more than 1 year or less than 1 year after HCT. The 2018 longitudinal study by Jin et al. (27) is characterised by the novelty of the setting of use of the CiTAS scale. The study aims to dynamically evaluate taste alteration and its correlation with weight loss in patients with cancer of the head and/or neck treated with radiotherapy in combination or not with a chemotherapy protocol or after surgery. Of the 161 patients enrolled, the complete results for 114 patients showed how taste alterations were present at the beginning of treatment, increasing halfway through the therapeutic cycle and remaining constant until the post-term follow-up of treatment. Within this time frame, all aspects of taste alteration investigated by CiTAS increased, decreasing relative to the intermediate period but with values that were higher than those of the initial period. Weight loss was recorded in all enrolled patients. The total CiTAS score, decline in basic taste, general taste alterations, discomfort, and phantogeusia and parageusia all had a significant negative effect on weight loss.

Discussion

Use of the CiTAS scale is not yet widespread as desired. To date CiTAS has been used to evaluate taste alteration even at late stages in patient undergoing chemotherapy. The QoL of patients with cancers is more influenced by chemotherapy; the QoL is considered as a fundamental outcome of the therapeutic process (10-12). Chemotherapy can cause adverse effects that have a negative impact on nutritional status, such as anorexia, changes in taste and smell, aversion to food, nausea and vomiting, mucositis, constipation, diarrhea and early satiety (18).

TAs are the most distressing side effect with a serious impact on the nutritional aspect and QoL of patients (5). Taste is an important subjective sensation that influence Body Mass Index. Patients with loss of taste have worse outcomes than those who have not lost their sense of taste and have been able to maintain food intake and nutritional support (20). TAs affect are underestimated because there is absence of specific subjective tools (6) able to fully evaluate TAs in patients undergoing chemotherapy. The CiTAS scale (23) is a tool for immediate and easy use (6).

Primary studies selected according to the inclusion criteria of this work show how this scale has been used on a very heterogeneous population (19), young and old (25) women, with different types of cancer (24). All patients undergoing chemotherapy treatments. Just the non-differentiation of the various chemotherapy treatments may represent a limitation that can be found in the current literature, just as other limitations could be the presence of comorbidity and/or other concomitant treatments that could influence TA. All the selected studies have investigated the TAs already after the first chemotherapy treatment. Only one study (7) waited three cycles of chemotherapy before proceeding with an evaluation of the TAs. However, we consider it a duty to point out the approach taken by Jin et al (27) which included a baseline assessment. Precisely because of what has been said so far, we believe that this approach is the most desirable. An early subjective assessment of taste and subsequently of its alterations may allow the implementation of specific and targeted intervention programs aimed at improving the QoL of these subjects. The selected studies show

Table 2. Description of articles selected

Title	Objectives	Design	Instruments	Results	Limitations
Antony, Pavithran, 2017. Taste alteration and quality of life of patients receiving chemotherapy	Determine taste alterations and their possible relationship with the Quality of Life of patients undergoing chemotherapy.	Descriptive-correlational.	Semi-structured questionnaire created ad hoc; reports from medical documents (days of chemotherapy, neoplasm, chemotherapy regimen); CiTAS; University of Washington Quality of Life Questionnaire.	All patients enrolled had taste alteration: 10% of the severe sample, and 50% of the entire moderate sample. Such taste alterations showed a negative correlation with the Quality of Life, highlighting how an increase in taste alteration is related to a worse Quality of Life.	The influence of any comorbidity on taste alteration was not investigated. Furthermore, a single chemotherapy regimen was not investigated.
Simeone et al., 2018. Taste disorders in younger and older patients undergoing cancer chemotherapy: A preliminary multicenter study	Investigate changes in taste alterations in people undergoing chemotherapy with an age of 40 years or less and in people aged 70 or over	Multicentric observational	Sociodemographic questionnaire created ad hoc; reports from medical documents (days of chemotherapy, neoplasm, chemotherapy regimen); CiTAS	This study showed a correlation between older age and taste alterations induced by chemotherapy. Furthermore, statistically significant differences between the young and the elderly group were observed for problems with chewing and dental prostheses.	Limited sample
Guillari et al., 2018. Dysgeusia in women undergoing cancer chemotherapy: results of a preliminary observational study	Description of qualitative taste alterations in women undergoing chemotherapy	Multicentric observational	Sociodemographic questionnaire created ad hoc; reports from medical documents (days of chemotherapy, neoplasm, chemotherapy regimen); CiTAS	The strong presence of dysgeusia is clear, particularly understood as a real distortion of taste sensation (phantogeusia and parageusia) in the female sample under examination	
Rea et al., 2018. An Investigation of Taste Alteration in Patients Undergoing Cancer Chemotherapy	Understand the factors influencing taste disturbances in patients undergoing chemotherapy	Multicentric observational	Sociodemographic questionnaire created ad hoc; reports from medical documents (days of chemotherapy, neoplasm, chemotherapy regimen); CiTAS	Major taste alterations were observed in the female gender and in patients with phantoegeusia and paraegeusia	There exists a wide variety of chemotherapy protocols analysed and the correlation between tumourlocalisation and taste disturbance was not tested.

(continued)

Table 2 (continued). Description of articles selected

Title	Objectives	Design	Instruments	Results	Limitations
Jin et al., 2018. Relationship between subjective taste alteration and weight loss in head and neck cancer patients treated with radiotherapy: A longitudinal study	Dynamically evaluate taste alteration and its correlation with weight loss in patients with cancer of the head and/or neck treated with radiotherapy in combination or not with a chemotherapy protocol or after surgery.	Prospective longitudinal observational	Sociodemographic data, type of tumour and type of treatment were found from clinical data; questionnaire created ad hoc for taste evaluation; CiTAS; weight and height measured at predetermined times useful for calculating BMI	Taste alterations are present at the beginning of treatment, increasing halfway through the therapeutic cycle and remaining constant until the post-treatment follow-up. Within this time frame, all aspects of taste alteration investigated by CiTAS increase, decreasing relative to the intermediate period but being higher than those of the initial period. Weight loss was recorded in all enrolled patients. The total CiTAS score, decline in basic taste, general taste alterations, discomfort, and phantogeusia and parageusia all had a significant negative effect on weight loss.	CiTAS created for evaluations with chemotherapy and non-radiotherapy treatments; absence of psychometric validation of the instrument; absence of quantitative analysis about food intake; strong loss of patients enrolled in the medium and long term and strong dominance of female patients should lead to interpreting the generalisability of the study with caution
Sato et al., 2017. A cross-sectional study on late taste disorders in survivors of allogeneic hematopoietic cell transplantation	Evaluate the prevalence of taste alterations and the predictive factors of such late taste disorders in patients who survived transplantation of allogeneic haematopoietic cells.	Transversal prospective	Information on patient characteristics and transplantation was collected from medical records; CiTAS.	Taste disorders were observed in almost half of the patients investigated. The most frequent form of taste disturbances at a late stage was reduced appetite. Almost all taste disturbances were mild in their severity. The taste disturbances investigated can return to normal levels after 1 year from transplantation. Among patients more than 1 year	The cause of taste disturbances could be multifactorial in patients undergoing allogeneic HCT due to the combination of various therapeutic treatments. Furthermore, although the effect of the oral condition, such as topical oral treatments, mouth hygiene and dental care, on post-HCG allogeneic taste disorders was not clarified in our study;

(continued)

Table 2 (continued). Description of articles selected

Title	Objectives	Design	Instruments	Results	Limitations
				after HCT, chronic oral GVHD was significantly associated with an increased risk of phantogeusia and parageusia, whereas that among patients less than 1 year after HCT was not. Immunosuppressive treatment did not affect any taste disturbance in patients either more than 1 year or less than 1 year after HCT.	an oral condition should be examined in future studies.
Sozeri and Kutlurkan, 2015. Taste Alteration in Patients Receiving Chemotherapy	Determine the factors that influence taste alterations in patients undergoing chemotherapy.	Descriptive	Patient Characteristics Identification Form; CiTAS	Taste alterations were observed more frequently in patients who have also had mouth sores along with xerostomia. There was no significant difference between other variables (age, gender, any other diagnosed disease, receiving drugs other than those for chemotherapy, smoking habits/oral therapy, diagnosis, stage and treatment protocol) and average scores obtained from CiTAS subscales	Non-RCT study

more descriptive-observational manuscripts, therefore, there are no primary studies that can be classified at the peak of scientific evidence. Longitudinal RCTs would be desirable for reinforcing the importance of this instrument. In addition to analyzing TAs in patients undergoing chemotherapy, this scale has also been used for patients undergoing another therapeutic

regimen, such as radiotherapy (27). This confirms the attention of international research regarding TAs and the reliability of this scale in evaluating subjective TAs. In addition, there exist psychometric validation studies (6, 23, 28) this means that more and more professionals in the world feel the need to evaluate the TAs in order to guarantee a correct QoL of the subjects subjected to

chemotherapeutic treatments. This aspect lead to hope for a future use of CiTAS in new populations and/or similar populations but with different cultural backgrounds.

Conclusions

The nurse plays an important role in evaluating the nutritional status and quality of life of cancer patients. Chemotherapy remains a fundamental therapeutic strategy for cancer diseases. The side effects of chemotherapy are well known and TAs are a distressing side effect that can significantly affect the nutrition and QoL of patients, so close attention must be paid from the start of therapy. The purpose of nursing care for patients undergoing chemotherapy is to prevent or reduce treatment-related symptoms and problems. To date, there are no guidelines for the evaluation and management of TA, yet a correct and subjective assessment of TA would allow the planning of specific and personalized actions aimed at providing adequate nutrition to support the maintenance and/or achievement of a correct body mass index. All of this can contribute in an important way to a better perception of QoL.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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