Effect of Nutritional Teaching Program on Knowledge, Practices, Taste Alterations, and Appetite among Breast Cancer Women undergoing Chemotherapy

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Abstract

Background: Cancer treatment may relate to appetite reduction and malnutrition, taste alterations, and dish-type preferences during chemotherapy in breast cancer women. Understanding women with cancer knowledge and practices regarding their nutrition is essential. Hence, the study aimed to evaluate the effect of nutritional teaching programs on knowledge, practices, taste alterations, and appetite among breast cancer women undergoing chemotherapy. **Subjects and method**: **Design**: A quasi-experimental research design was used with a pre-and post-test. **Setting**: the research was conducted in the outpatient clinic at Sohag Oncology Institution. **Subjects**: A convenient sample of all 100 breast cancer women undergoing chemotherapy was included within six months. **Three tools were used:** Tool (I) women's structured interviewing questionnaire, which included four parts: (a) demographic characteristics; (b) women's medical data, (c) women's nutritional knowledge among breast cancer women undergoing chemotherapy, and (d) women' practices nutritional knowledge among breast cancer women undergoing chemotherapy(pre/post). Tool (II) Chemotherapy-induced taste alteration scale (CiTAS), and Tool (III) Perceptions evaluation related to food intake. **Results**: There was a positive correlation (P=0.005) between women's knowledge scores and their practical knowledge post-one-month nutritional teaching program implementation. There were evident improvements in women's knowledge and practical knowledge regarding nutrition among breast cancer women undergoing chemotherapy post-nutritional teaching program implementation (P=0.005). In this study, it was found that slight and significant improvements regarding taste alterations, and appetite among breast cancer women undergoing chemotherapy post nutritional teaching program implementation. **Conclusion**: The implementation of the nutritional teaching program had a positive effect on improving knowledge, practices, taste alterations, and appetite among breast cancer women undergoing chemotherapy. **Recommendations**: A nutritional teaching program should be conducted regularly for women undergoing chemotherapy to discuss and teach them different aspects of nutrition and replicate the current study with a larger sample.

Keywords: Appetite, Breast cancer women undergoing chemotherapy, Knowledge and practices, Nutritional teaching program, Taste alterations.

Introduction:

Any tissue or organ in the body can develop cancer when aberrant cells proliferate out of control. It is the primary cause of cancer-related deaths and can spread to other organs that have metastasized (**The Global Cancer Observatory, 2020**). In 2020, there were approximately 10.0 million cancer deaths (9.9 million excluding non-melanoma skin cancer) and 19.3 million new cancer cases (18.1 million excluding non-melanoma skin cancer), making cancer the second leading cause of death worldwide (**World Health Organization, 2020**). Because of its high incidence and mortality, breast cancer is a significant global public health concern. An estimated 276,480 new cases of invasive breast cancer will be detected in women in the United States in 2020,

along with 48,530 new cases of non-invasive breast cancer. 64% of breast cancer cases are diagnosed at a localized stage, for which the 5-year survival is 99% (**Davis Lynn et al., 2022)**

Breast tissue, which includes the ducts that connect the lobules to the nipples and the glands known as lobules that produce milk, is where breast cancer starts. Connective, lymphatic, and fatty tissues comprise the rest of the breast. The kind, stage, grade, size, and hormone sensitivity of the cancer cells determine the available treatment options for breast cancer. Most women who have surgery also receive additional treatment, such as hormone therapy, radiation therapy, or chemotherapy, either before or after the procedure. For the majority of breast cancer types, chemotherapy is a treatment option (**Masmouei et al., 2019).**

Chemotherapy is chosen depending on the patient's age, general health, and personal preferences, as well as the tumor's stage and specific features (such as hormone receptor status) (Coa et al., 2019). In many cases, chemotherapy is used in conjunction with other treatments for breast cancer, such as hormone therapy, radiation therapy, or surgery. Chemotherapy for breast cancer may improve the prognosis, reduce the possibility of recurrence, reduce symptoms, or enable cancer patients to live longer and achieve a higher quality of life (**Eraky, 2019).**

There are two types of chemotherapy following breast surgery: adjuvant chemotherapy and neoadjuvant chemotherapy. Early breast cancer is treated with adjuvant chemotherapy, which reduces the chance of recurrence by eliminating cancer cells that may still be in the body. Neoadjuvant chemotherapy, on the other hand, may cause the tumor to shrink sufficiently so that a lumpectomy becomes an option. Neoadjuvant chemotherapy can help women with locally advanced breast cancer by shrinking the tumor in the breast and/or lymph nodes, which will facilitate surgical removal of the malignancy. Clinical malnutrition can occur in up to 85% of cancer patients, which impairs their response to treatment, raises the risk of side effects, and may shorten their survival. Through changes, cancer and cancer treatment impact nutritional status on the metabolic system and reduction in food intake (**Masmouei et al., 2019**).

Taste alterations are a very minor adverse effect for cancer patients. Cancer patients underreport it, and oncology professionals underestimate it despite its seriousness, frequency, and consequences. Due to a lack of understanding and a challenge in identifying and even articulating the emotions they feel in the way they perceive flavors, patients hardly ever express it to their healthcare professionals. Approximately 75% of chemotherapy patients said that their food tasted like cardboard, metal, or sandpaper, or was overly sweet, sour, salty, bitter, or tasteless. Taste abnormalities may persist during treatment and begin two to three weeks after chemotherapy (**Buttiron et al., 2023**). Although there is little research on taste alterations using subjective or objective analysis, it demonstrates how common taste alterations are in chemotherapy ranges between 49.4% (**Joseph et al., 2021).**

Additionally, at least one of the five fundamental senses is altered, with sweetness being the most affected. Patients who have reduced sweet thresholds also show higher sensitivity to sweet taste (**Kim et al., 2020**). However, compared to sweet tastes, salty tastes were found to be more influenced and challenging to taste. Chemotherapy-induced taste changes have been recognized as a significant issue, and additional research has examined how they affect patients' food and lifestyle choices. Cancer patients' altered tastes have been demonstrated to affect their appetite and eating patterns, which may result in a decrease in body weight and potential dietary shortages (**Grant et al., 2020**). Additionally, taste changes may raise a cancer patient's risk of malnutrition. However, research on the precise correlation between taste alterations and malnutrition is limited (**Giampieri et al., 2021).**

Nurses are in a unique position to inform and motivate women to take charge of their health and to be aware of breast cancer. Nurses are capable of identifying patients' needs, managing the consequences of their illnesses, and improving the quality of life for these patients. As an educator, the nurse must constantly gauge the patient's comprehension,

which is accomplished through in-person conversations, direct patient question answering, and decision-making process monitoring (**Kim et al., 2020**).

Nurses are crucial in identifying and detecting individuals who are at risk of malnutrition in the early stages. To properly plan patients' nutritional treatment and detect any changes in their nutritional status, nurses should do nutritional screenings both at the time of admission and during the patient's hospital stay (**Bahgat et al., 2019**). Early nutritional intervention can improve prognosis and enhance recovery while lowering hospital stay duration and complication rates, making it cost-effective. Effective nutritional intervention and cancer patient treatment depend on the creation and application of screening and assessment instruments (**Ahmed & Dawood, 2019).**

Significance of the study:

To preserve women's health, nutritional education can assist them in maintaining healthy behavioral patterns and managing other related health risk factors. Additionally, throughout care, the World Health Organization (WHO) advises healthcare providers to give clients appropriate and acceptable nutrition-related information (**Amin et al., 2022**). Women who have had breast cancer surgery should receive written booklets from their healthcare providers with information regarding dietary recommendations. The ideal method to learn about nutrition, however, was to listen to educators and medical professionals. This would help you keep good habits, improve your diet, and reduce your chance of developing breast cancer again (**The Cancer Net Editorial Board, 2019**).

It has been discovered that dietary treatments, such as flavor enhancement, oral supplements, tube feeding, and nutritional counseling, can improve health and lessen weight loss. The nutritional strategy may be contributing to the unprecedented success of cancer treatment. The study's significance Malnutrition associated with breast cancer is common and can range in incidence from 30% to 90%, depending on the tumor site, illness stage, and course of treatment **(James et al., 2019).**

Aim of the study

To evaluate the effect of nutritional teaching programs on knowledge, practices, taste alterations, and appetite among breast cancer women undergoing chemotherapy through:

- Assessing nutritional knowledge among breast cancer women undergoing chemotherapy
- Assessing practices nutritional knowledge among breast cancer women undergoing chemotherapy
- Assessing taste alterations among breast cancer women undergoing chemotherapy
- Designing and implementing guidelines for improving women's knowledge and practices among breast cancer women undergoing chemotherapy.
- Determining the effect of nutritional teaching programs on knowledge, practices, taste alterations, and appetite among breast cancer women undergoing chemotherapy

Research hypothesis:

- **H1:** Breast cancer women undergoing chemotherapy knowledge mean scores regarding nutrition will be improved after implementing the nutritional teaching program.
- **H2:** Breast cancer women undergoing chemotherapy practical knowledge mean scores regarding nutrition will be improved after implementing the nutritional teaching program.

H3: Breast cancer women undergoing chemotherapy taste alterations and appetite mean scores regarding nutrition will be improved after implementing the nutritional teaching program.

Subjects and Method:

Research design:

A quasi-experimental research design was used with a pre-and post-test

Setting:

The study was conducted in the Outpatient Clinic at Sohag Oncology Institution.

Subjects:

A convenient sample of all 100 breast cancer women undergoing chemotherapy was included within six months.

Data collection tools:

The tool I: A structured interview questionnaire was developed by the researchers after reviewing the related literature and research studies (**Amin et al., 2022, The Cancer Net Editorial Board, 2019**; **James et al., 2019),** it included four parts:

Part (1): It included demographic data among breast cancer women undergoing chemotherapy such as age, educational level, occupation, and residence.

Part (2): It included medical data related items such as duration of disease, stages of the disease, treatment received, type of tumor, family history, and types of complaints.

Part (3) Women's nutritional knowledge among breast cancer women undergoing chemotherapy (pre/post): In order to evaluate women's knowledge about nutrition, the researchers created a 12-question survey that asked about dietary practices, common obesity prevention guidelines, balanced weight, suggested foods, and information sources.

Scoring system:
If the woman answered "yes," she received a score of 1, and if she answered "no," she received a score of 0. Women were classified as having poor knowledge (less than 50%) if they scored between 1 and 4, as having average knowledge (between 50% and less than 75%) if they scored between 5 and 8, and as having good knowledge (more than 75%) if they scored between 9 and 12.

Part (4) Women's practical knowledge regarding nutrition sheets among breast cancer women undergoing chemotherapy (pre/post): The researchers created six phases in total. It was created to evaluate how women consume whole grains, vegetables, fruit, and legumes while reducing their intake of red and processed meat, fast food, and other processed meals that are heavy in fat, carbohydrates, or sugars. A "yes answer" received one point, while a "no answer" received zero. It ranged from 0 to 6. The final score was divided into "good and poor practices" in the following manner: good practices were more than 50% and poor practices were less than 50%.

Tool (II): Chemotherapy-induced taste alteration scale (CiTAS). The measure used to assess taste alterations subjectively was CiTAS, which has good validity and great reliability (Cronbach alpha = 0.9) (**Kano & Kanda, 2023**). The CiTAS was first developed as an 18-item, self-administered survey using a five-point Likert scale (**Simeone et al., 2019**). A higher score denotes more intense taste alterations **(Sozeri & Kutluturkan, 2018)**. Each subscale's prevalence was obtained by counting the number of patients who scored higher than 1 and calculating the total as a percentage of the research population. Larsen et al.'s method was also utilized to assess the overall prevalence of taste alterations **(Larsen et al., 2021).** The Arabic version of CiTAS was employed in this study following back-to-back translations, and Cronbach's alpha was found to be 0.883.

Tool (III) Perceptions evaluation related to food intake
The CiTAS tool, which has outstanding validity and great reliability (Cronbach alpha = 0.9), was used to subjectively assess taste changes (**Settle et al., 1979**). The 18-item, self-administered CiTAS was first developed on a five-point Likert scale **(Ames et al., 1993**). Higher TA intensity is indicated by a rising score (**Steinbach et al., 2010).** The overall prevalence of TAs was computed using the same method, which measured the prevalence associated with each subscale by counting the number of patients with scores greater than 1 and computing the sum as a percentage of the research population. After back-to-back translation, CiTAS was utilized in the Arabic version of this study, and Cronbach's alpha was found to be 0.883. " With "no desire" on the left and "a lot of will" on the right, a 10-cm VAS was used to confirm the appetite for particular food groups. Foods in the following categories were evaluated: starchy foods, legumes, vegetables, meat, poultry, fish, and eggs; soups, broths, and scalded foods; fruits; fruit juices; milk; dairy products; salty, sweet, acidic, bitter, and spicy foods. Without worrying about nutritional concerns, the patients were told to respond to this question based on their appetite before a meal.

Methods of data collection:

Validity of the tools:

The content validity of the tools and the instructional guideline, its clarity, comprehensiveness, appropriateness, and relevance were reviewed by five experts in medical-surgical nursing, oncology, and community health nursing field. Modifications were made according to the panel judgment to ensure sentence clarity and content appropriateness.

Reliability of the tools:

The Cronbach's α test was used to assess the reliability of the questions relating to tool I, which was 0. 898, the reliability of the questions relating to tool II was 0.883, and tool III was o.876.

A pilot study

A pilot study was conducted on 10% (10 women) of the total sample. The clarity and testing of the feasibility of the research process needed were carried out to develop the final form of the tools. No modifications were made. Women who were in the pilot were included in the study.

Ethical considerations:

Before the research started, Approval of the Ethical Research Committee of the Faculty of Nursing was obtained before conducting the study. The researchers met both medical and nursing directors of the selected settings to clarify the purpose of the study and get their approval. Written consent was obtained from the women to gain their cooperation. The aim of the study was explained and the expected outcomes from the implementation of the study were included in this letter to obtain permission for data collection. The objective of the study was explained to the women. The researcher informed the women that, the study was voluntary; they were allowed to refuse to participate in the study. Women had the right to withdraw from the study at any time, without giving any reason. Women were assured that their information would be confidential and used for research purposes only.

Administrative design:

Administrative permission was obtained through an issued letter from the Dean of the Faculty of Nursing, Sohag University to the Directors of the Outpatient Clinic affiliated with Sohag Oncology Institution to achieve this study.

Fieldwork:

A total of 100 women participated in the study. The investigators were present at pre-selected locations twice a week between 9 a.m. and 12 p.m. Within six months, from August 2023 to the end of January 2024, data was gathered. It took about 25 to 35 minutes to finish each interview questionnaire.

The nutritional teaching program was conducted through four main phases which are (assessment, planning, implementation, and evaluation)

A- Assessment Phase

Demographic and clinical data were obtained from the breast cancer women undergoing chemotherapy medical records and via direct questioning of the participants. For breast cancer women undergoing chemotherapy, the taste threshold test was conducted at three-time points: before the program. Also, before the program using Tool (I) part (2) and Tool II, women's knowledge and practice were evaluated.

b- Planning phase

The researchers reviewed the relevant literature and created a nutritional teaching program. The demands of the study participants guided the determination of the study's objectives. During the planning stage, the surroundings were set up, and an eye-catching pamphlet was created to help patients with breast cancer learn more about chemotherapy and diet. Three sessions were dedicated to the intervention. The setting was set up to protect the privacy of breast cancer patients receiving chemotherapy during the physical examination. As far as feasible, good ventilation was also maintained during the intervention. Nutritional education programs aim to enhance the clinical outcomes and nutritional condition of breast cancer patients receiving chemotherapy. The curriculum will be presented in an eye-catching booklet, including lectures and group discussions, and translated into Arabic. Each session schedule took about 20-30 minutes.

C- Implementation phase

Three time points were used to administer the taste threshold test surveys to breast cancer women receiving chemotherapy: before the program, visit one, visit two, and the last visit. The time before the patients began their first chemotherapy cycle was referred to as the baseline. The patients' second cycle began on visit one, their fourth cycle began on visit two, and finally, about a month after the conclusion of chemotherapy, the patient's final appointment was determined. Before scheduled chemotherapy and meals, each test was conducted. The assessment was done for CTRL. After reviewing relevant literature and assessing the actual needs of the women with breast cancer undergoing chemotherapy, the booklet was distributed to them in simplified Arabic and served as a supportive resource, covering all the information and practical aspects of healthy nutrition. A variety of educational techniques were employed, including talks, discussions, posters, and images.

Phase of a dietary education program for women with breast cancer receiving chemotherapy. The researcher gave the nutritional program, which was modified from Heal Well, a Cancer Nutrition Guideline, to the breast cancer patients receiving chemotherapy. Ten breast cancer patients receiving chemotherapy were split up into subgroups for the study; each subgroup had ten patients who had received three sessions of chemotherapy. Each session lasted between 20 and 30 minutes.

First session

The key topics of this session were: Introduction to Breast Cancer; Breast Cancer Treatments; Breast Cancer Causes, Risk Factors, and Symptoms; Maintaining a healthy weight; and Eating nutritious meals that provide the body with calories and nutrients for energy, repair, recovery, and healing.

Second session:

Adverse effects of treatment that may affect dietary consumption This session addressed side effects of chemotherapy for breast cancer, including altered appetite and unintended weight loss, nausea and vomiting, exhaustion, bowel changes, including diarrhea and constipation, altered taste and smell, unintended weight gain, sore mouth or throat, low white blood cell counts, and infection.

Third session:

It concentrated on food safety advice that is particularly crucial for cancer patients and their recuperators. Among other things, the patient should avoid spicy, extremely sweet, oily, or fried foods, eat small meals often, and drink liquids with ice chips or frozen juice chips. After eating, the patient should carefully brush and floss their teeth or dentures, use mouthwash without alcohol, choose liquid or soft foods like soups, stews, smoothies, and desserts, and use sugar-free ice lollies and cubes to comfort their gums and mouth. The most frequent adverse effect of chemotherapy for people with breast cancer is fatigue. Regular eating and as much exercise as possible might help patients feel less worn out and happier., temporarily rely on ready-to-eat foods like frozen dinners, fruits, and vegetables. Breast cancer women undergoing chemotherapy should drink plenty of fluids to prevent dehydration which makes fatigue worse. The researchers created and executed a theoretical and practical nutritional education program for breast cancer patients receiving chemotherapy.

Knowledge about nutrition for women with breast cancer receiving chemotherapy was part of the theoretical section. It was put into practice through role-plays, scenarios, educational videos, lectures, and posters. It took about 20 to 30 minutes for each lady to complete the questionnaire used to gauge their level of dietary knowledge. For the women, the researchers created an informative brochure with simple language and engaging photos.

Included in the nutritional teaching program were the following nutrition-related facts:

Nutritional knowledge of breast cancer and its therapies

The origins, risk factors, and symptoms of breast cancer

Preserving a healthy weight

BMI (body mass index): Typical recommendations to prevent obesity

After therapy, managing weight problems and maintaining a balanced weight.

Make sure the food is balanced. Control servings and amounts.

Comprehending food labeling

Making dietary plans that are healthy - Learning about nutritional supplements

As you treat breast cancer, eat healthily.

- Guidelines for chemotherapy patients' diets and dietary supplements during cancer treatment

Nutritional practices were covered in the practical section. To evaluate women's nutritional behaviors, the interview took about 20 to 30 minutes for each woman to complete the questionnaire. It was put into practice via lectures, posters, and instructional movies.

The following Nutritional guidelines for breast cancer patients receiving chemotherapy were included in the nutritional education program:

- Employing whole grains
- Fruit and vegetable consumption
- Eat more beans; cut out on processed and red meat; and eat quicker meals.
- Processed foods that contain a lot of sugar, starch, or fat

D-Evaluation Phase

It occurred after one month, each woman was re-interviewed to assess their knowledge, nutritional practices, taste function, food liking, and appetite. Reassessment of a woman was done using the same tool used in the pre-test to evaluate the effect of a nutritional teaching program on knowledge, practices, taste function, food liking, and appetite among breast cancer women undergoing chemotherapy.

Statistical analysis:

For data entry and statistical analysis, SPSS for Windows, version 20, was used. Qualitative factors were represented by means and SDs, while quantitative data were represented by frequencies and percentages. Tests for differences between the two means (t-test) were employed. To compare qualitative parameters, the chi-square (x2) test was employed. The Pearson's correlation coefficient test (γ) was employed. At a P-value <0.05, statistical significance was taken into account.

Results:

Table 1 shows that 60 percent of the women in the study were between the ages of 40 and 60. Most of them (70%) lived in rural areas, 70% were unemployed, and 45% had completed secondary school.

Table 2: reveals that 38% of the women in the study were in stage 2 of the disease, and 90% of the women in the study had cancer for less than a year.

Figure 1: Shows that non-spreading tumors were present in 75% of patients with breast cancer receiving treatment.

More than half (60%) of women with breast cancer undergoing chemotherapy had a family history of the disease, according to **Figure (2).**

Figure (3) shows that a breast lump was present in 51% of women with breast cancer receiving chemotherapy.

Figure (4) shows that 70% of the women with breast cancer who were having chemotherapy in the study said that their doctors were their main source of nutrition information.

Table (3) indicates that the total knowledge mean scores of the breast cancer patients taking chemotherapy before and after the deployment of the nutritional instruction program differed in a highly statistically significant way (P<0.001).

As shown in **Figure 5**, 60% of the breast cancer patients receiving chemotherapy who were the subject of the study had low levels of knowledge before the implementation of the nutritional training program, but their levels of knowledge improved to 73% after the program was implemented.

According to **Table 4**, the total practice mean scores of the breast cancer patients having chemotherapy before and after the nutritional education program was implemented differed by a highly statistically significant amount (P<0.001).

Figure 6 explains the overall practice score of the breast cancer patients receiving chemotherapy before and one month after the administration of the nutritional education program. It was found that the majority of the women (93%) had poor nutritional practices prior to the implementation of the nutritional training program and that this percentage dropped to 11% one month later. In contrast, 89 percent of them had solid practices one month

after the nutritional training program was implemented, compared to just 7% before.

Table 5 demonstrates that the total taste alterations mean scores among the breast cancer women in the study who were receiving chemotherapy after the nutritional teaching program was applied were highly statistically significant. Additionally, the mean scores for taste alterations were significantly lower during the various visits, highlighting the beneficial effects of the nutritional teaching program application (P<0.001).

As can be seen in **Table (6),** there was a significant improvement in the appetite mean scores over the course of the various visits, indicating the beneficial impact of the nutritional teaching program application. Additionally, there was a highly statistically significant difference in the total appetite mean scores among the breast cancer women undergoing chemotherapy after the program was implemented (P<0.001).

According to **Table (7),** the mean scores for overall knowledge and behaviors among the breast cancer patients having chemotherapy before and after the nutritional education program was implemented were significantly positively correlated (P<0.001).

Table (1): Personal data of the studied breast cancer women undergoing chemotherapy (n=100)

ems	No.	%
/omen's age in years		
l≤ 40 years	40	40
) ≤ 60 years	60	60
/omen ' education		
literate	10.0	10.0
ead and write	15.0	15.0
econdary education	45.0	45.0
igher education	30.0	30.0
ccupation		
/orking	30.0	30.0
ot working	70.0	70.0
esidence		
Rural	70	70
Urban	30	30

Table (2): Medical data of the studied breast cancer women undergoing chemotherapy (n=100)

em	No.	%
uration of disease:		
one year	90	90
one year	10	10
tages of disease		
tage 1	17	17
tage 2	38	38
tage 3	24	24
tage 4	21	21

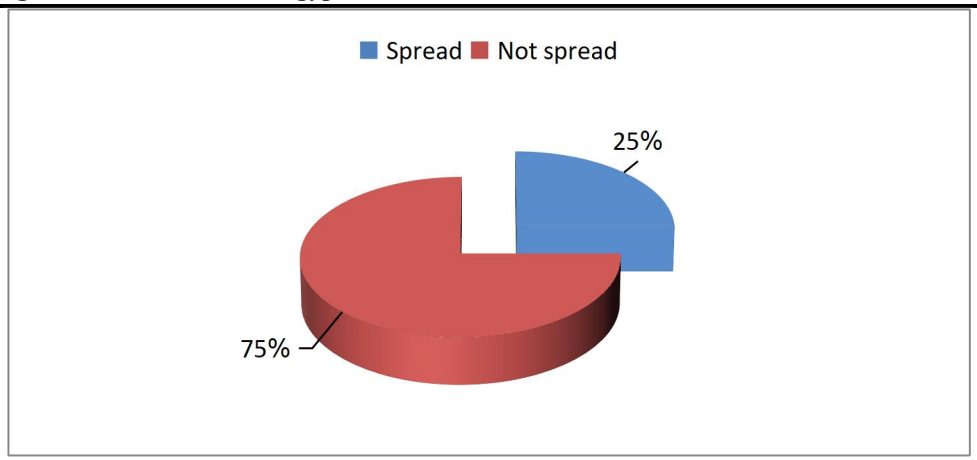

Figure (1): Type of tumor distribution among breast cancer women undergoing chemotherapy (n=100)

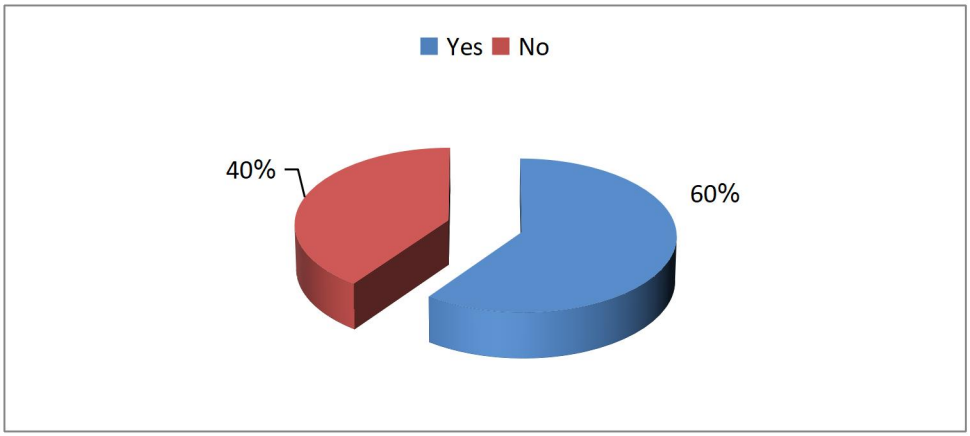

Figure (2): Family history distribution among breast cancer women undergoing chemotherapy (n=100)

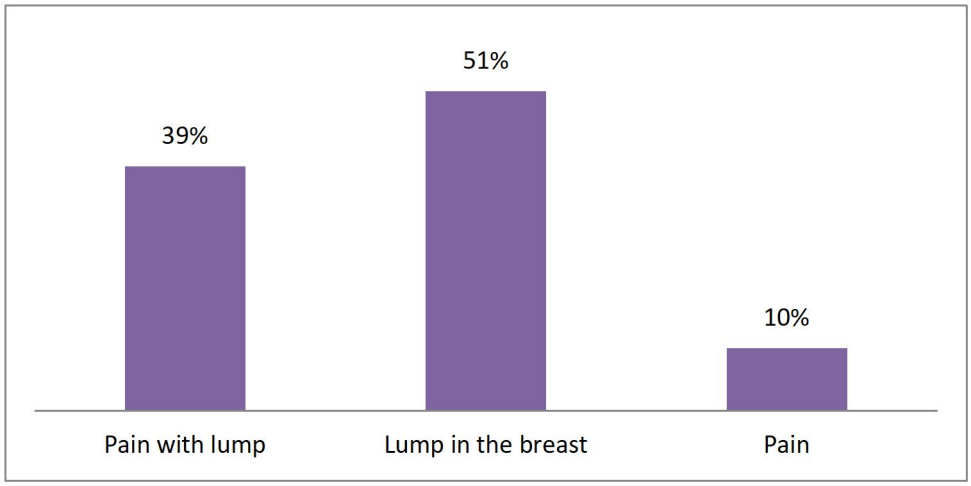

Figure (3): Types of complaints distribution among breast cancer women undergoing chemotherapy (n=100)

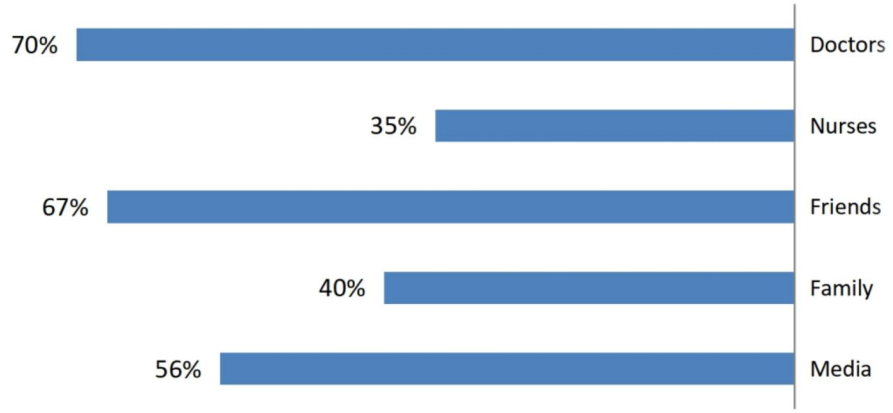

Figure (4): Source of nutritional knowledge among breast cancer women undergoing chemotherapy

Table (3): Total knowledge mean scores differences among the studied breast cancer women undergoing chemotherapy pre and post-nutritional teaching program application (N = 100)

Items	Study Group (n= 100)				X2	P-value
	Pre- Pre-nutritional teaching rogram applica tion		Post-nutritional teaching rogram applicat ion			
	No	%	No	%		
otal knowledge mean scores	4.22±1.1		10.3±1.3		F=55.7 P=0.001HS	

*Statistically significant level at P < .05

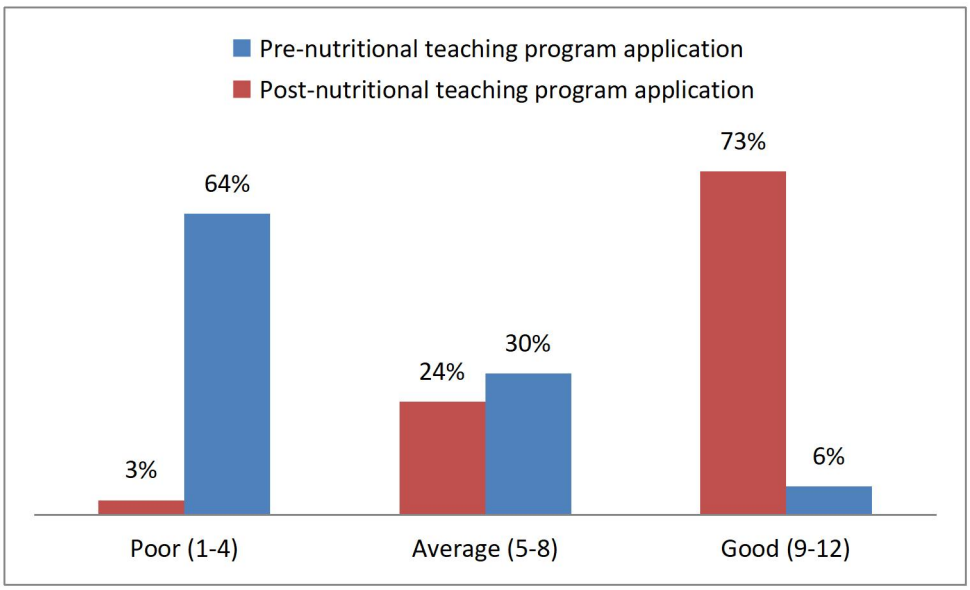

Figure (5): Total nutritional knowledge level among the studied breast cancer women undergoing chemotherapy pre and post-nutritional teaching program application (N = 100)

Table (4): Total practices mean scores differences among the studied breast cancer women undergoing chemotherapy pre and post-nutritional teaching program application (N = 100)

Items	Study Group (n= 100)				X2	P-value
	Pre- Pre-nutritional teaching program		Post-nutritional aching program			
	No	%	No	%		
otal practice mean scores	2.02±0.3		5.2±1.1		F=74.33	P=0.001HS

*Statistically significant level at P < .05

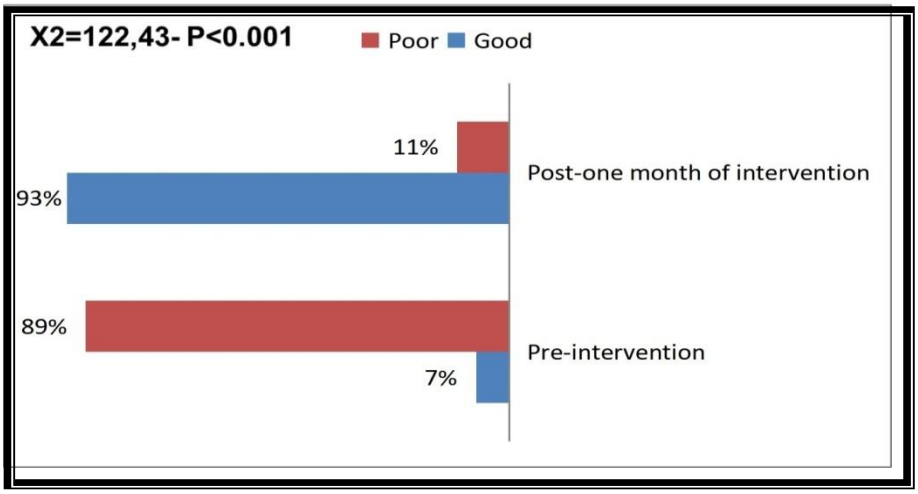

Figure (6): Total nutritional practical knowledge level among the studied breast cancer women undergoing chemotherapy pre and post-nutritional teaching program application (N = 100)

Table (5): Total taste alterations mean scores among the studied breast cancer women undergoing chemotherapy post-nutritional teaching program application (N = 100)

Items	Visit 1	Visit 2	Last visit	P-value
aste alterations	3.22 ± 0.32	2.77± 1.33	2.04±1.20	0.001

*Statistically significant level at P < .05

Table (6): Total appetite mean scores among the studied breast cancer women undergoing chemotherapy post-nutritional teaching program application (n = 100)

Items	Visit 1	Visit 2	Last visit	P-value
otal appetite mean scores	2.67 ± 0.22	3.03± 1.11	4.99±1.09	0.001

*Statistically significant level at P < .05

Table (7): Correlation coefficient between breast cancer women undergoing chemotherapy' knowledge and practice scores pre and post-nutritional teaching program application

nowledge	Practice			
	Pre-nutritional teaching program application		Post-nutritional teaching program application	
	R	P	R	P
Total knowledge pre-test	0.039	0.827(N.S)	---	---
Total knowledge post-test	---	---	0.417	0.005

Discussion:

Breast cells can give rise to a type of cancer known as breast cancer. The most prevalent cancer among women worldwide is breast cancer. A common course of treatment for breast cancer is mastectomy. Physical and mental issues arise as a result of breast cancer treatment. Therefore, it is the nurse's duty to determine the patient's needs, obtain a suitable nursing diagnosis, and start care plans. Physical and physiological issues are the result. The most likely cancer treatment to impair immunity is chemotherapy.

Fatigue, anorexia, and physical inactivity brought on by physical and psychological suffering are some of the side effects of anticancer medications (chemotherapy) that can worsen malnutrition and cause more muscle loss. A lower response to treatment and a lower quality of life are linked to malnutrition, which also reduces tolerance to anticancer treatments like chemotherapy (**Pedersini et al., 2022).** This study aims to assess how a nutritional education program affects breast cancer patients receiving chemotherapy in terms of their knowledge, habits, appetite, and taste changes.

The results of this study showed that three-fifths of the women in the study were between the ages of forty and sixty. This conclusion is supported by extended life expectancy and a rise in the risk of breast cancer in women around the age of 40 as a result of altered reproductive patterns, menopausal hormone use, the growing incidence of obesity, and genetic damage (mutations) in the body throughout this age range. This conclusion was compatible with **Ferlay (2018)**, who noted that most of the samples under study were between the ages of 15 and 39. It was also in line with **Coa (2019)**. **Jarvandi (2019)**, however, found that two-thirds of all newly diagnosed female breast cancer patients are 55 years of age or older, which contradicts this finding and this can be attributed to the postmenopausal period of life.

The results of this study indicated that slightly over three-fifths of the total samples reside in rural areas. **Sim (2019)** corroborated this finding by stating that women with breast cancer were more likely to live in rural areas. **Pakseresht (2019)**, who claimed that many breast cancer patients resided in urban areas, was in conflict with the current study's findings.

Regarding educational level, the present study revealed that nearly half of the total samples had secondary education, which interprets early detection of cancer at the first stage. This finding was consistent with **Beiki (2022)**, who reported that less than half of the total sample had secondary education, and also with **Ahmed and Dawood (2022)**, who found that two-thirds of the studied sample had secondary education. They also found that the highest percentage of the groups under study were illiterate.

Regarding the breast cancer stage, this result revealed that almost one-third of the women in the study had second-degree breast cancer. **Musarezaie and Zargham-Boroujeni (2019)** noted that a greater proportion of the groups under study received a second-stage diagnosis, which this data supported.

According to the current study, three-fifths of women with breast cancer receiving chemotherapy had a family history of the disease. This indicates that some genetic defects that do not advance breast cancer have been inherited (did not transfer from parent to child). This result was not comparable. The majority of their patients have an unfavorable family history, according to **Hawash, (2018)**. This result ran counter to that of **Mahdy, (2022)**, who found that the majority of their patients had no prior experience with breast cancer and a negative family history. This finding was consistent with **Hagrass, (2022)**, who found that a greater proportion of the patients under study had a positive family history, particularly a first relative degree related to genetic factors.

The recent study's findings showed that over half of the women experienced their first breast lump. **El-Shinawi et al. (2023)** observed that most patients identified a painless breast lump as a sign of breast cancer, which is consistent with this outcome.

The results of this study showed that almost two-thirds of the breast cancer patients receiving chemotherapy felt that doctors were their main source of nutrition information. This shows that women want to know accurate and healthful information from reliable sources.

According to the current study's findings, over half of the women experienced their first breast bump. This finding is consistent with that of **El-Shinawi et al. (2023**), who discovered that most patients identified a painless breast lump as a sign of breast cancer.

According to the current study's findings, almost two-thirds of the breast cancer patients receiving chemotherapy said that their doctors were their main source of nutrition information. This demonstrates women's desire to get accurate and healthful information from reliable sources.

The present study found that the total knowledge mean scores of the breast cancer patients receiving chemotherapy before and after the application of the nutritional teaching program differed by a highly statistically significant amount. This finding indicates that the application of the nutritional teaching program was beneficial in meeting the needs of the women and giving them the knowledge they needed to maintain a healthy and balanced diet.

According to the study's findings, three-fifths of the breast cancer patients receiving chemotherapy had low levels of knowledge prior to the implementation of a nutritional education program; however, after the program was implemented, the majority of the women had good levels of knowledge.

This outcome demonstrates the necessity of improving the awareness and knowledge of women with breast cancer undergoing chemotherapy in order to improve their knowledge of nutrition, and it also makes clear the significance of the use of nutritional education programs. These results make a lot of sense because they were applying the nutritional education program, and their knowledge has grown, which indicates that the participants needed to apply the program effectively.

The current study found a highly statistically significant difference between the mean scores for all practices of breast cancer women receiving chemotherapy before and after the application of the nutritional teaching program. It demonstrated the observable positive influence of the nutritional education program on enhancing practices, according to the researchers. The major changes in the women's practices that mirrored the primary objectives of the nutritional education program's implementation are validated by these.

The findings are corroborated by a number of studies, including **Boltong et al. (2020**), which examined how adjuvant breast cancer chemotherapy affected appetite, food liking, and taste function as well as related nutritional outcomes; **Drareni et al. (2019**), which examined the relationship between food behavior and taste and smell alterations in cancer patients undergoing chemotherapy; and **Vries et al. (2019**), which examined "Differences in dietary intake during chemotherapy in breast cancer patients compared to women without cancer." These studies found that the educational nutritional intervention was successful in increasing fruit consumption and decreasing the consumption of red and processed meat by women following breast cancer surgery.

The current study demonstrated that the total taste alterations mean scores among the breast cancer patients receiving chemotherapy after the nutritional teaching program was applied were highly statistically different from one another. Additionally, the mean scores for taste alterations were significantly lower during the various visits, highlighting the beneficial effects of the nutritional teaching program. Similar findings were made by **Sánchez-Lara et al. (2020**), who found that malignant neoplasia patients were more sensitive to bitter flavors than non-cancer participants. DeWys and Walters also showed that cancer patients had a greater sensitivity to bitter flavors and a dislike of meat. Possible explanations for the contradictory results include genetic background, lifelong exposure to varying degrees of sweetness, the type and/or length of malignancy, life-long exposure to different levels of sweetness, or genetic background. Different detection methods, conducted by (**Boltong et al., 2020; Steinbach et al., 2020)** may also contribute to inconsistent findings.

Another study by **Ozkan et al. (2022**) revealed a high prevalence of self-reported taste changes, up to 98.3%. This is in line with earlier research that found that up to 63.1%, 64% (**Ponticelli et al., 2019**), 69.9% (**Zabernigg et**

al., 2020), and 76.1% (**Gamper et al., 2022**) of people have taste changes.

This finding is corroborated by **Ozkan et al. (2022**), who discovered that cancer patients experienced more severe taste changes. They also found that cancer patients' eating habits are significantly impacted by taste changes, which may result in nutritional deficiencies (**Zabernigg et al., 2020). UDhuibhir et al. (2020)** observed no direct correlation between eating habits and taste changes following chemotherapy, while **McGettigan et al. (2019**) found no statistically significant association between malnutrition weight loss and changes in taste and smell. Antineoplastic side effects such as anorexia, nausea, and vomiting, as well as metabolic alterations like inflammation, increased catabolism, and anabolic resistance, are all linked to malnutrition during chemotherapy (**Baracos et al., 2018**).

However, our results suggest that, while not the only determinant, taste change plays a role in the development of malnutrition. However, more research is required to get more comprehensive findings. There were also conflicting results about weight loss and taste alterations. According to certain studies, patients with impaired taste lost weight **[Alonzi et al., 2021, Mahmoud et al., 2021]**, whereas other studies revealed no connection between taste alterations and weight changes (**Pedersini et al., 2022).**

The current study demonstrated a significant improvement in the appetite mean scores over the course of the various visits, highlighting the effectiveness of the nutritional teaching program application. It also revealed a highly statistically significant difference in the total appetite mean scores among breast cancer women undergoing chemotherapy after the nutritional teaching program application. Their taste thresholds may have changed, which could have an impact on these shifts in food choices. The selection of sweetened foods may have been influenced by the sensitivity to sweet flavors noted at the initial therapy appointment. Additionally, LFA may influence the selection of cancer patients receiving chemotherapy, which may lead to these individuals consuming less food overall. It is postulated that the degree of nausea control is likely to influence self-rated appetite and food liking (**Mattes et al, 2017**).

Dietary insufficiency and weight loss were more closely associated with appetite decrease than with changes in taste sensitivity. While not all subjects with taste or appetite deficiencies lost weight, there was a slight correlation between declining nutritional status and decreased hunger and a medium correlation with decreased BMI. In this study, the association between taste and food hedonics and changes in nutritional outcomes and dietary quality was unique to early breast cancer populations. Because of the bidirectional weight change and its unpredictable clinical implications, this relationship should be examined in other clinical settings (**Larsen et al., 2021**).

The current study found that the mean scores for total knowledge and practices among breast cancer patients receiving chemotherapy before and after the deployment of the nutritional teaching program showed a significant beneficial association. These demonstrated the significance of enhancing women's behaviors and knowledge in order to support their learning and application of quality knowledge. This link can be explained by the fact that the ladies under study were able to practice well after gaining adequate knowledge.

The present study's findings demonstrated that the implementation of a nutritional teaching program was successful in enhancing women's post-breast cancer nutrition practices and knowledge. The current study's objectives and hypotheses provided support for these findings. These findings align with those of **Cecilia et al. (2019**), who investigated "Nutrition education intervention for women with breast cancer: effect on nutritional factors and oxidative stress" and discovered that the intervention had improved the dietary practices of breast cancer patients.

Conclusion:

Based on the findings of the present study, it can be concluded that the implementation of the nutritional teaching program had a positive effect on improving knowledge, practices, taste alterations, and appetite among breast cancer

women undergoing chemotherapy.

Recommendations:

Based on the findings of the current study, the following recommendations are derived and suggested:

- Planned post-discharge education should be prepared and given to breast cancer women undergoing chemotherapy, as well as systemic education during the follow-up period.
- Regular nutritional education programs should be held for women undergoing chemotherapy to discuss and teach them various aspects of nutrition.
- Nursing staff should concentrate on early assessment of malnutrition signs and symptoms and dietary intake for breast cancer women undergoing chemotherapy.
- To maintain excellent health, extensive health education programs are being conducted for women receiving chemotherapy after breast cancer.
- The current study should be replicated with a bigger sample size in order to generalize the findings.

References

- Ahmed S., & Dawood W., (2019): Effect of an Educational Supportive Program onMastectomy Patients' Satisfaction, *IOSR Journal of Nursing and Health Science* , Vol.6,N. 6, pp.66-74.
- Alonzi, S., Hoerger, M., Perry, L., Chow, L., Manogue, C., & Cotogno, P. (2021): Changes in taste and smell of food during prostate cancer treatment. *Support Care Cancer*; 29: 2807–2809. https://doi.org/10. 1007/s00520-021-06050-x PMID: 33566164
- Ames, H., Gee, M., & Hawrysh, Z. (1993) Taste perception and breast cancer: evidence of a role for diet. *J Am Diet Assoc* 93(5):541–546
- Amin, A., Aldin, D., El-Zawahry, H., & Sherif , G. (2022): Practice, Effectiveness and Factors Affecting Self-care Behaviors in Managing Chemotherapy Side effects in Breast Cancer Patients. Res Sq; 1–15. Available: https://doi.org/10.21203/rs.3.rs-1692200/v1

Bahgat, Z., Alaa Elden, S., Atia, N., El Sheik, E., Elshemy, M. (2019): The Efficacy of Protocol of Care on Post MastectomizedWomen Outcomes. *IOSR Journal Of Nursing And Health Scienc*e, Vol. 5, N. 5, pp. 49-64.

Baracos VE. (2018): Cancer-associated malnutrition. *Eur J Clin Nutr*.; 72: 1255–1259. https://doi.org/10.

Beiki, O., Hall, P., Ekbom, A., & Moradi, T., (2022): Breast cancer incidence and case fatality among 4.7 million women in relation to social and ethnic background, *Breast Cancer Research*, Vol. 14, N. 1, pp. 5.

Bernhardson, B. (2023) 5 themes described the experiences of patients with chemotherapy induced oral mucositis. *Evid Based Nurs* 6(2): 62–.

Bernhardson, B., Tishelman, C., & Rutqvist, L. (2020): Chemosensory changes experienced by patients undergoing cancer chemotherapy: a qualitative interview study. *J Pain Symptom Manage* 34(4): 403–12.

Boltong, A., Aranda, S., Keast, R., Wynne, R., Francis, P., & Chirgwin, J. (2020): A Prospective Cohort Study of The Effects of Adjuvant Breast Cancer Chemotherapy on Taste Function, Food Liking, Appetite, and Associated Nutritional Outcomes. *Plos One;* 9(7):e103512. http://doi.org/10.1371/journal.pone.0103512

Buttiron Webber, T., Briata, I., DeCensi, A., Cevasco, I., Paleari, L. (2023): Taste and Smell Disorders in Cancer Treatment: Results from an Integrative Rapid Systematic Review. *Int J Mol Sci*; 24. https://doi. org/10.3390/ijms24032538 PMID: 36768861

Capra, S., Ferguson, M., & Ried, K. (2021): Cancer: impact of nutrition intervention outcome—nutrition issues for patients. Nutrition 17(9):769–772

Cecilia, C., Schiavon, K., & Vieira, V. (2019): Nutrition Education Intervention for Women with Breast Cancer: Effect on Nutritional Factors and Oxidative Stress; 47(1):2-9. DOI: 10. 1016/ *j. jneb*. 09.

Coa, K., Epstein, J., Ettinger, D., Jatoi, A., McManus, K., Platek, M., &Moskowitz, B., (2019): The impact of cancer treatment on the diets and food preferences of patients receiving outpatient treatment. *Nutrition and cancer*,

67(2),Pp. 339-353.

- Comeau, T., Epstein, J., Migas, C. (2021): Taste and smell dysfunction in patients receiving chemotherapy: a review of current knowledge. *Support Care Cancer* 9(8):575–580
- Davis Lynn, B., Chernyavskiy, P., Gierach, G., & Rosenberg, P. (2022): Decreasing incidence of estrogen receptor-negative breast cancer in the United States: trends by race and region. *J Natl Cancer Inst*;114(2):263–270.
- Drareni, K,, Dougkas, A,, Giboreau, A,, Laville, M,, Souquet, P, & Bensafi, M. (2019): Relationship between Food Behavior and Taste and Smell Alterations in Cancer Patients Undergoing Chemotherapy: A Structured Review. Semin Oncol; 46(2):160-72. http://doi.org/10.1053/j.seminoncol.05.002
- El-Shinawi,. M., Youssef, A., Alsara, M., Aly, M., Mostafa, M., Yehia, A., Hurlbert, M., Abd El-Tawab, R., & Mohamed, M. (2023): Assessing The Level of Breast Cancer Awareness Among Recently Diagnosed Patients in Ain Shams University Hospital, The Breast, Vol .22: pp 1210-1214.
- Eraky, A. (2019): Effect of nursing intervention on traumatic stress and coping strategies among women with breast cancer.M. Sc. Thesis in Maternal and New born Health Nursing for Doctorate degree, Faculty of Nursing, Menoufiya University, Egypt
- Ferlay, J., Hery, C., Autier, P., & Sankaranarayanan, R. (2018): Global Burden of Breast Cancer. In Breast Cancer Epidemiology; Springer: New York, NY,USA, pp: 1–19.
- Gamper, E., Giesinge, J., Oberguggenberger, A., Kemmler, G., Wintner, L., & Gattringer, K. (2022): Taste alterations in breast and gynaecological cancer patients receiving chemotherapy: Prevalence, course of severity, and quality of life correlates. *Acta Oncol (Madr)*; 51: 490–496. https://doi.org/10.3109/0284186X.2011.633554 PMID: 22129358
- Giampieri, R,, Pelati, E., Mobili, A., Copparoni, C., Crocetti, S., & Baleani, M. (2021): Prospective observational study of taste assay in patients with solid tumors treated with standard chemotherapy (POTATO). *Sup- port Care Cancer*; 29: 851–858. https://doi.org/10.1007/s00520-020-05553-3 PMID: 32504310

Grant, M., Kravits, K,, & Grant, M . (2000) Symptoms and their impact on nutrition. Semin Oncol Nurs; 16: 113–121. https://doi.org/10.1053/on.2000.5738 PMID: 10842780

Hagrass, S., Allah, E., Hassan, S., & Sawy, W., (2022): Improving the quality of life for women with arm lymphedema post- mastectomy in Zagazig City, *Aust J Basic Appl Sci*, Vol. 6, N.3, pp.428-442. 11.

Hawash M., Alaa Eldeen S., El Shatby A., ElMoghazy H., Hamida M., (2018): Effect of the nursing rehabilitation program on the prevention of lymphedema among post-mastectomy women, *IOSR Journal of Nursing and Health Science* , Vol.7, N. 6, pp.68-87.

James, F., Wootton, S., Jackson, A., Wiseman, M., Copson, E., & Cutress, R., (2019): Obesity in breast cancer–what is the risk factor?. *European journal of cancer*,51(6), Pp.705-720.

Joseph, V., Nolden, A, Kober, K., Paul, S., Cooper, B., Conley, Y. (2021): Fatigue, Stress, and Func- tional Status are Associated With Taste Changes in Oncology Patients Receiving Chemotherapy. *J Pain Symptom Manage*; 62: 373–382.e2. https://doi.org/10.1016/j.jpainsymman.2020.11.029 PMID: 33259906

Kano, T., & Kanda, K. (2013): Development and validation of a chemotherapy-induced taste alteration scale. *Oncol Nurs Forum*; 40: 79–85. https://doi.org/10.1188/13.ONF.E79-E85 PMID: 23448748

Kim, Y., Kim, G., Son, S., Song, M., Park, S., Chung, H. (2020): Changes in taste and food preferences in breast cancer patients receiving chemotherapy: a pilot study. *Support Care Cancer;* 28: 1265– 1275. https://doi.org/10.1007/s00520-019-04924-9 PMID: 31230121

Larsen, A., Thomsen, C., Sanden, M., Skadhauge, L., Anker, C., Mortensen, M. (2021): Taste alterations and oral discomfort in patients receiving chemotherapy. *Support Care Cancer*.

; 29: 7431–7439. https://doi.org/10.1007/s00520-021-06316-4 PMID: 34080053

- Mahdy, N., & Ali, R., (2022): Effect of Pre-discharge Guidelines on Women's Knowledge and Self-Care Practices Regarding Arm Lymphedema Prevention Post mastectomy, *J Am Sci,* vol. 8, N. 12, pp.1003-1017
- Mahmoud, F., Aktas, A., Walsh, D., & Hullihen, B. (2021): A Pilot Study of Taste Changes Among Hospice Inpatients With Advanced Cancer. *Am J Hosp Palliat Med*; 28: 487–492. https://doi.org/10.1177/ 1049909111402187 PMID: 21398265
- Malta, C., De Lima Martins, J., Carlos, A., Freitas, M, Magalhães, I., de Vasconcelos, H. (2022): Risk factors for dysgeusia during chemotherapy for solid tumors: a retrospective cross-sectional study. *Support Care Cancer*; 30: 313–325. https://doi.org/10.1007/s00520-021-06219-4 PMID:
- Masmouei B., Harorani M., Ghafarzadegan R., Davodabady F., Zahedi S., & Davodabady Z., (2019): The effect of progressive muscle relaxation on cancer patients' self-efficacy, Complementary therapies in clinical practice, vol. 34, N.6 ,pp.70-75.
- Mattes, R., Arnold, C., & Boraas, M. (2017): Learned food aversions among cancer chemotherapy patients. Incidence, nature, and clinical implications. Cancer 60(10):2576–2580
- McGettigan, N., Dhuibhir, P., Barrett, M., Sui, J., Balding, L., & Higgins, S. (2019): Subjective and Objective Assessment of Taste and Smell Sensation in Advanced Cancer. *Am J Hosp Palliat* Med; 36: 688–696. https://doi.org/10.1177/1049909119832836 PMID: 30827119
- McQuestion, M., Fitch, M., & Howell, D. (2021) The changed meaning of food: Physical, social and emotional loss for patients having received radiation treatment for head and neck cancer. *Eur J Oncol Nurs* 15(2): 145–51. Epub 2010/09/25.
- Musarezaie, A., & Zargham-Boroujeni, A. (2019): Quality of life and related factors among the women undergoing mastectomy. *Irani Journal of Nursing and Midwifery* Research; 20:287-91.
- Ozkan, İ., Taylan, S., & Eroğlu, N., (2022): Kolac,, N. The Relationship between Malnutrition and Subjective Taste Change Experienced by Patients with Cancer Receiving Outpatient Chemotherapy Treatment. *Nutr Cancer*; 74: 1670–1679. https://doi.org/10.1080/01635581.2021.1957485 PMID: 34328368

Pakseresht, S., Ingle, G., & Bahadur, A. (2019): Risk factors with breast cancer among women in Delhi. *Indian J Cancer*; 5(46):8-132.

Pedersini, R., Di Mauro, P., Zamparini, M., Bosio, S., Zanini, B, & Amoroso, V. (2022): Taste Alterations Do Not Affect Change in Food Habits and Body Weight in Breast Cancer Patients. *In Vivo (Brooklyn)*; 36: 1860–1867. https://doi.org/10.21873/invivo.12904 PMID: 35738619

Ponticelli, E., Clari, M., Frigerio, S., De Clemente, A., & Scavino E. (2019): Dysgeusia and health- related quality of life of cancer patients receiving chemotherapy: A cross-sectional study. *Eur J Cancer Care* (Engl).; 26: 1–7. https://doi.org/10.1111/ecc.12633 PMID: 28101929

Sánchez-Lara, K., Sosa-Sánchez, R., Green-Renner, D., Rodríguez, C., Laviano, A., Motola-Kuba, D., & Arrieta, O. (2020): Influence of taste disorders on dietary behaviors in cancer patients under chemotherapy. *Nutr J 9:*15

Settle, R., Quinn, M., Brand, J., Kare, M., & Mullen, J. (1979): Gustatory evaluation of cancer patients: preliminary results. *Nutr Cancer*:171–185

Simeone, S., Esposito, M., Gargiulo, G., Lanzuise, A., & Botti, S. (2019): The CiTAS scale for evaluat- ing taste alteration induced by chemotherapy: State of the art on its clinical use. *Acta Biomed*; 90: 17–25. https://doi.org/10.23750/abm.v90i6-S.8278 PMID: 31292411

Sim, X., Ali, R., & Wedren, S. (2019): Ethnic differences in the time trend of female breast cancer incidence: Singapore. *BMC Cancer*; 5(6): 70-261.

Steinbach, S., Hummel, T., Böhner, C., Berktold, S., Hundt, W., Kriner, M., Heinrich, P., & Prechtl, A. (2020): Qualitative and quantitative assessment of taste and smell changes in patients undergoing chemotherapy for breast cancer or gynecologic malignancies. *J Clin Oncol 27*(11):1899–1905

Steinbach, S., Hundt, W., Zahnert, T., Berktold, S., Böhner, C., & Schmalfeldt, B. (2020): Gustatory and olfactory function in breast cancer patients.

SupportCare Cancer 18(6):707–71

- Sozeri, E., & Kutluturkan, S. (2018): The Validity and Reliability of Turkish Version of the Chemotherapy-induced Taste Alteration Scale (CiTAS). Clin Nurs Res; 27: 235–249. https://doi.org/10.1177/ 1054773816662436 PMID: 27514732
- The Global Cancer Observatory (2020): - All Rights Reserved – December.
- U´Dhuibhir, P., Barrett, M., O'Donoghue, N., Gillham, C., El Beltagi, N., & Walsh, D. (2020): Self-reported and objective taste and smell evaluation in treatment-naive solid tumour patients. *Support Care Cancer*; 28: 2389–2396. https://doi.org/10.1007/s00520-019-05017-3 PMID: 31486983
- Van Cutsem, E., & Arends, J. (2022) The causes and consequences of cancer-associated malnutrition. *Eur J Oncol Nurs* 9(Supplement 2): S51–S63
- Vries, Y., Van Den, B., Vries, J., Boesveldt, S., Kruif, J., & Buist, N.. (2019): Differences in Dietary Intake during Chemotherapy in Breast Cancer Patients Compared to Women without Cancer. *Sup Care Cancer*; 25(8):2581-91. http://doi.org/10.1007/s00520-017-3668-x
- World Health Organization (WHO) (2020): Global Health Estimates: Deaths by Cause, Age, Sex, by Country and by Region. WHO; 2020.. who.int/data/gho/data/themes/mortality-and-global-health estimates/ghe-leading-causes-of-death https://cancerstatisticscenter.cancer.org Accessed on 27 September 2020.
- Zabernigg, A., Gamper, E., Giesinger, J., Rumpold, G., Kemmler, G., Gattringer, K. (2020): Taste Alterations in Cancer Patients Receiving Chemotherapy: A Neglected Side Effect? Oncologist; 15: 913–920. https://doi.org/10.1634/theoncologist.2009-0333 PMID: 20667968