Foot Reflexology Effect on Chemotherapy-Induced Nausea, Vomiting and its Relation on Patients' Hydration Status and Fatigue Level

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Abstract

Background: Chemotherapy is one modalities of treatment cancer, but it often causes side effects as nausea, vomiting as well as fatigue. Reflexology is hence reducing these side effects. **Aim of study** is to assess the effects of foot reflexology on chemotherapy- caused nausea, vomiting and its relation on patients' hydration status and fatigue level. The quasi-experimental design is the study design. **Setting;** Research was implemented in oncology unit at Minia University hospital**. Sample;** A purposive sample of 50 patients receiving chemotherapy was recruited into two equivalent groups (study as well as control). **Tools**; four tools were utilized; the 1st is structured interview questionnaire, 2nd tool: Rhodes Index of Nausea, Vomiting, as well as tool of Retching self-report assessment, 3rd tool is the Brief Fatigue Inventory self-report assessment and the 4th tool is the assessment of patient's hydration status. **Results**; the present research revealed that nearly one third of two groups (32%) have breast cancer with stage III of disease. Majority of study as well as control group (84% & 80% respectively) complain from severe scores of nausea, vomiting at baseline assessment which significantly decrease among study compared to control participants. Moreover, significant improvement in all hydration parameters including skin turgor (60%) & tongue moisture (40%) among study participants compared to (16% & 12% respectively) among control ones. **Conclusion**; foot reflexology was revealed to significantly reduce chemotherapy-induced nausea and vomiting with improving patient's hydration status plus decreasing fatigue level. **Recommendations**; it was recommended that applying foot reflexology can effectively reduce annoying adverse effects of chemotherapy in oncology unit.

Keywords: Foot reflexology, chemotherapy, nausea and vomiting, hydration, fatigue

Introduction

Cancer is an issue that outcomes from genetic or epigenetic change in the somatic cells as well as has unusual cell growth which may be spread to further bodily regions. They form a subset of neoplasm. The unregulated growth of cells in a group called neoplasm or tumor and they form a lump or mass and may be distributed diffusely **(Saini et al., 2020).**

Cancer ranks as a leading cause of death and an important barrier to increasing life expectancy in every country of the world. According to estimates from the World Health Organization (WHO) in 2019, cancer is the 1st or 2nd main reason of death pre the age of seventy years in 112 of 183 nations as well as ranks 3rd or 4th in a further 23 nations **(WHO, 2020).** Modified cancer mortality and incidence statistics for the end of 2020 have been provided by the Global Cancer Observatory 2020. According to estimates, there were 19.3 million recent cases of cancer globally in 2020, and a disease lost the lives of around 10 million individuals **(Sung et al., 2021).**

In 2020, breast cancer replaced lung cancer as the most prevalent cancer diagnosed worldwide. The five most common reasons of cancer-related death were first was lung, second was liver, third was stomach, fourth was breast, and last was colon cancers; liver cancer ascended from 3rd place in 2018 to 2nd place in 2020 **(Cao et al., 2021).**

Up to 2019, 324,949 patients in Egypt were receiving treatment for malignant neoplasms. According to worldwide cancer monitoring estimates from December 2020, the most common cancers in Egypt are breast (61,160), then the liver (28,977), followed by bladder (26,986), also non-Hodgkin lymphoma (19,096), a leukemia (14,274), brain as well as central nervous system (11,470), and finally prostate

(10,523), with a total cancer incidence of 278,165 (**Ibrahim and Shash, 2022).**

There are two sorts of cancer treatment modalities: advanced or modern and conventional (traditional). Currently, cancer treatments account for more than half of all current medical treatment trials globally. Factors like the cancer's nature, location, and severity help choose the best course of treatment and track its advancement. The most popular conventional treatment approaches include radiotherapy, chemotherapy, and surgery; in contrast, contemporary approaches involve hormone therapy, anti-angiogenic, immunotherapy, stem cell, as well as dendritic cell-based immunotherapy **(Debela et al., 2021).**

Chemotherapy means that chemicals are utilized to manage cancer by destroying cancerous cells and moreover by minimize tumor size but have severe side impacts **(Saini et al., 2020).** One of the most frequent adverse impacts experienced by people receive chemotherapy is nausea and vomiting. Nearly 50% of cancer patients experience acute, delayed, or predicted nausea as well as vomiting, despite advancements in antiemetic medicines meant to prevent and limit nausea as well as vomiting caused by cancer and chemotherapy. Additionally, even with very powerful antiemetics as serotonin antagonists, 38–80 percent of patients have severe nausea as well as vomiting, which leads to twenty percent of patients delaying or refusing treatment. Weight loss, hypotension, and dehydration are caused by uncontrollable nausea and vomiting **(Pekmezci and Hintistan, 2022)**.

Platinum-based chemotherapy is the adjuvant treatment for lung and digestive cancers according to national and international recommendations. Cisplatin is classified as a highly emetogenic chemotherapy (i.e., CINV present > 90%), whilst carboplatin as well as oxaliplatin are classified as fairly emetogenic chemotherapy (i.e., CINV incidence ranging from 30% to 90%). There are two types of CINV: acute (which occurs within a day of taking chemotherapy) and late (occurring within two and five days after treatment). Therapy efficacy may be lowered by CINV-related dose reduction, therapy deferral, or even cessation. Antiemetic medications, primarily 5-hydroxytrytamine 3 receptor antagonists, dexamethasone, as well as neurokinin-1 receptor antagonists, are used to control and manage two acute and late CINV **(Murat-Ringot et al., 2020).**

Decreased energy and/or an increased need to rest that is out of proportion to activity level are symptoms of the fatigue syndrome. Feelings of widespread weakness, difficulty concentrating, loss of interest in routine activities, sleep disorders, emotional instability, and cognitive issues can also accompany it. Chemotherapy is also frequently linked to fatigue, which lasts for months or even years after the treatment is finished. Additionally, targeted therapy - especially oral tyrosine kinase inhibitors - is strongly linked to fatigue, which causes 10%–20% of patients to cease completing treatment **(Kiss et al., 2022).**

Today, reflexology is a sophisticated therapeutic approach. Anecdotally, reflexology as a complementary therapy has been shown to have a variety of benefits **(Whatley, Perkins and Samuel, 2020)**. By methodically putting pressure to specific reflex spots, primarily found in the feet but also in the hands, based on other practices, reflexology is a complementary medicine technique that promotes relaxation and healing. It is thought that during this kind of therapy, particular energy channels flow through specific spots on the feet, as well as that by applying tension to these areas, the channels that are blocked are released, restoring equilibrium in the associated glands, organs, or systems **(Unlu et al., 2018).**

Reflexology is one of the therapeutic techniques that nurses can use actively in their work. Reflexology offers a person an immense amount of relief and relaxation, which is its greatest advantage. Furthermore, it has positive benefits on bloodstream regulation, immune system enhancement, and the elimination of many issues like headaches, hypertension, sexual problems, urinary system issues, and digestive issues (indigestion, constipation, nausea, vomiting, etc.) **(Özdelikara and Tan 2017).**

Foot reflexology is frequently chosen due to the closeness of the pressure areas to the skin surface in the feet. In this application, the blocked energy is dissolved in certain parts of the body with special scrubbing movements applied to the feet and this energy is disseminated to every living tissue and every cell and the self-healing power of the body is activated. With this

application, crystalline waste products like calcium and uric acid are removed by lymphatic and blood circulation, resulting in relaxation as well as comfort. Despite antiemetic medication, foot reflexology therapies have been reported to reduce nausea and vomiting symptoms. Furthermore, the use of foot reflexology has been present to be effective in decrease fatigue and enhancing the good sleep **(Pekmezci and Hintistan, 2022).**

Significant of the study

Chemotherapy is typically used to treat cancer, yet there are a number of potential adverse effects. The both most horrible and terrible side impacts of chemotherapy are nausea and vomiting. Many patients become more exhausting and stop receiving chemotherapy although with administering of antiemetic medications **(Abdelfattah et al., 2022).** Dehydration is caused by uncontrollably vomiting and feeling sick. 60–96% of cancer cases experiencing fatigue after chemotherapy **(Alizadeh et al., 2021).** These patients must practice foot reflexology, which offers numerous advantages including remarkable relief and relaxation. Furthermore, it has positive impacts on circulation regulation, immune system enhancement, and the removal of various issues including nausea and vomiting. Consequently, the current study use foot reflexology to decrease nausea, vomiting, as well as fatigue occurs with chemotherapy administration and assesses its effect on patient's hydration.

Aim of the study:

To assess the effects of foot reflexology on chemotherapy- induced nausea, vomiting, fatigue and its relation on patients' hydration status.

- To determine the effect of foot reflexology on the severity of chemotherapy-induced nausea and vomiting.
- To assess the effect of foot reflexology on fatigue related to both the disease and chemotherapy treatment.
- To evaluate the hydration status of patients experiencing chemotherapy-caused nausea as well as vomiting before and after foot reflexology intervention.

Research hypotheses:

H1: Patients with cancer and treated by chemotherapy, who receive foot Reflexology will experience less nausea & vomiting than those who do not receive such intervention,

H2: Patients with cancer and treated by chemotherapy, who receive foot Reflexology will experience improvement in hydration status than those who do not receive such intervention.

H3: Patients with cancer and treated by chemotherapy, who receive foot Reflexology will experience less fatigue than those who do not receive such intervention.

Study design:

Quasi-experimental design was utilized to accomplish the aim of the research. This method includes the designing of a comparison group and often utilized when it is impossible to randomize subjects to study and control groups **(Iwahori et al., 2022).**

Operational definition:

Foot reflexology:

The practice of reflexology entails manually pressing on particular foot points that are believed to represent particular internal organs. Stimulating the body's zones is intended to encourage the organs connected to those zones to more efficiently heal themselves.

Setting:

This research was implemented in oncology unit at Minia university hospital, the unit is located in the 1st floor and contain three sectors, one of them contain 10 beds for patients need inpatient admission, the other two sectors are designed for daily chemotherapy administration, each contain 5 beds. The unit located in Minia City and is affiliated to Minia University in Egypt.

Sample:

A purposive sample of 50 patients recently received chemotherapy participated in the current study based on the sample size calculation formula of (Isaac and Michael 1995)

(N= n x 30 / 100), in which:

N = Sample Size

N = Total number of 160 adult patients with admitted to oncology unit at Minia university hospital during the period 2021:2022.

N= 200 x 30 / 100 = 48 patients

The minimum sample size is 48

Study group: 25 patients and 25 patients for control group = 50 patients

Inclusion Criteria:

The subjects eligible in the study were:

- Ages between <18 to 64 yrs.
- Conscious adult males and females.
- Recently receiving chemotherapy.

Exclusion criteria:

- Subjects refusing to participate.
- Hemiparesis/ hemiplegia and paraplegia
- Diabetic foot and Diabetic ketoacidosis.
- Lower limb infections, gout, leg ulcers, peripheral vascular disease, deep vein thrombosis, cuts and bruises, and lymphedema
- Lower limbs amputation
- Sever GIT problem,
- Chronic renal failure or other problem affects hydration state.

Tools of data collection:

Four tools were used for data collection in the present study:

Frist tool: Structured interview questionnaire which include two parts:

- **Part I: Demographic Characteristics of patients**; including name, age, marital status, level of education, sex, occupation**).**
- **Part II: Medical data of the patients receiving chemotherapy**; include stage of cancer, types of chemotherapy, number of chemotherapy sessions.

Second tool: Rhodes Index of Nausea, Vomiting, and Retching (INVR) self-report assessment tool):

This tool was developed by **Rhodes and McDaniel in (1999)** and it was adapted as well as translated into Arabic language by the researchers to assess the effectiveness of reflexology on the experience of nausea, vomiting and retching among patients receiving chemotherapy.

There are eight self-report items in the INVR. Frequency and duration of nausea, and nausea-related distress were evaluated using 3 questions. The frequency and amount of vomiting, and vomiting -related distress were evaluated using the next three questions, and frequency and distress from retching were evaluated using the final two questions. Every item on the Likert scale has a score between 0 and 4. After 24 hours of each chemotherapy cycle, the patient's full statement is shown, along with a choice of one of five point responses.

Scoring system:

Five points were used to evaluate the patients' answers. "Zero for denoted no symptoms, then "one for mild symptoms, "also two for moderate symptoms, "then three for great symptoms, and "finally four for severe symptoms on the Likert scale. The sum of the item scores yielded a total score between 0 and 32, which was then interpreted as:

Zero indicate none (no experience with nausea or vomiting, from one to eight for mild nausea and vomiting, the range of nausea and vomiting experiences is from eight to sixteen for Moderate, then from seventeen to twenty-four for Great (strong or very arousing to the senses), and twenty-five to thirty-two for Severe.

Third tool: The Brief Fatigue Inventory (BFI) self-report assessment:

Anderson (1997) created this instrument, which was then modified and translated into Arabic to assess cancer patients' subjective perceptions of fatigue. There were nine items on the Brief Fatigue Inventory (BFI), which had an 11-point scoring system. Every question was asked during the 24 hours following a chemotherapy session. Using a scale of 0 (meaning "no fatigue") to 10 (meaning "as bad as patient can imagine"), the first three questions assess the degree of fatigue at current, typical, and worst levels. The six questions that follow evaluate how fatigue interferes with day-to-day activities: 1. General household activities, such as everyday tasks like cooking, dishwashing, laundry, and keeping the house clean. Activities related to self-care include eating, dressing, bathing, using the restroom, combing one's hair, moving about, and clothing. 3. Capacity to walk. 4. a relationships with other family members and friends. A 5. Taking pleasure in life. Finally 6. Emotion.

The possible answers are zero for (which means "does not interfere") to ten for (which means "completely interferes"). Higher self-reported levels of fatigue are correlated with higher BFI scores. From 0 to 10, the patient chooses the number that best represents fatigue level.

Scoring system for BFI; the total scores of the 1st, 2nd, and 3rd items were divided by three to determine the fatigue severity score. The total scores of the 4a, 4b, 4c, 4d, 4e, and 4f items were divided into 6 to get the score of fatigue's impact on daily activities. Zero indicates no exhaustion, one to three indicates low fatigue, four to six indicates moderate fatigue, and seven to ten indicates high fatigue.

Fourth tool: assessment hydration form: it was developed by the researchers & contains measurement for many parameters including pulse, temperature and BP, assessing tongue moisture, skin turgor, & dehydration urine color chart.

Ethical Consideration

An official permission to implement the actual research was taken from the ethical committee in nursing faculty (REC202372) and Minia university hospital director. Participants gave their oral agreement after being told of the study's goals, methods, advantages, nature, and follow-up. They also knew that they might leave the study at any moment and without explanation. By encrypting all data and safeguarding the collected information, each participant's confidentiality and anonymity were guaranteed.

Study fieldwork:

Phase I: Preparatory phase:

Using textbooks, journals, articles, magazines, and the internet, conduct a review of the prior and current literature in the subject of study to gain a comprehensive understanding of all aspects of the research topic. The study protocol was guided, planned, and developed during this phase. Additionally, a formal written agreement was taken one month pre the research's execution.

Prior to chemotherapy infusion at the start of the treatment cycle, individual interviews were conducted with the control and study groups. During this phase, medical and demographic information was gathered. Before beginning the application of foot reflexology (pre-intervention), the study and control patients underwent an initial examination (pretest) 24 hours following the chemotherapy cycle utilizing tools II, III, and IV to gather baseline data.

Implementation phase:

- When starting the 2nd chemotherapy session, the researchers implement foot reflexology for the study group at the start of chemotherapy infusion. The control group was merely getting standard hospital treatment, and evaluations were conducted 24 hours following each chemotherapy round. During this time, both the study as well as control group undergoing chemotherapy continue to receive the usual antiemetic medications.
- Before beginning the reflexology session, the foot was first massaged using a variety of techniques, mainly effleurage, shaking, rotation, and stretching. This helped to improve circulation, relax the feet, and facilitate reflexology because a relaxed person is more open to applying techniques.
- Put pressure on the foot at the "solar plexus" region to trigger the release of endorphins by sending a signal throughout the body. The thumb was pressed and raised three times to carry out the implementation. The patient's solar plexus was compressed while they were taking deep breaths, and the pressure was released as they were exhaling.
- In order to do general foot reflexology, the thumb (walking, circular, and hooking) technique was used to apply pressure to all reflex zones as well as cover every body parties. Particular foot reflexology was performed for 15 minutes on each foot, with a primary focus on the reflex areas of the heart, pituitary gland, lymph node, and gastrointestinal and urinary system organs. Every practice began with the right foot as well as progressed to the left.
- The foot reflexology chart served as a reference for the researchers. Every reflexology treatment lasted roughly 25 to 30 minutes, covering all of the reflex points on the foot.
- To ensure that the patients complete the self-report evaluation form, a follow-up study group call was scheduled to be conducted at the patients' homes.

Evaluation phase (post -test): The evaluation for both groups was done within the day before first chemotherapy session to assess and record the baseline assessment data. The researchers are document follow up measurement

two times after foot reflexology. The first follow up after one month and second assessment at the end of chemotherapy 3 months.

Results

Table (1) reveals that the mean of age for both study as well as control groups were 40.8±10.3 and 43.6±11.06 respectively in which 36% of the study participant; their age ranged between 31 to 40 years while in control group 52% their age ranged from 41- 50 years. Nearly half of both groups (56%, 56%, 68%, and 64% respectively) were male & married. Regarding occupation 52% and 40 % of both groups were employed. There were no statistically significant variations between the two groups related to their demographic Characteristics.

Table (2) displays that about one third of both groups had breast cancer (32%) and 24% of them had colon cancer. However, 40% and 36% of both groups their disease at stage I respectively and 32% of them had stage III, and 44% and 36% of both groups receive endoksan as chemotherapy. Moreover, 48% of study group received chemotherapy every one or two weeks, while 52% of control group had session of Chemotherapy every two weeks. There were no statistically significant variations between two groups related to medical data.

Table (3) shows that, the study group experienced less nausea, vomiting, and retching in the 12 hours following the chemotherapy session. Notably, 48% and 60% of both groups experienced three to four vomiting episodes in baseline assessment, while 76% of participants in the study group experienced one or two vomiting episodes three months after foot reflexology compared to 8% among control group receiving routine hospital care. It was observed that 24% of the study group still experienced nausea or a sick feeling in their stomach for more than six hours after chemotherapy, compared to this rate prior to the intervention.

However, 79% of this group experienced a reduction in nausea and a sick feeling to 2-3 hours only after the three-month intervention. After three months, 52% of the control group had nausea or stomach sickness for four to six hours. Additionally, 56% of the study group experienced dry heaves or vomiting for around 3 to 4 times only after a 3-month intervention, whereas 64% of the study group experienced these symptoms 5 to 6 times before the intervention. After three months, 40% of the control group worsened because they experienced dry heaves or vomiting three to six times without mentioning anything. The two groups' variations are statistically significant.

Figure (1) represents that, there was improvement among study participants post three months from intervention as it noticed that 84% of them were have severe nausea, vomiting and retching level prior intervention which changed after 3 months of foot reflexology application to be moderate in 92% of study group, while 84 % from control group still have severe level of nausea, vomiting as well as retching post three months. There are highly statistical significant variations between both groups.

Table (4) represents statistically significant variations in the mean scores of hydration status parameters (P, BP, and Temp.) between both groups before and post one as well as three months of application routine hospital care to control group and foot reflexology to study participants (0.009, 0.048, 0.029, 0.010 respectively).

Table (5) clears that, all participants in both groups had decrease skin turgor, dry tongue, & dehydrated urine according to dehydration urine color chart in pre intervention assessment which changed to 60% had normal skin turgor and 40% had moist tongue among study group participants after three months of application of foot reflexology while, about 84% among control group still have decreased skin turgor, 88% have dry tongue, and 72% of them have dehydrated urine after three month with highly statistical significant variations among both groups.

Table (6) reveals that there are no significant variations in fatigue level was observed between the study group (7.14±0.779) and control (7.12±0.767) groups prior to conduct the intervention ($p>0.05$). However, after three month of application of foot reflexology among study group and routine hospital care among control group a significant variations in fatigue level was seen between the study group (4.76±0.882) and control (6.84±0.606) groups ($p=0.001$).

Figure (2) clears that, there was a significant reduced in mean score of fatigue severity from 7.14±0.779 prior intervention in study group to

4.76± 0.882 post three months of applying foot reflexology, compared with the control group who had slight reduce in fatigue mean scores from 7.12±0.767 to 6.84 ± 0.606 with highly statistical significant variations between the two group.

Table (7) reveals that all patients in both groups suffer from high level of fatigue this is appears in total fatigue score in base line assessment 60% and 52% respectively that there was no significant difference. After three months from foot reflexology, decrease level of fatigue among study group as about 80% of patients had moderate level compared to 24% among control group with 76% of them had high fatigue level. There were highly statistical significance differences between both groups (0.001).

Table (8) shows that there is a statistical significant positive correlation between nausea and vomiting degree measured by Rhodes index score & patient's fatigue level, however there is no statistically significant correlation among control group.

Table (1): Percentage distribution of two groups related their demographic Characteristics (n=50)

Demographic Characteristics	Study Group (n=25)		Control Group (n=25)		Sig. test (p value)
	No	%	No	%	
Age					
18<30	4	16	4	16	**X^2 =4.30 (0.231)**
30 < 40	9	36	3	12	
40 < 50	8	32	13	52	
50 – 64	4	16	5	20	
Mean ± SD	40.8 ± 10.32		43.6 ± 11.06		**t=0.925 (0.359)**
Sex					
Male	14	56	14	56	**X^2 =0.000 (1.000)**
Female	11	44	11	44	
Marital Status					
Single	7	28	6	24	**X^2 =1.10 (0.575)**
Married	17	68	16	64	
Widow/Divorced	1	4	3	12	
Educational Level					
Illiterate	3	12	7	28	**X^2 =4.40 (0.110)**
Preparatory	8	32	11	44	
University	14	56	7	28	
Occupation					
Student	2	8	5	20	**X^2 =3.65 (0.301)**
Employ	13	52	10	40	
Unemployed	2	8	5	20	
House wife	8	32	5	20	

*** p = ≤ .05 (statistical significance)**

Table (2): Percentage distribution of medical data among two groups (n=50)

Medical Data	The Study Group (n=25)		The Control Group (n=25)		X^2	p-value
	No	%	No	%		
Diagnosis						
Colon Cancer	6	24	6	24	0.286	0.991
Lung Cancer	3	12	4	16		
Breast Cancer	8	32	8	32		
Leukemia	4	16	4	16		
Bladder Cancer	4	16	3	12		
Stage of Cancer						
I stage	10	40	9	36	0.119	0.942
II stage	7	28	8	32		
III stage	8	32	8	32		
Type of Chemotherapy						
Lunistin	5	20	1	4	9.66	0.068
Exelatic	3	12	5	20		
Cerboblatile	1	4	2	8		
Gemzar	4	16	1	4		
Endoksan	11	44	9	36		
Taxol	1	4	7	28		
Frequency of Session of Chemotherapy / week						
One	12	48	8	32	2.49	0.303
Two	12	48	13	52		
Three	1	4	4	16		

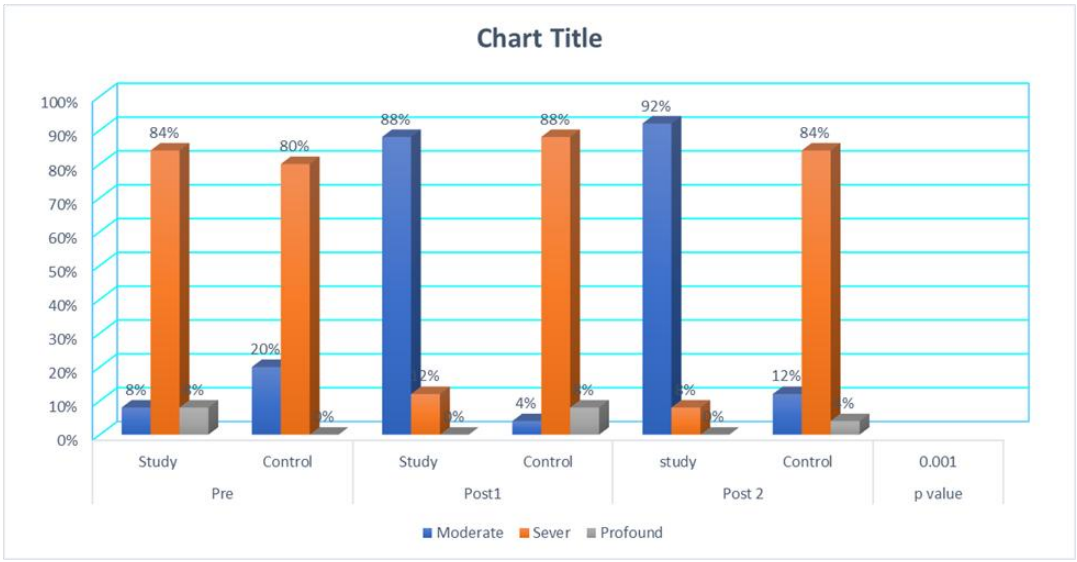
*** p = ≤ .05 (statistical significance)**

Table (3): Percentage Distribution of Study and Control Group Regarding their Modified Rhodes Index of Nausea, Vomiting and Retching pre, post one and three months (n=50)

Complaint	Pre		Post 1 month		Post 3 months		Friedman test P value
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
In the last 12 hour, I vomited …… Times							
0- I didn't throw up	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7.37 (0.025*)
1- 1 to 2	3 (12)	4 (16)	16 (64)	1 (4)	19 (76)	2 (8)	
2- 3 to 4	12 (48)	15 (60)	8 (32)	12 (48)	6 (24)	13 (52)	
3- 5 to 6	10 (40)	6 (24)	1 (4)	11 (44)	0 (0)	9 (36)	
4- 7 or more	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	1 (4)	
X^2 **(p value)**	1.50 (0.620)		25.6 (0.001**)		28.2 (0.001**)		
2- In the past twelve hours, I have experienced dry heaves or a sound like vomiting, I have felt ……. Distress							
0- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	49.3 (0.001**)
1- Mild	0 (0)	0 (0)	16 (64)	1 (4)	20 (80)	2 (8)	
2- Moderate	11 (44)	9 (36)	8 (32)	16 (64)	5 (20)	16 (64)	
3- Great	14 (56)	15 (60)	1 (4)	8 (32)	0 (0)	7 (28)	
4- Severe	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)	0 (0)	
X^2 **(p value)**	1.19 (0.773)		22.6 (0.001**)		29.1 (0.001**)		
3- In the past twelve hours, I have felt ……. Distress from vomiting							
0- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	17.1 (0.001**)
1- Mild	1 (4)	3 (12)	13 (52)	0 (0)	15 (60)	0 (0)	
2- Moderate	8 (32)	11 (44)	10 (40)	16 (64)	10 (40)	14 (56)	
3- Great	14 (56)	11 (44)	2 (8)	9 (36)	0 (0)	11 (44)	
4- Severe	2 (8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
X^2 **(p value)**	3.39 (0.334)		20.7 (0.001**)		30.6 (0.001**)		
4- In the last 12 hours, I have experienced stomach aches or nausea							
0- Not at all	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6.39 (0.041*)
1- 1 hour or less	0 (0)	3 (12)	3 (12)	0 (0)	6 (24)	0 (0)	
2- 2 to 3 hours	12 (48)	12 (48)	19 (76)	13 (52)	19 (76)	12 (48)	
3- 4 to 6 hours	7 (28)	9 (36)	3 (12)	11 (44)	0 (0)	13 (52)	
4- More than 6 hours	6 (24)	1 (4)	0 (0)	1 (4)	0 (0)	0 (0)	
X^2 **(p value)**	6.30 (0.075)		9.16 (0.007**)		22.6 (0.001**)		
In the past twelve hours, I have felt ……. Distress from nausea							
0- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
1- Mild	1 (4)	3 (12)	7 (28)	0 (0)	8 (32)	2 (8)	

Complaint	Pre		Post 1 month		Post 3 months		Friedman test P value
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
2- Moderate	13 (52)	10 (40)	17 (68)	7 (28)	17 (68)	4 (16)	5.23 (0.045*)
3- Great	8 (32)	12 (48)	1 (4)	16 (64)	0 (0)	18 (72)	
4- Severe	3 (12)	0 (0)	0 (0)	2 (8)	0 (0)	1 (4)	
X^2 (p value)	4.72 (0.188)		27.6 (0.001**)		34.2 (0.001**)		
6- in the past twelve hours, each time I vomited I produced a …… amount							
0- I didn't vomit	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5.12 (0.050*)
1- Small (up to ½ cup)	2 (8)	6 (24)	10 (40)	1 (4)	13 (52)	2 (8)	
2- Moderate (1/2 to 2 cup)	14 (56)	11 (44)	15 (60)	15 (60)	12 (48)	15 (60)	
3- Large (2-3 cups)	8 (32)	7 (28)	0 (0)	7 (28)	0 (0)	7 (28)	
4- Very large (3 cups or more)	1 (4)	1 (4)	0 (0)	2 (8)	0 (0)	1 (4)	
X^2 (p value)	2.58 (0.534)		16.5 (0.001**)		13.5 (0.001**)		
7- In the past twelve hours, I've had nausea and stomach sickness …… times							
0- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8.54 (0.014*)
1- 1 to 2	2 (8)	4 (16)	9 (36)	0 (0)	12 (48)	1 (4)	
2- 3 to 4	7 (28)	7 (28)	13 (52)	9 (36)	13 (52)	8 (32)	
3- 5 to 6	16 (64)	12 (48)	3 (12)	14 (56)	0 (0)	15 (60)	
4- 7 or more	0 (0)	2 (8)	0 (0)	2 (8)	0 (0)	1 (4)	
X^2 (p value)	2.88 (0.429)		19.4 (0.001**)		29.2 (0.001**)		
8- In the past twelve hours, I've experienced dry heaves or vomiting for a while without mentioning anything. …… times							
0- No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6.21 (0.024*)
1- 1 to 2	2 (8)	6 (24)	8 (32)	1 (4)	9 (36)	1 (4)	
2- 3 to 4	5 (20)	9 (36)	16 (64)	11 (44)	14 (56)	10 (40)	
3- 5 to 6	16 (64)	8 (32)	1 (4)	9 (36)	2 (8)	10 (40)	
4- 7 or more	2 (8)	2 (8)	0 (0)	4(16)	0 (0)	4 (16)	
X^2 (p value)	5.74 (0.132)		16.5 (0.001**)		16.1 (0.001**)		

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance).**



*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

Figure (1): Comparison between Study and Control Group Regarding their Total Modified Rhodes Index Scores of Nausea, Vomiting as well as Retching pre, post one and three months (n=50)

Table (4): Mean scores of hydration status parameters (P, BP & Temp.) among study and control group pre, post one and three months (n=50)

Parameters	Pre Intervention		Post 1 month		Post 3 months		ANOVA test (P value)
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	
Pulse							
	88.9 ± 8.46	85.2 ± 8.74	86.7 ± 8.40	76.7 ± 9.69	82.2 ± 5.33	86.9 ± 4.96	4.95 (0.009**)
t (P value)	1.52 (0.133)		3.88 (0.001**)		3.21 (0.002**)		
Systolic Blood Pressure							
	120.1 ± 10.8	122.8 ± 7.75	127.5 ± 5.30	118.2 ± 4.47	128.2 ± 8.75	122.4 ± 8.89	3.13 (0.048*)
t (P value)	0.938 (0.353)		6.64 (0.001**)		2.29 (0.026*)		
Diastolic Blood Pressure							
	81.6 ± 7.60	83.3 ± 8.62	80.9 ± 83.2	75.4 ± 2.73	82.6 ± 6.13	76.6 ± 5.90	3.67 (0.029*)
t (P value)	0.731 (0.468)		5.32 (0.001**)		3.54 (0.001**)		
Temperature							
	37.9 ± 0.317	37.6 ± 0.375	37.3 ± 0.276	37.4 ± 0.284	37 ± 0.373	37.3 ± 0.379	3.46 (0.010*)
t (P value)	t= 0.676 (0.502)		t= 0.756 (0.453)		t= 2.29 (0.026*)		

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

Table (5): Comparison between Two Groups Regarding their Hydration State (Skin turgor, Tongue moisture & Dehydration Urine Color chart) pre, post one and three months (n=50).

Parameters	Pre Intervention		Post 1 month		Post 3 months		Friedman test (P value)
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	
Skin turgor							28.4 (0.001**)
- Normal	0 (0)	0 (0)	12 (48)	4 (16)	15 (60)	4 (16)	
- Decreased	25 (100)	25 (100)	13 (52)	21 (84)	10 (40)	21 (84)	
t (p value)	……		5.46 (0.019*)		10.27 (0.003**)		
Tongue moisture							19.8 (0.001**)
- Moist	0 (0)	0 (0)	10 (40)	2 (8)	10 (40)	3 (12)	
- Dry	25 (100)	25 (100)	15 (60)	23 (92)	15 (60)	22 (88)	
t (p value)	……		7.01 (0.008**)		5.09 (0.024*)		
Dehydration Urine Color chart							8.85 (0.012*)
- Hydrated	0 (0)	0 (0)	10 (40)	2 (8)	10 (40)	4 (16)	
- Dehydrated	25 (100)	25 (100)	15 (60)	23 (92)	15 (60)	18 (72)	
- Severe dehydrated	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (12)	
t (p value) …… 7.01 (0.008**)	5.37 (0.048*)						

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

Table (6): Comparison between Two Groups Regarding their Fatigue Level pre, post one and three months (n=50).

Complaint	Pre Intervention		Post 1 month		Post 3 months		Friedman test P value
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
Rate your level of fatigue right now							
	6.52±1.71	6.68±1.65	5.40±1.15	6.92±1.89	4.68±0.748	6.48±1.50	14.6 (0.001**)
	0.336 (0.738)		3.43 (0.001**)		5.35 (0.001**)		
Rate your usual level of fatigue during past 24 hours							
	7.24±1.12	7.44±1.41	6.56±1.12	7.16±1.37	4.80±0.645	6.32±1.10	49.1 (0.001**)
	0.552 (0.583)		2.69 (0.017*)		5.92 (0.001**)		
Rate your Worst level of fatigue during past 24 hours							
	7.12±1.33	6.88±1.36	5.96±0.611	7.44±1.12	4.68±0.690	6.76±1.20	26.1 (0.001**)
	0.629 (0.532)		5.79 (0.001**)		7.51 (0.001**)		
How much did exhaustion affect your overall level of activity throughout the last week?							
	6.92±1.03	7.32±1.02	5.20±0.957	7.32±1.18	4.60±0.816	6.68±1.28	43.1 (0.001**)
	1.36 (0.178)		6.97 (0.001**)		6.84 (0.001**)		
Please rate the extent to which your mood was affected by exhaustion within the last week.							
	7.12±1.26	7.36±0.952	5.36±1.03	7.28±0.936	4.76±1.01	6.80±1.04	39.5 (0.001**)
	0.184 (0.453)		6.87 (0.001**)		7.02 (0.001**)		
Rate how much, in the last week, fatigue was affected your walking ability							
	7.36±1.11	6.84±1.14	5.56±0.960	6.76±1.05	5.08±1.15	6.72±1.02	29.5 (0.001**)
	1.62 (0.110)		4.21 (0.001**)		5.32 (0.001**)		
Rate how much, in the last week, fatigue was affected with your normal work							
	7.36±1.18	6.96±1.09	5.48±1.12	7.00±1.15	4.96±1.33	6.92±1.22	24.2 (0.001**)
	1.23 (0.222)		4.71 (0.001**)		5.40 (0.001**)		
Rate how much, in the past week, fatigue interfered with your relations with other people							
	7.32±1.10	6.600±1.15	5.12±1.09	6.84±1.24	4.60±1.25	6.68±1.06	20.1 (0.001**)
	1.35 (0.129)		5.18 (0.001**)		6.29 (0.001**)		
Rate how much, in the last week, fatigue was affected with your enjoyment of life							
	7.60±0.912	7.84±1.06	5.24±1.16	7.80±1.11	4.56±1.19	6.28±1.10	39.3 (0.001**)
	0.854 (0.397)		5.18 (0.001**)		8.38 90.001`**)		
Total mean score							
	7.14±0.779	7.12±0.767	5.54±0.706	7.16±0.810	4.76±0.882	6.84±0.606	56.4 (0.001**)
	0.081 (0.936)		7.56 (0.001**)		9.74 (0.001**)		

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

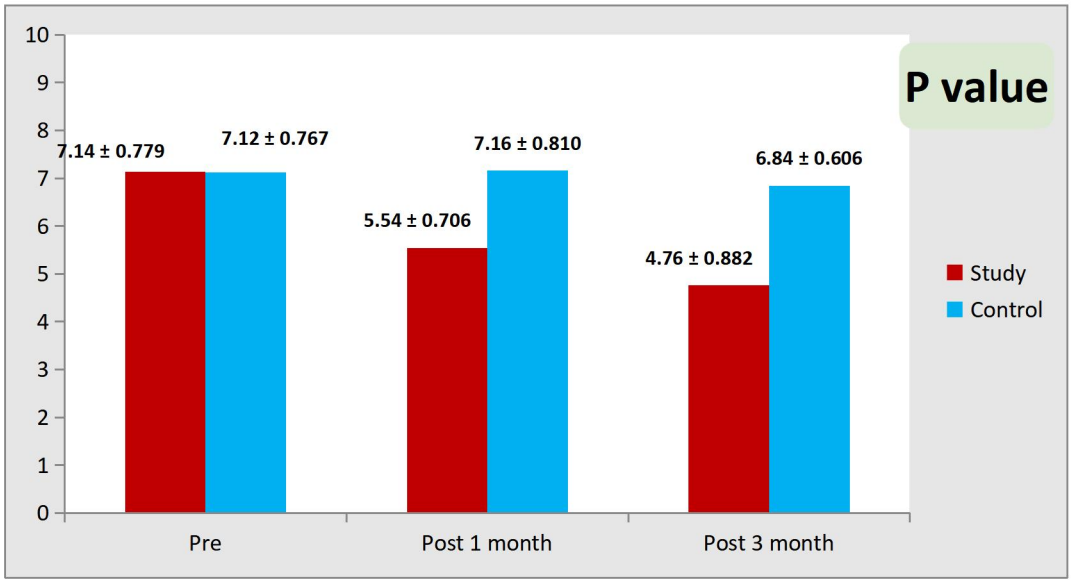


Figure (2): Mean Scores of Fatigue Severity among Study and Control Groups pre, post one and three months (n=50).

Table (7): Comparison between Two Groups Regarding their Total Fatigue Scores pre, post one and three months (n=50).

Fatigue	Pre Intervention		Post 1 month		Post 3 months		Friedman test P value
	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	Study (n=25)	Control (n=25)	
Fatigue severity							
Low fatigue level (1-3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	16.1 (0.001**
Moderate fatigue level (4-6)	9 (36)	8 (32)	15 (60)	9 (36)	25 (100)	8 (32)	
High fatigue level (7-10)	16 (64)	17 (68)	10 (40)	16 (64)	0 (0)	17 (68)	
	0.089 (0.765)		4.88 (0.019*)		25.7 (0.001**)		
Fatigue effect							
Low level (1-3)	0 (0)	0 (0)	0 (0)	0 (0)	5 (20)	0 (0)	13.4 (0.001**)
Moderate level (4-6)	7 (28)	11 (44)	21 (84)	0 (0)	20 (80)	6 (24)	
High level (7-10)	18 (72)	14 (56)	4 (16)	25 (100)	0 (0)	19 (76)	
	1.38 (0.239)		36.2 (0.001**)		35.4 (0.001**)		
Total fatigue scores							
Low level (1-3)	0 (0)	0 (0)	2 (8)	0 (0)	5 (20)	0 (0)	7.76 (0.021*)
Moderate level (4-6)	10 (40)	12 (48)	21 (84)	2 (8)	20 (80)	6 (24)	
High level (7-10)	15 (60)	13 (52)	2 (8)	23 (92)	0 (0)	19 (76)	
	0.325 (0.569)		38.4 (0.001**)		35.4 (0.001**)		

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

Table (8): Correlation between Rhodes Index Scores & Patient's Fatigue scores among Study Group & Control Group Post three months (n=50)

Variables	Total Rhodes Score			
	Study		Control	
	R	*p*	*R*	*p*
Fatigue level	0.316	0.025*	0.065	0.757

*** p = ≤ .05 (statistical significance)** **** p = ≤.01 (highly statistical significance)**

Discussion

The most frequent adverse effects of chemotherapy for cancer patients are chemotherapy-induced nausea and vomiting (CINV) (Mosa et. al., 2020). Chemotherapy regimens are always more likely to be interrupted, refused, or withdrawn by cancer patients **Tian et al., (2020).** Since antiemetic medicines cannot control CINV alone and can induce a different of side effects, fifty nine percent of patients seek non pharmacological therapy **Zorba & Ozdemir, (2018).** By implementing pressure to specific pressure points on the foot, a practitioner of foot reflexology can activate the body and enhance health advantage to various sections of the body.

Many cultures around the world have been using foot reflexology for thousands of years **(Wang et al., 2020)**. Additionally, according to **Sevilay and Hilal (2019)**, it is one of the alternative therapy modalities that cancer patients use the most frequently (more than one-third). According to **Samarehfekriet al. (2020)**, the fundamental mechanisms of reflexology are believed to aid in relaxation, endorphin release, pain perception and transmission management, and body energy release. Therefore, the purpose of this study was to evaluate how foot reflexology affected chemotherapy-induced nausea, vomiting, and exhaustion, as well as how it related to the patients' level of hydration.

According to the current study's findings, the mean age of the study and control groups was 40.8±10.3 and 43.6±11.06, respectively. In the former, over one-third of the study participants were between the ages of 31 and 40, while in the latter, less than half of them were between the ages of 41 and 50. This result is consistent with **Eladham et al.'s (2021)** finding that the age group of forty to fifty years old had the highest percentage of breast cancer cases.

More than half of both groups are male, which is consistent with the findings of **Sontakke et al. (2020)**, who found that the majority of the two groups were male. This finding contrasts with that of a study conducted at the Oncology Center of Mansoura University Hospital by **Abdelfattah et al. (2022)**, which found that the highest percent of the study group was female, and above three-fourths of the control group were female. The current study made clear that nearly half of the patients in both groups were employed, and sixty-six of the patients in two groups were married. This outcome was comparable to **Eladham et al., (2021)** they clarified that the high percent of patients in two groups were married and contradicted with their occupation.

Concerning the educational level the actual research revealed that above fifty percent of study group have university education but under fifty percent of control group are preparatory education. This was in line with **Abdelfattah et al**., (**2022**) they found that above fifty percent of patients in the study group were university level. Furthermore, this result is in line with **Özdelikara and Tan's (2017)** findings, two-fifths of the patients in both groups had completed primary school. But, this finding disagreed with the result by **Eladham et al. (2021)** who explained that secondary school students made up the largest percentage in both the research and control groups.

Concerning the medical data, the actual study showed that thirty-three of both groups have breast cancer & nearly one third of both groups suffer from colon cancer. However, less than half of both groups complain from stage I of their disease and one third of them at stage III. From the researchers point of view the early know of breast cancer is a result of increased awareness in Egyptian media through the one million seha campaign to conduct medical examination for woman. This discovery is consistent with **Azim, et al. (2023)** who stated that a comprehensive meta-analysis and systematic review conducted in Egypt showed that breast cancer was the most prevalent malignancy, making up forty-two percent of all cancer cases in Egyptian women, most of which were in advanced stages.

This result is agree with **Rostom et al. (2022)** they reported that half of patients have the breast cancer was diagnosed at early stages (0–II), and one third had locally advanced stage III, and only seven percent had stage IV of cancer. While this was contradicted with study done by **Eladham et al. (2021)** they found that breast cancer was diagnoses at stage II.

Additionally, this data is consistent with **Rashad et al. (2024)**, they stated that almost thirty-three of patients in Egypt with early-onset colorectal cancer are under forty years of age. Depend on the evidences, the researcher believes that obesity, a sedentary lifestyle, processed food

consumption, and the use of sweetened beverages are the main causes of the rise in colon cancer incidence in Egypt. However, no direct causal relationship has been established between these factors and early-onset colorectal cancer.

Based on the correlation between foot reflexology and nausea and vomiting, the study's findings showed that foot reflexology sessions helped cancer patients experience less nausea as well as vomiting from chemotherapy. Following the adoption of foot reflexology sessions, the study group's Rhodes Index for nausea and vomiting scale differed significantly from that of the control group, which only received routine hospital care. As it shown that, there was improvement among study participants after three months of application foot reflexology as it was noticed that majority of study group had moderate level of nausea, vomiting with highly statistical differences between both groups.

This result were supported by **Sontakke et al. (2020)** who performed foot reflexology sessions twice a day for three days on patients with cancer. They reported that foot reflexology significantly reduces chemotherapy-induced nausea and vomiting in patients. Furthermore, this outcome is consistent with the findings of **Sevilay and Hilal (2019)**, who revealed that foot reflexology, can prevent or reduce nausea as well as vomiting in patients with lung cancer received chemotherapy.

Similarly, **Eladham et al. (2021) and Wanchai & Armer (2020)** demonstrated the advantages of foot reflexology sessions in alleviating chemotherapy-caused nausea, vomiting, as well as fatigue in patients with breast cancer. The same finding was supported by **Asha et al. (2020)**, who concluded that foot reflexology helps patients undergoing highly emetogenic chemotherapy experience less nausea and vomiting from the treatment.

In conclusion, **Audrey et al. (2021)** stated that foot reflexology helps the body regain homeostasis by applying pressure to particular foot areas. The idea is that the body's organs, glands, and systems are represented by reflex zones in the foot. When combined with traditional treatment, foot reflexology appears to reduce some of the side impacts of chemotherapy. Additionally, individuals with cancer breast who receive chemotherapy plus foot reflexology have shown a considerable reduction in nausea and vomiting brought on by the disease.

The authors commented that, because foot reflexology is depend on the idea that the feet are mirror images of the body and have reflex areas that contributed to every of the body's glands, structures, as well as organs, the authors noted that the study group experienced less nausea, vomiting, and retching, which supports the therapeutic impact of foot reflexology massage. Also, it is a known truth that stimulating a reflex in any zone will cause the corresponding organ to become more active.

Therefore, by modifying the Autonomic Nervous System (ANS), massage has mechanical impact that increase circulation, remove waste from the body, increase joint movement, relieve pain as well as decrease tension of the muscle, and lower stress and anxiety in a variety of populations. Additionally, massage has an effect on patients' psychological well-being, and psychological phenomena influence the limbic nervous system, which is the center of personal's emotions and is linked to the vomiting center by neural fibers. By establishing a connection between massage signals and the limbic nervous system as well as vomiting center, massage can effectively alleviate nausea as well as vomiting. Consequently, they suggested that the study group receive reflexology therapy across several sessions.

Concerning hydration state, it was significantly improved one & three months post application of foot reflexology among study participants presented by improvement of skin turgor, tongue moisture, vital signs, and also urine concentration assessed through a dehydration urine color chart compared to control participants who had no significant changes.

This result is in line with **Kang, (2022)** who mentioned that since CINV impairs quality of life and treatment compliance in older patients, it should be treated differently because of physiological and/or psychological alterations. Comorbidities and poly-pharmacy should also be taken into account. **Whatley, Perkins, and Samuel, (2022)** reported that, Water is necessary for homeostasis because it transports nutrients to the cells and removes waste from them. In addition, water serves as a lubricant, shock absorber, solvent, and thermo-regulator. For all

bodily systems to function at their best, enough hydration is essential. Because water is linked to inflammatory cytokines, stagnation of dynamic fluid health has been linked to aging and poor tissue health.

Concerning findings of the vital signs, the actual study reflected that there is improvement in BP among study group post implementation of foot reflexology with a statistically significant variations between both groups before as well as after intervention. The researchers' opinion was that, the reflexology procedure is simple plus quick to perform, and it doesn't involve any special equipment and has effects on reducing sympathetic activity. This opinion compatible with **Reafaat Abdelkader Atia, (2024)** who reported that, foot reflexology massage, if applied effectively, are reducing sympathetic activity and lead to improve on physiological parameters including heart beats, rare of the respiration, systolic and diastolic blood pressure as well as oxygen saturation.

This was in line with **Jing et al., (2022)** who reported that foot reflexology improved O2 saturation and had positive impacts on vital signs, heart beats, blood pressure, and rate of respiration, according to short-term follow-up data.

Related to fatigue among cancer patients taking chemotherapy, during baseline assessment, the actual study showed that respondents in two groups complained of growing physical discomfort, decreased general activity, and decreased capacity to complete typical tasks, including walking and work outside the home. Patients also mentioned that feeling fatigued has a detrimental impact on their happiness, relationships with friends and family, and quality of life. However, after three month there was high significant variations in fatigue level between the study participants compared to control ones.

This was in line with **Hesami et al., 2021,** who found that there was decrease in fatigue level after foot reflexology than before intervention in studied group more than control group. **Additionally, Rambod**, **Pasyar, & Shamsadini (2019)** and **Wanchai & Armer, (2020)** found that foot reflexology decreases fatigue among patients with cancer treated with chemotherapy.

Omar et al., (2024) explained that foot reflexology massage activates the body's life force, establishes a balance of energy, and permits energy to flow freely. It also has therapeutic effects by stimulating the nerve pathways to relieve congestion and encourage relaxation response throughout the body, may be responsible for the positive results in the intervention group. Foot reflexology also gets rid of waste products and poisons from chemotherapy. Conversely, reflexology has been shown to decrease stress and anxiety through deep as well as intense relaxation, promote energy circulation by releasing blocked energy channels throughout the body, and lessen symptoms of fatigue.

Conclusion

Applying of foot reflexology among patient with cancer who receives chemotherapy has positive effect on reducing chemotherapy-induced nausea and vomiting which positively improve patient's hydration status. Moreover, it has good effect on decreasing fatigue among those patients, which can improve patients' ability to complete chemotherapy courses, improve patients' quality of life, & decrease their complaints.

Recommendations:

- As a supplementary therapy that helps reduce cancer treatment-related symptoms like nausea, vomiting, and fatigue, oncology nurses should take foot reflexology courses.
- Creating a unit for applying foot reflexology to reduce annoying adverse effects of chemotherapy in oncology unit.
- More researches are recommended to ascertain the additional impact of foot reflexology on health and reducing adverse effects of cancer treatment.

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