

The Effect of Foot Reflexology on Chemotherapy Induced Nausea, Vomiting and Fatigue among Breast Cancer Patient

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Abstract: Chemotherapy-induced nausea and vomiting and Cancer-related fatigue is one of the most common side effects experienced by patients with cancer. The degree of nausea was worst in the acute phase in highly emetogenic chemotherapy. Conducting research in the non-drug treatment areas may provide new or better solutions to control this common complaint. Aim: The study aims determine the effect of foot reflexology on chemotherapy induced nausea, vomiting, and fatigue among breast cancer patient. Method: A Quasi-experimental design with Pre and Post Test was used for the current study. The study was carried out at the Chemotherapy Units at the Alexandria Main University. Subjects: It comprised a convenience sample of 50 breast cancer patients who were planned for chemotherapy. They were divided into two equal groups: study and control. Tools: Two tools were used in this study for data collection, in addition to patient's Bio- sociodemographic data.1) Rhodes Index of Nausea, Vomiting, and Retching self-report assessment tool and 2) The Brief Fatigue Inventory self-report assessment tool. Results: There were highly statistically significant differences between study and control group after 2nd & 3rd foot reflexology intervention in relation to total score of experience, occurrence and distress of nausea, vomiting and retching as well as fatigue severity and its effect on living activities(P<0.001). Conclusion The present study proved that foot reflexology decreased the experience, occurrence and distress of nausea, vomiting and retching as well as fatigue in the experimental group. Recommendations: Oncology nurses should seek courses of foot reflexology as complementary therapy which help decrease cancer and cancer treatment related symptoms including chemotherapy induced nausea, vomiting and fatigue.

Keywords: Breast cancer, Nausea, fatigue, chemotherapy.

I. INTRODUCTION

Breast cancer is the cancer that forms in tissues of the breast, usually the ducts or lobules. It occurs in both men and women, although male breast cancer is rare about 1% (European Society for medical oncology [ESMO], 2018).

Breast cancer is the most frequent cancer among women with an estimated. 2 million new cancer cases diagnosed in 2018 (23% of all cancers), and ranks second overall (10.9% of all cancers) while in 2019, it is estimated that breast cancer statistics were 271,270(268,600 female, 2,670 male) new cases, deaths about 42,260(41,760 female and 500 male)(American Cancer Society, 2020). It is now the most common cancer both in developed and developing regions (Zaidi & Dib, 2019).

Breast cancer is divided into 3 types based on the presence or absence of different proteins in the breast cancer cells. **Hormone receptor–positive** breast cancer makes up 70% of breast cancer cases and has either estrogen receptor (ER) or progesterone receptor (PR) protein in the cancer cells; Human Epidermal Growth factor receptor 2 (**ERBB2-positive**) (formerly known as HER2-positive) breast cancer makes up 15% to 20% of breast cancer cases and has high levels of ERBB2 protein on the cancer cells; and **triple-negative** breast cancer makes up 15% of breast cancer cases and does not have ER, PR, or ERBB2 protein in the cancer cells (Waks & Winer, 2019).

There are many different types of cancer treatment, including surgery, radiation therapy, and/or systemic therapy e.g., chemo-therapy, hormonal therapy, immune therapy and target therapy. One method of treatment may be used alone or in combination depending on the type and stage of cancer; tumor characteristics; and the patient's age, health condition, and preferences. Chemotherapy is a treatment which uses drugs to destroy cancer cells. It is sometimes used after breast cancer surgery to kill any undetectable cancer cells that may be left in the breast or lymph nodes (American Cancer Society 2016).

Chemotherapy works best against fast-growing cells, like cancer cells. It prevents or stops the cancer cells' ability to multiply and grow, resulting in cell death. Chemotherapy can also damage healthy cells and cause side effects. (University Health Network [UHN], 2018) Chemotherapy induced nausea and vomiting (CINV) remained as two of the most prevalent and worrisome side effects and is still a critical issue in adriamycin and cyclophosphamide (AC) treated patients, despite antiemetic treatment. CINV was indicated as the major symptom being overlooked by healthcare professionals. Patients demanded as much information about these side effects as possible before chemotherapy was given (Chan & Ismail, 2014; De Laurentiis et al., 2018b).

Chemotherapy-induced nausea and vomiting (CINV) can significantly affect patient care and quality of life (QOL). It can result in complications including metabolic disturbances, decreased functional ability, diminished physical and mental well-being, weight loss, anorexia, esophageal tears, and reduced treatment compliance. CINV also results in increased use of health care resources, more hospital admissions, and more outpatient visits (Ettinger, Berger & Barbour, 2008; Sommariva, Pongiglione & Tarricone, 2016).

Oncology nurses play a pivotal role in the care of patients receiving chemotherapy and are in a prime position to facilitate better care of patients experiencing chemotherapy-induced nausea and vomiting (CINV). However, to do so, they must be kept well apprised of the most recent guidelines, the latest developments in CINV therapy, and the expanding knowledge of CINV pathophysiology. (Hawkins & Grunberg, 2009).

Cancer-related fatigue (CRF) is a multi-dimensional symptom that is defined as a distressing, persistent, and subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or its treatment, which is not proportional to recent activity and interferes with patients usual functioning, abilities to perform activities associated with daily living and limits their personal and social roles within their family and community resulting in a significant decrement in overall QoL. (Hawkins & Grunberg, 2009; National Comprehensive Cancer Network [NCCN], 2017).

Cancer related fatigue (CRF) is also associated with significant levels of psychological distress, and it imposes a financial burden by limiting a patient's ability to work effectively. This economic effect can extend to caregivers and family members, who may have to reduce their working hours in order to provide care for a patient with CRF. Fatigue can cause a person with cancer to avoid or skip treatments. It may also negatively affect other areas of life, including mental and physical health, relationships with other (American International Medical University [AIMU], 2015; Hansen, Walter & Case, 2019).

Effective interventions to reduce CRF-both during and following treatment-are urgently needed and have the potential to improve physical functioning, QoL, emotional and psychological health, and to relieve some of the financial burden that a diagnosis of cancer can bring (Hofman, Ryan, Figueroa-Moseley, Jean-Pierre & Morrow, 2007; American Society of Clinical Oncology [ASCO], 2017).

The management of fatigue is difficult but there are some pharmacological and nonpharmacological interventions to alleviate it. It is important for nurses to provide patients and their families with lifestyle education and guidance programs

on the benefits of pharmacological and non-pharmacological interventions to effectively manage fatigue to enhance survival and quality of life (Lavdaniti, 2019). The use of complementary and alternative medicine (CAM) by cancer patients is of vital importance. In Europe, about 40% of all cancer patients use CAM during their oncology treatment. Reflexology is one of the available interventions in manual complementary therapies, which provides a good opportunity for nurses to take care of patients (Fremd et al., 2017; Lettner, Kessel & Combs, 2017). Nurses consider complementary therapies as adjunctive therapy methods for improving patients' condition (Kahangi, Moeini & Babashahi, 2012; Park & Park, 2015).

Reflexology is a complementary medicine procedure based on the principle of providing relaxation and healing by systematically applying pressure to specific reflex points mostly located in the feet but also in the hands, depending on some other practices. In this procedure, it is believed that some energy channels pass through certain points in the feet, and that when pressure is applied to these points, the blocked channels are unblocked in such a way as to restore the balance in the corresponding organs, glands or systems (Lynn, 1996). Since reflexology is based on simple manual techniques that do not require any drugs or invasive intervention, it is considered to be a safe procedure. So indeed, apart from a few reports and warnings, the literature does not contain important reports about undesirable effects caused by reflexology (Afterwards, reflexology became a procedure preferred by many people because of certain reasons such as the facts that it is a safe and easy-to-apply procedure based on simple manual techniques that do not require any drugs or invasive intervention (Kunz & Kunz, 2003; Jones, Thomson, Lauder, Howie & Leslie, 2012).

Conducting research in the non-drug treatment areas may provide new or better solutions to control this common complaint. Hence, the researcher decided to conduct the present study with the aim of evaluating the effect of foot reflexology on the chemotherapy induced nausea, vomiting and fatigue among breast cancer patients.

AIM OF THE STUDY:

Determine the effect of foot reflexology on chemotherapy-induced nausea, vomiting, and fatigue among breast cancer patients.

RESEARCH HYPOTHESIS:

- 1- Breast cancer patients who receive foot reflexology will state reduction in chemotherapy induced nausea and vomiting than patients who will not receive it.
- 2- Breast cancer patients who receive foot reflexology will state reduction in chemotherapy induced fatigue than patients who will not receive it.

II. MATERIALS AND METHOD

MATERIALS

Design: A quasi-experimental research design was used for this study.

Setting: The study was conducted in the Chemotherapy Units at the Alexandria Main University.

Subjects: Convenience sample of 50 adult female patients with breast cancer and receiving chemotherapy were selected w. Participants were divided into two equal groups (study and control group).

Tools of the study: Two tools were used in this study for data collection, in addition to patient's Bio- sociodemographic data.

Tool (1): Rhodes Index of Nausea, Vomiting, and Retching self-report assessment tool):

It was developed by Rhodes and McDaniel in (1999) and this tool was adapted and translated into the Arabic language according to review of literature by the researcher to assess the effectiveness of reflexology on the experience of nausea, vomiting and retching among patients receiving chemotherapy. Internal consistency coefficient of the Nausea, Vomiting, and Retching Index" was determined as 0.94.

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Rhodes index of nausea, vomiting, and retching (INVR) include an eight self-report questions. The first three questions was used to assess the patients feeling and their experience of (a) frequency of nausea, (b) duration of nausea, (c) distress from nausea, and the second three questions was used to assess (d) frequency of vomiting, (e) amount of vomiting, (f) distress from vomiting, and the last two questions was used to assess (g) frequency of retching, and (h) distress from retching. The likert type scale for each item is scored from 0 to 4. The patient's complete statement with selection of one of five point responses after 24 hour from each chemotherapy cycle.

Scoring system:

Patients' responses were evaluated using five points likert scale ranged from "0" for no symptoms, "one" for mild symptoms, "two" for moderate symptoms, "three" for great symptoms, and "four" for severe symptoms.

- Items score was summed for a total score with a range of 0-32 and interpreted as follows:

0 = None (No experience of nausea and vomiting).

1-8 = Mild experience of nausea and vomiting

9-16 = Moderate experience of nausea and vomiting

17-24 = Great experience of nausea and vomiting (Strong or highly stimulating to the sense)

25-32=severe experience of nausea and vomiting.

Tool 2: The Brief Fatigue Inventory (BFI) self-report assessment tool:

This tool was developed by Anderson (1997) and was adapted and translated into the Arabic language according to review of literature by the researcher to assess subjective perception of fatigue in cancer populations. Factor analysis for the original validation study found the scale to be uni-dimensional (6.9). Reliability was excellent with an internal consistency coefficient of 0.96 for scale items (Mendoza et al., 1999; Paramita et al., 2016)

The Brief Fatigue Inventory (BFI) was a 9-item, 11-point rating scale. The time period for all questions was over the past 24 hours. **The first three questions, measure fatigue severity** from 0; indicating "no fatigue," to 10; indicating "as bad as patient can imagine," at current, usual, and worst levels. **The following six questions assess fatigue interference with daily activities including:**

- 1- General activity or working activities inside home(includes both daily chores as cooking, washing dish, ,doing Landry and maintaining hygienic place of residence.
- 2- Self-care activities as (bathing, dressing, eating, toileting, combing hair, transferring and mobility).
- 3- Walking ability.
- 4- The relations with other family, friends.
- 5- Enjoyment of life.
- 6- Mood.

Response options range from 0, indicating "does not interfere," to 10, indicating, "Completely interferes." Higher scores on the BFI correspond to greater self-reported levels of fatigue.

The patient selects the number from 0-10 that reflects the intensity of fatigue. It is classified as follow: 0, indicating "does not interfere," to 10, indicating, "Completely interferes." Higher scores on the BFI correspond to greater self-reported levels of fatigue.

Scoring system for fatigue severity and its effect on life activities

Fatigue severity score was assessed and calculated by dividing the total scores of the first, second, and third items into 3. The score of fatigue's effect on life activities was assessed and calculated by dividing the total scores of 4a, 4b, 4c, 4d, 4e, and 4f items into 6.

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- Zero score = No fatigue
- 1–3 = Low-level of fatigue
- 4–6 = Moderate-level of fatigue
- 7–10 = High-level of fatigue.

METHOD:

The study was accomplished as follows:

- Written approval was obtained from the Alexandria Main University Hospital administrative authority to collect the data after explaining the aim of the study.

Development and content validity of the study tools:

- Tool I (Rhodes Index of Nausea, Vomiting, and Retching) was adapted and translated to Arabic by the researcher to assess experience, occurrence and distress of nausea, vomiting and retching.
- Tool II (The Brief Fatigue Inventory (BFI) tool was adapted and translated to Arabic by the researcher to measure fatigue severity and assess fatigue interference with daily activities.
- The tools (I&2) were submitted to five experts from the Faculty of Nursing, Alexandria University to review and test content validity, and modifications were done based on their suggestions.
- Development of foot reflexology Handout booklet:
- An informational booklet on reflexology was developed by the researcher after gaining knowledge from a training program on reflexology and reviewing of an extensive review of related literature (Beckmann & Le Quesne, 2005; Kunz & Kunz, 2008; Embong et al., 2015; Salvo, 2015; Suman et al., 2016; Rooney, 2019)
- **Reliability:** Reliability to the adapted tools was tested by using the Cronbach's Alpha Statistical Test. The tool I & II were proved to be internally reliable, with a Cronbach's Alpha Test of 0.767 and 0.984 respectively that indicated high reliability of the tools.
- **Pilot study:** A pilot study was carried out on 10% of patients to test the clarity and applicability of the tools. Necessary modifications were done before data collection for the actual study; those patients were excluded from the study sample.
- **Sampling:** A convenience sample of 50 adult female patients with breast cancer and receiving chemotherapy were recruited for the study. Recruited subjects were assigned to two equal groups (control and study group).

Data collection:

- The data were collected over a period of 9 months, starting from July 2019 to March 2020.
- Participants meeting the inclusion criteria were selected and they were equally, and sequentially recruited into either control or study group (25 patients each) as following:

Control group who would receive the routine hospital care (Antiemetic medication only).

Study group who would receive the routine hospital care and foot reflexology.

The study was carried out on four phases:

I. Assessment phase

- The control and study group were interviewed individually in the first chemotherapy cycle before chemotherapy infusion. sociodemographic and clinical data was collected in this phase. Initial assessment (Pretest) of both the study

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and control patients was carried out for the 24 hours after the first chemotherapy cycle using tool I and II to collect baseline data before starting the foot reflexology program.

II. Planning phase:

- Reflexology program was designed by the researcher after reviewing recent review of literature and after receiving training program in reflexology (Beckmann & Le Quesne, 2005; Kunz & Kunz, 2008; Embong et al., 2015; Salvo, 2015; Suman et al., 2016; Rooney, 2019).
- Foot Reflexology was applied by the researcher for the study group in the second chemotherapy cycle at the beginning of chemotherapy infusion. After that post reflexology, assessment was carried out for the 24 hours after every chemotherapy cycle after reflexology session.
- The control group was receiving routine hospital care only and assessment was carried out for the 24 hours after every chemotherapy cycle.
- Reflexology program was applied in totally three sessions in each chemotherapy cycle (every 21 days), and post assessment was applied to the patients for the 24 hours which immediately follow each reflexology sessions by asking the patient to fill the self- report assessment sheet of Rhodes Index of nausea, vomiting and brief fatigue inventory (tool I & II).
- Each reflexology session was taken approximately 25- 30 minute for each foot to all reflex point.
- The experimental and control group who receive the same chemotherapy which is every 21 days, continue to receive the standard antiemetic treatments during the study period.
- Follow up of study participants was planned to be carried out at home over the phone to confirm that the patients fill out the self- report assessment sheet.

Implementation phase:

- Firstly the foot was relaxed by applying primarily effleurage, shaking, rotation, and stretching methods before starting the reflexology session, this help to increase circulation, provide relaxation to the feet and make reflexology work easier because a relaxed person is more receptive to technique application.
- Apply pressure to the “solar plexus” point in order to send message to whole body stimulate the release of endorphins. The implementation was in the form of pressing and lifting the thumb 3 times. While the patient was inhaling deep breath, pressure was applied to solar plexus, and while the patient exhaling breathes the pressure was relieved .

Foot massage phase include

General foot reflexology was done by making foot massage on all reflex zones and cover all body system for each foot for 10-15 minute by making pressure using thumb (Walking, circles and hooking) technique.

Specific foot reflexology: the reflex point of organs of the gastrointestinal and urinary systems, heart, pituitary gland and lymph node were the primary focus on both feet it was done for each foot for 15 minute. Each session was started on the right foot and continued on the left one. The researcher was guided by foot reflexology chart

Evaluation phase(post -test):

Evaluation(Posttest) for control group was done 24 hour after second, third, fourth chemotherapy cycle following routine hospital care which was done in each chemotherapy cycle. While evaluation for study group was done 24 hour after second, third and fourth foot reflexology session which was done in each chemotherapy cycle. Both groups was carried out using the same tools used in assessment phase (Tool I&II). Comparison between the two groups was implemented to determine effect of reflexology among breast cancer patients undergoing chemotherapy.

Statistical Analysis:

- Data were fed to the computer and analyzed using IBM SPSS software package version 20.0.
- Qualitative data were described using number and percent. Quantitative data were described using minimum and maximum, mean and standard deviation.
- Comparison between the control and study groups regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square was conducted using Fisher's Exact test or Monte Carlo correction.
- Correlate between two normally distributed quantitative variables using Pearson coefficient.
- Reliability statistics was assessed using Cronbach's Alpha test.
- For normally distributed quantitative variables, comparison between the control and study groups was analyzed using Student t-test.
- Significance of the obtained results was judged at the 5% level.
- Body mass index (BMI, ratio of height and weight, expressed as body weight in kg/ height in cm²)

Ethical consideration:

- Written informed consent was obtained from eligible study subjects after explanation of the aim of the study.
- The privacy and confidentiality of patients' responses were assured.
- The patients were informed that their participation is voluntary and they have right to refuse participation in the study.

III. RESULTS

Part I: Biosociodemographic characteristics of both the study and control group of breast cancer patients receiving chemotherapy. (Table 5 - 7).

Table (5): Frequency distribution of socio demographic characteristic of both the study and control group of breast cancer patients receiving chemotherapy.

Table (5) showed the socio-demographic characteristic of the study and control group of breast cancer patients receiving chemotherapy. **Regarding patient's age**, the results revealed that the highest percentage in both study and control group 52% and 48% respectively were between 40 to 50 years old, with no statistically significant differences between the two studied groups ($p= 0.178$).

Regarding level of education, the largest proportion in both study and control group (72% and 52%) respectively were secondary school. Additionally, there was no statistical significant differences were detected between the two groups regarding the level of education ($p= 0.240$). In relation to marital status, the majority of the studied patients in the study and control group (84% and 72% respectively), were married. No statistically significant difference was found between the two groups ($p= 0.343$).

Regarding occupation, more than half percent of patients in both study and control group (64% and 68% respectively) were housewives. **Moreover**; it was found that, the majority of patients in study group (80%) and more than half of control group (56%) had not sufficient monthly income to fulfill the daily requirements from patient's point of view, with no statistical significant differences between the two studied groups ($p= 0.0690$). The results of the present study showed that 52% of the study group was from rural area. Whereas, more than two third (68%) of the control group comes from urban area. No statistically significant differences were detected between the two groups ($p= 0.152$).

Table (5): Frequency distribution of socio demographic characteristics of both the Study and Control Group of breast cancer patients Receiving Chemotherapy

Socio-demographic data	Study group (n = 25)		Control group (n = 25)		χ^2	p
	No.	%	No.	%		
Age (in years)						
▪ 30 – 40	3	12.0	8	32.0	3.456	0.178
▪ 40 – 50	13	52.0	12	48.0		
▪ 50 – 60	9	36.0	5	20.0		
Educational Level					4.019	MC p= 0.240
▪ Read and write	0	0.0	1	4.0		
▪ Preparatory	4	16.0	3	12.0		
▪ Secondary	18	72.0	13	52.0		
▪ University	3	12.0	8	32.0		
Marital status					2.899	MC p= 0.343
▪ Single	0	0	1	4.0		
▪ Married	21	84.0	18	72.0		
▪ Divorced	4	16.0	3	12.0		
▪ Widow	0	0.0	3	12.0		
Occupation					1.972	MC p= 1.000
▪ Housewife	16	64.0	17	68.0		
▪ Employee	5	20.0	4	16.0		
▪ Manual	3	12.0	2	8.0		
▪ Others	1	4.0	2	8.0		
Income (from patient's point of view)					3.309	0.069
▪ Not enough	20	80.0	14	56.0		
▪ Enough	5	20.0	11	44.0		
Area of residence					2.053	0.152
▪ Rural	13	52.0	8	32.0		
▪ Urban	12	48.0	17	68.0		

χ^2 : Chi square test MC: Monte Carlo

p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

Table (6): Frequency distribution of the studied patients according to body weight, height and body mass index measurements before first, second, third, and fourth chemotherapy cycle.

Concerning body mass index (BMI), the table illustrated that more than two third of study group (68.0%) and more than half (52.0%) of control group were overweight before first chemotherapy cycle. Also, it was found that more than two third (72%) of the study group and about half (48.0%) of control group were overweight before third and fourth chemotherapy cycle. No statistical significant differences were found between the two studied groups before the 1st, 2nd, 3rd and 4th chemotherapy cycle ($p=0.239$, $p= 0.145$, $p= 0.144$, and $p= 0.144$ respectively) as regards body mass index measurement.

Table (6): Frequency distribution of the studied patients according to body weight, height and body mass index measurements before first, second, third, and fourth chemotherapy cycle.

Body mass index measurements	Study group (n = 25)		Control group (n = 25)		Test of sig.	P
	No.	%	No.	%		
Body weight in (kg): Before first cycle Min. – Max. Mean ± SD.	64.0 – 110.0 80.24 ± 12.54		70.0 – 104.0 79.44 ± 8.39		t=0.265	0.792
Before second cycle Min. – Max. Mean ± SD.	65.0 – 112.0 81.32 ± 12.73		70.0 – 106.0 80.28 ± 8.61		t=0.338	0.737
Before third cycle Min. – Max. Mean ± SD.	65.0 – 112.0 81.56 ± 12.74		70.0 – 105.0 80.44 ± 8.65		t=0.364	0.718
Before fourth cycle Min. – Max. Mean ± SD.	65.0 – 110.0 81.68 ± 12.59		70.0 – 105.0 80.44 ± 9.05		t=0.400	0.691
Height(cm): Min. – Max. Mean ± SD.	157.0 – 171.0 165.64 ± 4.01		153.0 – 171.0 163.64 ± 4.32		t=1.697	0.096
Body mass index Before first cycle Normal Overweight Obese Min. – Max. Mean ± SD.	1 17 7	4.0 68.0 28.0	0 13 12	0.0 52.0 48.0	$\chi^2=2.747$	^{MC} p=0.239
Before second cycle Normal Overweight Obese Min. – Max. Mean ± SD.	0.0 18 7	0.0 72.0 28.0	0 13 12	0.0 52.0 48.0	$\chi^2=2.122$	0.145
Before third cycle Normal Overweight Obese Min. – Max. Mean ± SD.	0 18 7	0.0 72.0 28.0	1 12 12	4.0 48.0 48.0	$\chi^2=3.398$	^{MC} p=0.144
Before fourth cycle Normal Overweight Obese Min. – Max. Mean ± SD.	0 18 7	0.0 72.0 28.0	1 12 12	4.0 48.0 48.0	$\chi^2=3.398$	^{MC} p=0.144
Min. – Max. Mean ± SD.	25.39 – 44.30 29.76 ± 5.50		25.26 – 37.56 30.01 ± 3.25		t=0.196	0.846
Min. – Max. Mean ± SD.	25.28 – 44.30 29.85 ± 5.51		24.91 – 37.20 30.06 ± 3.22		t=0.169	0.867
Min. – Max. Mean ± SD.	25.39 – 43.51 29.89 ± 5.45		24.91 – 37.20 30.06 ± 3.33		t=0.132	0.896

t: Student t-test

p: p value for comparing between the studied groups *: Statistically significant at $p \leq 0.05$

Table (7): Frequency distribution of the study and control group according to the types, staging, and grading of breast cancer.

As regards, types of breast cancer tumors, this table reveals that more than two third (72% and 70.2 %) of the study and control group respectively had was diagnosed as invasive ductal carcinoma. In relation to stage of breast cancer, about three quarter of study and control group (76% and 72%), respectively had been diagnosed stage II breast cancer. While, 24.0% and 28.0% respectively, of study and control group had been diagnosed with stage III breast cancer. Concerning grade of breast cancer, it was found that tumor size (T2) represents more than half (64.0%) of study group and more than one third (36.0%) of the control group. While, 60% of the study group represents lymph node size (N 1) and 40% of control group was N0 and N1 respectively. In relation to tumor metastasis, 100% of study and control group had no metastasis (M0).

It can be noticed that, there were no statistically significant differences detected between both study and control group in relation to the types, staging, and grading of breast cancer tumors where p value were p=1.000, p = 0.747, p= 0.098, p= 0.160, respectively.

Table (7): Frequency distribution, of the study and control group according to the types, staging, and grading of breast cancer.

Types, stage, & grades of breast cancer tumors	Study group (n = 25)		Control group (n = 25)		χ^2	p
	No.	%	No.	%		
Types of breast cancer tumors						
Invasive ductal carcinoma	18	72.0	18	70.2	2.011	MC p=1.000
Invasive lobular carcinoma	7	28.0	6	24.0		
Ductal carcinoma situ	0	0.0	1	4.0		
Stage						
II	19	76.0	18	72.0	0.104	0.747
III	6	24.0	7	28.0		
Grade						
T					7.249	MC p=0.098
T0	0	0.0	1	4.0		
T1	2	8.0	7	28.0		
T2	16	64.0	9	36.0		
T3	4	16.0	7	28.0		
T4	3	12.0	1	4.0		
N					3.662	0.160
N0	4	16.0	10	40.0		
N1	15	60.0	10	40.0		
N2	6	24.0	5	20.0		
M						
M0	25	100.0	25	100.0	—	—

χ^2 : Chi square test MC: Monte Carlo

p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

Part II: Percentage and difference, mean scores and total scores related to experience, occurrence and distress of nausea, vomiting and retching among study and control group before and after foot reflexology massage session in each chemotherapy cycle of breast cancer patients receiving chemotherapy (Tables 8-9).

Table (8): Percentage and difference between the study and control group, in relation to severity and total scores of nausea, vomiting and retching in the four sessions of chemotherapy.

Table (8) showed that in relation to severity of nausea, vomiting and retching, it was found that, more than half of the study and control group (52.0% and 64.0%), respectively had experienced moderate nausea, vomiting and retching in the first cycle of chemotherapy, with no statistical significant differences between the two groups (p =0.101). Regarding the second cycle of chemotherapy, it was found that, moderate experience of nausea, vomiting and retching had represented the highest percentage (64.0 % and 60.0 %), for both study and control group, with no statistical significant differences were detected between the two groups (p =0.218).

Concerning the third cycle of chemotherapy, it was noticed that, approximately three quarters (72.0%) of the study group, as compared to 52.0% of the control group, reported moderate experience of nausea, vomiting and retching. As regard to the fourth cycle of chemotherapy, the results show that; 60.0% and 36.6% for both study and control group respectively, had reported moderate experience of nausea, vomiting and retching. There were highly statistically significant differences were detected between control and study groups in third and fourth chemotherapy cycle after applying foot reflexology with p value equal 0.001* and <0.001* respectively.

Table (8): Percentage and difference between the study and control group in relation to severity and total scores of nausea, vomiting and retching in the four sessions of chemotherapy.

Rhodes index of nausea, vomiting and retching according to severity.	Study group (n = 25)		Control group (n = 25)		Test of Sig	P
	No.	%	No.	%		
First cycle						
None	1	4.0	1	4.0	$\chi^2=5.751$	^{MC} p=0.101
Mild	4	16.0	7	28.0		
Moderate	13	52.0	16	64.0		
Great	7	28.0	1	4.0		
Severe	0	0.0	0	0.0		
Total score	12.48 ± 5.73		9.72 ± 4.35		t=1.917	0.061
Second cycle						
None	0	0.0	1	4.0	$\chi^2=4.179$	^{MC} p=0.218
Mild	9	36.0	6	24.0		
Moderate	16	64.0	15	60.0		
Great	0	0.0	3	12.0		
Severe	0	0.0	0	0.0		
Total score	10.76 ± 4.19		11.32 ± 5.03		t=0.428	0.671
Third cycle						
None	0	0.0	1	4.0	$\chi^2=14.214^*$	^{MC} p=0.001*
Mild	7	28.0	2	8.0		
Moderate	18	72.0	13	52.0		
Great	0	0.0	9	36.0		
Severe	0	0.0	0	0.0		
Total score	9.56 ± 3.32		14.08 ± 5.28		t=3.623*	0.001*

Fourth cycle						
None	1	4.0	1	4.0	$\chi^2=$ 18.317*	MC P <0.001*
Mild	9	36.0	3	12.0		
Moderate	15	60.0	9	36.0		
Great	0	0.0	12	48.0		
Severe	0	0.0	0	0.0		
Total score	8.84 ± 3.89		15.40 ± 5.61		t=4.803*	<0.001*

χ^2 : Chi square test MC: Monte Carlo t: Student t-test

p: p value for comparing between the study and control group.

*: Statistically significant at $p \leq 0.05$

1st chemotherapy cycle: pretest was done for both (control and study group) 24 hour after chemotherapy. NB (No reflexology intervention was given to study group).

2nd, 3rd and 4th chemotherapy cycle: Assessment was done 24 hour after chemotherapy cycle.

NB: Control group receive only routine hospital care while study group receive routine hospital care in addition to foot reflexology massage.

Table (9): Mean scores, difference and total scores related to experience, occurrence and distress of nausea, vomiting and retching among study and control group before and after foot reflexology massage session in each chemotherapy cycle of breast cancer patients receiving chemotherapy.

Table (9) revealed that in relation to nausea, vomiting and retching experience, it was found that there were no significant difference between study and control group in the first and second chemotherapy cycle, while a significant difference were detected between them after third and fourth chemotherapy cycles.

In relation to occurrence of nausea, vomiting and retching, the study showed that there were no significant differences in all items of symptom occurrence after **first and second chemotherapy cycle** except occurrence of vomiting, it was significant after second chemotherapy cycle with P value equal 0.045*. While statistically significant differences between study and control group in (vomiting and retching occurrence) were detected **after third chemotherapy cycle** with P value equal (<0.001* and 0.021* respectively) except occurrence of nausea it was not significant.

In relation to all symptoms occurrence (nausea, vomiting and retching) the result showed that there were a significant difference between study and control group **after fourth chemotherapy cycle** with P value equal 0.011* for nausea occurrence and <0.001* for both vomiting and retching occurrence.

The present study revealed that in relation to symptom distress from (nausea, vomiting and retching), there were no significant differences between study and control group in the first and second chemotherapy cycle except for distress from vomiting, it was found that there were a significant difference after first chemotherapy cycle with P value equal 0.007*.

In relation to symptom distress from (nausea, vomiting and retching) **after the fourth chemotherapy cycle**, it's apparent that there were a highly significant difference between study and control group with P value equal <0.001* for both, distress from nausea and retching, while P value for distress from vomiting equal 0.010*.

In relation to nausea, vomiting and retching total percent score after foot reflexology intervention; there were no statistically significant differences between control and study group in the first and second chemotherapy cycle (P=0.061 and 0.671 respectively). While, highly statistically significant differences were detected between the two group in third and fourth chemotherapy cycle after foot reflexology intervention with (P= 0.001* and <0.001* respectively).

Table (9): Mean scores, difference and total scores related to experience, occurrence and distress of nausea, vomiting and retching among study and control group before and after foot reflexology massage session in each chemotherapy cycle of breast cancer patients receiving chemotherapy.

Symptom experience, occurrence and distress	Study group (n = 25)	Control group (n = 25)	T	P
First cycle				
Nausea experience	6.04 ± 2.42	4.80 ± 2.08	1.941	0.058
Nausea occurrence	3.68 ± 1.68	3.08 ± 1.58	1.303	0.199
Nausea distress	2.36 ± 0.86	1.72 ± 0.74	2.825*	0.007*
Vomiting experience	3.96 ± 2.21	3.08 ± 1.89	1.514	0.137
Vomiting occurrence	2.92 ± 1.75	2.24 ± 1.45	1.493	0.142
Vomiting distress	1.04 ± 0.84	0.84 ± 0.62	0.955	0.344
Retching experience	2.48 ± 1.90	1.84 ± 1.49	1.327	0.191
Retching occurrence	1.36 ± 1.04	0.96 ± 0.79	1.535	0.132
Retching distress	1.12 ± 0.93	0.88 ± 0.73	1.019	0.314
Total score	12.48 ± 5.73	9.72 ± 4.35	1.917	0.061
Second cycle				
Nausea experience	5.48 ± 2.02	4.96 ± 2.79	0.754	0.454
Nausea occurrence	3.64 ± 1.58	3.04 ± 1.86	1.230	0.225
Nausea distress	1.84 ± 0.69	1.92 ± 1.04	0.321	0.749
Vomiting experience	3.32 ± 1.60	4.04 ± 1.67	1.556	0.126
Vomiting occurrence	2.36 ± 1.11	3.08 ± 1.35	2.056*	0.045*
Vomiting distress	0.96 ± 0.79	0.96 ± 0.68	0.000	1.000
Retching experience	1.96 ± 1.49	2.32 ± 1.68	0.804	0.426
Retching occurrence	1.16 ± 0.90	1.32 ± 0.95	0.614	0.542
Retching distress	0.80 ± 0.65	1.00 ± 0.82	0.961	0.341
Total score	10.76 ± 4.19	11.32 ± 5.03	0.428	0.671
Third cycle				
Nausea experience	5.08 ± 1.47	6.40 ± 2.36	2.372*	0.022*
Nausea occurrence	3.28 ± 1.34	4.04 ± 1.59	1.825	0.074
Nausea distress	1.80 ± 0.58	2.36 ± 0.91	2.603*	0.013*
Vomiting experience	2.88 ± 1.62	4.88 ± 1.86	4.064*	<0.001*
Vomiting occurrence	2.20 ± 1.26	3.80 ± 1.47	4.131*	<0.001*
Vomiting distress	0.68 ± 0.48	1.08 ± 0.81	2.124*	0.040*
Retching experience	1.60 ± 1.22	2.80 ± 1.91	2.640*	0.012*
Retching occurrence	0.84 ± 0.69	1.44 ± 1.04	2.399*	0.021*
Retching distress	0.76 ± 0.60	1.36 ± 0.95	2.669*	0.011*
Total score	9.56 ± 3.32	14.08 ± 5.28	3.623*	0.001*
Fourth cycle				
Nausea experience	4.84 ± 1.99	7.00 ± 2.40	3.464*	0.001*
Nausea occurrence	3.12 ± 1.56	4.32 ± 1.63	2.660*	0.011*
Nausea distress	1.72 ± 0.79	2.68 ± 0.90	4.005*	<0.001*
Vomiting experience	2.60 ± 1.94	5.04 ± 2.26	4.096*	<0.001*
Vomiting occurrence	1.92 ± 1.66	3.92 ± 1.85	4.031*	<0.001*
Vomiting distress	0.68 ± 0.48	1.12 ± 0.67	2.688*	0.010*
Retching experience	1.40 ± 1.00	3.36 ± 1.93	4.501*	<0.001*
Retching occurrence	0.72 ± 0.54	1.88 ± 1.09	4.757*	<0.001*
Retching distress	0.68 ± 0.48	1.48 ± 0.96	3.725*	0.001*
Total score	8.84 ± 3.89	15.40 ± 5.61	4.803*	<0.001*

t: Student t-test p: p value for comparing between the study and control group *: Statistically significant at p ≤ 0.05.

1st chemotherapy cycle: pretest was done for both (control and study group) 24 hour after chemotherapy. NB (No reflexology intervention was given).

2nd, 3rd and 4th chemotherapy cycle: Assessment was done 24 hour after chemotherapy cycle.

NB: Control group receive only routine hospital care while study group receive routine in addition to foot reflexology massage.

Part III: Frequency distribution and differences in fatigue severity and living activities related to fatigue among the study and control group before and after foot reflexology massage sessions of breast cancer patients receiving chemotherapy (Table 10&11).

Table (10) Frequency distribution and differences of fatigue severity among the study and control group before and after foot reflexology massage sessions of breast cancer patients receiving chemotherapy.

Table (10) exhibited that, in relation to fatigue severity after first chemotherapy cycle, (76% and 84%) respectively of patients in the study and control group had moderate level of fatigue. At second chemotherapy cycle and after first foot reflexology session, patients in the study group had moderate and high level of fatigue respectively as follows (80.0% and 4.0 %). while, 88% of patients in the control group had moderate level of fatigue and 8.0% had high level of fatigue).

Regarding fatigue severity after the third chemotherapy cycle and after the second reflexology session, it can be seen that 24% of patients in the study group had low level of fatigue, 76% moderate severity with no one suffer from severe level of fatigue. While, 80.0% of patients in control group had moderate level of fatigue and 20.0% of them had high level of fatigue. Finally, the result of the last chemotherapy cycle after third reflexology session shows that fatigue severity among study group was 68% moderate and 32% mild level while, 72% of control group had moderate severity and 28% had high level of fatigue. There were a statistical significant difference between the control and study groups in relation to severity of fatigue in the third and fourth chemotherapy cycle only.

Table (10): Frequency Distribution and differences in Fatigue Severity among the Study and Control Group before and after Foot Reflexology Massage Sessions of Breast Cancer Patients Receiving chemotherapy.

Fatigue severity	Study group (n = 25)		Control group (n = 25)		Test of Sig	P
	No.	%	No.	%		
First cycle						
No fatigue	0	0.0	0	0.0	$\chi^2=1.790$	MC p= 0.619
Low level fatigue	4	16.0	4	16.0		
Moderate level fatigue	19	76.0	21	84.0		
High level fatigue	2	8.0	0	0.0		
Total score	5.23 ± 1.30		4.51 ± 0.91		t=2.265*	0.028*
Second cycle						
No fatigue	0	0.0	0	0.0	$\chi^2=2.158$	MC p= 0.496
Low level fatigue	4	16.0	1	4.0		
Moderate level fatigue	20	80.0	22	88.0		
High level fatigue	1	4.0	2	8.0		
Total score	5.07 ± 1.18		5.20 ± 1.00		t=0.432	0.668
Third cycle						
No fatigue	0	0.0	0	0.0	$\chi^2=10.973^*$	MC p= 0.002*
Low level fatigue	6	24.0	0	0.0		
Moderate level fatigue	19	76.0	20	80.0		
High level fatigue	0	0.0	5	20.0		
Total score	4.47 ± 1.13		5.85 ± 0.96		t=4.670*	<0.001*
Fourth cycle						
No fatigue	0	0.0	0	0.0	$\chi^2=15.898^*$	MC p <0.001*
Low level fatigue	8	32.0	0	0.0		
Moderate level fatigue	17	68.0	18	72.0		
High level fatigue	0	0.0	7	28.0		
Total score	4.12 ± 1.18		6.36 ± 1.14		t=6.825*	<0.001*

χ^2 : Chi square test MC: Monte Carlo t: Student t-test

p: p value for comparing between the study and control group

*: Statistically significant at $p \leq 0.05$

1st chemotherapy cycle: pretest was done for both (control and study group) 24 hour after chemotherapy. NB (No reflexology intervention was given).

2nd, 3rd and 4th chemotherapy cycle: Assessment was done 24 hour after chemotherapy cycle.

NB: Control group receive only routine hospital care while study group receive routine hospital care in addition to foot reflexology massage.

Table (11): Difference in living activities among the study and control group related to fatigue before and after foot reflexology massage sessions of breast cancer patients receiving chemotherapy.

Table (11) Clarified that in relation to the effect of fatigue on living activities, it can be noticed that, patients in the study group had lower mean scores than those of the control group after two foot reflexology sessions. In addition, there were highly statistically significant differences between the study and control group after third and fourth chemotherapy cycle with p value equal <0.001*.

It is apparent, respectively that the **effect of fatigue on living activities** Mean ± SD after third chemotherapy cycle (after second foot reflexology sessions) (4.69 ± 1.03) and (5.70 ± 0.87) in the study group and control group. As for the fourth chemotherapy cycle after third foot reflexology session, the result showed that the Mean ± SD = 4.49 ± 1.31 in the study group while, it was 6.30 ± 0.77 in the control group.

Table (11): Difference in living activities among the study and control group related to fatigue before and after foot reflexology massage sessions of breast cancer patients receiving chemotherapy.

Fatigue's effect on living activities	Study group (n = 25)		Control group (n = 25)		Test of Sig	P
	No.	%	No.	%		
First cycle						
Not interfere	0	0.0	0	0.0	$\chi^2=11.513^*$	MC p=0.002*
Slightly interfere	1	4.0	11	44.0		
Moderately interfere	21	84.0	13	52.0		
Highly interfere	3	12.0	1	4.0		
Total score	5.33 ± 1.37		4.44 ± 1.20		t=2.453*	0.018*
Second cycle						
Not interfere	0	0.0	0	0.0	$\chi^2=1.371$	MC p=0.698
Slightly interfere	1	4.0	3	12.0		
Moderately interfere	22	88.0	21	84.0		
Highly interfere	2	8.0	1	4.0		
Total score	5.13 ± 0.95		5.15 ± 1.09		t=0.092	0.927
Third cycle						
Not interfere	0	0.0	0	0.0	$\chi^2=8.077^*$	MC p=0.011*
Slightly interfere	6	24.0	0	0.0		
Moderately interfere	19	76.0	23	92.0		
Highly interfere	0	0.0	2	8.0		
Total score	4.69 ± 1.03		5.70 ± 0.87		t=3.755*	<0.001*
Fourth cycle						
Not interfere	0	0.0	0	0.0	$\chi^2=16.917^*$	MC p<0.001*
Slightly interfere	11	44.0	0	0.0		
Moderately interfere	13	52.0	19	76.0		
Highly interfere	1	4.0	6	24.0		
Total score	4.49 ± 1.31		6.30 ± 0.77		t=5.951*	<0.001*

χ^2 : Chi square test MC: Monte Carlo t: Student t-test

p: p value for comparing between the study and control group

*: Statistically significant at p ≤ 0.05

1st chemotherapy cycle: pretest was done for both (control and study group) 24 hour after chemotherapy. NB (No reflexology intervention was given to study group).

2nd, 3rd and 4th chemotherapy cycle: Assessment was done 24 hour after chemotherapy cycle.

NB: Control group receive only routine hospital care while study group receive routine hospital care in addition to foot reflexology massage.

Part IV: Correlation Between the studied group Age and Body Mass Index (BMI) In Relation To Total Scores of Rhodes Index of Nausea, Vomiting and Retching and Total Scores of The Brief Fatigue Inventory (BFI) of Breast Cancer Patients Receiving Chemotherapy. (Tables 12- 17)

Table (16): Correlation between the score of two studied group’s age and body mass index (BMI) in relation to total scores of Rhodes index of nausea, vomiting and retching on breast cancer patients receiving chemotherapy. (N = 50).

The table clarified that nausea, vomiting, and retching significantly correlated negatively with age. As the age increase, nausea, vomiting, and retching decreases. While it was significantly correlated positively with BMI. As the BMI increase, nausea, vomiting, and retching increases.

Table (16): Correlation between the score of two studied group’s age and BMI with total scores of Rhodes index of nausea, vomiting and retching of Breast Cancer Patients Receiving Chemotherapy. (n = 50)

Rhodes index of nausea, vomiting and retching items Score	Age		BMI (Average)	
	R	P	R	p
Nausea experience	-0.440*	0.001*	0.375*	0.007*
Vomiting experience	-0.428*	0.002*	0.373*	0.008*
Retching experience	-0.436*	0.002*	0.270	0.058
Overall	-0.496*	<0.001*	0.394*	0.005*

r: Pearson coefficient *: Statistically significant at $p \leq 0.05$

Table (17): Correlation Between Scores of the Two Studied Group’s Age and Body Mass Index (BMI) with Total Scores of The Brief Fatigue Inventory (BFI) of Breast Cancer Patients Receiving Chemotherapy (N = 50):

Table 17 revealed that fatigue severity and fatigue effect on living activities significantly correlated negatively with Age. As the age increase, fatigue severity and fatigue effect on living activities decreases. While, it was significantly correlated positively with BMI. As the BMI increase, fatigue severity and fatigue effect on living activities increases.

Table (17): Correlation Between Scores of The Two Studied Group’s Age and BMI with Total Scores of Brief Fatigue Inventory (BFI) of Breast Cancer Patients Receiving Chemotherapy (N = 50)

Total score of brief fatigue inventory (BFI)	Age		BMI (Average)	
	R	P	R	P
Fatigue severity	-0.380*	0.007*	0.599*	<0.001*
Fatigue’s effect on living activities	-0.249	0.081	0.286*	0.044*

r: Pearson coefficient *: Statistically significant at $p \leq 0.05$

IV. DISCUSSION

Discussion of this thesis covered **four themes** among control and study group. **The first theme** included socio-demographic data and clinical data, **the second theme** include patients’ Rhodes index of nausea, vomiting and retching self-report assessment, **the third theme** include fatigue severity and its effect on daily living activities and the **fourth theme** related to correlation between the two studied groups age and body mass index.

Concerning sociodemographic characteristics, the selection of the subjects of the present study result revealed that, there was no significant difference between patients in the control and study group in relation to sociodemographic data and clinical data. The findings of the present study revealed that the highest percentage of patients in both study and control group were between 40-50 years old, this finding is consistent with Soliman et al. (2017) who reported that the highest peak age of breast cancer was ranged between 40 to 60 years of old. In addition, this result is in agreement with that reported by Weledji and Tambe (2018) that the breast cancer is the most common cancer among women with an age 40-55 years old.

The role of age as a risk factor in the development of BC was determined by Ma et al. (2020) who found that two long noncoding RNAs (lncRNAs) (AL139280.1 and AP000851.1) and three microRNAs (mRNAs) (MT1M, HBB, and TFPI2) were differential risk biomarkers in patients with BC. In addition, study by (Arshi et al., 2018; Pereira Fernandes, Bitar, Jacobs, & Barry, 2018) who ascertain that there are age-dependent variations in (lncRNA) expression profiles.

Regarding the marital status and occupation; the present study clarified that the majority of patients in both groups were married and housewives, so they are as a household may use of insecticides and detergents which contribute to potential risk of breast cancer. This result was similar to Hoffmann et al. (2018) who mentioned that, the majority of the women in both groups were married, and most of them were housewives. This finding was in disagreement with the result by (Soliman, El Gahsh & Shehata, 2018) who revealed that the majority of the study group was widowed and near half of the study group had administrative work. Also, this finding contradicted Hayes et al. (2012) who explained that unmarried and nulliparous had an increased risk for developing breast cancer due to prolonged or repeated exposure to estrogen hormones.

Concerning the stage of breast cancer; the study's findings showed that more than half of both control and study groups were diagnosed with breast cancer at stage II. This may due to lack of awareness about the disease and its implications. This result was in harmony with Musarezaie and Zargham-Boroujeni (2015) who emphasized that a higher percentage of the studied group were diagnosed at the second stage. This result could be due to that the majority of the subjects were secondary school (low level of education) and were not aware of breast self-examination for early detection of cancer at the first stage.

In relation to body weight and body mass index: It was observed that the study and control groups' body weight increased gradually with each chemotherapy cycle. This increase may due to lack of exercise and decreased level of their functional abilities. This result was congruent with study of Ricci et al. (2014) who founded that most patients with breast cancer showed an increase in the body mass index after adjuvant chemotherapy, especially after the AC chemotherapy regimen. Nyrop et al. (2020) added that weight gain, weight loss, or stable body weight in women with early breast cancer vary greatly by treatment plan. However, pre-menopausal patients have the highest risk for weight gain. Jung, Kim and Chung (2020) found that weight gain is a common among many breast cancer survivors receiving adjuvant chemotherapy. As many as 50–96% of women experience significant weight gain during treatment. Average increases range of body weight from 2.5–6.2kg; this may occur as a result of cancer related fatigue and decreased energy expenditure.

Effect of foot reflexology on reducing/controlling chemotherapy induced nausea, vomiting and retching:

Concerning assessment of chemotherapy induced nausea, vomiting and retching experience: It was observed that, more than half of patients in the control and study groups had moderate severity of CINV and about quarter of them had great level in the first 24 hour after first chemotherapy cycle before applying any reflexology intervention with mean score of 9.72 ± 4.35 and 12.48 ± 5.73 respectively. The present study revealed that the study subject were convenient and no statistically significant difference between them. This result in line with Matourypour et al. (2016) who stated that there are systemic complication due to treatment with chemotherapy, multiple complications were observed in patients, among these complications were nausea and vomiting which were the worst, the most prevalent, and the most troublesome to those patients. It was experienced by 70–80% of patients. So, the success of this treatment has been challenged to a large extent. In addition, studies reported that about 70% of the patients undergoing chemotherapy experience anticipatory, acute, and delayed vomiting even after taking antiemetic and anti-nausea drugs.

In addition to study of Naito et al. (2020) who shows that the proportion of patients with nausea and vomiting of patients receiving HEC in the acute phase (≤ 24 h from administration of emetogenic agents), 44.9% experienced nausea, and 12.8% experienced vomiting and stated that the degree of nausea was worst on the first day and gradually improved.

Moreover, De Laurentiis et al. (2018a) was concluded that CINV is still a critical issue in AC-treated patients, despite antiemetic treatment.

Also, the present study shows that the average of the **total scores of INVR** of the patients was calculated, it was observed that the average of the total scores of nausea, vomiting, and retching experience, occurrence, and distress of the patients in the experimental group gradually decreased while the patients in the control group gradually increased. also, the result revealed that the difference between the average of the total scores of INVR in the intergroup was statistically significant after third and fourth chemotherapy cycle (after application of foot reflexology session) since P value equal $<0.001^*$ and **0.001 respectively**. This result indicates the benefits of applying reflexology for patients undergoing chemotherapy.

Chemotherapy induced nausea, and vomiting was explained by Adel (2017) who stated that, in acute CINV, free radicals generated by toxic chemotherapeutic agents stimulate enterochromaffin cells in the gastrointestinal tract, causing the release of serotonin. Subsequently, serotonin binds to intestinal vagal afferent nerves via 5-HT₃ receptors, which trigger the vomiting reflex via the nucleus of the solitary tract (NTS) and chemoreceptor trigger zone (CTZ) in the central nervous system (Adel, 2017). Abell and Parajuli (2017) stated that nausea is associated with increased sympathetic and decreased parasympathetic tone and that some researchers hypothesize that sympathetic activity can be a defensive reaction against nausea and vomiting.

Decreased experience, occurrence and distress of nausea, vomiting and retching among study group support the therapeutic effect of foot reflexology massage, as it's based on the principle that the feet are mirrors of the body and they have reflex points that correspond to each of the body's gland, structure and organs. It's a fact, when a reflex is massaged in any zone; it stimulates the corresponding organ in that zone. So, massage has mechanical effects that improve circulation, remove waste products from the body, improve joint mobility, relieve pain and reduce muscle tension, reduce anxiety and stress in various populations by modulating Autonomic nervous system (ANS) function (Hughes et al., 2011). Reflexology also has psychological benefits including relaxation and improving sense of wellbeing by stimulating the release of endorphins, that act as natural pain killer and mood elevators Kardan, Zarei, Bahrami Taghanaki, Vagharseyyedin and Azdaki (2019).

In addition, massage has a psychological impact on patients and the involvement of psychological phenomenon affects the limbic system, the center of people's feelings, which is connected to vomiting center by neurological fibers; so, it can be effective in improving nausea and vomiting by connecting massage signals to the limbic system and vomiting center. While, some researchers stated there is a need for more explanation and clarification about the real mechanism of massage therapy on nausea and vomiting (Mazlum, Chaharsoughi, Banihashem & Vashani, 2013).

Moreover, foot massage could increase heart rate and relaxation, possibly mediated by increased parasympathetic action and decreased sympathetic activity. Massage has an influence on vagal nerve activity via oxytocin, which has been shown to influence the release of gastro intestinal hormones by action in the vagal nerve and the nucleus of the solitary tract. Massage causes a release of oxytocin not only into the circulation but also into various brain areas (Holst, Lund, Petersson & Uvnäs-Moberg, 2005). Oxytocin seems to have anxiolytic effects and relaxation, which in turn reduces the nausea (Holst et al., 2005). Also, it's suspected that performing a foot massage will activate the parasympathetic nervous system, thus allowing the body to relax (Billhult, Bergbom & Stener-Victorin, 2007). Lu et al. (2011) showed that, a higher vagal modulation, lower sympathetic modulation, and lower blood pressures can be observed following 60 minutes of foot reflexology in both angiographically patent controls and coronary artery disease (CAD) patients.

The present findings were supported by Sevilay and Hilal (2019) who found that foot reflexology has positive effects on nausea-vomiting of lung cancer patients receiving chemotherapy and concluded that foot reflexology application, can be used as supportive for reducing/avoiding nausea and vomiting. Özdelikara and Tan (2017b) added that foot reflexology massage reduces the symptoms of chemotherapy (nausea, vomiting, fatigue, etc.,) among breast cancer patients after performing 50-60-minute foot reflexology in each chemotherapy cycle during chemotherapy infusion (3 successive reflexology sessions) 21 days apart. The result revealed that the patients experience, occurrence, distress of nausea, vomiting, retching and fatigue reduced over the first 24 after each chemotherapy cycle.

The same result was confirmed by Asha, Manjini and Dubashi (2020) who reported that the foot massage therapy is effective in reducing chemotherapy-induced nausea and vomiting among patients undergone highly emetogenic

chemotherapy and helped to conclude that foot massage can be considered effective intervention in chemotherapy patients. In this study the researcher performed foot massage to assess its effect on chemotherapy-induced nausea and vomiting among patients undergoing highly emetogenic chemotherapy by providing three sessions of foot massage in the first chemotherapy cycle, 20 minutes before starting chemotherapy, 20 minutes during chemotherapy and immediately after completion of chemotherapy. Each session took 20 minutes (10 minutes for each leg). And the post- test was done 48 hours after undergoing chemotherapy, through a phone call.

Moreover, Grealish, Lomasney and Whiteman (2000) studied a sample of 87 subjects; a 10-minute foot massage (5 minutes per foot) was found to have a significant immediate effect on the perceptions of pain, **nausea**, and relaxation when measured with a visual analog scale. The researcher recommended the use of foot massage as a complementary method and as a relatively simple nursing intervention for patients experiencing nausea or pain related to the cancer experience.

According to the results of the current study regarding the positive effect of foot reflexology on CINV, the first and second proposed hypothesis is approved; breast cancer patients who receive foot reflexology state reduction in chemotherapy induced nausea and vomiting than those who do not receive it.

Fatigue severity and its effect in daily living activities

Regarding fatigue among breast cancer patients receiving chemotherapy, the current study demonstrated that subjects in both groups after the first chemotherapy cycle before any reflexology intervention, complaint from increasing physical discomfort, decreasing general activity and ability to perform normal work including both work outside the home , daily chores and ability to walk. Also patients expressed that fatigue have negative effect on their mood, relationship with their family, friends and enjoyment of life.

There are many reasons for fatigue which develops during the process of chemotherapy treatment (Ozcelik & Çiçek, 2009). Fatigue that occurs during chemotherapy has also been associated with a cluster of other common symptoms, including pain, difficulty sleeping and muscle weakness. Fatigue may interact with other common adverse effects of chemotherapy drugs, such as nausea and vomiting, by increasing their perceived severity. Cancer-related fatigue can exacerbate the experience of other symptoms, negatively affect mood, interfere with the ability to carry out everyday activities, and negatively impact on quality of life. This may occur as a result of accumulation of metabolic wastes in the body, loss of appetite, nausea, and anemia are among these reasons (Bennett et al., 2016).

The current study showed that **the average of the total scores of fatigue severity and fatigue effect on living activities** after the second, third and fourth chemotherapy cycle following foot reflexology intervention including general activity and ability to perform normal work including both work outside the home and daily house chores, ability to walk, mood, relationship with their family, friends and enjoyment of patients life in the experimental group gradually decreased but that of the patients in the control group gradually increased. It was also found that this difference between a average of the total score of brief fatigue inventory in the intergroup was statistically significant after third and fourth chemotherapy cycle (after second- and third-foot reflexology session).

The positive results in the experimental group may be attributed to application of foot reflexology massage that has therapeutic effects in stimulating the nerve pathways to release congestion and promote relaxation response for the entire body, activates the life force in the body, and creates a balance of energy and allowing energy to flow freely. According to this theory the fatigue experienced among the studied group had been decreased which indicates a balanced flow of energy (Stephenson, Weinrich & Tavakoli, 2000; Taha & Ali, 2011). Moreover, reflexology massage increase blood and lymph circulation, release of congestion, bringing in oxygen, nutrients, mineral, enzymes and hormones. It's also eliminating toxins and waste product generated from chemotherapy. On the other hand, it is indicated that reflexology decreases stress and anxiety with the help of a deep relaxation and an intensive relaxing, and it also provides recirculation of energy by opening the blocked energy canals throughout the body and decreases fatigue symptoms.(Stephenson et al., 2000; Wang, Tsai, Lee, Chang & Yang, 2008; Wilkinson, Lockhart, Gambles & Storey, 2008; Sharp et al., 2010; Taha & Ali, 2011)

Quattrin et al. (2006) examined the effectiveness of reflexology foot massage in hospitalized cancer patients undergoing second or third chemotherapy cycles and concluded that reflexology foot massage can be considered a support treatment

used in combination with traditional medical treatments and executed by an expert, qualified person to help cancer patients receiving chemotherapy feel better and also cope better with their disease which support the result of the present study. In addition a quasi-experimental, pretest-posttest research design was conducted by Ozdelikara and Agcadiken Alkan (2018) to determine the effects of reflexology on **fatigue** severity and anxiety in patients with multiple sclerosis (MS) and concluded that reflexology can be an effective method for reducing fatigue severity and anxiety in patients with MS.

A number of studies showed that relaxation and improvement of sleep pattern through massage therapies decreased fatigue this is in line with the result of the present study. Lee, Han, Chung, Kim and Choi (2011) found that reflexology applied for 30 min increased sleep quality and reduced fatigue by allowing the patients to relax. Also Lee, Kim, Kang and Moon (2013) concluded that foot reflexology which given to patients receiving chemotherapy relaxes them and thus increases their quality of sleep and allays some of their symptoms.

Moreover the studies done by Dogan (2014), Valizadeh, Seyyedrasooli, Zamanazadeh and Nasiri (2015), Unal and Balci Akpınar (2016) and Zengin and Aylaz (2019b) concluded that Reflexology eliminates muscle strains, increases the quality of sleep by providing relief of pain and relaxation, so decrease fatigue. Also, the researchers added that developments in the field of health have its reflection upon the role of the nurses and their responsibilities. For this reason, nurses should use nonpharmacological methods when appropriate and be able to apply therapies such as reflexology which will help in management of the individual in a holistic way. Similar finding come from Rambod, Pasyar and Shamsadini (2019) who showed that, both intervention and control groups were the same in terms of fatigue, pain, and sleep quality ($p > 0.05$) before foot reflexology. However, a significant difference was found between the two groups regarding fatigue, pain, and sleep quality after the intervention (all $p < 0.05$).

In relation to **fatigue severity** the results of the present study were in accordance with the results of studies conducted by Nourmohammadi, Motaghi, Borji, Tarjoman and Soltany (2019) and Hesami, Kalhor, Roshani and Fathi (2019) **who revealed** that fatigue severity decreased in patients with breast cancer who received foot reflexology massage and improve quality of life for those patients. Therefore, recommended community health nursing staff to use this complementary medicine to enhance patients' health conditions. Their results are in conformity with those of the current study. **According to the results of the current study regarding to the positive effect of foot reflexology on Fatigue severity and its effect in daily living activities**, third proposed hypothesis is approved; breast cancer patients who receive foot reflexology state reduction in chemotherapy induced fatigue than those who do not receive it.

In relation to correlation between the studied group age and body mass index (BMI) in relation to total scores of Rhodes Index of Nausea, Vomiting and retching and the total scores of the brief fatigue inventory (BFI) of breast cancer patients receiving chemotherapy.

The present study shows that there was negative correlation between the studied group age and total scores of nausea, vomiting, retching. This is congruent with A multivariate logistic regression analysis done by Nawa-Nishigaki et al. (2018) who indicated that age under 55-year-old had a significant risk for both nausea and vomiting among breast cancer patients receiving Adriamycin and cyclophosphamide. In addition to study of Warr, Street and Carides (2011) and Tokumaru et al. (2018) who stated that indicated that age breast cancer patients receiving Adriamycin and cyclophosphamide under 55-year-old was a significant risk for both nausea and vomiting. Moreover, this result confirmed by Ruiz-Casado et al. (2020) who found that fatigue was consistently higher in younger, obese and diabetic women. Furthermore, in the present study there were positive correlation between the studied group body mass index and total scores of brief fatigue inventory. This result is in accordance with Inglis et al. (2020) who was found that obese breast cancer survivors had greater levels of CRF, inflammatory markers and certain fatty acids.

From the ongoing discussion, it can be concluded that, the foot reflexology for breast cancer patients receiving chemotherapy is essential and fundamental in order to decrease and control chemotherapy induced nausea, vomiting and fatigue and improve patients' quality of life. Therefore, continuous educational and training programs should be provided to oncology nurses, patients and their relatives to perform it at home with a regular schedule to reach optimum effect. In addition, the rehabilitation program should be considered as an integral part in the hospital routine care for breast cancer patients receiving chemotherapy.

V. CONCLUSION

Based on the findings of the present study, it can be concluded that experience, occurrence and distress of nausea, vomiting and retching as well as fatigue mean% score of the studied patients were highly statistically significant improved after performing foot reflexology intervention.

VI. RECOMMENDATIONS

Based on the finding of the study, the following recommendations are suggested:

- Oncology nurses should seek courses of foot reflexology as complementary therapy which help decrease cancer and cancer treatment related symptoms including chemotherapy induced nausea, vomiting and fatigue.
- Oncology nurses should perform foot reflexology intervention for patients in hospital, teach and train them and their relative to perform it at home with a regular schedule to reach **optimum** effect.
- Administrator should encourage nurses to take courses of complementary alternative medicine and encourage its application in chemotherapy units.
- Specific rooms for health education for breast cancer patients receiving chemotherapy should be available at any time to teach patients about foot reflexology technique to be able to make self care using foot reflexology at home.
- It is essential to increase the level of awareness among public, patients and health care providers regarding importance of performing foot reflexology intervention especially during receiving chemotherapy.
- Further research is recommended to be done to determine the effect of foot reflexology on quality of life among breast cancer patients receiving chemotherapy.

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