Reflexology Effects on Pain and Psychological Status among Patients who Undergone Cardiothoracic Surgery

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Abstract

Background: Many studies reported that reflexology relieves pain and enhances psychological status of patients' post- cardiothoracic surgeries. Nurses play a critical role in managing pain and maintaining psychological status post- cardiothoracic surgeries. The study aimed to evaluate the effect of reflexology on pain and psychological status regarding patients with cardiothoracic surgeries.
Setting: The study was conducted in the cardiothoracic intensive care units in cardiothoracic hospital at Sednawy Zagazig University Hospital., Egypt.
Subjects: A purposive sample of 80 patients who were admitted to the cardiothoracic surgery department and were subjected to cardiothoracic surgery during the study period divided into two groups of patients (study and control), (40 patient) for each group**.** Three tools were used for collection of data, structured interview questionnaire to assess demographic and health history assessment data for patients, numerical rating scale to assess pain level and patient's psychological status assessment questionnaire to assess psychological status.
Results: There was statistically significant decrease in pain, anxiety, fatigue level and enhancing sleep quality in the study group after applying hands and foot reflexology compared to control group and the improvement was more significant in the study group than in the control group.
Conclusion: Hands and foot reflexology has a positive effect in decreasing pain, anxiety, fatigue level and enhancing sleep quality of patients after cardiothoracic surgeries.
Recommendations: This study recommended periodic evaluation and validation of the training given and training programs should be included both theoretical and practical to patients who prepared for cardiothoracic surgery on cardiothoracic surgery units and their relatives.
Keywords: Cardiothoracic Surgeries, Pain, Psychological Status, Reflexology

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Introduction:

Chronic heart diseases kill nearly 4 million people in Europe every year approximately 44% of all deaths, with ischemic heart disease accounting for 44% of these CVD deaths and stroke accounting for 25% **(Townsend et al., 2022).** The high prevalence of cardiovascular risk factors (e.g., smoking, hypertension, diabetes, poor lifestyle…etc.) contributes to a burden of cardiovascular morbidity and mortality generally in the Middle East and particularly in Egypt **(Yusuf et al., 2020).**

Cardiothoracic Surgery is the specialty involved with the treatment of diseases affecting organs within the thorax (the chest), principally the heart, lungs, and esophagus. It is a relatively young specialty which has grown rapidly since the Second World War (the first successful open-heart procedure using the heart-lung machine was performed in 1953). Procedures are often lengthy and complex, requiring support from advanced forms of technology during surgery and intensive therapy for the patient after surgery **(Czerny et al., 2019).**

Acute Pain is a critical problem following each type of cardiothoracic surgery. In the context of etiology Skin incisions, sternal retraction, dissections, internal mammary artery graft preparation, endotracheal intubation, chest drain, and sternal wires. Pain stimulates the hypothalamic–pituitary–adrenal axis and activates the sympathetic nervous system. Blood pressure rises, heart rate rises, and a hyper glycemic condition develops because of increased adrenaline release. This unfavorable circulatory condition can cause arrhythmias, such as atrial fibrillation, and increase myocardial oxygen demand, making patients more susceptible to ischemic events **(Saber et al., 2021).**

Insufficient pain management in the early stages after cardiothoracic surgery may cause patients to breathe shallowly and quickly because they are afraid of experiencing pain. As a result, pulmonary dysfunction may occur. Severe pain can delay early recovery and cause a decline in movement, which increases the risk of thromboembolic complications. In addition, pain-induced anxiety increases muscle tons, which increases oxygen consumption and lactic acid production in muscles **(Anwar et al., 2022).**

Cardiothoracic surgery causes anxiety in most patients due to several factors such as severe pain, consequent fatigue, disability, and fear of death. Post-operative anxiety can negatively affect the outcome of surgery and may result in prolonged recovery. Anxiety provokes hemodynamic stress reactions that induce higher myocardial oxygen consumption and impending adverse effects on cardiac functioning **(Chandrababu et al., 2020).**

Fatigue is a subjective feeling of weakness, loss of energy, exhaustion, and malaise. This disorder lowers one's sense of wellbeing and has various consequences on the physical, emotional, and cognitive aspects of life. Most patients of cardiothoracic surgeries experience fatigue post operatively, which can range in prevalence from 60% to 97%. Untreated fatigue may cause a person to become more dependent on others, become weak, and experience a loss of bodily and psychological comfort, which can result in hemodynamic instability **(Sabry et al., 2020).**

According to recent reports, about 80% of patients undergoing cardiothoracic operations have different levels of sleep disturbance before and after the procedure and fear of the procedure have been reported in 60% of patients. The main reasons for this include fear of death, potential problems, lack of knowledge of environmental change, and fear of changes in postoperative lifestyle. Also, hospitalization and waiting for surgery are major sources of sleep disturbance and tension in these

patients. Moreover, patients with preoperative sleep disturbance experience more postoperative pain, less relief of symptoms, reduced physical capacity, dissatisfaction with treatment, more re-admission, lower improvement, and lower level of quality of life after surgery **(Khaledifar et al., 2017).**

An increase in the level of pain, anxiety, fatigue, and sleep disturbance has a negative effect on patient's healing and recovery, e.g., they increase the duration of hospitalization and leads to patient's death. A study showed that psychological status is an important factor in patients' mortality after cardiothoracic operations. Enhancing patients' psychological status as a nursing intervention can reduce the sympathetic response to anxiety in patients. Reducing sympathetic stimulation reduces heart rate, pain, and other symptoms **(Rahmani et al., 2017).**

Reflexology is a unique form of massage that usually puts pressure on the foot's & hand's reflex area. It is believed that these areas are related to various parts of the body, and the pressure on these areas will affect the body's physiological response **(Zeidabadi et al., 2022).**

Reflexology is assumed to facilitate relaxation, release endorphins, and modulate pain-impulse transmission and pain perception. Subsequently, relaxation can affect quality of sleep, reduce anxiety and fatigue. In addition, touch, and massage of reflex points in the foot may reduce post operative patients' pain **(Naseri et al., 2019).**

Nurses play a key role in pain assessment and in advising on the standards of pain management in postoperative recovery on surgical wards. Nurses are the main providers of professional care within the postoperative care setting **(Chatchumni et al., 2016).** There are two pain management strategies used by nurses for patient who report pain postoperative, and this include: pharmacological pain management strategies as (Non-Steroid Anti-Inflammatory Drugs (NSAIDs) oral or parenteral, paracetamol, opioids oral or parenteral, morphine, pethidine) **(Rafati et al., 2016).** Non-pharmacological pain management strategies as (cognitive behavioral strategy including cognitive and sensory information, and different ways of giving information, physical methods as positioning, emotional support and reassurance, reflexology massage, heat, relaxation, teaching and distraction**) (Twycross et al., 2015).**

All nurses caring for patients after surgery are concerned about providing safe, effective pain, anxiety, fatigue, sleep disturbance management. Registered nurses, at all levels of practice, are primarily patient advocates who play an important role in correctly managing postoperative pain, anxiety, fatigue, sleep disturbance. Reflexology was discovered to be an important part of the healing process for patients after surgery. Patients are more likely to experience discomfort as a result of surgical procedures **(Youniss et al., 2021).**

Significance of the study:

According to Statistics of Egyptian Cardio Thoracic intensive care unit at Zagazig University Hospital in the years of (2022), 86 percent of 300 cardiothoracic patients had postoperative pain, with 75 percent having moderate/severe pain in the immediate postoperative period. Even though about 88 percent were given pain medications, 80 percent reported side effects and 39 percent had moderate/severe pain even after taking them **(Hospital records of Zagazig University 2022).** Persistent pain increases levels of anxiety, fatigue, and sleep disturbance which lead to hemodynamic instability and affect surgery outcomes **(Awaludin et al., 2022).** Therefore, this study will be carried

out to assess the effect of reflexology on pain and psychological status regarding patients with cardiothoracic surgeries.

Aim of the study: evaluate the effect of reflexology on pain and psychological status regarding patients with cardiothoracic surgeries.

Research Hypothesis:

- H1: Pain level among patients of the study group will be decreased than that of the control group.
- H2: The level of anxiety and fatigue will be decreased, and sleep quality will be enhanced among patients of the study group compared to the control group

Research design: A quasi-experimental research design with pre-post test was conducted to achieve the aim of the study. Quasi-experimental research designs (QEDs), as the name suggests, use nonexperimental (or non-researcher-induced) variation in the main independent variable of interest, essentially mimicking experimental conditions in which some subjects are exposed to treatment and others are not on a random basis. QEDs improve our understanding of the causal effects of various educational policies and interventions by focusing on internal validity—did the policy or intervention being studied cause a significant change in the observed outcome **(Gopalan et al., 2020).**

Setting: The study was conducted in the cardiothoracic intensive care units in cardiothoracic hospital at Sednawy Zagazig University Hospital, which located in cardiothoracic hospital on the fifth floor and the unit consists of ten beds, nursing office and physician's office.

Subjects: A purposive sample of 80 patients who were admitted to the cardiothoracic surgery department and were subjected to cardiothoracic surgery during the study period were enrolled according to the following criteria:

Inclusion Criteria:

Patients age between 18-60 years, ejection fraction more than 40 %, heart rate of more than 60 beat per minute, systolic blood pressure of higher than 90 mmHg, partial thromboplastin time of more than 60 seconds, healthy feet and available for telephone communication.

Exclusion Criteria:

Patients who subjected to emergency cardiothoracic surgery, patients with hands or feet problems such as sores, neuropathy, fungal skin infection or past scars and those who received more than one inotropic drug after operation, drainage of more than 400 mL at first 4h after surgery, hemodynamic instability, mechanically ventilators patients or who require mechanical ventilation more than 24 h after the surgery, patients with disturbed conscious level and those who received sedatives before intervention were excluded.

Sample size:

Patients was selected randomly, divided into two groups (40 patients for each study group & Control group). Sample size calculation based on year 2022 census report of patients' admission to the cardio-thoracic surgery department, the total number of subjects assigned to perform cardiothoracic surgeries was 400. Steve thompon equation was used to calculate the sample size, at 5% ∞ error (95.0% significance) and 20.0 β error (80.0% power of the study) (Peacock, & Peacock, 2011).

$$n = \frac{N \times p(1-p)}{[[N-1 \times (d^2 \div z^2)] + p(1-p)]}$$

Where: N= Population size (400), Z= degree of standardization for 95.0% significance, it is equal to 1.96, d= Error percentage (0.05), P= Percentage of occurrence of event or not, it is 0.5. Accordingly, the sample size was determined to be 39.99. Totally, 80 patients will be enrolled and randomly assigned to two groups (40 patients in each group): reflexology group who will receive hands & feet reflexology massage after being admitted to the cardio-thoracic ICU and the control group who will be given the routine care without reflexology massage.

Tools of data collection:

The following tools were used to collect data in this study. They were designed by the researcher after extensive review of the relevant literature **(Elsayed et al., 2019)**, **(Jozwiak et al., 2018)**, **(Zimmerman et al., 2017)** and **(Shahid et al., 2011).**

Tool I: Structured Interview Questionnaire: to assess demographic and health history assessment data. as the following parts:

Part I: Patient's Demographic Characteristic: which were composed of ten closed ended questions including: patient's age, gender, marital status, educational qualification, current job, monthly income, residence, body mass index, smoking and suffering from chronic diseases "

Part II: Patients' Health History Assessment: which were composed of five items including (present illness which consists of five items including "chief compliant, medical diagnosis, surgery type, allergy and taking any medications", past surgical history, family history, laboratory investigations which consists of four items including " liver functions (seven subitems), kidney functions (two subitems), complete blood picture (five subitems) and blood virology test (three subitems)" and imaging assessment which consists of six items including " chest x-ray, echocardiography, computed tomography scan (CT), cardiac magnetic resonance imaging (MRI), electrocardiogram (ECG) and cardiac catheterization".

Tool II: Pain Assessment Scale (Numerical Rating Scale): assess the degree of pain. It was consisted of a series of numbers representing the entire possible range of pain intensity includes: "no pain (0), mild Pain (1-3), moderate Pain (4-6), sever Pain (7-10)", is most commonly 0 to 10, with 0 being "no pain" and 10 being "the worst pain imaginable.

The scoring system:

The total scores of visual analogue pain scale ranged from (0-10), the higher scores reflect the worst pain. It was categorized as the following: (0) was considered "no pain", (1-3) was considered "mild pain", (4-6) was considered "moderate pain", (7-9) was considered "severe pain" and (10) were considered "worst possible pain."

Tool IV: Assessment Psychological Status Questionnaire for Patient Post Cardiothoracic Surgery: assess psychological status and were consisted of three parts:

Part I: Assess anxiety level by using Hamilton Anxiety Rating Scale (HARS): this part consists of 85 items and covers 14 sections as (anxious mood four items, tension seven items, fears six items, intellectual two items, depressed mood five items, somatic (muscular) seven items, somatic (sensory) five items, cardiovascular symptoms six items, respiratory symptoms four items, gastrointestinal symptoms ten items, genitourinary symptoms eight items, autonomic symptoms seven items, behavior

at interview eight items and insomnia six items) each defined by a series of symptoms, and measures both psychic anxiety (mental agitation and psychological distress) and somatic anxiety (physical complaints related to anxiety).

The scoring system:

The total scores of Hamilton Anxiety Rating Scale ranged from (0-340), the higher scores reflect the worst level of anxiety. It was categorized as the following: (0-85) was considered "mild anxiety", (85-170) was considered "moderate anxiety", (170-255) was considered "moderate/severe anxiety" and (>340) was considered "severe and worst anxiety".

Part II: Assess fatigue level by using Fatigue Assessment Scale (FAS): to evaluate the degree of fatigue symptoms. This part consists of ten items of self-report evaluating symptoms of fatigue including: " bothered by fatigue, get tired very quickly, don't do much during the day, have enough energy for everyday life, physically, feeling exhausted, having problems to start things, having problems to think clearly, feel no desire to do anything, mentally, feeling exhausted, when doing something, you can concentrate quite well".

The scoring system:

The total scores of fatigue assessment scale ranged from (0-40), the higher scores reflect the worst level of fatigue. It was categorized as the following: less than 10 indicates “normal” (i.e. healthy) levels of fatigue. between 10 and 20 indicates “mild” levels of fatigue, between 20 and 30 indicates “moderate” levels of fatigue. 30 or more indicates severe fatigue.

Part III: Assess sleep quality by using Sleep Quality Scale (SQS): consisting of twenty-eight items and evaluates six domains of sleep quality: daytime dysfunction (12 items), restoration after sleep (four items), difficulty in falling asleep (four items), difficulty in waking up (three items), satisfaction with sleep (three items) and difficulty in maintaining sleep (two items).

The scoring system:

The SQS consists of 28 items, scored on a scale of 0 to 84, with higher scores indicating better sleep quality. A score of 78 or higher is considered normal sleep, while a score of 75 or lower is considered abnormal sleep.

Administrative and ethical consideration:

An official permission was obtained from the Dean of the faculty of Nursing and from the director of Zagazig University Hospital before conducting the study. Additional oral consents were taken from the patients who participated in the study after explaining its purpose. They were given an opportunity to refuse participation, and they were assured that the information would be used for research purposes only. All ethical issues were taken into consideration during all phases of the study. The ethical research considerations in this study included the following: The research approval was obtained before intervention guidelines implementation, the objectives and the aims of the study were explained to the participants, the researcher confirmed the anonymity and confidentiality of subjects, and subjects were allowed to choose to participate or not and they had the right to withdraw from the study at any time without penalty. The researcher confirmed that the data and information collected would be confidential and would be used only to improve the patients' health.

Pilot study:

A pilot study for tools of data collection was carried out on eight patients within selected criteria in order to test for clarity, relevance, comprehensiveness, understandability, feasibility, applicability

and ease for implementation. The results of the data obtained from the pilot study helped in modification of the tools, items were then corrected or added as needed. Patients who shared in the pilot study were excluded from the main study sample.

Field work*:*
After an official permission was taken from the dean of the faculty of Nursing, from the manager of Zagazig University Hospitals and from the head of cardiothoracic department, the implementation phase for data collection started as following: The selection of patients, the collection of data, and the implementation of the intervention lasted over a period of 11 months, began from December 2022 to the end of October 2023. The questionnaire was designed by the researcher. Data used was collected every day from the cardiothoracic intensive care unit, Sednawy Hospital in the morning and afternoon where the intervention were implemented, at Zagazig University Hospitals, from 11:00 am to 3:00 pm. The reflexology intervention was applied to each patient individually. It was necessary for the researcher to introduce herself to the patients and explain the purpose of the study.

Each reflexology session took approximately 60 minutes, 20 minutes for hand reflexology and 40 minutes for foot reflexology. The data was collected in a simplified English language. The total time of intervention duration took 11 months: 5months for control group and 6months for study group. The sessions began with assessment of patients' condition (interviewing the patients regarding demographic characteristics and identification) and demonstrating the importance of the intervention before the intervention application.

An initial assessment was carried out for the patient to ensure that he/she was free from exclusion criteria. Before starting the reflexology massage technique, the pain level and psychological parameters of the patients were recorded twice (immediately and one hour before the intervention and the average was taken). Questionnaires were filled in by the researcher in pre and post phase.

Content validity and Reliability:

Content validity was used for the modified tools and the designed booklet to determine whether the tools covered the aim or not. It was developed by a panel of seven experts from different specialties including medical and nursing faculty staff, 2 professors from cardiothoracic surgery medicine, Faculty of Medicine, Zagazig University and 5 assistant professors from medical surgical nursing, Faculty of Nursing, Zagazig University. Reliability was done by using Cronbach's Alpha test and retest to measure the internal consistency (reliability of used tool). % of improvement = (after value – before value) / before value) * 100.

Statistical analysis:

All data were collected, tabulated, and statistically analyzed using IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. Quantitative data were expressed as the mean ± SD &median (range), and qualitative data were expressed as number & (percentage). t Test was used to compare between two groups of normally distributed variables. The Paired t Test was used to compare paired continuous data normally distributed. The percentage of categorical variables were compared using, Chi square test or Fisher Exact test when appropriate. Marginal Homogeneity Test was used to compare between paired ordinal data. Pearson' correlation coefficient was calculated to assess relationship between various study variables, (+) sign indicate direct

correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate weak correlation. Linear regressions are a predictive analysis. Linear regression is used to describe data and to explain the relationship between one dependent continues variable and one or more independent variables. All tests were two sided. p-value < 0.05 was considered statistically significant, p-value ≥ 0.05 was considered statistically insignificant.

Results:

Table 1: shows demographic characteristics of the studied patients with cardiothoracic surgery in both groups. It was found that nearly two thirds of the studied patients (65%) and nearly three quarters (72.5%) of the controlled patients aged more than 50 years with mean ± SD 51.37±7.66 and 50.1±6.77, more than three fifths (62.5%) of the studied patients and more than three quarters of the controlled patients (77.5%) not smokers, more than half of the studied patients (55%) and nearly half of the controlled patients (47.5%) were suffering from chronic diseases. There was no statistically significant difference between different variables.

Table 2: Present Illness of the studied patients with cardiothoracic surgery in both groups was displayed in table 2. It was revealed that nearly two thirds of the studied patients (65%) and nearly three quarters (70%) of the controlled patients had a chest pain, furthermore about one half of the studied patients (50%) and more than two fifths of the controlled patients (42.5%) had dyspnea, nearly one third of the studied patients (32.5%) and more than one third of the controlled patients (35%) had tachycardia. There was no statistically significant difference between different variables.

Table 3: Table 3, displays frequency and percentage distribution of surgery type of the studied patients with cardiothoracic surgery in both groups. It was found that nearly one third of the studied patients (30%) and nearly one fifth of the controlled patients (17.5%) had undergone coronary artery bypass graft surgery, while only 5% of the studied patients and 2.5% of the controlled patients had undergone mitral valve repair surgery. There was no statistically significant difference between different variables.

Table 4: frequency and percentage distribution of past surgical and family history of the studied patients with cardiothoracic surgery in both groups was clarified in table 4. It was found that the majority of the studied and most of the controlled patients (85%), (90%) had previous surgeries and nearly one third of studied and controlled patients (32.4%), (30.6%) had cardio thoracic surgeries. There was no statistically significant difference between different variables.

Table 5: shows frequency and percentage distribution of pain score of the studied patients with cardiothoracic surgery in both groups. It was found that there was no statistically significant difference between the study and the controlled group regarding pain level before reflexology intervention, but there was statistically significant difference between the study and the controlled group regarding pain level after the reflexology intervention with p value= 0.022 and the improvement was more significant in the study group (25.44%) than in the control group (3.57%).

Table 6: displays frequency and percentage distribution of anxiety score of the studied patients with cardiothoracic surgery in both groups. There was statistically significant difference between the study and the controlled group regarding anxiety level after the reflexology intervention with p value= 0.0001 and the improvement was more significant in the study group (30.56%) than in the control group (2.68%).

Table 7: shows frequency and percentage distribution of fatigue score of the studied patients with cardiothoracic surgery in both groups. There was statistically significant difference between the study

and the controlled group regarding fatigue level after the reflexology intervention with p value= 0.0001 and the improvement was more significant in the study group (23.84%) than in the control group (4.95%).

Table 8: shows frequency and percentage distribution of sleep quality score of the studied patients throughout study phases. It was found that there was no statistically significant difference between the study and the controlled group regarding total sleep quality score before reflexology intervention, but there was statistically significant difference between the study and control group regarding all items of sleep quality after the reflexology intervention and the improvement was more significant in the study group than in the control group, also regarding study group there was statistically significant difference between all items of sleep quality in pre and post reflexology intervention.

Table 9: shows correlation coefficient between pain, fatigue, sleep quality and anxiety scores at pre and post reflexology intervention in the study group. It was revealed that there was statistically significant positive correlation between pre intervention pain score and post intervention fatigue score and anxiety score of the studied patients with P value at 0.0001 and 0.027 respectively, also, there was a highly statistically significant negative correlation between pre intervention fatigue score and post intervention sleep quality score of the studied patients with P value= -.433, also there was statistically significant positive correlation between pre intervention anxiety score and post intervention fatigue score of the studied patients with P value= 0.644. There was a highly statistically significant negative correlation between pre-intervention sleep quality score and post intervention anxiety score of the studied patients with P value= -.490.

Table 1: Frequency and Percentage Distribution of Demographic Characteristics of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Demographic Characteristics	Study Group		Control Group		χ^2	P-value
	no.	%	no.	%		
Age						
<50 years	14	35.0	11	27.5		
>50 years	26	65.0	29	72.5	0.524	0.469
Mean ±SD	51.37±7.66		50.1±6.77			
Median (Range)	53(29-62)		51(35-59)			
Gender						
Males	18	45.0	16	40.0	0.21	0.65
Females	22	55.0	24	60.0		
Marital Status						
Married	38	95.0	37	92.5	0.213	0.64
Single	2	5.0	3	7.5		
Educational Qualification						
Educated	33	82.5	36	90.0	0.95	0.33
Illiterate	7	17.5	4	10.0		
Current Job						
Working	26	65.0	25	62.5	0.05	0.82
Not working	14	35.0	15	37.5		

Monthly Income						
Enough	2	5.0	3	7.5	0.213	0.64
Not Enough	38	95.0	37	92.5		
Residence						
Rural	23	57.5	23	57.5	0.000	1
Urban	17	42.5	17	42.5		
Body Mass Index (BMI)						
Under Weight	1	2.5	3	7.5	1.13	0.57
Normal Weight	22	55.0	22	55.0		
Obese	17	42.5	15	37.5		
Smoking						
Smoker	15	37.5	9	22.5	2.14	0.14
Non-Smoker	25	62.5	31	77.5		
State of Smoking						
Current Smokers	3	20.0	1	2.5	F	0.25
Ex Smoker	12	80.0	8	20.0		
Suffering from Chronic Disease						
Yes	22	55.0	19	47.5	0.45	0.502
No	18	45.0	21	52.5		
Disease Type						
Diabetes	9	22.5	6	15.0	6.62	0.47
Hypertension	8	20.0	6	15.0		
Gastro-Intestinal Tract	0	.0	2	5.0		
Renal	1	2.5	1	2.5		
Neurological	0	.0	1	2.5		
Respiratory	3	7.5	1	2.5		
Others	1	2.5	2	5.0		

Table 2: Frequency and Percentage Distribution of Present Illness of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Present Illness	Study Group		Control Group		χ^2	P-value
	no.	%	no.	%		
Chief Complain						
Chest Pain					0.23	0.633
No	14	35.0	12	30.0		
Yes	26	65.0	28	70.0		
Cyanosis						
No	29	72.5	27	67.5	0.24	0.626
Yes	11	27.5	13	32.5		
Dyspnea						
No	20	50.0	23	57.5	0.453	0.501
Yes	20	50.0	17	42.5		

Tachycardia						
No	27	67.5	26	65.0	0.06	0.81
Yes	13	32.5	14	35.0		
Tachypnea						
No	36	90.0	38	95.0	f	0.68
Yes	4	10.0	2	5.0		
Fainting						
No	32	80.0	35	87.5	0.83	0.363
Yes	8	20.0	5	12.5		
Nausea						
No	38	95.0	39	97.5	f	1.000
Yes	2	5.0	1	2.5		
Irritability						
No	36	90.0	39	97.5	f	0.359
Yes	4	10.0	1	2.5		
Palpitations						
No	34	85.0	36	90.0	0.46	0.499
Yes	6	15.0	4	10.0		
Activity Intolerance						
No	37	92.5	35	87.5	f	0.712
Yes	3	7.5	5	12.5		
Shortness of Breathing						
No	37	92.5	35	87.5	f	0.712
Yes	3	7.5	5	12.5		
Arrhythmia						
No	34	85.0	31	77.5	0.74	0.39
Yes	6	15.0	9	22.5		

Table 3: Frequency and Percentage Distribution of Surgery Type of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Surgery Type	Study Group		Control Group		χ^2	P-value
	no.	%	no.	%		
Cardiac Catheterization						
No	35	87.5	32	80.0	0.83	0.363
Yes	5	12.5	8	20.0		
Coronary Artery Bypass Graft						
No	28	70.0	33	82.5	1.73	0.189
Yes	12	30.0	7	17.5		
Open Heart						
No	37	92.5	36	90.0	f	0.99
Yes	3	7.5	4	10.0		
Mitral Valve Repair						
No	38	95.0	39	97.5	f	0.99
Yes	2	5.0	1	2.5		

FET: Fisher exact test , $\chi 2$: Chi square test , non-significant(p>0.05)

Table 4: Frequency and Percentage Distribution of Past Surgical and Family History of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Past Surgical and Family History	Study Group		Control Group		χ^2	P-value
	no.	%	no.	%		
Previous Surgery						
Yes	34	85.0	36	90.0	0.46	0.499
No	6	15.0	4	10.0		
Type of Surgery						
Cardio Thoracic Surgery	11	32.4	11	30.6	0.026	0.83
Non-Cardio Thoracic Surgery	23	67.6	25	69.4		
Family History of Similar Problem						
Yes	12	30.0	6	15.0	2.58	0.11
No	28	70.0	34	85.0		
Allergy						
No	38	95.0	40	100.0	f	0.58
Yes	2	5.0	0	0.0		
Type of Allergy						
Egg	1	50.0	0	0.0	-	-
Dust	1	50.0	0	0.0		

FET: Fisher exact test , *: statistically significant (p<0.05), **: statistically highly significant (p<0.001)

Table 5: Frequency and Percentage Distribution of Pain Level of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Pain	Study Group				Control Group				T	P1	T	P 2
	Pre-Study Group		Post Study Group		Pre-Control Group		Post Control Group					
	No.	%	No.	%	No.	%	No.	%				
Pain Score Mean ±SD Median (Range)	2.85±1.001 3(1-4)		2.13±1.09 2(1-4)		2.8±1.09 2.5(1-4)		2.7±1.11 2.5(1-4)					
Paired T	3.28				0.377				0.214	0.831	2.33	0.022*
P	0.002				0.708							
% Improvement	25.44				3.57							
Pain level												
Mild Pain	25	62.5	34	85.0	26	65.0	28	70.0				
Moderate Pain	15	37.5	6	15.0	14	35.0	12	30.0				

T: students t test, p1: compare pre study group &control, p2: compare post study group &control,
P: compare pre & post intervention within group, p>0.05 no significant, *p<0.05 significant,

Table 6: Frequency and Percentage Distribution of Anxiety Level of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Anxiety	Study Group				Control Group				T	P1	T	P 2
	Pre-Study Group		Post Study Group		Pre-Control Group		Post Control Group					
	No.	%	No.	%	No.	%	No.	%				
Anxiety level												
Mild Anxiety Leve (l0-17)	10	25.0	22	55.0	9	22.5	10	25.0				
Moderate Anxiety Level (18-24)	15	37.5	12	30.0	17	42.5	18	45.0				
Moderate/Sever Anxiety Level (25-30)	8	20.0	6	15.0	8	20.0	7	17.5	0.12	0.903	4.48	0.0001*
Sever Anxiety Level >30	7	17.5	0	0	6	15.0	5	12.5				
Anxiety Score Mean ±SD Median (Range)	23.15±6.64 23(14-37)		16.08±7.44 15.5(6-30)		23.33±6.16 23.5(14-35)		22.7±5.65 23.5(12-33)					
Paired T	5.33				0.66							
P	0.0001				0.575							
% Improvement	30.56				2.68							

T: students t test, p1: compare pre study group &control, p2: compare post study group &control,
P: compare pre & post intervention within group, p>0.05 no significant, *p<0.05 significant,

Table (7): Frequency and Percentage Distribution of Fatigue Level of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Fatigue	Study Group				Control Group				T	P1	T	P 2
	Pre-Study Group		Post Study Group		Pre-Control Group		Post Control Group					
	No.	%	No.	%	No.	%	No.	%				
Fatigue level												
Mild/Moderate	23	57.5	36	90.0	22	55.0	27	67.5				
Severe	17	42.5	4	10.0	18	45.0	13	32.5				
Fatigue Score Mean ±SD Median (Range)	32.17±4.26 33(24-37)		24.5±5.11 24(22-35)		31.9±6.11 32.5(24-41)		30.32±6.37 32(22-41)		0.234	0.82	4.5	0.0001*
Paired T	12.47				1.46							
P	0.0001				0.15							
% Improvement	23.84				4.95							

T: students t test, p1: compare pre study group &control, p2: compare post study group &control,
P: compare pre & post intervention within group, p>0.05 no significant, *p<0.05 significant,

Table (8): Frequency and Percentage Distribution of Sleep Quality Score of the Studied Patients with Cardiothoracic Surgery in both Groups (n= 40):

Sleep Quality	Study Group n.40		Control Group n.40		T	P1	T	P 2
	Pre-Study Group	Post Study Group	Pre-Control Group	Post Control Group				
Day Time Dysfunction Score					.881	.381	5.376	.0001*
Mean ±SD	14.9±5.81	23.95±8.14	13.90±4.22	15.78±5.13				
Median (Range)	12(8-33)	22.5(8-36)	12(9-27)	15(9-30)				
Paired T	5.1		1.83					
P	0.0001*		0.074					
% Improvement	60.74		13.49					
Feel Fresh after Sleep Score					1.97	.052	5.036	.0001*
Mean ±SD	5.42±2.03	7.3±2.52	4.63±1.55	4.75±1.97				
Median (Range)	5(3-11)	8(2-12)	4(2-9)	4(1-10)				
Paired T	3.45		0.321					
P	0.001		0.75					
% Improvement	34.7		2.70					
Difficulty in Awaken up Score					1.120	.266	4.771	.0001*
Mean ±SD	3.1±1.36	5.78±2.62	2.8±1.02	3.53±1.43				
Median (Range)	3(1-7)	5(2-9)	3(1-7)	3(1-7)				
Paired T	5.44		2.42					
P	0.0001*		0.02*					
% Improvement	86.29		25.89					
Sleep Satisfaction Score					.805	.423	5.988	.0001*
Mean ±SD	3.93±1.47	5.4±1.997	3.65±1.58	3.18±1.24				
Median Range)	4(1-7)	5(3-8)	4(1-8)	3(1-6)				
Paired T	3.37		1.47					
P	0.002*		0.148					
% Improvement	37.58		13.01					
Difficulty in Maintain Sleep Score					1.420	.159	4.353	.0001*
Mean ±SD	2.65±0.66	3±0.32	2.37±1.03	2.2±0.86				
Median (Range)	3(1-4)	3(2-4)	2(0.00-4)	3(0.00-4)				
Paired T	2.72		0.32					
P	0.009*		0.75					
% Improvement	25.44		3.57					
Difficulty in Falling Sleep Score					-1.109	.271	2.804	.006*
Mean ±SD	3.73±1.43	6.4±2.21	3.28±1.78	5.1±1.93				
Median (Range)	3(0.00-6)	5.5(2-9)	3(0.00-6)	5(1-9)				
Paired T	11.26		4.61					
P	0.0001*		0.0001*					
% Improvement	71.58		55.73					
Total Sleep Quality Score					1.109	.271	2.804	.006*
Mean ±SD	32.6±9.3	51.95±15.28	29.68±7.48	33.55±9.27				
Median (Range)	29(22-59)	47.5(24-71)	26.5(20-57)	31.5(22-56)				

Paired T		5.9				2.25		
P		0.0001*				0.03*		
% Improvement		59.36				13.06		
Sleep Quality								
Good Sleep	25	62.5	35	87.5	24	60.0	28	70.0
Bad Sleep	15	37.5	5	12.5	16	40.0	12	30.0

T: students t test, p1: compare pre study group &control, p2: compare post study group &control,
P: compare pre & post intervention within group, p>0.05 no significant, *p<0.05 significant,

Table (9): Correlation Matrix between Pain, Fatigue, Sleep Quality and Anxiety Scores at Pre and Post Reflexology Intervention in Study group:

Pre-Intervention Study Group	Pain Score		Fatigue Score		Sleep Quality Score		Anxiety Score	
	R	P	R	P	R	P	R	P
Pain Score	1							
Fatigue Score	-0.024	0.884						
Sleep Quality Score	-0.084	0.608	0.119	0.465	1			
Anxiety Score	-0.004	0.979	-0.031	0.85	0.116	0.476	1	
Age	0.124	0.444	-0.073	0.656	0.191	0.237	0.053	0.744
Post Intervention Study Group								
Pain Score	1							
Fatigue Score	.637**	0.0001	1				0.644**	
Sleep Quality Score	-0.18	0.267	-.433**	0.005	1		1	
Anxiety Score	.350*	0.027		0.0001	-.490**	0.001	0.285	
Age	-0.055	0.737	0.205	0.204	-0.167	0.302		0.075

Discussion:

Regarding the age of studied patients, the result of present study showed that nearly two thirds of the studied patients and nearly three quarters of the controlled patients aged more than 50 years with mean ± SD 51.37±7.66 and 50.1±6.77. These results were matched with **Kolbadinejad et al., (2023)** who studied " Effect of Foot Reflexology Massage on Death Anxiety and Well-being of Patients Undergoing Coronary Artery Bypass Graft: A Randomized Controlled Trial " and found that nearly two thirds of the studied patients and nearly three quarters of the controlled patients aged more than 50 years with mean ± SD 60.39 ± 7.74 and 61.11 ± 9.68 years. Findings of the current study indicate that aged patients have high prevalence risk of cardiothoracic diseases because aging may cause changes in the heart and blood vessels that may increase the person's risk of developing cardiopulmonary diseases.

Regarding present illness, the current study revealed that nearly two thirds of the studied patients and nearly three quarters of the controlled patients had chest pain and about one half of the studied patients and more than two fifths of the controlled patients were suffering from dyspnea. This finding is supported by **Ibrahim et al., (2024)**, who reported in study about " The Effect of Foot Reflexology on Pain Severity Associated with Mediastinal Chest Drain Removal in Patients Undergoing Open-Heart Surgery " and found that about one half of the studied patients and nearly one half of the

controlled patients had chest pain and about two fifths of the studied and controlled patients were suffering from dyspnea.

Regarding surgery type, the current study revealed that nearly one third of the studied patients and nearly one fifth of the controlled patients had undergone coronary artery bypass graft surgery. The CABG procedure is indicated for patients with three vessel disease, poor left ventricular ejection fractions (LVEF)>35%, or significant disease in the left main coronary artery. It may also be indicated as an emergent "rescue" procedure in patients whose coronary artery dissects or fractures during an attempted percutaneous procedure. This finding is supported by **Bang et al., (2020),** who reported in study about " Effects of auricular acupressure on the quality of sleep and anxiety in patients undergoing cardiac surgery: A single-blind, randomized controlled trial " and found that nearly one third of the studied and controlled patients had undergone coronary artery bypass graft surgery.

Regarding family history for cardiothoracic patients, the current study presents that nearly one third of studied patients had family history for cardiopulmonary diseases. This result is consistent with **Tian et al., (2020),** who reported in study about "Differentiating the effects of ambient fine and coarse particles on mortality from cardiopulmonary diseases: a nationwide multicity study" that about one third of studied patients had at least one relative with some form of cardiopulmonary diseases which most of them had family histories in first-degree relatives. This indicates that a family history of cardiopulmonary diseases in the first-degree relative increased the risk of developing cardiopulmonary diseases.

Regarding the effect of reflexology on pain, the current study revealed that there was statistically significant difference and decrease in pain level among study group compared to control group at the post phase of the reflexology intervention. This finding is supported by **Abdou & Abd El-Hafez, (2018),** who reported in study about " Effect of Foot Reflexology Practice on Acute Pain and Anxiety of Critically ill Patients after Cardiothoracic Surgery " and **Hashemzadeh et al., (2019),** who reported in study about " Effects of Foot Reflexology on Post-sternotomy Hemodynamic Status and Pain in Patients Undergoing Coronary Artery Bypass Graft: A Randomized Clinical Trial " and they stated that reflexology reduced the severity of pain. The precise mechanism of reflexology is not clear, but some of the theories, that explain how this technique functions, include the gate control theory of pain, the nerve impulse theory, and the theory of the increased secretion of endorphins and enkephalins (that controls the pain). Finally, the secretion of endorphins may cause morphine-like analgesic properties as well and this resulting in reducing pain severity.

The current study revealed that there was statistically significant difference and decrease in anxiety level among study group compared to control group at the post phase of the reflexology intervention. This finding is supported by **Şahin & Çilingir, (2022),** who reported in study about " The effects of foot reflexology upon pain, anxiety, and patient satisfaction among patients having undergone open-heart surgery " and **Chandrababu et al., (2019),** who reported in study about " Effectiveness of reflexology on anxiety of patients undergoing cardiovascular interventional procedures: A systematic review and meta-analysis of randomized controlled trials " and they stated that reflexology reduced anxiety level. This may be due to, in the reflexology method, pressure is applied on reflex points via specific hand and finger techniques to release blocked energy in certain parts of the body, thereby stimulating the self-healing power of the body and leading to physical transformation by alleviating anxiety.

The current study revealed that there was statistically significant difference and decrease in fatigue level among study group compared to control group at the post phase of the reflexology intervention. This finding is supported by **Ali et al., (2023),** who reported in study about " Effect of hand reflexology in ameliorating anxiety, pain, and fatigue among patients undergoing coronary angiography " and **Gunes et al., (2024),** who reported in study about " The effect of reflexology on pain, anxiety, fatigue, and sleep in patients undergoing coronary artery bypass graft surgery: A randomized controlled trial " and they stated that reflexology reduced fatigue level. This may be due to reflexology stimulating the reflex points in the hands and feet by massage, encourages self- healing and allows distribution of bodily energy to organs in a balanced way. As a result of stimulation of reflex points, reflexology facilitates energy flow in the body by allowing communication between electromagnetic fields in the body, and it helps the re-flow of energy in blocked channels. This situation reduces post operative fatigue by providing relaxation and comfort in the body.

The current study revealed that there was statistically significant difference and improvement in quality of sleep among study group compared to control group at the post phase of the reflexology intervention. This finding is supported by **Bakavoly et al., (2023),** who reported in study about " Comparison of the Impacts of Benson Relaxation Technique and Foot Reflexology Massage on Sleep Quality of Patients with Systolic Heart Failure: A Randomized Clinical Trial " that reflexology improved quality of sleep-in study group compared to control group at post intervention phase. Reflexology is the stimulation of neural pathways, through which reflex areas are stimulated using the fingers to transmit nerve impulses and this restore proper flow of the bloodstream and maintain homeostasis which results in improving quality of sleep. On the otherwise, this finding is controversy with **Fazlollah et al., (2021),** who reported in study about " The effect of foot reflexology massage on delirium and sleep quality following cardiac surgery: A randomized clinical trial " that reflexology doesn't affect quality of sleep.

The current study revealed that there was a highly statistically significant positive correlation between pre intervention pain score and post intervention fatigue score and anxiety score of the studied patients. According to recent research, the relation between pain, fatigue and anxiety may be due to several factors as: general health, genetic factors, possible side effect of treatment, individual differences in symptom awareness and symptom amplification, according to this hypothesis, people higher in symptom awareness and symptom amplification focus more on internal states, becoming preoccupied with symptoms and exaggerating their effects. Also, pain may result in impaired physical activity, leading to loss of normal daily activities and mental distress, resulting in increased levels of anxiety and fatigue. This finding is supported by **Vassend et al., (2018),** who reported in study about " Fatigue symptoms in relation to neuroticism, anxiety-depression, and musculoskeletal pain " and **Solvik et al., (2020),** who reported in study about " Pain, fatigue, anxiety and depression in older home-dwelling people with cancer " that there was a highly statistically significant positive correlation between pain, fatigue and anxiety score of the studied patients, while this finding is controversy with **Enns et al., (2018),** who reported in study about " The association of fatigue, pain, depression and anxiety with work and activity impairment in immune mediated inflammatory diseases " that there was no statistically significant relation between pain , fatigue and anxiety.

The current study revealed that there was a highly statistically significant negative correlation between pre-intervention fatigue score and post intervention sleep quality score of the studied patients.

pre-intervention fatigue can result in weak daily performance, irritability, depression and difficulty in concentration and attention. Therefore, it can influence on patient physiological and psychological status. In this regard, one of important outcomes of fatigue is decreased sleep quality which considered as an unpleasant and ambiguous symptom that affects negatively on individual's life by influencing on individual ability to perform activities and important roles of life. This finding is supported by **İncesu et al., (2024),** who reported in study about " The assessment of fatigue and sleep quality among children and adolescents with familial Mediterranean fever: A case-control and correlation study " that there was highly statistically significant negative correlation between pre-intervention fatigue score and post intervention sleep quality score of the studied patients, while this finding is controversy with **Baattaiah et al., (2023),** who reported in study about " The relationship between fatigue, sleep quality, resilience, and the risk of postpartum depression: an emphasis on maternal mental health " that there was no statistically significant relation between fatigue and sleep quality.

The current study revealed that there was statistically significant positive correlation between pre intervention anxiety score and post intervention fatigue score of the studied patients. This finding is supported by **Vassend et al., (2018),** who reported in study about " Fatigue symptoms in relation to neuroticism, anxiety-depression, and musculoskeletal pain " and **Solvik et al., (2020),** who reported in study about " Pain, fatigue, anxiety and depression in older home-dwelling people with cancer " that there was a highly statistically significant positive correlation between fatigue and anxiety score of the studied patients. This relation may relate to the fact that anxiety consumes both physical and mental energy because it engages the fight-or-flight response. This response prepares the body to face a threat, so it triggers physiological changes like an increased heart rate and tense muscles. This is your system's way of preparing you to either engage the bear in combat to defend yourself (fight) or run away as fast as you can (flight). Having this system frequently or constantly activated uses a lot of energy, which is one reason anxiety can cause fatigue and leave an individual feeling exhausted.

The current study revealed that there was a highly statistically significant negative correlation between pre-intervention sleep quality score and post intervention anxiety score of the studied patients. This finding is on the same line with **Wang et al., (2023),** who reported in study about " Effect of Sleep Quality on Anxiety and Depression Symptoms among College Students in China's Xizang Region: The Mediating Effect of Cognitive Emotion Regulation " that there was a highly statistically significant negative correlation between sleep quality score and anxiety score of the studied patients. Patients with poor sleep quality due to side effects of some medications, wound pain and staying in the intensive care unit may become fatigued and unable to concentrate, which may not only affect their physical health in the long run but also create a vicious cycle of poor performance, anxiety, and poor sleep quality. Ineffective sleep patterns and poor sleep quality can worsen anxiety symptoms, and they increase the likelihood of developing such symptoms.

Conclusion:

According to the outcomes of the current study it can be concluded that use of hands and foot reflexology technique after cardiothoracic surgery significantly decreases in pain, anxiety, fatigue level and enhancing sleep quality. A higher significant improvement was observed in reflexology group compared to control group. Therefore, those complementary approaches can be used as an effective

measure without causing any problems for decreasing pain, anxiety and fatigue level and enhancing sleep quality among patients after cardiothoracic surgery.

Recommendations:

1. Training programs should be applied for patients on hands and foot reflexology techniques and use it as a part of usual routine care for patients after cardiothoracic surgery.
2. Illustrated guide of reflexology technique should be available for patients on each Cardio-Thoracic intensive care unit.
3. Future studies and repeating this study on a large sample size for generalization.

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