Effect of Foot Reflexology Massage versus Benson Relaxation Technique on Physiological Parameters and Pain after Open Heart Surgery

Sanaa Saber Mohamed[(1)], Olfat Farouk Thabet[(2)], Zahra Ahmed Sayed[(3)], Ragaa Dahi Mohamed[(4)].

1. Lecturer of Critical Care & Emergency Nursing, Faculty of Nursing, Sohag University, Egypt.
2. Lecturer Fellow at Assuit University Hospital " Heart Hospital, medical surgical nursing, Assuit University, Egypt.
3. Lecturer of Critical Care Nursing, Faculty of Nursing, Aswan University, Egypt.
4. Lecturer of Critical Care & Emergency Nursing, Faculty of Nursing, South Valley University, Qena, Egypt.

Abstract

Background: physiological instability and pain are among the most common problems of patients post open heart surgery. Many studies reported that non-pharmacological and complementary interventions improve physiological instability reduce post-operative pain; **therefor** current study **aimed** to study the effect of foot reflexology massage versus Benson relaxation technique on physiological parameters and pain after open heart surgery, **Study design:** A randomized controlled trial was used . **Methods:** the study was carried at Cardio-Thoracic intensive care unit (CTCU) at Assuit Heart University Hospital. **Subject**: the study performed on 90 patients, they were divided into three groups (foot reflexology, Benson relaxation and control group). **Two tools** were used: patient's assessment sheet and Assessment of Chest pain intensity. **Results:** a statistically significant difference between the groups was reported in terms of all physiological variables (P=0.001) after applying foot reflexology and Benson relaxation and the improvement were more significant in reflexology group than Benson group. Also a statistically significant difference between the groups was reported in relation to pain intensity. **Conclusion** Foot reflexology and Benson relaxation significantly improved the physiological status and pain of patients after open heart surgery. So, it **recommended** applying a training program for critical care nurses on open heart surgery units on foot reflexology technique and Benson's relaxation technique to be able to use them as a part of routine nursing care for patients.

Keywords: Reflexology, Benson's relaxation, Open heart surgery and physiological parameters.

Introduction:

Cardiovascular disease is one of the leading causes of death, disability, and reduces the quality of life worldwide, accounting for half of all fatalities in developing nations. One of the most important approaches in the treatment of heart diseases is open heart surgery, which has been linked to reduction in patient mortality **(Teimori F, et al, 2019).** Cardiac surgery that include coronary artery bypass grafting (CABG) and heart valve surgery represent the most common classes of surgical procedure performed globally **(Elsaed M. M, et al, 2020).**

Acute Pain is critical problem following each type of cardiac surgeries. In the context of etiology Skin incisions, sternal retraction, dissections, internal mammary artery graft preparation, endotracheal intubation, chest drain, and sternal wires **(Bigeleisen, et al; 2015).**

Pain stimulates the hypothalamic–pituitary–adrenal axis and activates the sympathetic nervous system. Blood pressure rises, heart rate rises, and a hyperglycemic condition develop as a result 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 **(Jayakumar, et al; 2019).**

Pain following open heart surgery is often undertreated. In literature the prevalence of moderate to severe pain after cardiac surgery is 17% to 40% **(Abdou F, et al, 2018).** One of essential issues for patients following cardiac surgery is postoperative pain management, which is consider one of the challenging problems for critical care nurses. It is widely recognized that postoperative pain have negative impact on cardiac surgery outcomes, Despite this, recent surveys reveal very limited effectiveness in pain treatment, as patients continue to perceive poorly controlled pain,

and studies characterize pain as under-medicated and unrelieved **(WicN, et al, 2017)**.

Successful pain management in critical care setting depends on assessment, pharmacological and non-pharmacological adequate interventions and evaluation of the patient's response There are variety of pharmacological and non-pharmacological interventions for decreasing patients' stress, pain and anxiety **(Engelman, et al, 2019)**. However, there are numerous problems related to pharmacological intervention as disturbed level of consciousness and rising risk of drug dependence **(Vincent, J. L, 2017)**.

Nurses currently utilise non-pharmacological interventions, such as procedures for reducing patients' pain and enhancing their healing and wellbeing, such as diversion, calming music, relaxation techniques, reflexology massage, and biofeedback. **(Shehata, et al, 2021)**.

Complementary strategies and non-pharmacological interventions are noninvasive, simple and less expensive, and have less or no adverse effects compared with pharmacological interventions **(Elsayed, E, A. et al, 2019)**.

One of the most well-known complementary therapies is reflexology, but the exact mechanism by which it works is still unclear. It is believed that during reflexology, energy moves through vertical zones from the leg into the head to circulate throughout the body. Therefore, all organs, glands, bones, and muscles can be affected when pressure is applied to an organ's reflecting point. Reflexology professionals think that the hands and feet serve as the body's mirror and map since they reflect the body's organs in the foot, palm, and ear **(Rahmani. Z, et al; 2017)**.

Reflexology massage generates a sense of safety is achieved through reducing tension and stress. For the purpose of pain relief, deep pressure can be applied to specific body parts. **(Kandemir, D. and Oztekin, S, D, 2019)**.

Number of studies reported the immediately effect of foot reflexology on lowering pulse rate, systolic and diastolic blood pressure, and improving arterial oxygen saturation **(Elsayed, E, A. et al, 2019)**. Also was documented that it is an efficient technique in lowering postoperative pain, in addition to lowering anxiety level **(Koraş, K., and Karabulut, N, 2018)**, and controlling incision pain post open heart surgery **(Elsayed, E, A. et al, 2019)**.

Relaxation can be done in a variety of ways. It is thought that Herbert Benson's (1970) idea is particularly good. The application of Benson's relaxation technique is simple and quick to master, and neither special knowledge nor sophisticated tools are needed. Additionally, this method is appropriate for patients of all ages. By reducing sympathetic activity and the negative effects of an overactive sympathetic nervous system in a variety of people, the approach can also improve heart rate, respiratory rate, blood pressure, and oxygen consumption. **(Tahmasbi, H., and Soghra Hasani, S. 2016)**.

Benson relaxation is a practice focused on relaxation as a main component of meditation, where four motions are used to improve relaxation. The Benson relaxation technique has a positive effect on the physiological symptoms of patients who are candidates for open heart surgery **(Teimori F, et al, 2019)**. According to previous studies, Benson's relaxation significantly reduces somatic contractions (physiological response against tension) reducing the physical and psychological consequences of stress **(Painchault, et al, 2020)**

The critical care nurse has a significant role in controlling, managing, and relieving post-operative acute pain and/or stabilizing patient condition following heart surgery and in critical care setting. Apparently, the medications cost a lot of money so, there is an essential to increase the trainings about the use of non-pharmacological interventions in nursing practice within intensive care units (ICUs). So can be use the foot reflexology practice and Benson's relaxation which is easy, less cost and with little or no risks or complications for the patients.

Significant of the study:

Among the significant issues after open heart surgery are hemodynamic stability and pain management, and it is main challenging front critical care nurses to achieve them. According to Statistics of Egyptian Cardio-Thoracic intensive care unit (CTCU) at Assuit Heart University Hospital in the years of (2019) revealed that the number of patients

undergoing open heart surgery were 375 **(Hospital records of Assuit University 2019).**

Aim of the study:

Current study aimed to study the effect of foot reflexology massage versus Benson relaxation technique on physiological parameters and pain after open heart surgery.

Research hypothesis

1- What is the effect of foot reflexology practice on Physiological parameters and pain after open-heart surgery?
2- What is the effect of Benson relaxation technique on physiological parameters and pain after open heart surgery?

Subjects and methods

Research design:

A randomized controlled trial was used to fulfill the aim of this study.

Setting:

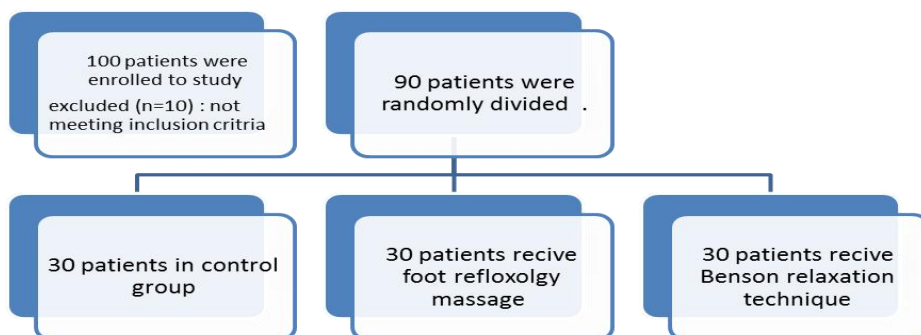The study was carried at the Cardio-Thoracic intensive care unit (CTCU) at Assuit Heart University Hospital.

Sample:

Based on year 2019 census report of Cardio-Thoracic intensive care unit (CTCU) at Assuit Heart University Hospital, the total number of patients assigned to perform open heart surgery was 375. The sample had been estimated with margin of error at 5% and confidence interval level at 95% & 5.0% significance) and 20.0 β errors (80.0% power of the study). A total of 90 adult critically ill cardiac surgery patient of both sex were assigned into three equal groups (control group, reflexology group and Benson relaxation group, 30 patients for each).

Inclusion criteria:

The inclusion criteria for the eligible patient were age range from 18 to 65 years old, and patients undergoing cardiac surgery for the first time.

Exclusion criteria:

This study exclude the patients who were had any medical problem in their foot, patients who receive sedative medications before the time of intervention also patients with decrease conscious level.

Figure (1): Flow chart of the study group patients

Study tools:

Tool one: patient's assessment sheet:

This tool developed by the researcher after reviewing of the related literatures to assess the studied patients regard the socio-demographic and medical data, it includes two main parts as following.

Part one: patient socio-demographic and clinical data

The first part included demographic data such as age, sex, marital status, occupation, patient's education. And it also cover the patient medical history date include past medical diagnosis , history of previous hospitalization, previous surgery performed, smoking history and history of long term medication use.

Part two: physiological parameters assessment:

Including Vital signs (pulse rate b/m, respiratory rate c/m, temperature c, and blood pressure (BP) mmHg (systolic BP, diastolic BP and mean arterial blood pressure and oxygen saturation (Sapo2).

Tool two: Assessment of Chest pain intensity:

Using Visual Analog Scale which adopted from **Mann& Carr, 2006** to assess severity of chest pain. The average score change on pain intensity as measured by Visual Analog Scale. The scale is a measuring tool with length of 0-10 cm. High scores on the scale indicates that pain intensity is high.

Methods:

The study was conducted though out three main phases, which are preparatory phase, implementation phase and evaluation phase.

Preparatory phase:
1- An official Permission was taken from the Heart Assuit university hospital authority to facilitate the implementation of the study after explanation the aim of the study.
2- An approval was obtained from the local ethical committee and the study was followed the common ethical principles in clinical research.
3- **Content validity:** The tools were tested for content related validity by jury of 6 specialists in the field of critical care nursing and critical care medicine from Assuit and Sohag University, and the necessary modifications were done.
4- **A pilot study** was carried out on 10% of the studied sample (9 patients) to test the clarity and applicability of the tools. The tool was applicable and there wasn't any modification. According to the results of the pilot study subjects included in to the study.
5- **Ethical considerations: -** Informed consent was obtained from each patient. The investigator emphasized that the participation is voluntary and the confidentiality and anonymity of the subjects was assured through coding the data. Subjects were assured that they can withdraw from the study at any time without any rational.

Implementation phase:
- The implementation phase which was conducted over a period of one year starting from January 2020 to December 2020.
- During this phase 30 legible patients who are willing to participate in the study were selected to constitute the control group, then their matches 60 patients who are willing to participate in the study also were recruited to constitute the reflexology and Benson groups.

- The three groups were assessed using for socio-demographic, clinical data using part one of the first tool as base line data from the patients records.
- **Control group:** received the routine care of post open heart surgery care by the critical care nurses in the unit.
- **For Reflexology group:** Before starting the foot reflexology massage technique the physiological parameters of the patients and pain level were recorded twice (immediately and one hour before the intervention).
- First, the researcher stripped away any metal object from her hands (e.g. ring), washed and warmed them, lubricated them with baby oil to facilitate massaging that has no other therapeutic effect. Then the legs of the patients were washed and dried.
- The **steps of massage** were as follows: first, the patient was placed in a supine position with a pillow under the feet so that the feet were bent slightly and the head was at an angle of 30–45 degrees. The massage area was uncovered from 10 cm above the patient's knee. Then, the researcher began to massage after examining the feet for the presence of the massage barriers.
- While standing in front of the patient, the researcher started general reflexology with massage all reflex points in plantar with thumb and fore finger and then specialized reflexology was done through the pressure point of foot reflex such as (solar plexus, hypothalamic, pituitary, spinal cord, and adrenal gland sand pelvic). First, for the left foot and then for the right foot (20 min each).
- After the foot reflexology massage technique the physiological parameters of the patients and pain level were recorded twice (immediately and one hour after the intervention).
- **For Benson group**: Before starting the Benson relaxation technique the physiological parameters of the patients and pain level were recorded twice (immediately and one hour before the intervention).
- Dr. Herbert Benson coined the phrase "relaxation reaction" in the 1970s to describe the body's ability to counter the fight-or-flight response and lower physiological and psychological distress indicators including heart rate, blood pressure, and anxiety **(Benson, 2000).**

- Benson's relaxation response technique comprises from four simple stages: (1) Sitting in a comfortable and relaxed position with eyes at a soft gazes or closed. (2) Relaxing the body, beginning with the toes and moving towards the head. (3) Breathing at a pace that is comfortable for the individual and, when exhaling, choosing a word or phrase to repeat (e.g., "calm"). (4) Maintaining a nonresistant attitude **(Benson, 2000).** According to Benson (2000), the four components of his relaxation response technique must all be practiced to fully benefit from the intervention. Sitting in a comfortable position with the eyes at a soft gaze or closed allows the mind the opportunity to decrease or eliminate external distractions that may be present, choosing and repeating a word or phrase while exhaling decreases internal distractions within the brain and assists in clearing the mind, relaxing the entire body releases unwanted or unknown tension within the muscles, allowing the body to further progress to a state of relaxation, finally, maintaining a nonresistant attitude encourages the individual to refrain from focusing on the thoughts that pass through the mind and to re-focus instead on the chosen word.
- After applying Benson relaxation technique the physiological parameters of the patients and pain level were recorded twice (immediately and one hour after the intervention).
- The patients in the three groups were followed for three consequent days.

Statistical analysis:

The data entry and data analysis were done using SPSS version (19). Data were presented as number, percentage, and mean standard deviation. A chi-square test was used to compare qualitative variables. If normally distributed, quantitative data (HR, RR, SBP, DBP, MAP, and SPO2) were represented as mean standard deviation (SD). The similarity of the two groups' demographic traits was evaluated using either the Chi-Square test or Fisher's exact test. The repeated measurements of analysis of variance (RM-ANOVA) test were employed to examine any differences in the variations in physiological parameters between the groups. P-Values considered statistically significant when P <0.05.

Results:

Table (1): illustrate that 83.3% of the studied sample were in age group 46 to 65 years old. Two thirds of the studied sample was male and 36% were females. Regarding marital status the table shows that majority of the sample were married 97.8%. And shows that the heights percent of the studied sample were university educated 32.2%. In relation to past medical history two thirds of the studied sample had IHD (ischemic heart disease), and the majority had no history of previous surgery. Regarding history of smoking about half of the sample was smoker. And the table shows no statically significant difference between the three groups in relation to all items.

Table (2):- Shows statistically significant decrease in the heart rate in reflexology and Benson groups after the intervention comparing to control group with statistically significant difference in the first and second group (P=0.015 & P=<0.001 respectively), while shows no significant difference between three groups in 3rd day (.P=0.995).

Table (3):- Demonstrates statistically significant decrease in the respiratory rate in the Reflexology and Benson groups after the intervention comparing to control group, with statistically significant difference between groups in the 1st and 2nd day (P=<0.001& P=<0.001), but shows no statistically significant difference between three groups in 3rd day (.P=0.240).

Table (4): A statistically reduction in the **systolic blood pressure (SBP)** was observed in both Reflexology and Benson groups after the intervention comparing to control group, with statistically significant difference between groups in the 1st and 2nd day (P=<0.001), while shows no statistically significant difference between groups in the 3rd day (P=0.074). Regarding to **Diastolic Blood Pressure (DBP)** the table revealed decrease in the both Reflexology and Benson groups after the intervention comparing to control group, with statistically significant difference between groups in the 1st and 2nd day (P=<0.001& P=0.002 respectively),and no statistically significant difference between groups in the 3rd day was noted (P=0.729).

Table (5):- Regarding the MAB the table displays statistically decrease improvement in both Reflexology and Benson groups after the intervention comparing to control group, with

statistically significant difference between groups in the 1st and 2nd day (P=0.003 & P=<0.001 respectively), however shows no statistically significant difference between groups in the 3rd day (P=0.809).

Table (6): A statistically significant elevation improvement in the Oxygen Saturation was observed in both Reflexology and Benson groups after the intervention comparing to control group, with statistically significant difference between groups in the 1st and 2nd day (P=<0.001), and no statistically significant difference between three groups in the 3rd day (P=0.322).

Table (7): Demonstrated presence of statistically significant difference between three groups regarding intensity of pain (P <0.001). Also, decreasing in pain severity score was found in reflexology and Benson groups after applying each intervention comparing to control group through the three days.

Table (8): shows presence of statically significant difference between Reflexology and Control and also between Benson and Control after applying the intervention (p value <0.001) from the 1st to the 3rd day, while show no of statically significant difference between groups in the 1st day before the intervention. Also the table demonstrates presence of no of statically significant difference between Reflexology and Benson from the 1st to the 3rd day.

Table (1): Comparison between Control, Reflexology and Benson groups in relation to patient's Demographic and clinical data.

Groups / Variables	Control group (n=30)		Reflexology group (n=30)		Benson group (n=30)		Participants (n=90)		Significant test	P. value
	No	%	No	%	No	%	No	%		
Age										
from 36-45 year	3	10.0	6	20.0	6	20.0	15	16.7	χ^2= 1.440	0.487
from 46-65 year	27	90.0	24	80.0	24	80.0	75	83.3		
Gender							0	0.0		
Male	23	76.7	20	66.7	18	60.0	61	67.8	χ^2=1.993	0.381
Female	7	23.3	10	33.3	12	40.0	29	32.2		
Marital status										
Married	28	93.3	30	100.0	30	100.0	88	97.8		
Widow	1	3.3	0	0.0	0	0.0	1	1.1	χ^2=4.091	0.394
Divorced	1	3.3	0	0.0	0	0.0	1	1.1		
Education										
Illiterate	10	33.3	6	20.0	9	30.0	25	27.8		
Primary	5	16.7	9	30.0	9	30.0	23	25.6	χ^2= 9.132	0.166
Secondary	8	26.7	2	6.7	3	10.0	13	14.4		
University	7	23.3	13	43.3	9	30.0	29	32.2		
Past medical history										
None	3	10.0	1	3.3	0	0.0	4	4.4		
IHD	19	63.3	20	66.7	25	83.3	64	71.1		
IHD/CABG	0	0.0	7	23.3	3	10.0	10	11.1		
IHD/Post CABG	2	6.7	0	0.0	0	0.0	2	2.2		
IHD+DM	2	6.7	1	3.3	0	0.0	3	3.3	χ^2= 22.869	0.117
IHD+IMD	1	3.3	1	3.3	0	0.0	2	2.2		
IHD+ Severe MI	1	3.3	0	0.0	1	3.3	2	2.2		
Post CABG	1	3.3	0	0.0	1	3.3	2	2.2		
S.A.R+IHD	1	3.3	0	0.0	0	0.0	1	1.1		
History of previous hospitalization										
No	8	26.7	3	10.0	6	20.0	17	18.9	χ^2= 2.756	0.252
Yes	22	73.3	27	90.0	24	80.0	73	81.1		
History of past Surgery										
No	27	90.0	30	100.0	27	90.0	84	93.3	χ^2=3.214	0.200
Yes	3	10.0	0	0.0	3	10.0	6	6.7		
Duration of past Medication use	5.80±2.30		5.15±0.92		6.5±2.2				F=2.737	0.072
Smoking										
Yes	19	63.3	12	40.0	15	50.0	46	51.1	χ^2= 3.291	0.193
No	11	36.7	18	60.0	15	50.0	44	48.9		

Chi square test for qualitative data between the two groups   Oneway Anova test quantitative data between the three groups or more

Table (2): Comparison between Control, Reflexology and Benson groups related to heart rate (pulse)

Pulse	Groups	1hr.before intervention	Immediately before intervention	immediately after intervention	1hr.after intervention	RM-ANOVA Between Groups
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
1st day	Control	100.53±17.2	102.77±12.16	105±15.22	106.2±17.17	F=2.178
	Reflexology	98.37±21.52	99.3±11.41	95.03±12.08	92.4±20.02	P=0.015*
	Benson	101.1±21.99	98.9±20.23	95.83±21.24	96.27±18.87	Partial η2=0.070
2nd day	Control	106.97±16.62	107.77±18.07	106.67±19.59	107.57±15.83	F=3.144
	Reflexology	101.63±12.27	100.27±14.38	98.23±12.97	96.5±13.23	P=<0.001**
	Benson	110.2±22.32	106.83±18.23	101.83±12.89	96.87±19.5	Partial η2=0.098
3rd day	Control	104.2±13.79	102.27±13.82	101.57±13.51	98.9±11.69	F=0.220
	Reflexology	100.13±16.47	100.07±15.7	93.58±20.87	96.73±14.29	P=0.995
	Benson	101.11±15.32	99.89±13.19	92.81±9.01	93.53±9.53	Partial η2=0.052

Repeated measures of analysis of variance (RM-ANOVA) test   **Significant level at P value < 0.05, **Significant level at P value < 0.01*

Table (3): Comparison between Control, Reflexology and Benson groups related to Respiratory Rate (RR)

RR	Groups	1hr.before intervention	Immediately before intervention	Immediately After intervention	1hr.after intervention	RM-ANOVA Between Groups
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
1st day	Control	24.48±8.96	27.8±10.69	25.47±7.59	26.83±8.42	F=5.079
	reflexology	25.3±4.49	23.2±4.41	21.57±5.06	20.47±4.71	P=<0.001**
	Benson	20.47±5.92	23.43±8.92	19.13±4.78	20.67±6.08	Partial η2=0.154
2nd day	Control	27.13±7.91	28.87±8.21	29.83±7.73	31.13±6.78	F=11.217
	reflexology	23.97±4.01	25.4±7	21.4±4.34	20.73±4.27	P=<0.001**
	Benson	22.97±7.21	23.7±7.76	21.87±6.64	20.77±6.69	Partial η2=0.279
3rd day	Control	30.3±6.14	28.5±5.34	28.9±6.27	27±5.62	F=1.355
	reflexology	27.33±5.55	25.2±5.25	22.04±5.99	22.88±3.68	P=0.240
	Benson	25.3±7.1	22.89±6.08	21.33±3.9	20.2±1.78	Partial η2=0.311

Repeated measures of analysis of variance (RM-ANOVA) test   ***Significant level at P value < 0.01*

Table (4): Comparison between Control, Reflexology and Benson groups related to systolic and diastolic blood pressure

Day	Variables	Groups	1hr.before intervention	Immediately before intervention	Immediately After intervention	1hr.after intervention	RM-ANOVA Between Groups
			Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
1st day	SBB	Control	125.2±24	128.4±19.33	125.87±18.92	125.67±15.79	F=5.543
		reflexology	139.6±21.88	130.17±15.82	123.27±8.58	120.27±12.72	P=<0.001**
		Benson	124.63±27.43	118.97±23.8	112.73±23.79	112.27±22.47	Partial η2=0.160
	DBB	Control	68.37±13.62	75.17±13.28	72.63±12.98	69.57±11.14	F=3.078
		reflexology	72.07±12.22	70.67±13.86	66.7±9.28	65.97±9.25	P=0.001**
		Benson	71.47±15.46	65.7±14.58	64.77±13.51	62.23±13.66	Partial η2=0.096
2nd day	SBB	Control	122.37±15.77	123.1±17.57	123.7±17.48	126.47±14.95	F=11.138
		reflexology	133.17±11	131.1±10.34	123.5±10.61	124.23±13.3	P=<0.001**
		Benson	113.77±17.93	111.6±21.05	107.43±18.07	107.77±18.31	Partial η2=0.277
	DBB	Control	72.13±11.22	71.27±12.51	72.1±10.32	72±11.57	F=2.712
		reflexology	71.27±12.34	68.9±11.21	69.9±11.92	71.07±11.21	P=0.002**
		Benson	64.83±11.86	68±13.1	62.57±10.45	65.5±12.74	Partial η2=0.086
3rd day	SBB	Control	123.63±13.11	125.8±12.88	127.27±11.47	125±10.83	F=2.045
		reflexology	140.4±10.55	132.53±11.69	122.04±8.16	116.36±5.05	P=0.074
		Benson	121.56±19.11	121.33±18.85	114.89±17.61	117.92±3.96	Partial η2=0.506
	DBB	Control	71.07±11.28	72.2±12.02	72.8±10.37	73.63±9.02	F=0.696
		reflexology	71.73±13.32	69.53±7.89	71.96±10.01	62.88±16.49	P=0.729
		Benson	70.56±10.68	71.33±10.48	66.56±9.15	71±7.83	Partial η2=0.258

Repeated measures of analysis of variance (RM-ANOVA) test   ***Significant level at P value < 0.01*

Table (5): Comparison between Control, Reflexology and Benson groups related to Mean Arterial Pressure (MAP)

MAP	Groups	1hr.before intervention	Immediately before intervention	Immediately After intervention	1hr.after intervention	RM-ANOVA Between Groups
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
1st day	Control	85.47±17.49	90.93±12.9	88.97±12.96	87.27±13.1	F=2.607 P=0.003** Partial η2=0.082
	Reflexology	92.13±14.95	90.67±9	89.6±13.78	85.6±12.96	
	Benson	93.1±17.8	88.3±19.65	80.5±13.11	81.47±15.74	
2nd day	Control	85.3±13.19	86.27±14.79	85.33±13.65	87.4±9.89	F=3.357 P=<0.001** Partial η2=0.104
	Reflexology	89.2±12.37	93.97±13.75	87.6±10.88	91.83±8.81	
	Benson	83.5±15.37	86.13±16.49	81.1±18.14	78.17±18.41	
3rd day	Control	86.87±10.9	89.67±11.11	88.6±11.84	87.53±10.61	F=0.611 P=0.809 Partial η2=0.133
	Reflexology	92.77±13.43	90.3±10.74	83.83±9.93	75.36±7.94	
	Benson	84.22±16.33	84.78±15.5	77.7±16.01	83.93±6.83	

*Repeated measures of analysis of variance (RM-ANOVA) test   **Significant level at P value < 0.01*

Table (6): Comparison between Control, Reflexology and Benson groups related to Oxygen Saturation (SPO2)

SPO2	Groups	1hr.before intervention	Immediately before intervention	Immediately After Intervention	1hr.after intervention	RM-ANOVA Between Groups
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
1st day	Control	97.83±3.41	97.5±4.42	98.03±2.44	98.6±2.04	F=12.049 P=<0.001** Partial η2=0.295
	Reflexology	98.97±1.19	98.83±1.37	99.23±1.01	98.33±1.32	
	Benson	97.10±2.04	94.23±3.32	99.23±1.99	99.43±1.38	
2nd day	Control	98.37±1.77	97.6±2.36	97.47±2.83	97.13±2.94	F=7.865 P=<0.001** Partial η2=0.213
	Reflexology	90.1±15.74	93.93±2.27	97.83±1.29	97.4±2.03	
	Benson	97±1.98	97.23±1.63	99.2±0.96	99.3±0.84	
3rd day	Control	96.73±2.91	96.17±3.39	96.4±3.66	97.13±2.01	F=1.189 P=0.322 Partial η2=0.229
	Reflexology	96.27±2.69	96.23±2.54	97.46±1.72	96.82±2.09	
	Benson	96.56±2.06	96.52±2.33	99±0.92	98.93±1.28	

*Repeated measures of analysis of variance (RM-ANOVA) test   **Significant level at P value < 0.01*

Table (7): Comparison between Control, Reflexology and Benson groups related to Chest Pain intensity

Days	Chest Pain intensity	Control group N=30	Reflexology group N=30	Benson group N=30	P. value
		Mean ±SD	Mean ±SD	Mean ±SD	
1st day	Before intervention	9±1.26	9.1±0.71	9.47±0.63	<0.001**
	After intervention	9.43±1.45	7.3±1.18	7.6±0.93	<0.001**
2nd day	Before intervention	8.25±0.7	4.3±0.75	4.4±0.81	<0.001**
	After intervention	7.93±0.9	1.63±0.67	2.1±1.16	<0.001**
3rd day	Before intervention	6.41±0.84	1.95±1.21	1.25±0.44	<0.001**
	After intervention	6.79±0.98	1.5±0.55	1±0	<0.001**

One-way Anova test quantitative data between the three groups or more with Lcd Method   P. value: Comparison between All group

Table (8): Paired comparison of mean pain intensity score in the three groups.

Group	Pain intensity	
1st day	Before	After
Reflexology and Control	0.053	<0.001**
Reflexology and Benson	0.398	0.308
Benson and Control	0.061	<0.001**
2nd day	Before	After
Reflexology and Control	0.045*	<0.001**
Reflexology and Benson	0.610	0.055
Benson and Control	0.031*	<0.001**
3rd day	Before	After
Reflexology and Control	0.012*	<0.001**
Reflexology and Benson	0.008**	0.430
Benson and Control	0.051	<0.001**

Discussion

Cardiothoracic surgeries are becoming increasingly significant as essential and common kinds of critical care surgeries implemented worldwide **Stephens, R.S., &Whitman, G J. 2015.** Successful results depend on best postoperative care in the intensive care unit despite of operation type that performed. Postoperative difficulties in the ICU have been linked to the majority of avoidable issues after surgery **Abdou, F., Abd El-Hafez, A, I., 2018.**

Critical care nurses must evaluate and investigate every open heart surgery patient for pain and anxiety in order to offer the essential care for preventing and reducing disabilities **Ahamadi, M., 2014.** According to the research, there are two types of pain relief methods: pharmacological and non-pharmacological. Non-pharmacological approaches are increasingly being used in hospital settings to lessen or eliminate pain and improve physiological parameter **Abdou, F., Abd El-Hafez, A, I., 2018**.

Hence the current study was conducted to examine the effect of foot reflexology massage versus Benson relaxation procedure on physiological parameters and severity of pain post open heart surgery.

The results of current study, a significant decrease in pulse, breathing rate, systolic Blood pressure, diastolic blood pressure and mean arterial blood pressure is observed in both the reflexology and Benson group immediately and one hour after applying each intervention from the first to the third day comparing to the control group and a significant difference was noted between the three groups across the first 2 days, and no difference noted between groups in the third day, this can be explained based on **Kandemir, D. and Oztekin, S, D, 2019** who said that every organ, gland, and body part has reflected points in its hands, feet, and ears. By reducing tension and stress, reflexology massage creates a sense of security and safety, which help to improve the physiological indicators in the cardiothoracic post-operative period.

These results are consistent with **Elsayed, E, A. et al., 2019**; who examine the Effect of Foot Reflexology on Physiological Indicators among Open-Heart Surgery Patients, who reported the effectiveness of foot reflexology massage on improving physiological parameters including heart rate, respiratory rate, systolic blood pressure, diastolic blood pressure and oxygen saturation among most of patient categories.

Similarly the study carried by **Khaledifar, et al., 2017**, who examine the influence of reflex therapy and massage therapy on vital signs and tension before cardiac angiography there was a significant progress in some of vital indicators containing diastolic blood pressure, cardiac rhyme and breathing rate. However, they founded that the change in systolic blood pressure was not significant.

Other study carried by **Zolfaghari et al., 2012** who examine effects of therapeutic touch on vital signs and dysrhythmia in women undergoing cardiac catheterization, presented that therapeutic touch significantly reduced the cardiac pulse, breathing rate and blood pressure during catheterization in the study group. Also similar to results of study by **Hosseini et al., 2017** who observed the effect of foot massage on vital signs of critically ill patients in the ICU, and exposed significant differences in the mean cardiac rhythm, which is consistent with the current study.

From the researchers' point of view, these outcomes could be linked to the fact because reflexology coactivates double branches of autonomic nervous system which could be beneficial in improving hemostasis, physiological parameters and reduce pain.

Also the study conducted with **Azami, et al., 2015** observed that foot reflexology decrease Mean Arterial Pressure among neurosurgical patients in ICUs. On the other hand, numerous investigations failed to demonstrate that foot reflexology has a positive impact on physiological markers. This may be the result of a number of factors, including the use of foot reflexology by two separate people. **Ebadi, A., et al., 2015.**

The result of the current study is in constant with **Teimori F, et al, 2019** who conducted a study to evaluate effect of Benson

relaxation on physiological conditions in patients post open heart surgery; this showed that, Benson relaxation had a significant improving result on reducing the physiological parameters that make patients relaxed. Additionally the same results informed by **Poorolajal J., et al; 2017,** who investigate the influence of Benson relaxation procedure on the hemodynamic parameters, and reported that When compared to the control group, the intervention group's blood pressure, pulse, average number of cardiac rhythms, and breathing rates all considerably decreased (P 0.001).

From the researchers' point of view, Benson's relaxation procedure is simple plus quick to performed, and it doesn't involve any special skills or equipment. Furthermore, this approach can be used on critically ill patients. Therapeutic techniques to control sympathetic activity and avoid consequences connected with an overactive sympathetic nervous system in patients group.

Regarding **oxygen saturation Sao2** the current study results revealed statistically significant increase progress in oxygen saturation was observed in both Reflexology and Benson groups after the intervention comparing to control group, with statistically significant difference among groups in the 1st and 2nd day (P=<0.001), and no statistically significant difference between groups in the 3rd day. This come in the same with **Sayari, S, et al; 2018** who study the impact of foot reflexology massage on physiological indicators in patients with acute myocardial infarction, and illustrated that the proportion of blood oxygen saturation in investigational group was rising (P <0.001) but there was no significant difference among the placebo and control groups. Incremental variations in blood oxygen saturation immediately and 20 minutes after intervention were significantly different from the pre intervention in three groups. In all cases, the rise in the study group was greater with (P<0.001). But these changes were not significant in 20 minutes after the technique when compare to the immediately after intervention in three groups. Variations in vital sign and heart rhythm were not significantly different among the three groups in different intervals.

In relation to the mean score of **pain intensity**, the present results exposed that a statistical significant difference among the mean of pain score in reflexology, Benson group and the control group post applying each intervention. The study displays decrease in mean of pain score between intervention groups who exposed to foot reflexology and Benson relation technique comparing to the control group.

This result was in the similar with the result of **Brent A.B. et al; 2010** who reported the effectiveness and feasibility of massage therapy provided in the after cardiovascular operation, reported that Patients receiving massage therapy had significantly decreased pain, and a latest 104 open heart surgery patients participated in a trial that showed reduced pain and stress for those who received massage therapy. From the researchers' point of view, due to the unique challenges faced by critically cardiac ill patients (extended operative duration, significant musculoskeletal instable, and positional needs), so we support the performance of foot reflexology technique and Benson guided relaxation by critical care nurses within ICU may be significant beneficial in this groups of patients .

The same results was documented by **Abdou, F., Abd El-Hafez, A, I., 2018** , who reported that there was a statistically significant difference in the mean pain score between the study group and the control group right away, after 15 minutes, and after 55 minutes. The study also revealed a minor difference in the mean pain score between study patients who were exposed to foot reflexology. Additionally the study carried by **ELmetwaly, A, A, M , 2020,** who study Relaxation Technique: Improving Thoracic Surgery Patients' Sleep Quality, Anxiety Level, and Pain Intensity had reported that the level of pain was significantly higher improved among study group after using Benson's relaxation technique than control group especially pre- and post-operative by three days.

Also results of the study done by **Keihani Z., 2019** revealed that Benson's relaxation technique had a significant impact on the level of post-operative spinal anesthesia-induced discomfort. As before and after the

intervention, the control group's mean pain score was 5.34 and 5.62, respectively (P .003), while in the study group, it was 5.28 and 4.03, respectively (P .001). Additionally the same results were documented by **Ju, w., et al., 2019,** who study reported a systematic evaluation and meta-analysis of the effectiveness of relaxation therapy as a nursing intervention for post-operative pain management in patients after abdominal surgery.

Conclusion

According to the outcomes of the current study it can be conclude that, use of foot reflexology technique and Benson's relaxation procedure after open heart surgery significantly improve Physiological signs including vital sign, oxygen saturation and decrease in pain level. With a higher significant improvement was observed in reflexology group compared to Benson's relaxation group. Therefore, those complementary approaches can be used such as an effective nursing measure without causing any problems for stabilizing Physiological indicators and decrease pain level among patients after open heart surgery.

Recommendations:

Based on the results findings it recommended that:

1- Training program should be applied for critical care nurses on foot reflexology technique and Benson's relaxation technique and use them as a part of usual routine nursing care for patients after open heart surgery.

2- Illustrated guide of reflexology technique and Benson's relaxation technique should be available on each Cardio-Thoracic intensive care unit.

3- Future studies and repeating this study on a large sample size for generalization.

References:

Abdou, F. Abd El-Hafez, A, I., (2018): Effect of Foot Reflexology Practice on Acute Pain and Anxiety of Critically ill Patients after Cardiothoracic Surgery International Journal of Innovative Research in Medical Science (IJIRMS), 03 (08), ISSN: 2455-8737.

Ahamadi, M. (2014): Comparing the effect of metatarsus and ankle reflexology massage on patient's state anxiety after coronary artery bypass graft surgery.

Azami, H. Paveh, B, K. Rezaei, M. & Samadzadeh, S. (2015): The impacts of short-term foot massage on mean arterial pressure of neurosurgical patients hospitalized in intensive care units. Iranian Journal of Critical Care Nursing, 8(3), 133-142.

Benson, H. (2000). The relaxation response, New York, NY: HarperCollins Publishers.

Bigeleisen, P. E., & Goehner, N, (2015). Novel approaches in pain management in cardiac surgery. Current Opinion in Anesthesiology, 28(1), 89-94.

Brent, A, B. Cutshall, S, M. Wentworth, L, G. Engen, D, Messner, P, Q. Wood, K, M. Brekke, K, M. Kelly, R, F. (2010): Effect of massage therapy on pain, anxiety, and tension in cardiac surgical patients. Complementary therapies in clinical practice, 16(2): p. 92-95. https://doi.org//10.1016/j.ctcp.2009.06.012.

Ebadi, A. Kavei, P. Moradian, S. T. & Saeid, Y. (2015): The effect of foot reflexology on physiologic parameters and mechanical ventilation weaning time in patients undergoing open-heart surgery: A clinical trial study. Complementary Therapies in Clinical Practice, 21(3), 188-192.

ELmetwaly, A, A, M. Shaaban, E, G, E. Mohamed, E, M, H. (2020): Benson Relaxation Technique: Reducing Pain Intensity, Anxiety level and Improving Sleep Quality among Patients Undergoing Thoracic Surgery, Egyptian Journal of Health Care, 11(4).

Elsaed, M, M. Mohamed, H, A. Ebrahim, N, M. (2020): Factors Affecting Post Open-Heart Surgery Outcomes for Hospitalized patients, Egyptian Journal of Health Care 11(1): page (41).

Elsayed, E, A. Kandeel, N, A. Abd El-Aziz, W, W. (2019): The Effect of Foot Reflexology on Physiological Indicators and Mechanical Ventilation Weaning Time among Open-Heart Surgery Patients. American Journal of Nursing Research, 7(3): 354-361. https://doi.org/10.12691/ajnr-7-3-16.

Engelman, D. T., Ali, W. B., Williams, J. B., Perrault, L. P., Reddy, V. S., Arora, R. C., ... & Boyle, E. M. (2019). Guidelines for perioperative care in cardiac surgery: enhanced recovery after surgery society recommendations. Jama Surgery, 154(8), 755-766.

Hosseini, F. Avazeh, A. Elahi, N, Shariati, A. & Souri, H. (2017): The effect of massage on comatose patients' vital signs, hospitalized in intensive care units. Journal Arak United Med Science, 9 (3):26-35.

Jayakumar, S, Borrelli, M, Milan, Z, Kunst, G, & Whitaker, D, (2019). Optimising pain management protocols following cardiac surgery: A protocol for a national quality improvement study. International journal of surgery protocols, 14, 1-8.

Ju, W. Ren, L. Chen, J. & Du, Y. (2019): Efficacy of relaxation therapy as an effective nursing intervention for post-operative pain relief in patients undergoing abdominal surgery, Experimental and Therapeutic Medicine, 18(4), 2909-2916.

Kandemir, D, & Oztekin, S, D, (2019): How effective is reflexology on physiological parameters and weaning time from mechanical ventilation in patients undergoing cardiovascular surgery. European Journal of Integrative Medicine, vol (26), pp. 43–49.

Keihani, Z. Jalali, R. Shamsi, M, B. & Salari, N. (2019): Effect of Benson Relaxation on the Intensity of Spinal Anesthesia-Induced Pain after Elective General and Urologic Surgery, 34(6):1232-1240. https://doi.org/10.1016/j.jopan.

Khaledifar, A. Nasiri, M. Khaledifar, B. Khaledifar, A. &Mokhtari, A. (2017):

The effect of reflex therapy and massage therapy on vital signs and stress before coronary angiography: An open-label clinical trial. 13(2), 50-55.

Koraş, K. & Karabulut, N. (2018): The Effect of Foot Massage on Postoperative Pain and Anxiety Levels in Laparoscopic Cholecystectomy Surgery: A Randomized Controlled Experimental Study. Journal of Peri Anesthesia Nursing, 1-8.

Mann E, Carr E. (2006). Pain management, Philadelphia: Blackwell, p.p 1290-1295.

Painchault, T., Perrin, L., Loijens, L. W., van der Linden, X., Theuws, H. M., & Zimmerman, P. H. (2020). Application of scientific measures to demonstrate the relaxing properties of Peony fragrance in hair care products. Journal of Sensory Studies, 35(2), e12560.

Poorolajal, J. Ashtarani, F. Alimohammadi, N. (2017): Effect of Benson relaxation technique on the preoperative anxiety and hemodynamic status: A single blind randomized clinical trial, Artery Research 17: C, 33–38, DOI: https://doi.org/10.1016/j.artres.

Rahmani, Z. Rejeh, N. Heravi-Karimooi, M. Tadrisi S. D, & Vaismoradi, M. (2017): Effect of hand reflexology on anxiety and physiological variables among patients hospitalized in the cardiac care unit: a randomized placebo controlled clinical trial," Journal of Nursing Education and Practice, 8(4), pp. 35–42.

Sayari, S. Nobahar, M. & Ghorbani, R. (2018): Effect of foot reflexology massage on physiological indices in patients with acute myocardial infarction, Journal of Semnan University of Medical Sciences 20(3), 417-602: ISSN: 1608-7046

Shehata, O. S. M., Eita, L. H., Mansour, A., Alhalawany, R. M., Abou-Shehata, O. E. K., & Atia, M. M. (2021). Effect of Therapeutic Foot Reflexology Massage on Anxiety and Sleep quality among Hospitalized Cardiac Patients, SYLWAN, 165(9).

Stephens, R, S. & Whitman, G, J. (2015): Postoperative critical care of the adult cardiac surgical patient. Part I: routine postoperative care. Critical care medicine, 43(7): p. 1477-1497.

Teimori, F. Pishgooie, S. Malmir, M. & Rajai, N. (2019): The Effect of Benson Relaxation on the Physiological Symptoms in Patients undergoing Open Heart Surgery, Complementary Medicine Journal. 9(3):3812-3823. https://doi.org/10.32598/cmja.9.3.3812.

Vincent, J, L. (2017): Optimizing sedation in the ICU: the eCASH concept, Signa Vitae, 13(3), 10-13.

WicN, E., Grant, M., & Wu, C. (2017). Postoperative multimodal analgesia pain management with nonopioid analgesics and techniques, JAMA Surgery, 152(7), 691.

Zolfaghari, M. Eybpoosh, S. & Hazrati, M. (2012): Effects of therapeutic touch on anxiety, vital signs, and cardiac dysrhythmia in a sample of Iranian women undergoing cardiac catheterization. J Holist Nurs; 30(4): 225-34. https://doi.org/0898010112453325.