

Impact of Foot Reflexology on Pain Intensity, Physiological Indicators, and Comfort among Patients Undergoing Abdominal Surgery

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Abstract

Background: discomfort and pain from abdominal surgery are frequent side effects. Therefore, controlling them is very necessary. Foot reflexology appears to be useful in reducing pain and increasing comfort as a complementary care that is becoming widely accepted and popular. **Aim:** This study aimed to investigate the impact of foot reflexology on pain intensity, physiological indicators, and comfort among patients undergoing abdominal surgery. **Design:** A quasi-experimental research design was used to conduct current study. **Setting:** The study was carried out at the Surgical Department at Mansoura University Hospital. **Subjects and method:** A purposive sample of 200 patients undergoing abdominal surgery was recruited in this study; the studied patients were assigned into two groups, the study and control groups (with 100 patients in each group). **Tools:** Three tools were used to collect data: **Tool (I):** a structured interviewing questionnaire. **Tool (II):** Numeric Pain Rating Scale (NPRS), and **Tool (III):** Comfort Questionnaire. **Results:** The present study reported that (25%) of the study group patients had severe pain post intervention compared to (42%) in the control group after intervention. The study group's mean scores on the Comfort Questionnaire were significantly higher than those of the control group. Moreover, there were highly statistically significant differences in foot reflexology among the studied patients regarding pain and comfort scores between the study and control groups. **Conclusion:** Foot reflexology has a positive effect on pain reduction and increases comfort among patients undergoing abdominal surgery. **Recommendation:** Foot reflexology could be applied as a non-pharmacological strategy and complementary therapy along with routine care to manage pain and increase comfort among patients undergoing abdominal surgery.

Keywords: Comfort, Foot reflexology, Pain intensity, Physiological Indicators& patients undergoing abdominal surgery

Introduction:

Abdominal surgery is major of an invasive procedure that requires a bodily incision and is usually connected to pain, bleeding and the chance of morbidity and death. Surgery patients therefore experience anxiety in the lead-up to their procedure. Pain management in adult surgical patients is thought to be a difficult condition to treat. The majority of adult patients with surgery appointments reported feeling more anxious and in pain (Kaur et al., 2019).

One of the most prevalent postoperative complaints among patients worldwide is pain. Postoperative discomfort is typical, even with the availability of medications and anesthetic treatments. About 41% of patients postoperative reported moderate to severe pain level even with sedative use (Hisato & Umamoto, 2017). A comprehensive survey revealed that 86% of 300 patients had postoperative pain, with 75% presenting moderate to severe pain right after surgery. Despite the fact that 88% of patients had pain medication, 80% of them suffering from adverse effects, and 39% of patients still had moderate to severe pain after taking the drugs (Gan et al., 2017).

Although there are numerous pharmaceutical and non-pharmacological treatments available to assist clients in achieving the best possible pain management, every patient's response is different. Painkillers are currently the go-to therapy for immediate pain reduction postoperatively. To prevent the unfavorable side effects of opioid, alternative methods and non-pharmacological strategies to pain and comfort management, like reflexology, are becoming more and more popular worldwide (Van Dijk, et al., 2016).

In reflexology, certain spots on the hands, feet, and ears that correspond to various bodily regions are directly pressured. It is a straightforward, non-pharmacological, non-invasive treatment. According to the zones and reflex areas theory, the feet represent the various bodily parts (abdomen, eyes, nose, stomach, and neck) (Sung, 2019). Comfort and relaxation are improved by reflexology, just like other massage techniques. In post-operative recovery, pressure applied to the toe stimulates the pituitary, releases endorphins and enkephalins, and promotes comfort (Chanif et al., 2019).

Reflexology massage eases stress and tension, which enhance feeling of security. Deep pressure that will be administered to particular body areas to relieve pain (Kandemir & Oztekin,

2019). Numerous studies have documented the immediate benefits of foot reflexology for improving arterial oxygen saturation level, systolic and diastolic blood pressure, and heart rate and managing incision pain following surgery (Elsayed et al., 2019). It has also been shown to be a successful method for reducing postoperative pain (Koraş & Karabulut, 2018). Previous research indicates that reflexology dramatically lowers the body's physiological reaction to stress, as well as its negative effects on body mind relationship (Painchault et al., 2020).

One complementary and alternative approach to addressing pain and comfort that is noninvasive and nonpharmacological is foot reflexology, thereby employed as a means of avoiding the adverse effects of analgesic medications (Van Dijk, et al., 2016). Reflexology is the scientific study of human health using quantized reflex areas on the hands, feet, and ears. The reflexology hypothesis states that the skin layers of the hands, feet, and ears acts as a representative of the target points of body parts. Impulses produced on these reflexology areas by external stimulations of specific intensities are thought to travel through neural pathways or act as hormones when they reach the target body organs. Studies in the past have shown that reflexology greatly lowers the physiological reaction to stress and lowers physical activities (Ghaljaei & Jalalodini, 2021).

Simple and less expensive foot reflexology is considering one among the most widely used popular forms of reflexology therapy. The foundation of foot reflexology massage theory is assisting the body's inherent ability to regain equilibrium. Similar to how touching the skin can release the body's natural endorphins, which lower tension, the pain would also naturally diminish. Additionally, applying pressure to the hands or feet might lessen discomfort and promote comfort by activating large-diameter fibers that close the pain gate and prevent pain from being transmitted (EL-Fekey, et al., 2018). Moreover, foot reflexology activates vast primary afferents that release endorphins and gamma-aminobutyric acid (GABA) via the stimulation of cutaneous mechanoreceptors (Jazayeri et al., 2021). Additionally, the benefits of foot reflexology massage include improved circulation, which uplifts and relaxes the body. By affecting the neurological, cardiovascular, and locomotor systems as well as the nervous system, this lessens the sense of pain and anxiety. It also relieves muscle spasm and pain, improving general wellbeing and health (Chanif et al., 2019).

Reflexology restores balance and improves comfort by applying pressure to responsive spots on the foot that correspond to every part of the

body. Reflexologists think that pressing particular sole reflex points during illness may release calcium and uric acid crystals that have built up in nerve endings, clear obstructions in nerve pathways, and improve blood circulation flow all over the human body (Ballard et al., 2019). Numerous studies have backed up the benefits of foot reflexology massage, including one that reduced postoperative pain (Öztürk et al., 2018), and another that increased comfort and reduced discomfort (Rambod, et al., 2019). In the critical care unit, nurses also used foot reflexology massage in addition to routine care to lessen pain and stabilize physiological indicators in patients undergoing coronary artery bypass graft surgery (Abbaszadeh et al., 2018).

To ensure the success of the procedure, nurses play critical and effective role in counseling, education, and assistance. Play a significant part in helping people experience reduced pain and discomfort as well. According to Esther Lilly & Dakshayani (2018), non-pharmacological therapeutic strategies and methods include informational therapies, attention-focused techniques, distraction and calming therapies.

Significance of the study:

Most recent study approved that the percentage of patients complaining from post-operative pain was 84.17%, 92.5% and 96.66% at the fifth post-operative hour, second and third post-operative day, around 14% to 55% of people in Western nations have moderate to severe pain, with the prevalence of pain peaking on the day of surgery. Data are few in low- and middle-income countries, another study showed that the prevalence rises to 95% (Ndebea, et al., 2020). Reflexology is an effective technique for increasing muscular **relaxation** as it improving blood circulation flow which activates the parasympathetic action of nervous system. The pain reducing strategies after the operation incorporated into nursing routine care also all Complementary methods and non-pharmacological interventions are simple, less expensive, noninvasive, and have less adverse effects compared with pharmacological methods (Ray et al., 2017). Reflexology was initially discovered in Egypt. As it was Egyptians incorporated it into many aspects of daily life, including medicine. The details of using this technique were detected in the finding of hieroglyphic mural in the pyramid of Saggara. However, recently, the utilization of reflexology treatment in Egyptian culture is very limited and uncommon in medical or nursing fields despite the proven benefits of the technique. Numerous research conducted in various nations

have thoroughly examined the impact of foot reflexology (Chandrababu et al., 2019).

Foot reflexology may improve patients' physiological markers and has a good impact on decreasing heart rate (HR), systolic and diastolic blood pressure (Abbaszadeh et al., 2018). It has been demonstrated that foot reflexology massage is a useful method for reducing analgesic use and postoperative discomfort. According to reports, foot reflexology can help with post-operative incision discomfort (Sadeghi Shermeh et al., 2019). Therefore, the study was investigating impact of foot reflexology on pain intensity, physiological indicators, and comfort among patients undergoing abdominal surgery.

Operational definition:

Physiological indicators: are measurable biological functions that provide insight into the health and well-being of an individual. These indicators may include items as pulse rate, blood pressure, and respiratory rate

Aim of the study

This study aimed to investigate the impact of foot reflexology on pain intensity, physiological indicators, and comfort among patients undergoing abdominal surgery through:

- Assessing pain intensity among patients undergoing abdominal surgery.
- Assessing physiological indicators among patients undergoing abdominal surgery.
- Assessing comfort level among patients undergoing abdominal surgery.
- Evaluating the impact of foot reflexology on pain intensity, physiological indicators, and comfort among patients undergoing abdominal surgery.

Research hypothesis:

H₁. Patients undergoing abdominal surgery who receive foot reflexology are expected to experience less pain intensity than those who do not.

H₂. Patients undergoing abdominal surgery who receive foot reflexology are expected to experience more comfort than those who do not.

H₃. Patients undergoing abdominal surgery who receive foot reflexology are expected to experience enhancement in physiological indicators than those who do not.

Methodology

Research design:

A quasi-experimental research design was used to conduct the current study

Setting:

The study was carried out at the Surgical Department at Mansoura University Hospital

Sample:

A non-probability purposive sampling technique was utilized to select a sample of 200 patients undergoing abdominal surgery who were assigned into two equal groups based on their hospitalization admission code number, 100 for the study group (who underwent foot reflexology) and 100 for the control group (who received routine care only).

Sample size calculation:

A purposive t sample of 200 Post abdominal surgery who attending to inpatient department at Mansoura University Hospital. The sample estimated by power analysis (The sample size of (200.) participants divided to two group 100 control and 100 study, will be calculated using a power analysis. A Power of .80 ($\beta = 1-.80 = .20$) at alpha .05 (one-sided) will be used as the significance level and high significance was at <0.001.

Inclusion criteria included:

Patients from both sexes, age 18 - 60 years, who are not suffering from chronic disease, or having abdominal surgery, and agreed to take part in our study

Exclusion criteria included:

Patients with chronic or mental diseases, patients with a history of chronic pain, and patients dis agreed to be taken part of the study.

Tools for data collection:

The researcher used Three tools for data collection divided into

A structured interview questionnaire

It was developed by the researchers after reviewing related literature (Gan et al., 2017; Kaur et al., 2019). It was consisting of two parts

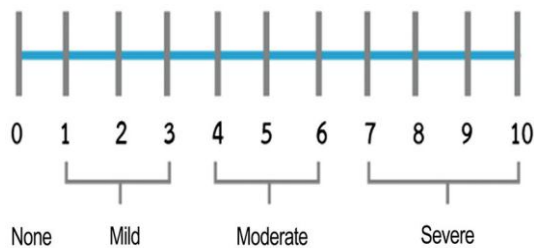
Part (1): It included patients' demographic data which involved four items as: age, gender, educational level, and place of residence.

Part (2): It included patients' medical history; which have four items about prior hospitalization, past surgery, surgery type and analgesic consumption history.

Pain Numeric Rating Scale (PNRS)

The pain numeric rating scale (PNRS) is a common standardized scale for pain assessment which determine severity of pain. It was adopted from McCaffery, (1999). However, literate patients ($r = 0.94$) outperformed uneducated ones ($r = 0.71$). The Numeric Rating Scale (NRS) uses a single 11-point numeric scale to allow patients to choose a value between 0 and 10 to evaluate their

pain intensity. PNRS has good test-retest reliability in both literate and illiterate patients ($r = 0.96$ & 0.95 , respectively). So, NPRS was used to quantify pain severity before and after each massage session in this study, with patients asked to select a number that matched their level of discomfort. The NRS uses a 0-10 scale. The NRS has a 0–10 scale that can be used to describe pain severity as no pain (0), mild level of pain (1-3), moderate level of pain (4-6), and severe level of pain (7-10).



(III) Comfort Questionnaire

It is a 34-item questionnaire adopted from **Karakaplan & Yldz (2010)** and used to measure patients' comfort in terms of their bodily, psychological, spiritual, and sociocultural well-being. It depends on the General Comfort Scale, the Turkish version translated by **Kuguoglu & Karabacak (2008)**. The responses were estimated as a 5-point Likert system of agreement with 5 (strongly agree) being the highest level and 1 (strongly disagree) being the lowest. The items with negative statements were subjected to reverse coding. The scale's minimum and maximum scores range from 34 to 170. Scores of about 170 imply high degrees of comfort.

(IV) **Physiological indicators assessment tool:** These indicators may include items as: heart rate, respiratory rate and blood pressure,

Validity and Reliability of the tools:

The content validity of the tools for their appropriateness, clarity, comprehensiveness, and relevance were reviewed by three expert professors: in field of medical-surgical nursing. No modifications done according to the panel decision.

The tools reliability was tested by using Cronbach's alpha coefficient test, this demonstrated that the tools' contents were comparatively homogeneous, as evidenced by each tool's moderate to high reliability. The test-retest reliability coefficient of tool (I) was 0.89, tool (II) was 0.94, and tool(III) has been demonstrated as $r = 0.81$ to assess the feasibility and clarity of the research method.

A pilot study:

A pilot study was carried out on 10% (20 patients) of the study sample. For production the final tools form, no modifications were made. patients participating in the pilot were included in the study

Ethical and administrative considerations:

Before conduct the research study, the Approval was taken from Mansoura Faculty of Nursing Ethical Research Committee before starting the study. The researchers met with the nursing and medical directors of the chosen setting to clarify the purpose of the study and obtain their approval. informed consent was obtained from patients to gain their cooperation. Collecting data was voluntary and confidential. Researchers explained the study objective and methodology for all patients. The right to decline from the study was confirmed.

The procedure of data collection:

The official permissions for collecting data were obtained by submitting an official letter issued from dean of nursing faculty to the directors of the study setting. Collected data process occur within four months from beginning of November 2023 through February's end 2024. The researchers visited the study setting three days per week (Monday, Thursday and Wednesday) from 9:30 am to 12:30 pm. The study was conducted through preparation, interviewing, assessment, implementation, and evaluation.

1-Preparation for the study:

- After reviewing related recent national and international literature has been done to construct current study tools.
- To accurately identify the reflection sites on the foot and understand how to apply pressure, the researcher completed one -month specific training program on providing foot reflexology massage under the supervision of a specialist trainer in the fields of physical medicine, rheumatology, and rehabilitation. Thus, the approved working procedure was used. Next, give volunteers and a few of her relative's foot reflexology massages before giving it to the patients with abdominal surgery.
- **The selected points of foot reflexology:** The first was the solar plexus point, which lay between the middle and upper thirds of the sole. Known as the "relaxation point," it can induce a profoundly calming effect and improve comfort by interacting with the entire neurological system. The brain point, which is situated at the base of the big toe, was the second point. It promotes the parasympathetic nervous system's ideal operation, which aids the body in adjusting to the effects of pain. Additionally, it is utilized to reduce pain in the body and prevent the body's painkillers, endorphins, and enkephalins, from being released (**Ruth Hull 2011**). The third point was the adrenal point, which is situated on the foot just above the kidney point and halfway

between the diaphragm line and waistline. It helps the body cope with pain and reduces it. The pituitary point, which is situated in the middle of the big toe, helps balance all body hormones by regulating and controlling their activities and helps prevent the body from experiencing low energy (Elsayed et al., 2019).

- **Interview and assessment:**

- After the researcher gave her initial introduction to the study's subjects, who were undergoing abdominal surgery, and went over its goals, the subjects were split into two groups: 100 patients underwent abdominal surgery made up of the control group and another 100 patients made up of the study group.
- Following recruitment, each patient undergoing abdominal surgery is interviewed separately by the researchers to gather information about their medical history and demographics. They do this by utilizing a structured interviewing questionnaire (Tool I). This assessment took roughly 20 to 25 minutes to complete.

- **Implementation:**

- Patients in the control group received routine care accordance with hospital policy of care post the abdominal surgery. The patients in the study group received routine care additionally to foot reflexology massage 20 minutes before the abdominal surgery.
- **For the study group**, before applying the foot reflexology, the researcher prepared the studied patients and the environment as follows:
 - Prepare the warm, quiet, well-ventilated room for foot reflexology massage intervention.
 - Provide a full explanation of the foot reflexology massage procedure as meaning, benefits, duration, and reflexology points for the studied patients.
 - Ask the patients to wash their feet with warm water and soap before intervention.
 - The researcher should keep her nails short and clean as well as remove any jewelry. Wash and warm her hands, and lubricate them before touching the patients. Then get a general overview of the feet, look at the color, feel their temperature, and changes in skin texture. Finally, move the feet to check for mobility and flexibility (Ruth Hull, 2011).
- The researcher sat in a fully relaxed and comfortable position in front of the patients. Then the patient was instructed to lie down in a comfortable position, usually supine. Small

pillow was placed under the foot of patient's. Firstly, the patients's feet were examined for pain and sensitivity. Then the researcher put a tiny amount of non-therapeutic lotion on her hand to facilitate massaging starting with the right foot. Followed by performing a general massage to warm up the feet. Also, with just one hand's palm and fingers of the researcher, the sole, back, and toes of the patient's leg were massaged, and these movements were repeated several times. This technique enables the patients to get ready for specific reflexology by relaxing their feet and legs. It took two minutes. (Mansouri et al., 2017)

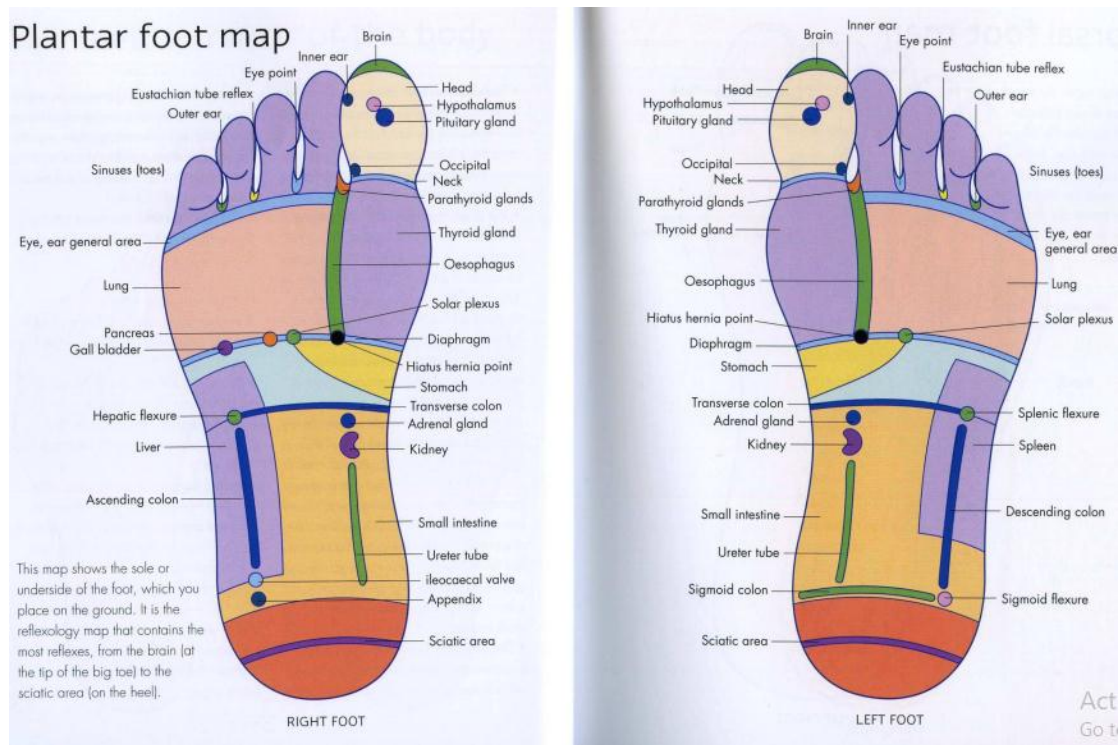
- Then pressure was used on points on the feet that correspond to the pain and comfort in the body. These points are four significant points which include the solar plexus, brain, adrenal, and pituitary. The rotating thumb technique was used as the researcher put his four fingers on dorsal aspect of the patient's foot and kept the thumb free to work on the sole. Bend the thumb from the first joint to between a 75 and 90-degree angle to ensure that the thumbnail doesn't dig into the flesh then apply firm pressure with the tip of the thumb to the point to be worked on by rotating the thumb clockwise, then lift the thumb, move to the next point and repeat the procedure. Therefore, the basic movements were; press in, rotate, lift, and move. The researcher performed reflexology for 8 minutes on each foot. The cycle of foot reflexology massage was applied in the second patients foot as the first foot for 10 minutes. Total 20 min for both (Louise Keet 2008).

Selected Points of physiological indicators

Based on the reflexologists claim, the points on the planter foot surface that may be in responsibility for preserving physiological indicators of ventilation and reduction dependence were chosen. These points included the diaphragm, lung, solar plexus and heart. The diaphragm reflex point runs along the horizontal crease just below ball of the foot and is involved in respiration. While solar plexus point (relaxation point) is located at the midline below the ball of both feet (El-Refaye & Elsis, 2017). This point interacts with the whole body nervous system and can trigger significant relaxation effect. The heart reflex point is located on the base of the big toe of plantar aspect of both feet. The specific point enhances heart function and improve blood circulation. The lung reflex point regulates oxygen levels, breathing rate and maintain the chest and lungs open (Mansouri et al., 2017).



Louise Keet. (2008): The Reflexology Bible: The Definitive Guide to Pressure Point Healing. 1st ed. Octopus Publishing Group Ltd 2008. Pp 96-174.



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Evaluation:

- The researchers reassess the level of pain intensity Numeric Pain Rating Scale (Tool II) and comfort levels for patients undergoing abdominal surgery by comfort scale (Tool III) 20 minutes after performing the proposed intervention foot reflexology.

Analysis of data:

The gathered information was coded, arranged, and input into a computer. A statistical software for social science, version 26.0 (SPSS, Chicago, IL), was used for all statistical analyses. For quantitative variables, the arithmetic mean and standard deviation were employed to quantify the dispersion of results around the mean and to characterize the central tendency of observations. When compare between two variables with quantitative data, the Student's t-test was employed; when comparing variables with categorical data, the Chi-square [X2] test was utilized. The threshold for statistical significance was fixed at $p < 0.05$.

Results:

Table (1) : showed that the mean age in the study group was 44.45 ± 9.34 , whereas in the control group, it was 43.33 ± 8.79 years, and 52% and 54% of the studied patients in both groups were females respectively. Regarding the education level, more than half of the patients in the study group (52%) had secondary education compared to 50% in the control group. In terms of residence, the same table revealed that (72%) of study group lived in urban areas in comparing to 70% in the control group. In terms of demographic data, there was no statistically significant difference between the study and control groups.

Figure (1): it was clear that (74% and 68%) of patients undergoing abdominal surgery in both the study group and the control group respectively were not hospitalized previously.

Figure (2): Portrayed that (72%) of undergoing - abdominal surgery patients in the study groups had no previous surgery compared to 70% in the control group.

Figure (3): Illustrated that patients in both the study and the control groups (60% and 67%) respectively hadn't history of analgesic consumption.

Figure (4): Showed that (40% and 42%) of the studied patients had a higher prevalence of hepato-

biliary surgeries in both the study group and the control group respectively.

Table (2): Demonstrated that there was a highly statistically significant differences in the pain scores among the studied two groups after foot reflexology intervention ($P = <0.001$).

Figure 5: Highlighted that (47%) of the study group had severe pain compared to (44%) in the control group which decreased to be (25 % & 42%) respectively post foot reflexology intervention.

Table (3): displayed that there was a statistically significant decrease in the heart rate in the study group after foot reflexology intervention compared to the control group, with a statistically significant difference between the two studied groups ($P=<0.001^{**}$).

Table (4):- displayed that there was a statistically significant decrease in the respiratory rate in the study group after foot reflexology intervention compared to the control group, with a statistically significant difference between the two studied groups ($P=<0.001^{**}$).

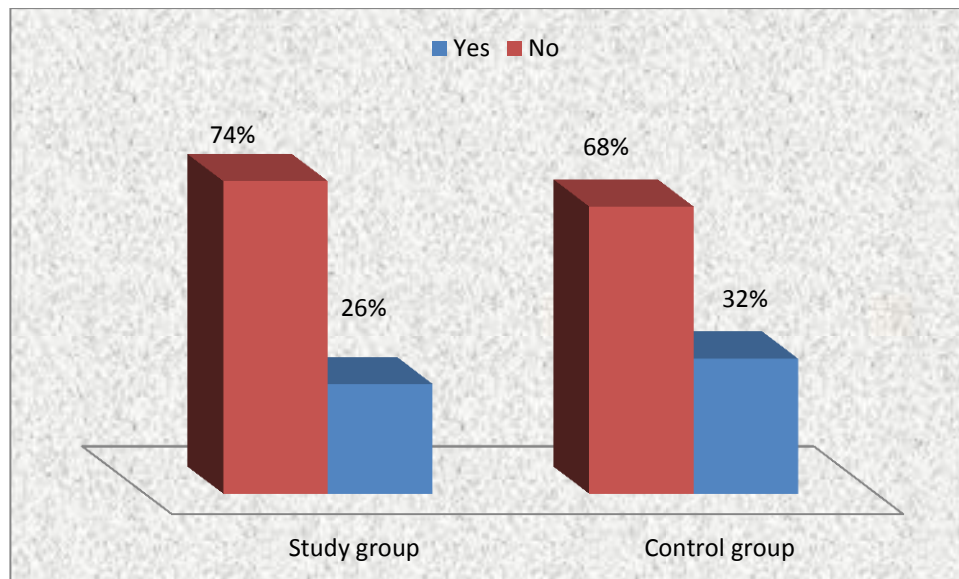
Table (5): A statistical reduction in the **systolic blood pressure (SBP)** was observed in reflexology groups after the foot reflexology intervention compared to the control group, with a statistically significant difference between groups pre and post-intervention ($P=<0.001$). Concerning **diastolic blood pressure (DBP)** the table revealed a decrease in reflexology groups after the foot reflexology intervention compared to the control group, with statistically significant differences in the pre and post-intervention($P=<0.001^{**}$).

Table (6): compared to the control group, patients in the study group were seen to be more comfortable and relaxed with statistically significant differences between pre and post-reflexology intervention regarding physical, psych spiritual, and sociocultural comfort.

Table (1): Patients' distribution according to their demographic data in both study and control groups (N=200)

Item	Study group (n=100)		Control group (n=100)		X ²	P - Value
	No.	%	No.	%		
Age						
- 20 < 40	56	56.0	58	58	4	0.5 ^{NS}
- 40 ≤ 60	44	44.0	42	42		
Mean±SD	44.45 ± 9.34		43.33 ± 8.79			
Gender						
- Male	48	48	46	46	2.1	0.5 ^{NS}
- Female	52	52	54	54		
Patients' education						
- Primary education	22	22.0	25	25.0	2	0.8 ^{NS}
- Secondary education	52	52.0	50	50.0		
- University education	26	26.0	25	25.0		
Residence:						
- Urban	72	72.0	70	70.0	3	1.4 ^{NS}
- Rural	28	28.0	30	30.0		

NS-non-significant

**Figure (1): Patients' distribution according to previous hospitalization history in both study and control groups (N=200)**

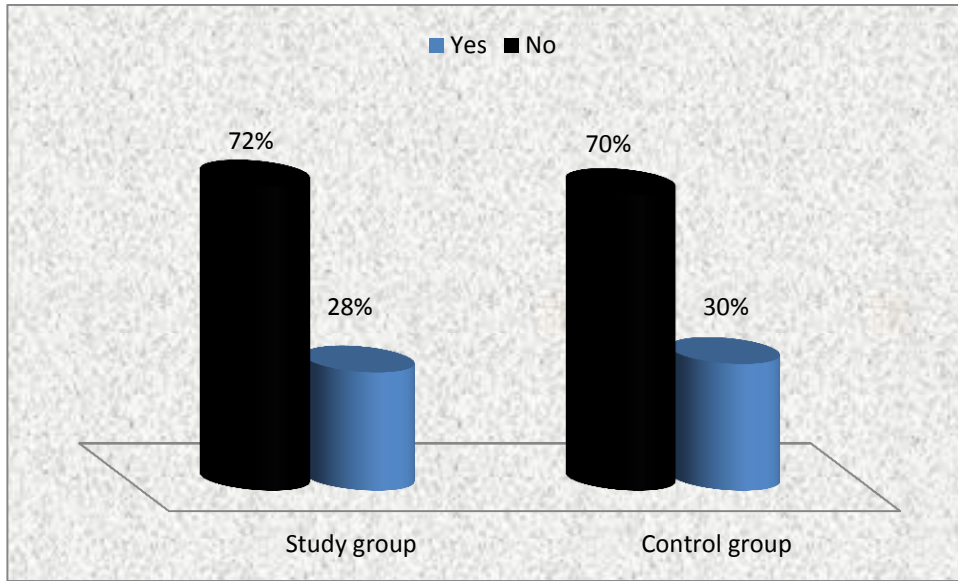


Figure (2): Patients' distribution according to previous surgery in both study and control groups (N=200)

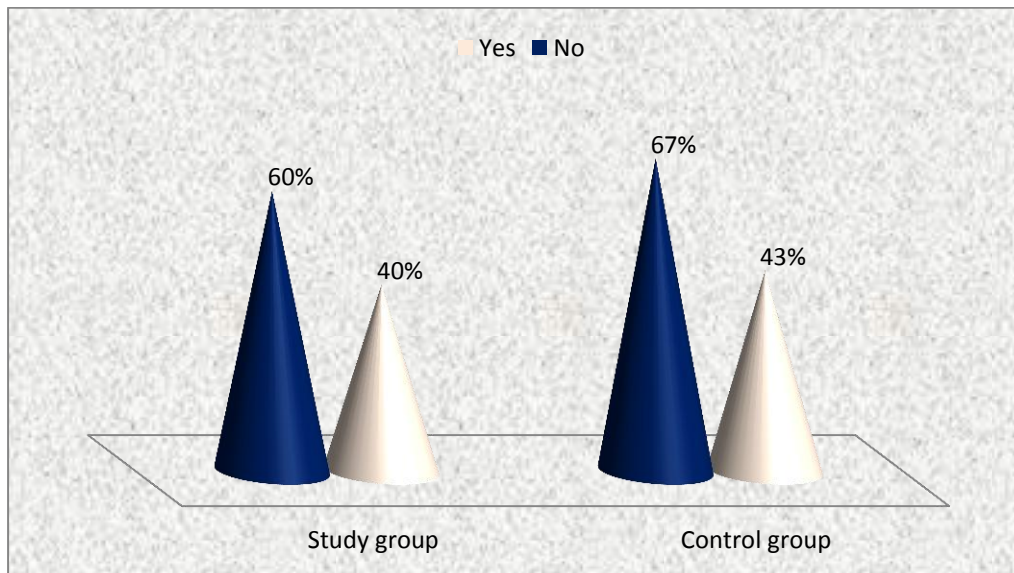


Figure (3): The studied patients' distribution according to the history of analgesic consumption in both study and control groups (N=200)

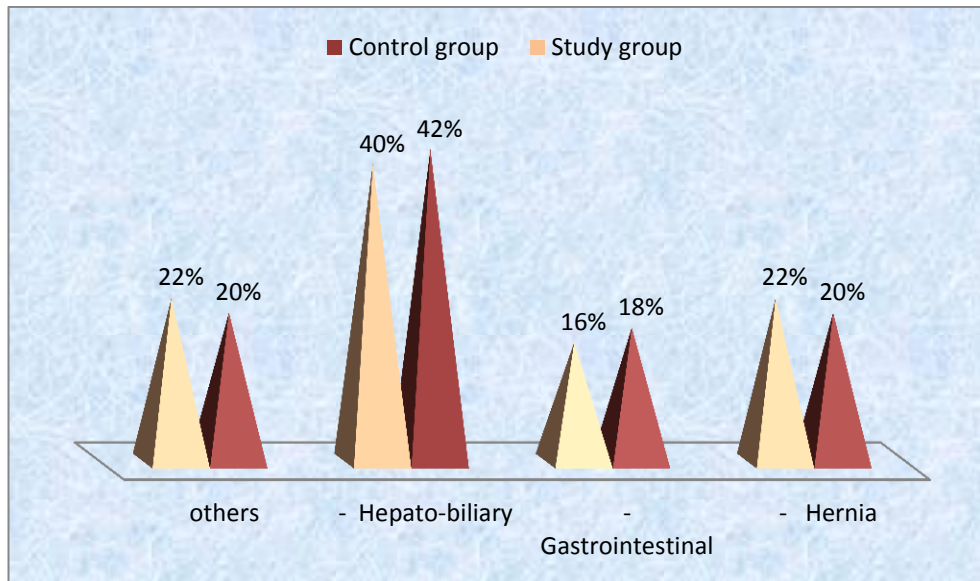


Figure (4): Patients' distribution according to surgery type in both study and control groups (N=200)

Table (2): Patient's distribution in study and control group according to Mean ±SD of pain level pre and post-foot reflexology intervention (N=200)

Pain scores	Study group (n=100)	Control group (n=100)	t-test	P-value
	Mean ±SD	Mean ±SD		
Pre foot reflexology	8.0 ±0.3	8.2 ±0.4	0.443	0.660
Post foot reflexology	6.3 ±1.2	7.6 ±0.7	5.238	<0.001 *

*Statistically significant level at P < .0001

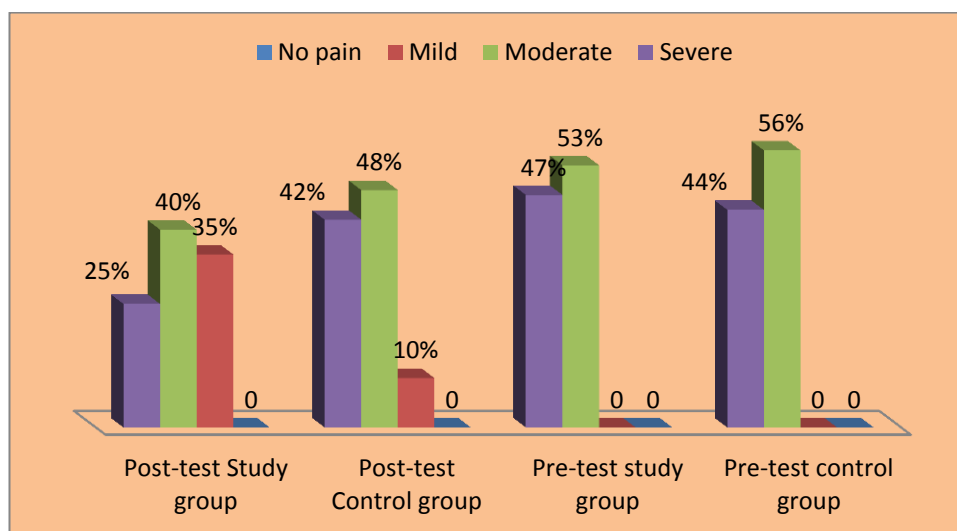


Figure (5): Distribution Percentage of the studied patients regarding their pain levels pre and post-foot reflexology intervention in the control and study groups

Table (3): Mean score differences between patients undergoing abdominal surgery in Control and study groups regarding their heart rate pre and post-foot reflexology intervention

Variable Heart Rate	Pre-foot reflexology intervention	Post-foot reflexology intervention	Paired t-test Between Groups
	Mean \pm SD	Mean \pm SD	
Control group	104.22 \pm 15.03	103.21 \pm 13.46	15.156 P=<0.001**
Study group	102.33 \pm 14.12	94.66 \pm 17.8	

*T-test*Significant level at P value < 0.05, **Significant level at P value < 0.001*

Table (4): Mean score differences between patients undergoing abdominal surgery in Control and study groups regarding their respiratory rate pre and post-foot reflexology intervention

Variable Respiratory Rate	Pre-foot reflexology intervention	Post-foot reflexology intervention	Paired t-test Between Groups
	Mean \pm SD	Mean \pm SD	
Control group	30.88 \pm 6.25	29.7 \pm 4.65	13.259 P=<0.001**
Study group	29.9 \pm 6.78	22.69 \pm 5.68	

*T-test*Significant level at P value < 0.05, **highly Significant level at P value < 0.001*

Table (5): Mean score differences between patients undergoing abdominal surgery in Control and study groups regarding their systolic and diastolic blood pressure pre and post-foot reflexology intervention.

Items	Groups	Pre-foot reflexology intervention	Post-foot reflexology intervention	Paired t-test Between Groups
		Mean \pm SD	Mean \pm SD	
Systolic blood pressure	Control	123.33 \pm 6.639	122.55 \pm 6.49	14.259 P=<0.001**
	Study	139.22 \pm 13.57	120.33 \pm 7.47	
Diastolic blood pressure	Control	74.67 \pm 6.58	72.59 \pm 7.31	11.233 P=<0.001**
	Study	75.44 \pm 12.88	68.58 \pm 5.09	

*T-test*Significant level at P value < 0.05, **highly Significant level at P value < 0.001*

Table (6): Comparison of comfort scores in the control and study groups post-foot reflexology intervention

Comfort scores (Sub dimension)	Study Group	Mean (SD)	Control Group	Mean (SD)	Test T	P - value
	Lowest-Highest (Median)		Lowest-Highest (Median)			
Physical comfort	47–70 (62)	62.8 (4.6)	30–66 (47.8)	47.7 (5.3)	14.33	<0.001
Psych spiritual comfort	46–50 (50)	50.4 (1.3)	41–50 (49)	49.0 (1.6)	5.22	<0.001
Sociocultural comfort	40–50 (45.3)	46.5 (2.3)	28–42 (35.7)	36.6 (2.3)	17.12	<0.001
The total score	139–170 (156.6)	155.7 (4.6)	107–151 (131.1)	131.3 (9.4)	19.55	<0.001

* Significant level at P < 0.001

Discussion:

Pain is one of the most prevalent symptoms with both acute and chronic illnesses report having it. Nurses play a crucial role in the management of postoperative pain especially application of non-pharmacological intervention methods, especially following abdominal surgery discomfort and pain are common patients complain, which is defined as a severe, ongoing, and subjective feeling of physical, emotional, and cognitive weariness that interferes with everyday activities. (Noe, 2020). The current study result supports the hypothesis comparison to patients who did not receive foot massage, foot reflexology significantly influences the stabilization of physiological indicators (HR, RR, SBP, DBP) of postoperative patients. This improving related to presence of around 15000 nerves in the feet that enhancing all body parts.

Pharmacologic and non-pharmacologic approaches to pain reducing management are the two most popular ones. However, not all aspects of postoperative pain may be completely relieved by the medication. According to Chanif et al., (2019), non-pharmacological interventions as patient massage may therefore assist to relieve postoperative pain. The study distinguished between two groups of pain management strategies: pharmaceutical and non-pharmacological pain relief procedures. Non-pharmacological techniques are being used more frequently in hospital and clinical settings to enhance physiological parameters and lessen or eliminate pain (Abdou & Abd El-Hafez, 2018). Hence the current study conducted in order to investigate impact of foot reflexology on pain intensity, physiological indicators, and comfort among patients undergoing abdominal surgery.

According to the current study, almost of patients in both groups lived in urban areas, and the mean age of post-abdominal surgery patients was 44.45 ± 9.34 years in the study group and 43.33 ± 8.79 years in the control group. Additionally, over half of the patients in both groups had secondary education. The study and control groups did not differ statistically significantly in terms of demographic data. According to the researchers, this reflected that the two study populations' homogeneity and the study's generalizability.

The results of the study showed that both the study and control groups' post-abdominal surgery patients had a higher proportion of female patients. Males and females respond to pain differently, with females exhibiting stronger pain sensitivity. Female sex hormones seem to be connected to these differences (Bartley & Fillingim, 2018).

The study's conclusions indicated that majority patients undergoing abdominal surgery in the control and the study group, respectively, had never been hospitalized before, had never had surgery before, and had never used analgesics before. Additionally, there was no discernible difference between the two groups' medical data. This finding suggests that both groups had similar baseline levels of discomfort, tiredness, and pain, according to the researchers. Thakur, N. (2021). also observed similar results in their study, "A Study to Evaluate Effects of Foot Massage on Incisional Pain Post-surgery Patients, Selected Hospitals in Punjab."

The current findings showed that, following foot reflexology, there were a highly statistically significant variations in the pain scores of the study group ($P = <0.001$). According to the study, reflexology can help reduce pain and anxiety because essential energy travels from the foot into every region of the body. A blockage of any kind to this flow will ultimately result in disease. Certain reflexology sites can be stimulated to release energy and break down these barriers to the flow of the canals in each foot. It also inactivates the pain pathways by secreting substances that resemble morphine (Karamisefat, et al., 2021). The findings of Brent et al. (2020), who examined the feasibility and effectiveness of foot reflexology given after a cardiac procedure and discovered that patients who got it reported significantly less pain, were similar to this particular conclusion.

As concerning to mean score of pain, the study results lined with Abdou & Abd El-Hafez (2018), who stated that there was a statistically significant difference in the mean score of pain between study group and control group at the beginning, after 15 minutes, also after 55 minutes. Furthermore, there was a small difference in the average pain score among the research subjects who had foot reflexology. Additionally, ELmetwaly (2020) investigated how foot reflexology affected the degree of anxiety, the quality of sleep, and the level of discomfort experienced by patients having thoracic surgery. They discovered that, both before and after the treatment, the study group's degree of discomfort dramatically decreased compared to the control group.

Furthermore, Keihani, et al., (2019) research revealed that foot reflexology had a major impact on how painful post-operative spinal anesthesia felt. The control group had higher mean pain scores before and after the intervention, while the study group had lower mean pain levels. Furthermore, a thorough evaluation and meta-analysis of the efficacy of foot reflexology as a nursing intervention for postoperative pain management in patients after abdominal surgery

were included in the research by **Ju et al., (2019)**, which produced comparable results.

The present study's findings showed that, in comparison to less than half of the patients in the control group, one quarter of the study group's patients experienced severe pain, indicating a decrease in pain intensity. The researchers indicate the efficiency of the foot reflexology intervention, and this finding validates the fundamental hypothesis of the study by highlighting the advantages of foot reflexology on patients' pain levels. Additionally, the results aligned with those of **Kaur et al., (2019)**, who examined " effects of hand-foot massage on postoperative pain in pen-heart surgery" and found that relaxation techniques were useful in reducing postoperative pain in undergoing open heart surgery patients.

The results of a study by **Bakir et al., (2018)**, which showed that applying foot reflexology to individuals with rheumatoid arthritis is useful in lowering their pain symptoms, corroborated this conclusion. Additionally, the current study's findings were consistent with those of **Taheri et al., (2019)** earlier investigation into pain in patients following appendectomy, which found that foot reflexology had a beneficial effect on pain reduction. Additionally, this was lined with another study conducted by (**Ghaljaji & Jalalodini, 2021**).

, which found that after receiving 20 minutes of foot reflexology, leukemic sample participants' pain mean ratings considerably decreased. The researcher believes that because vital energy travels down the pathways of the foot to all regions of the body, reflexology has positive effects on reducing pain and anxiety. Illness will eventually result from any obstruction to this flow. Reflexology points that are stimulated can dissolve these obstructions to the flow of the canal, releasing energy in each foot and deactivating the pain pathways by releasing substances that resemble morphine (**Karamisefat et al., 2021**).

The study's findings indicated that, when compared to the control group, there was a statistically significant drop in blood pressure, heart rate, and respiratory rate following the foot reflexology intervention. There was also a statistically significant difference between the two groups under investigation. Because foot reflexology reduces cortisol output and muscle tension. It also affects respiratory function, cardiac workload, and heart rate. By raising parasympathetic nervous system activation and lowering sympathetic nervous system stimulation, this technique modulates the hypothalamus and achieves its effects (**Karamisefat et al., 2021**).

Reflexology coactivates two autonomic nerve system branches, which may promote hemostasis, improve physiological parameters, and reduce discomfort, which could account for these effects, according to the researchers. The reflexology method, requires no specific equipment or skills and may be completed quickly and easily. This strategy can also be applied to people who are sick. Therapeutic approaches to lower sympathetic activity and avoid consequences associated with a hyperactive sympathetic nervous system in a patient population.

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Similar to this, the study by **Khaledifar et al., (2017)**, which looked at effects of reflex therapy and massage therapy on tension and vital signs pre cardiac angiography, showed a noteworthy improvement in several vital indicators, including, cardiac rhyme, diastolic blood pressure and breathing rate. They discovered a change in systolic blood pressure. **Zolfaghari et al. (2018)** examined the effects of touch on the dysrhythmia and vital signs of female cardiac catheterization patients in a different study. The study group's heart pulse, respiration rate, and blood pressure all considerably dropped throughout the catheterization procedure, according to the findings. The results of this investigation are consistent with another study that found that patients' mean heart rhythms differed by **Hosseini et al. (2017)** that looked at the effect of foot massage on vital indicators.

The study's findings indicated that the study group patients were perceived as being more at ease and at ease than those in the control group, with statistically significant differences observed in the pre-and post-foot reflexology intervention regarding physical, psycho-spiritual, and socio-cultural comfort. According to the researcher, applying pressure on particular foot relaxation sites, such as the solar plexus, improves blood flow and allows energy from tense areas of the body to be released, which can improve patients' physical and mental well-being.

Conclusion:

Based on the study results and hypothesis of present investigation foot reflexology intervention has a positive effect on pain reduction and increases comfort among patients undergoing abdominal surgery.

Recommendation:

Based on the results findings it recommended that:

- Foot reflexology should be used as a supplemental therapy and non-pharmacological approach in addition to routine care, to help patients undergoing abdominal surgery feel more comfortable and manage their pain,
- To make generalizations, future research should replicate this work using a bigger sample size.
- Spreading knowledge about foot reflexology among medical and surgical nurses, which they should include in their daily work.

References:

- **Abbaszadeh, Y., Allahbakhshian, A., Seyyedrasooli A., Sarbakhsh P., Goljarian S., Safaei N. (2018):** Effects of foot reflexology on anxiety and physiological parameters in patients undergoing coronary artery bypass graft surgery: A clinical trial. *Journal of Complementary Therapies in Clinical Practices*; 31(1): 220-228. doi: 10.1016/j.ctcp.2018.02.018.
- **Abdou F., Abd El-Hafez A. (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*; 3 (8): 2121-2128.
- **Bakir E., Samancioglu S., Gursoy S. (2018):** The effects of reflexology on pain and sleep deprivation in patients with rheumatoid arthritis: A randomized controlled trial. *Complementary Therapies in Clinical Practice*; 31(1) 315-319
- **Ballard, A., Khadra, C., Adler, S., Trottier, E. D., & Le May, S. (2019):** Efficacy of the Buzzy device for pain management during needle-related procedures: A systematic review and meta-analysis. *The Clinical Journal of Pain*; 35(6), 532–543.
- **Bartley, A., & Fillingim, T. (2018):** Evaluation of efficacy and feasibility of foot reflexology in patients experiencing chronic or persistent pain. *Bulletin du Cancer, John Libbey Eurotext*; 1073 - 1079. Published by Elsevier. <https://hal.archives-ouvertes.fr/hal-03488391>
- **Brent, A, B. Cutshall, S, M. Wentworth, L, G. Engen, D, Messner, P, Q. Wood, K, M. Brekke, K, M. Kelly, R, F. (2020):** Effect of massage therapy on pain, anxiety, and tension in cardiac surgical patients. *Complementary therapies in clinical practice*, 16(2): p. 92-95.
- **Chandrababu, R., Rathinasamy, E. L., Suresh, C., & Ramesh, J. (2019):** Effectiveness of reflexology on the anxiety of patients undergoing cardiovascular interventional procedures: A systematic review and meta-analysis of randomized controlled trials. *Journal of Advanced Nursing*, 75(1), 43-53.
- **Chanif, C., Petpichetchian, W., & Chongchareon, W. (2019):** Does foot massage relieve acute postoperative pain? *Nurse Media Journal of Nursing*, Jan 31; 3(1):483-97.
- **El Fekey E., Omara H., El Refaye GH. (2018):** Effect of Foot Reflexology on Stress and Anxiety during Pregnancy. *Medical Journal of Cairo University*; 86(3): 1607-1611.
- **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).
- **El-Refaye, G. E., & Elsisy, H. F. E. M. (2017):** The blood pressure response to foot reflexology adjunct to transcendental meditation training on postmenopausal hypertension. *Physical Therapy and Rehabilitation*, 4(4), 1-8.
- **Elsayed, A., Kandeel, N., Abd El-Aziz, 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(4): 412-419.
- **Esther Lilly, A., & Dakshayani, B. (2018):** Effect of preoperative teaching on the anxiety level of patients with neurosurgery. *Indian Journal of Psychiatric Nursing*, 15(2), 1. <https://doi.org/10.4103/2231-1505.262432>.
- **Gan TJ, Habib AS, Miller TE, White W, Apfelbaum JL. (2017):** Incidence, patient satisfaction, and perceptions of post-surgical pain: Results from a US national survey. *Current Medical Research and Opinion*, Jan 1; 30(1):149-60. DOI: 10.1185/03007995.2013.860019

- **Ghaljaei F., Jalalodini A. (2021):** The effects of foot reflexology on pain and physiological indicators in children with leukemia under chemotherapy: a clinical trial study. *Reports of Practical Oncology and Radiotherapy*; 26(6): 955–961.
- **Hisato Takagi TA, Umemoto T. (2017):** Perioperative Depression or Anxiety and Postoperative Mortality in Cardiac Surgery: A Systematic Review and *Meta-analysis*, Springer. DOI: 10.1007/s00380-017-1022-3.
- **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.
- **Jazayeri, Z., Sajadi, M., & Dalvand, H. (2021):** Comparison of the effect of foot reflexology and body massage on physiological indicators and bilirubin levels in neonates under phototherapy. *Complementary Therapies Medicine*; 59(2): 102684. doi: 10.1016/j.ctim.2021.102684, indexed in Pubmed: 33609634.
- **Ju, W. Ren, L. Chen, J. & Du, Y. (2019):** Efficacy of relaxation therapy as an effective nursing intervention for postoperative 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.
- **Karakaplan, S., & Yıldız, H. (2010):** A study on developing a postpartum comfort scale. *Maltepe University Journal of Nursing Science and Art*, 3, 55–65. <http://hemsirelik.maltepe.edu.tr/dergiler/cilt3sayi1/55-65.pdf>
- **Karamisefat M., Cheraghi F., Soltanian A., (2021):** Tehrani T. The Effect of Foot Massage on Pain of Preschoolers Undergoing Venipuncture: A Clinical Trial. *Evidence-based care Journal*; 10(4): 49-58
- **Kaur S, Lobo DJ, Latha T. (2019):** Role of foot and hand massage on the anxiety for postoperative open-heart surgery patients: A Randomized Control Trial. *International Journal of Nursing Education*, Jul 1; 5(2):205.
- **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. & Koraş K. (2019):** The Effect of Foot Massage on Postoperative Pain and Anxiety Levels in Laparoscopic Cholecystectomy Surgery: A Randomized Controlled Experimental Study, *Journal of Perianaesthesia Nursing*; 34(3):551-558. Doi: 10.1016/j.jopan.07.006.
- **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.
- **Kuguoglu, S., & Karabacak, U. (2008):** Turkish version of the General Comfort Questionnaire. *Istanbul University Florence Nightingale School of Nursing Journal*, 16, 16–23.
- **Louise Keet. (2018):** The Reflexology Bible: The Definitive Guide to Pressure Point Healing. 1st ed. Octopus Publishing Group Ltd 2008. Pp 96-174. ISBN 978 - 1-841 -81 341-7
- **Mansouri, A., Shadadi H., Moghadam, M. (2017):** Evaluation of the effect of foot reflexology massage on vital signs and anxiety after blood transfusions in children with thalassemia. *Bali Medical Journal*; 6(3): 623-629
- **McCaffery M. (1999):** Pain management: problems and progress. In: McCaffery M, Pasero CL. Pain: clinical manual. 2nd ed. St. Louis: Mosby:1–14. 1. <https://doi.org/10.1046/j.1365-2702.2000.0374c.x>
- **Noe, C. E. (2020):** *Pain Management for Clinicians, 1st*, Springer, Switzerland, p; 88.
- **Ndebea, A,S., Heuvel, S., Temu, R, Kaino, M,M., Boekel, R, Steegers, M**

- (2020), Prevalence and Risk Factors for Acute Postoperative Pain After Elective Orthopedic and General Surgery at a Tertiary Referral Hospital in Tanzania. Volume 2020:13 Pages 3005—3011 DOI <https://doi.org/10.2147/JPR.S258954>
- **Öztürk R., Sevil U., Sargin A. (2018):** The effects of reflexology on anxiety and pain in patients after abdominal hysterectomy: A randomized controlled trial. *Journal of Complementary Therapies in Medicine*; 36 (1): 107-112
 - **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.
 - **Rambod M, Pasyar N., Shamsadini M. (2019):** The effect of foot reflexology on fatigue, pain, and sleep quality in lymphoma patients: A clinical trial. *European Journal of Oncology Nursing*; 43: 101678. <https://doi.org/10.1016/j.ejon.2019.101678>
 - **Ray, B. S., Natha, H., & Nageshwar, V. (2017):** Foot reflexology: effect on pain and anxiety in the post-operative patient. *International Education and Research Journal*, 3(5), 49-51.
 - **Ruth Hull. (2011):** The Complete Guide to Reflexology. 3rd ed. Healing Arts Press Co., Pp 70-80. ISBN13: 9781644116265
 - **Sadeghi Shermeh, M., Bozorgzad, P., Ghafourian, A., Ebadi, A., Razmjoei, N., Afzali, M., & Azizi, A. (2019):** Effect of foot reflexology on sternotomy pain after coronary artery bypass graft surgery. *Iranian Journal of Critical Care Nursing Summer*, 2, 51-4.
 - **Sung, A. (2019):** Complementary and alternative medicine in cancer pain management: a systematic review. *Indian Journal of Palliative Care*; 21(1): 105–115. Doi: 10.4103/0973-1075.150202.
 - **Taheri, H., Salahshour, V., Abedi, A., & Sajadi, M. (2019):** Comparing the Effect of Foot and Hand Reflexology on Pain Severity after Appendectomy: A Randomized Clinical Trial. *Iranian journal of nursing and midwifery research*; 24 (6): 451–456. https://doi.org/10.4103/ijnmr.IJNMR_8518
 - **Thakur, N. (2021).** A Quasi Experimental Study to Assess the Effectiveness of Foot Massage on Incisional pain and sleep pattern among Post Caesarean Mothers admitted in selected hospitals, Hoshiarpur, Punjab. *Asian Journal of Nursing Education and Research*, 11(3), 395-400.
 - **Van Dijk J., Vervoort S., Van Wijck A., Kalkman, C., & Schuurmans, M. (2016):** Postoperative patients' perspectives on rating pain: A qualitative study. *International journal of nursing studies*; 53(1):260-9.
 - **Zolfaghari, M. Eybpoosh, S. & Hazrati, M. (2018):** 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>.