

# Effects of Reflexology on Post-Operative Pain Severity after Laparoscopic Appendectomy for Patients at Surgical Units

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## Abstract

**Background:** Reflexology is a type of massage that involves applying different amounts of pressure to the feet, hands, and ears. It is based on a theory that, these body parts are connected to certain organs and body systems. **Aim:** The study was aimed to evaluate the effect of reflexology on post-operative pain severity after laparoscopic appendectomy for patients at surgical units. **Methods:** A quasi-experimental research design was utilized to conduct this study in the general surgery department at Benha University Hospital. A purposive sample of (60) adult patients post laparoscopic appendectomy were included in this study. Three tools were used; (Tool I) patients' knowledge assessment questionnaire, (Tool II) patients' practice observational checklist and (Tool III) visual pain analogue scale to assess pain severity. **Results:** This study showed that most patients (study group) had an unsatisfactory level of total knowledge and inadequate total practice regarding reflexology technique after laparoscopic appendectomy pre intervention (22% and 2%). This result improved significantly regarding all knowledge and practice elements post intervention, where the majority of patients (study group) had satisfactory level of total knowledge and adequate total practice (82% and 95%). Also, there was marked improvement in pain severity among the study group pre and post intervention. While, there was no improvement noticed in the control group regarding their total knowledge, practice, and pain severity pre and post intervention. **Conclusion:** The current study concluded that, performance of the study group post intervention concerning pain severity has been greatly improved after application of reflexology technique that supports the first and second research hypotheses. Also, there was a significant negative correlation between patients' performance and pain severity immediate post intervention for the study group that supports the third research hypothesis. The study **recommended** continuous in-service training programs and repeating the study on a high probability sample to achieve generalization of the findings.

**Keywords:** Reflexology, laparoscopic appendectomy, patients, postoperative pain severity.

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## Introduction

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Reflexology is considered to be a form of Complementary and Alternative Medicine (CAM). CAM refers to treatments used to, or instead of conventional medical care. The House of Lords Select Committee for Science and Technology has placed reflexology in group two, categorized as therapies used mostly to complement conventional medicine. Its popularity has increased in recent years as the public seek more holistic ways to maintain good health and well-being. In fact CAM is increasingly being considered as a safe and effective way of reducing the causes and impacts of pain and disease (*Lee, et al., 2011*).

Reflexology is a treatment based on the principle that there are areas and points on the feet, hands, and ears that are connected through the nervous system to corresponding parts of the body. When pressure is applied to these areas and points, it stimulates the movement of energy along the nerve channels and helps to restore homeostasis balance in the body (*Zarifian, 2017*).

The benefits of reflexology include its ability to stimulate nerve function, increase energy, boost circulation, induce a deep state of relaxation, and eliminate toxins from the body. Moreover, it helps to stimulate the central nervous system, prevent migraines, and treat urinary tract conditions. This type of massage speeds up recovery after an injury or surgery, reduces sleep disorders, and relieves depression and pain. It also helps in relieving side effects associated with

cancer treatment and even decreases the pain of pregnancy, even the one occurring after delivery (*Staughton, 2020*).

Contraindications of reflexology include Internal bleeding, either recently or currently, being under the influence of alcohol or banned substances, varicose veins or a history of similar conditions, contagious skin conditions, athlete's foot or other fungal conditions, viral infections causing vomiting or diarrhea, severe bruising, bone fractures of bone bruises, gout, or swelling and inflammation in and around joints, any cuts, open wounds or sores, excessive scar tissue, sunburn, internal implants and haematomas (*Fuller, 2016*).

The roles and responsibilities of nurses had changed regarding technological advances and scientific knowledge. As a result, there is a need for inclusion and proper use of complementary therapies in nursing interventions. At this point, nurses need to learn about therapies with multidimensional benefits such as reflexology. Reflexology is thought to have a powerful therapeutic effect between nurse and patient, because touching creates a safe and unbiased environment and has strong therapeutic aspect through a sincere nurse-patient relationship (*küçükkeleşçe & Karaca, 2017*).

## Significance of the study:

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Appendicitis is one of the most common surgical emergencies, and it is one of the most common causes of abdominal pain. Globally, the incidence of appendicitis or appendectomy is around 100 per 100,000 person years

(*Ferris et al., 2017*). Appendicitis occurs in 7% of the US population, with an incidence of 1.1 cases per 1000 people per year. (*Craig and Brenner, 2020*).

### **Aim of the study**

The study was aimed to evaluate the effect of reflexology on post-operative pain severity after laparoscopic appendectomy for patients at surgical units.

### **Operational definition**

Patients' performance means patients' knowledge and practice.

### **Research Hypotheses**

The following research hypotheses were formulated to fulfill the aim of the study:

- H1:** Performance of the study group will be improved post intervention than the control group.
- H2:** The study group will be able to manage pain post intervention than the control group.
- H3:** There will be significant negative correlation between patients' performance and pain severity post intervention for the study group.

### **Subjects and Methods**

#### **Research design**

A quasi-experimental (pre/posttest) design was utilized to achieve the study's aim.

#### **Research Setting**

The study was conducted in general surgery department affiliated to Benha University Hospital, Benha Egypt. The general surgery department contains 10

rooms, a nursing station and physician office, and each room includes 5 beds.

#### **Sample:**

A purposive sample of 60 adult patients post laparoscopic appendectomy were included in this study, and divided randomly into two equal groups (30 study & 30 control groups). **Group I (study group):** consisted of (30) patients who received the intervention along with the routine hospital care. And **Group II (control group):** consisted of (30) patients who received the routine hospital care only. According to the following criteria:

#### **Inclusion criteria:**

- 1- Patients between the ages of 30–60 years, of both sexes.
- 2- Patients who agreed to participate in the study and able to communicate effectively.

#### **Exclusion criteria:**

- 1- Patients who had hands and feet amputations, diseases (arthritis), inflammation, phlebitis, or edema, burn wound, lesion or fractures in hands and feet; had any problems related to vessels and blood, diabetes, visual disorders, hearing disorders and also hypersensitivity to hands and feet massage.
- 2- Patients with appendicular mass, appendicular abscess, or localized peritonitis also were excluded from this study.

According to statistical office of Benha University Hospital, the total annual admissions of patients with laparoscopic appendectomy surgery who met the previously mentioned criteria

were 80 patients (*Statistical Office in Benha University Hospital, 2019*). Sample size was calculated according to the following equation that adopted from *Taylor, (2014)*:

$$n = \frac{N}{1+N(e)^2}$$

Where: n = sample size, N= total population size, e = margin error (0.05).

After doing the equation, the sample was (66) patients divided randomly into two equal groups, (30) patients for study group and (30) patients for control group and (6) patients were chosen for pilot study and were excluded later from the main study.

### **Data Collection Tools**

Three tools were used to collect data for this study; patients' knowledge assessment questionnaire, Observational checklist to assess patients' practice regarding reflexology & Visual Analogue Pain Scale. The first and second tools were developed by the researcher after reviewing recent related literature.

#### **Tool I: Patients' Knowledge Assessment Questionnaire:**

This tool was developed by the researcher. It was translated into Arabic language after reviewing recent relevant literature. It involved the following two parts:

**Part (1):** is concerned with the assessment of patients' socio-demographic characteristics related to their age, sex, marital status, educational level, and family history regarding appendectomy.

**Part (2):** aimed to assess patients' knowledge about reflexology. It was adapted from *El-Abd, (2018)*. It included (6) items related to the definition, types, benefits, effects, principles and precautions of reflexology.

The questionnaire tool contained (12) questions about reflexology. All knowledge items were multiple-choice questions. The patients were asked to reply to these questions with only one correct response for each question pre and post intervention.

#### **Scoring system:**

Two scoring levels for questions were used. The correct answer was scored (1), the incorrect answer, and not known was scored (0). The total score was (12) resulting from adding the total number of questions. Then the results were converted into a percentage. Total knowledge score was categorized as:

- $\geq 70\%$  was considered a satisfactory level of knowledge (8 degrees or more).
- $< 70\%$  was considered as an unsatisfactory level of knowledge (Less than 8 degrees).

#### **Tool II: Observational checklist to assess Patients' Practice regarding reflexology:**

It was aimed to assess patients' practice regarding reflexology technique. It was adapted from *Tuggle, (2012)*, the checklist included (21) steps related to preparation (4steps), and procedure (17 steps). Each patient was observed and the checklist was filled by the researcher.

**Scoring system:**

Two scoring levels were used: done was scored (1), and not done was scored (0). The total score was (21), resulting from multiplying the total number of scores, and then the results were converted into a percentage. Total practice score was categorized as:

- $\geq 70\%$  was considered an adequate level of practice (14 scores or more).
- $< 70\%$  was considered as an inadequate level of practice (Less than 14 scores).

**Tool III: Visual Analogue Pain Scale:**

It was adopted from *Griensven, et al., (2013)* to assess the severity of pain levels for patients post laparoscopic appendectomy. The scale composed of (5) items ranged from "no pain" to "worst possible pain".

**Scoring system:**

The total scores of visual analogue pain scale ranged from (0-10), the higher scores reflect the worst pain. It was categorized as the following:

- 0 was considered "no pain".
- 1-3 was considered "mild pain".
- 4-6 was considered "moderate pain".
- 7-9 was considered "severe pain".
- 10 were considered "worst possible pain"

**Field work:**

**Ethical considerations:** After explaining the aim of the study, official permission for data collection was obtained from the director responsible for the general surgery department at Benha University Hospital. Verbal consent was obtained from patients to

participate in this study after explaining the study's aim.

Patients were informed about confidentiality of the obtained information and the nature of the study. They were reassured that the obtained information was used only for the purpose of the study. They have the right at any time to withdraw from the research without giving any reason.

A pilot study was conducted on six patients (10%) of all patients at general surgery department to test the feasibility of research process, clarity and applicability of the study tools and to estimate the time needed for filling the questionnaire, checklist & pain scale. Also, to identify any possible obstacles that may hinder data collection. Some improvements were made to the developed tools. The patients who were included in the pilot study were excluded from the main study sample.

The content validity was done through a panel of five experts in the medical surgical nursing specialty for face and content validity. Their opinions were requested via an assessment form. The experts were asked to grade each item as "essential," "useful but inadequate," or "unnecessary." According to the panel's judgment on the clarity of sentences and appropriateness of the content, minor modifications were carried out. The consensus among experts regarding the structured interviewing questionnaire was 98% and the observational checklist was 97% for most items. The same experts revised the developed intervention program based on the current literature, and all recommended modifications were made. The reliability of the tools has, therefore,

been checked using the method of internal consistency. The Cronbach alpha reliability coefficient was (0.976) for the knowledge questionnaire and (0.807) for the observational checklist which proved high.

The researcher developed the intervention program after reviewing the related literature. It covered the following information: definition, types, benefits, effects, principles, technique and precautions of reflexology.

The study was conducted through three phases:

**Assessment Phase:** It was carried out for all studied subjects by the researcher to collect baseline data regarding patients' knowledge & practice about laparoscopic appendectomy. The researcher attended the clinical setting two days per week during morning shifts. The researcher interviewed each patient after his/her admission to the hospital to collect baseline data about socio- demographic data, medical data and knowledge assessment sheet using (**Tool I**). All the studied patients were observed after laparoscopic appendectomy using (**Tool II**) before applying the intervention. Then, both groups were assessed for pain severity using (**Tool III**).

**The implementation phase** included the following steps:

- Setting general and specific objectives.
- Preparation of materials needed for session's implementation.
- The researcher dialed with control group firstly to avoid contamination of data then study group.

- The researcher divided the studied patients (study group) into five groups, and each group consisted of six patients.
- The intervention was carried out for each group from study group separately through the conduction of sessions according to the studied patients' actual needs assessment.
- The intervention was conducted in 5 sessions, two sessions per week. Each session lasted about 30 minutes, including periods of discussion according to the patients' progress and feedback.
- Different teaching tools and media were used, including seminars, group discussions, and presentations.
- Sampling and data collection were started and completed during the period from July 2020 till the end of December 2020.
- Each group attended the following sessions:

The first session covered the definition, types, and benefits of reflexology. The Second session started with a review of the previously presented principles and advancement to the next step, which centered on reflexology effects on health. The third session concentrated on precautions and principles of reflexology.

The fourth session began with reviewing the points that were previously instructed. It focused on the preparations and precautions for reflexology and demonstrating about proper position during procedure. The fifth session focused on demonstration of postoperative reflexology technique.

**Evaluation Phase:** The evaluation had been made immediately after intervention by using the same tools of the pretest. The researcher reassessed knowledge, practice and pain level to the control group and, evaluating the effect of intervention on knowledge, practice and pain management of the study group by comparing the results pre and post intervention.

A comparison between both groups (study group and control group) was done for two times: the first before intervention and the second was done after intervention to determine the effect of reflexology on post-operative pain severity after laparoscopic appendectomy for patients at surgical units.

### Data Analysis

The data collected were structured, tabulated, and statistically analyzed using SPSS (Version 20 of the statistical computer software package). Average and standard deviations were determined for the spectrum of quantitative variables. The number and percentage distribution were computed for qualitative variables. A Chi-square test was used to analyze the relationship between qualitative variables. Paired t-test was used to determine the mean difference between two sets of observations. For interpretation of outcomes of significance, significance was adopted at  $p \leq 0.05$ , and high statistically significant at  $p \leq 0.001$ .

### Results:

**Table (1): shows that,** 66.6% and 63.3% of the study and control groups aged between 30- < 40 years with mean age of  $39.9 \pm 11.75$  and

$38.9 \pm 12.23$  respectively. As well, 66.7% and 46.7% of both groups were males respectively. Also, 90% and 93.3% of both groups were married respectively. Moreover, 46.7% and 36.7% of both groups were illiterate respectively. As well, 56.7% of study group and 63.3% of control had family history of appendicitis respectively.

**Table (2): shows that,** there was high statistically significant difference between study and control groups post intervention regarding all items of knowledge as observed (P-value =0.001). As well, 93.3, and 90% of the study group had incorrect answers about benefits, definition, and precautions of reflexology respectively pre intervention which improved to be correct post intervention as observed: 70%, and 86.6% compared to the control group which had no improvement noticed post intervention for the same items as observed: 13.3, and 6.6% pre intervention, and 16.6%, and 10% post intervention respectively.

**Figure (1) illustrates that,** there was marked improvement in study group regarding satisfactory level of knowledge from 22% pre intervention to 82% post intervention compared to control group which had no improvement noticed pre and post intervention.

**Table (3): shows that,** there was high statistically significant difference between study and control groups post intervention regarding all items of practice as observed (P-value =0.001). As well, 90% of the study group didn't perform the procedure perfectly pre intervention which improved to be 86.6% post intervention compared to the

control group which had no improvement noticed for the same items as observed: 6.6% pre intervention, and 16.6% post intervention respectively.

**Figure (2) illustrates that,** there was marked improvement in study group regarding adequate level of practice from 2% pre intervention to 95% post intervention compared to control group which had no improvement noticed pre and post intervention.

**Table (4): shows that,** there was no statistically significant difference between study and control groups pre intervention regarding pain severity. While, there was high statistically significant difference between them post intervention. As well, 73.3% of the study group complained of severe pain pre intervention with mean pain level  $5.4 \pm 1.3$  compared by none of them post intervention, while, there was no improvement in pain severity among the control group pre and post intervention.

**Table (5): shows that,** there was no statistically significant difference between study and control groups pre intervention regarding their physiologic parameters. While, there was high statistically significant difference between them post intervention. As well, there was marked improvement in the study group physiologic parameters pre intervention compared to post intervention. While, there was no improvement in physiologic parameters among the control group pre and post intervention.

**Table (6): shows that,** there was statistically significant positive correlation between total pain score and physiologic parameters among study

group pre and post intervention. While, there was no statistically significant correlation between total pain score and physiologic parameters among control group pre and post intervention.

**Table (7): shows that,** there was statistically significant negative correlation between total pain score and total performance scores among study group pre and post intervention which means that when patients' knowledge and practice levels increase, the severity of pain will decrease. While, there was no statistically significant correlation between total pain score and total performance scores among control group pre and post intervention.



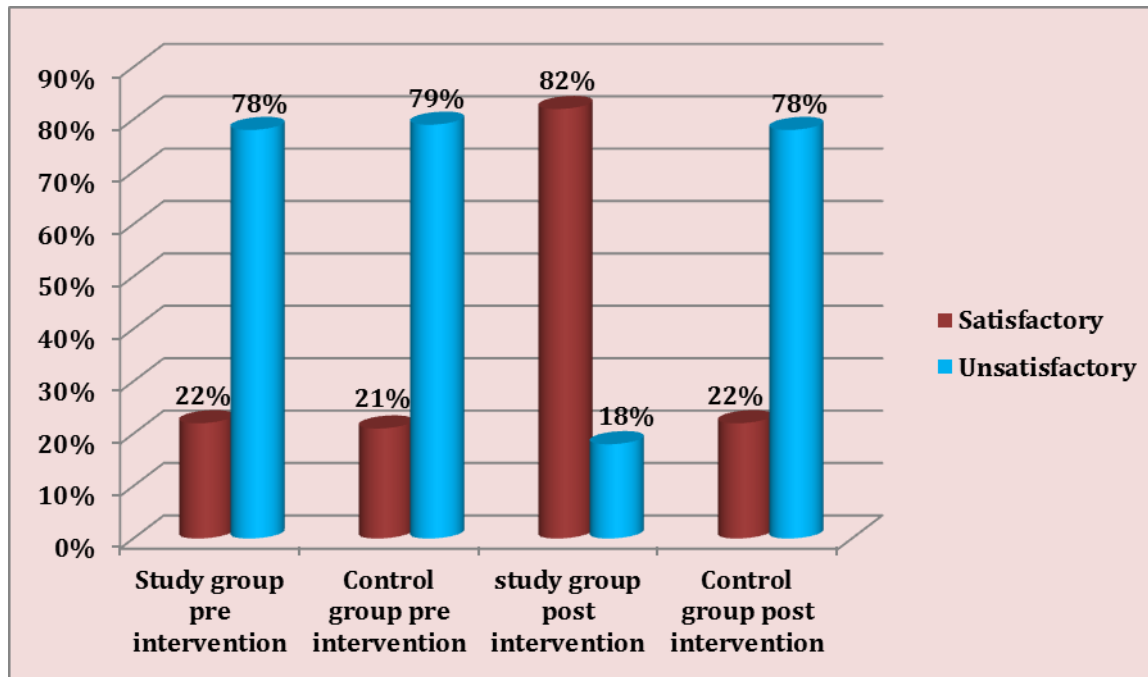
**Table (1): Distribution of patients (both groups) regarding their demographic characteristics (n=60).**

Items	Patient data	Study group n=30		Control group n=30	
		N	%	N	%
Age	30- < 40	20	66.66	19	63.33
	41- < 50	5	16.6	6	20.0
	51- < 60	5	16.6	5	16.6
	Mean $\pm$ SD	39.9 $\pm$ 11.75		38.9 $\pm$ 12.23	
Sex	Female	10	33.3	16	53.3
	Male	20	66.7	14	46.7
Marital status	Married	27	90.0	28	93.3
	Not Married	3	10.0	2	6.7
Educational level	Illiterate	14	46.7	11	36.7
	Primary education	9	30.0	10	33.3
	Secondary education	6	20.0	5	16.7
	University education	1	3.33	4	13.3
Family history	Yes	17	56.7	19	63.3
	No	13	43.3	11	36.6

Table (2): Comparison of patients' total knowledge (both groups) pre and post program intervention (n=60)

Knowledge items	Pre- Intervention								Post- Intervention								X <sup>2</sup> 1	P-value	X <sup>2</sup> 2	P-value
	Study group n=30				Control group n=30				Study group n=30				Control group n=30							
	Correct		Incorrect		Correct		Incorrect		Correct		Incorrect		Correct		Incorrect					
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%				
Definition of reflexology	3	10	27	90	2	6.6	28	93.3	26	86.6	4	13.3	3	10	27	90	0.213	0.644	22.79	.000**
Types of reflexology	5	16.6	25	83.3	3	10	27	90	24	80	6	20	7	23.3	23	76.6	0.39	0.531	24.75	.000**
Benefits of reflexology	2	6.6	28	93.3	4	13.3	26	86.6	21	70	9	30	5	16.6	25	83.3	5.00	0.525	14.58	.000**
Effects of reflexology on pain	5	16.6	25	83.3	3	10	27	90	24	80	6	20	7	23.3	23	76.6	0.00	1.000	17.28	.000**
Principles of reflexology on pain	4	13.3	26	86.6	3	10	27	90	21	70	9	30	5	16.6	25	83.3	5.00	0.525	14.58	.000**
Precautions during reflexology	3	10	27	90	2	6.6	28	93.3	26	86.6	4	13.3	3	10	27	90	0.213	0.644	22.79	.000**

X<sup>2</sup>1 between study and control group pre-program. X<sup>2</sup>2 between study and control group post- program.  
 High statistically significant at (p≤0.001) \*\* x2=chi-square test

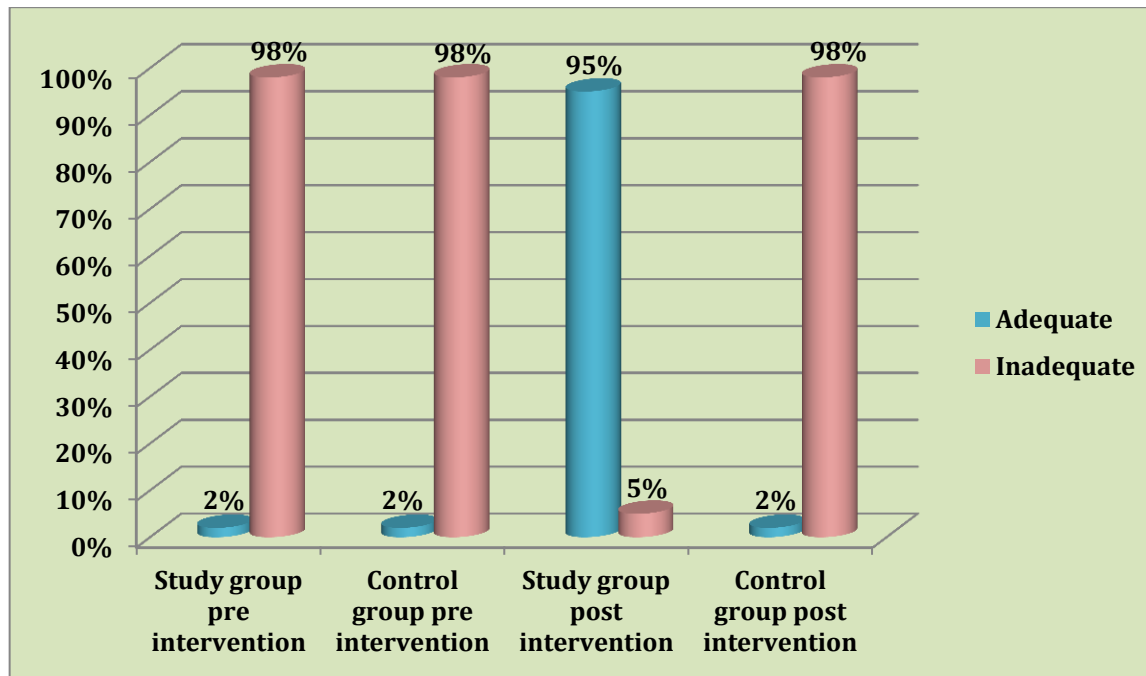


**Fig (1): Distribution of patients (both groups) regarding their total knowledge score pre and post intervention (n=60)**

Table (3): Comparison of patients' total practice (both groups) pre and post program implementation (n=60)

Practice items	Pre- preprogram								Post- preprogram								X <sup>2</sup> 1	p-value	X <sup>2</sup> 2	P- value
	Study group n=30				Control group n=30				Study group n=30				Control group n=30							
	Done		Not done		Done		Not done		Done		Not done		Done		Not done					
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%				
Preparation	5	16.6	25	83.3	3	10	27	90	24	80	6	20	7	23.3	23	76.6	0.00	1.000	17.28	.000**
Precautions before procedure	4	13.3	26	86.6	3	10	27	90	21	70	9	30	5	16.6	25	83.3	5.00	0.525	14.58	.000**
Performing procedure	3	10	27	90	2	6.6	28	93.3	26	86.6	4	13.3	5	16.6	25	83.3	0.213	0.644	22.79	.000**
Finishing procedure	4	13.3	26	86.6	3	10	27	90	21	70	9	30	7	23.3	23	76.6	5.00	0.525	14.58	.000**

X<sup>2</sup>1 between study and control group pre-program. X<sup>2</sup>2 between study and control group post- program.  
 High statistically significant at (p≤0.001)\*\* x2=chi-square test



**Fig (2):** Distribution of patients (both groups) regarding their total Practice score pre and post intervention (n=60)

Table (4): Comparison between patients (both groups) regarding their pain severity pre and post program (n=60)

Pain severity	Pre- preprogram				Post- preprogram				X <sup>2</sup> 1	P-value	X <sup>2</sup> 2	P-value
	Study group n=30		Control group n=30		Study group n=30		Control group n=30					
	N	%	N	%	N	%	N	%				
Mild	0	4.0	0	0.0	23	76.6	0	0.0	0.821	.663	0.070	.000*
Moderate	8	26.6	9	30.0	7	23.3	26	33.3				
Severe	22	73.3	21	70.0	0	0.0	20	66.6				
Mean ±SD	5.4 ± 1.3		5.9 ± 1.4		3.96 ± 1.6		5.7 ± 1.8					

X<sup>2</sup>1 between study and control group pre-program. X<sup>2</sup>2 between study and control group post- program.

High statistically significant at (p≤0.001) \*\* x<sup>2</sup>=chi-square test

Table (5): Comparison between patients (both groups) regarding their physiologic parameters pre and post intervention (n=60)

Physiologic parameters	Pre- preprogram		Post- preprogram		Paired t-test	P1	Paired t-test	P2
	Study group n=30	Control group n=30	Study group n=30	Control group n=30				
	Mean±SD	Mean±SD	Mean±SD	Mean±SD				
Pulse rate	90.70 ± 10.86	93.0±9.01	73.57±6.97	81.20±8.69	0.079	0.001	0.124	.000**
Respiratory rate	22.05±5.01	21.04±6.02	18.03±5.04	20.06±7.03	0.248	0.263	0.129	.000**
Systolic blood pressure	152.1±15.01	148.0±14.07	124.8±6.76	144.4±13.30	1.56	0.210	13.09	.000**
Diastolic blood pressure	98.67±9.42	97.27±10.52	70.67±4.69	89.87±8.80	0.213	0.644	22.79	.000**

P1 between study and control group pre-program P2 between study and control group post- program

High statistically significant at (p≤0.001) \*\*

Table (6): Correlation between total pain score and physiologic parameters among study and control groups pre and post intervention (n=60).

Physiologic Parameters	Total Pain							
	Study				Control			
	Pre		Post		Pre		Post	
	r	P-value	r	P-value	r	P-value	r	P-value
Pulse rate	0.019	0.001**	0.360	0.001**	0.004	0.985	0.059	0.757
Respiratory rate	0.006	0.001**	0.494	0.001**	0.127	0.504	0.153	0.530
Systolic blood pressure	0.195	0.001**	0.352	0.001**	0.139	0.504	0.240	0.688
Diastolic blood pressure	0.301	0.001**	0.443	0.001**	0.150	0.593	0.036	0.850

Statistically in-significant at ( $p>0.05$ ) statistically significant at ( $p\leq 0.05^*$ ) high statistically significant at ( $p<0.001^{**}$ )

Table (7): Correlation between total pain score and total performance scores among study and control groups pre and post intervention (n=60).

Total Performance	Total Pain							
	Study				Control			
	Pre		Post		Pre		Post	
	r	p-value	r	p-value	r	p-value	r	p-value
Total Knowledge	-0.120	-0.570	-0.324	-0.052*	0.412	0.684	0.519	0.602
Total Practice	-0.130	-0.693	-0.093	-0.025*	0.501	0.623	0.456	0.639

Statistically in-significant at ( $p>0.05$ ) statistically significant at ( $p\leq 0.05^*$ ) high statistically significant at ( $p<0.001^{**}$ )

## DISCUSSION

The present study aimed to evaluate the effect of reflexology on post-operative pain severity after laparoscopic appendectomy for patients at surgical units.

The study hypothesized that Performance of the study group will be improved post intervention than the control group; the study group will be able to manage pain post intervention than the control group. Also, there will be significant negative correlation between patients' performance and pain severity post intervention for the study group.

The current study revealed that more than half of study and control groups aged between 30- < 40 years with mean age of  $39.9 \pm 11.75$  and  $38.9 \pm 12.23$  respectively. This result was in the same line with *Yelon, et al., (2014)*, who reported that peak incidence of appendicitis, occurs between the second and third decades of life.

The current study revealed that, more than half of patients were males. This result was in agreement with *De Wijkerslooth, et al., (2020)*, who reported the same results in their study entitled "Disease burden of appendectomy for appendicitis: a population-based cohort study."

Also, this result was supported by *Wang, et al., (2019)*, who mentioned in their study entitled "Laparoscopy versus open appendectomy for elderly patients, a meta-analysis and systematic review" that, The risks of developing appendicitis through lifetime is higher in males than in females.

The present study revealed that, the majority of both groups were married. This result was incongruent with *Alosayfir, et al., (2018)*, who reported in their study entitled "The Prevalence of People Underwent Appendectomy Procedure in Saudi Arabia" that more than half of participants were single .

The present study revealed that, more than half of both groups had family history of appendicitis. This result was in accordance with *Lloyd, (2019)*, who reported that family history is one of the risk factors of having appendicitis .

Regarding total knowledge score pre and post intervention, the current study illustrated that, there was marked improvement in study group regarding satisfactory level of knowledge post intervention compared to pre intervention. This emphasizes the effectiveness of the intervention in improving patients' knowledge about reflexology.

This result was in the same line with *Afifi, et al., (2017)*, who revealed in their study entitled "Impact of An Educational Session about Foot Reflexology on Nursing Students' Knowledge and Attitude: A Quasi Experimental Study" that, knowledge level in the post-session was higher and better than in pre-session.

Regarding total practice score pre and post intervention, the current study revealed that, there was marked improvement in study group practice post intervention compared to pre intervention. This emphasizes the effectiveness of the intervention in improving patients' practice regarding reflexology.



This result was in agreement with *Embong, et al., (2015)*, who reported in their study entitled “Revisiting reflexology: Concept, evidence, current practice, and practitioner training” that, reflexology was widely accepted, and evidenced positive effect in a variety of health conditions. Also, recommended that adequate training for practitioners is necessary to ensure the consistency of service provided.

Regarding pain severity, the present study showed that there was high statistically significant difference between study and control groups post intervention. This result was in agreement with *Rejeh, et al., (2020)*, who reported in their study entitled “The Effect of Hand Reflexology Massage on Pain and Fatigue in Patients after Coronary Angiography: A Randomized Controlled Clinical Trial” that, Statistically significant difference was observed in pain and fatigue scores between both groups after the intervention. The intervention had medium to large effects on patients’ pain and fatigue levels.

Regarding correlation between total pain score and physiologic parameters among study and control groups pre and post intervention. The current study revealed that, there was statistically significant positive correlation between total pain score and physiologic parameters among study group post intervention. This result was supported by *Khanna, et al., (2018)*, who reported in their study entitled “Comparison between critical-care pain observation tool and physiologic indicators for pain assessment in the critically ill, mechanically ventilated adult patients”

that, there was a significant increase in both hemodynamic variables (systolic blood pressure and diastolic blood pressure) during painful procedures except for the heart rate during positioning.

This result was inconsistent with *Meeuse, et al., (2013)*, who reported in their study entitled “Heart Rate Variability Parameters Do Not Correlate with Pain Intensity in Healthy Volunteers” that, heart rate variability parameters may detect responses to pain, but are not suitable to assess pain intensity.

Regarding correlation between total pain score and total performance scores among study and control groups pre and post intervention, the current study revealed that, there was statistically significant negative correlation between total pain score and total knowledge & practice scores among study group pre and post intervention. From the researcher point of view, this may be due to the effect of reflexology intervention on the study group. These results were in the same line with *Taheri, et al., (2019)*, who reported in their study entitled “Comparing the Effect of Foot and Hand Reflexology on Pain Severity after Appendectomy: A Randomized Clinical Trial” that, the results showed that foot reflexology was more effective than hand reflexology in pain alleviation.

## CONCLUSION

The current study concluded that, performance of the study group post intervention concerning pain severity has been greatly improved after application of reflexology technique that supports the first and second

research hypotheses. Also, there was statistically significant negative correlation between patients' performance and pain severity post intervention for the study group that supports the third research hypothesis.

## RECOMMENDATIONS

The present study recommended conducting in-service training programs periodically and regularly to teach patients self-care skills after laparoscopic appendectomy surgery. In addition, innovative educational programs are needed to improve patients' knowledge and practices. Also, repeating the study on a high probability sample to achieve generalization of the findings.

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