

# Efficacy of Heat Pads versus Effleurage Massage in Reducing Shoulder Pain after Gynecological Laparoscopic Operations

<sup>1</sup>Amira A, El-Naser., <sup>2</sup>Aida A, El-Razek., <sup>3</sup>Jamila G, Ayooob

<sup>1</sup>Assistant Lecturer of Maternal and Newborn Health Nursing Faculty of Nursing, Menoufia University

<sup>2</sup>Professor of Maternal and Newborn Health Nursing Faculty of Nursing, Menoufia University

<sup>3</sup>Assistant Professor of Maternal and Newborn Health Nursing Faculty of Nursing, Menoufia University

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**Abstract:** Background: Laparoscopy as a minimal tool can accurately and quickly confirm the diagnosis and reduce both delay in diagnosis and non-therapeutic laparotomy rate. Shoulder pain is a common complaint following gynecological laparoscopic surgery. A heating pad has become an established complementary modality in some invasive procedures and an effective tool for decreasing pain and anxiety. Massage influences the soft tissues of the body. It is used to relax muscles tense and to be calm. There are different massage techniques that may help to reduce pain such as effleurage massage. Design: A quasi-experimental design (non-equivalent group design) (case & control) was utilized and a convenience sample of 90 women after gynecological laparoscopic operation were enrolled. Setting: The current study was conducted at obstetrics and Gynecology departments of two settings in Menoufia governorate: University Hospital and Shebin El-Koom Teaching Hospital. Results: The study finding revealed women who use heat pads after gynecological laparoscopic operations had less shoulder pain intensity than those who don't women who use effleurage massage after gynecological laparoscopic operations had less shoulder pain intensity than those who don't. women who used Effleurage Massage revealed a higher efficacy than both Heat pad and control groups in post intervention. Conclusion: Effleurage Massage revealed a higher efficacy than both heat pads in reducing shoulder pain after laparoscopic operation. Recommendation: Nursing education curriculum should be updated to include non- pharmacological management of shoulder pain after laparoscopic operation.

**Keywords:** Effleurage massage, Gynecological laparoscopic operation, Heat pad, Shoulder pain.

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## 1. INTRODUCTION

Li & Li (2021) stated that the pain after laparoscopic surgery has not disappeared. Many patients may feel shoulder pain, which is more uncomfortable than abdominal incision and visceral pain and is rarely seen in traditional laparotomy. Because most patients think shoulder pain has nothing to do with surgery, it makes them more anxious. This may lead to discomfort and a poor quality of life after laparoscopic surgery and significantly reduce patient satisfaction.

Shoulder pain is a common complaint following gynecological laparoscopic surgery. This type of pain is known as gas pain. The pain is felt initially underneath the abdomen, and then it moves up to the shoulder. Although the pain is transient in most cases, it usually lasts about two or three days (Jasim et al., 2017). Pain management is recognized as an important indicator of standards of accreditation in health and quality of health care. For this reason, one cannot neglect the importance of pain management quality in postoperative care. Quality development includes an assessment of the quality of care at regular intervals (Köse Tamer & Sucu Dağ, 2020).

Nurses' experiences with practical knowledge affect the nursing process. Expert nurses with practical knowledge have more positive attitudes toward patients than less experienced nurses. The nurse's role is to assess the patients' physical and emotional status and health practices. The nurse is responsible for providing effective patient care, including pain management using non-pharmacological techniques. Non-pharmacological pain management methods include heat pads and massage (Sinha, 2019).

Heating therapy involves the use of heat to relax the muscles, facilitate blood circulation, and promote metabolism, thus relieving pain. It is inexpensive, saves time, and requires no special training or skill. Furthermore, heating therapy elicits a sympathetic reaction that increases blood circulation in areas other than those directly in contact with heat. Heating therapy can also relieve pain by increasing the threshold of pain delivery fibers (Suk et al., 2022).

The heating pad has become an established complementary modality in some invasive procedures and an effective tool for decreasing pain and anxiety. Therefore, we sought to assess the impact of using a heating pad on patients' perceptions of anxiety, distress, and pain (Kim et al., 2019). Massage influences the soft tissues of the body. It is used to relax muscles and to help calm people. There are different massage techniques that may help to reduce pain such as lower back massage, smooth strokes, also called effleurage, counter pressure, and hip squeezes. Massage stimulates our body to release endorphins, the natural pain-killing, mood-lifting chemicals produced in the brain (Choudhary et al., 2021).

Effleurage should be performed at regular and continuous intervals, as the pain tends to increase when the massage is stopped because the nervous system is already accustomed to the stimulus. Hence, repetition of slow, steady speed and comfortable pressure are the keys that make effleurage massage more effective in pain management. Moreover, effleurage is appropriate to be used by an effleurage maternity nurse because it is a simple and easy procedure to be applied (Youssef, 2018).

### **Significance of the study**

A gynecological laparoscopic operation is a typical method to diagnose and treat various gynecological conditions. Compared to open surgery, this minimally invasive procedure has lower morbidity, reduces hospital stays from one week to less than 24 hours, and allows patients to resume normal activities. (Yucel & Eyup, 2018). Shoulder-tip pain (STP) is the most painful side effect after a gynecological laparoscopic operation. It occurs in up to 80% of women worldwide, with the potential for significant morbidity, delayed discharge, and readmission (Philip Kaloo et al., 2019). In Egypt, 35%-70% of patients feel this pain after an operation. Although opioids are helpful in masking pain, they may lead to adverse effects such as sedation, nausea, vomiting, and gastrointestinal ileus (Sallama & Ali, 2018). Heat pads and effleurage massage are non-pharmacological pain control methods with no adverse side effects that can be used when analgesics are insufficient or cannot be used (Sinha, 2019). Reducing this pain to the level at which narcotic analgesics are no longer required is an important step toward performing laparoscopy and enhancing women's recovery. Consequently, the researcher was motivated to investigate the Comparison between efficacy of heat pads and effleurage massage in reducing shoulder pain after gynecological laparoscopic operations.

### **Purpose of the Study**

#### **The purpose of the study is to:**

Investigate the efficacy of heat pads versus effleurage massage in reducing shoulder pain after gynecological laparoscopic operations.

### **Hypotheses of the Study**

- 1-Women who used heat pads after gynecological laparoscopic operations experienced less shoulder pain than those who do not.
- 2-Women who received effleurage massage after gynecological laparoscopic operations experienced less shoulder pain than those who do not.
- 3- Women who used effleurage massage after the gynecological laparoscopic operation reported less shoulder pain than women who use heat pads.

## 2. METHOD

### Research Design:

A quasi-experimental design (non-equivalent group design) (case & control) was utilized in implementing this study.

### Research Settings:

The current study was conducted in the Obstetrics and Gynecology departments of two settings in the Menoufia governorate: University Hospital and Shebin El-Koom Teaching Hospital.

### Sample Type:

A convenience sample of 90 women after a gynecological laparoscopic operation fulfilled the following criteria.

### Inclusion criteria for the sample:

Women's ages should range from 25-55 years, immediately within 24 hours (after gynecological laparoscopic operations); women should have no medical disorders.

### Sample Size:

Reviewing the previous study (Ibrahim & Kamal, 2020), that examined the same outcomes and found higher efficacy of effleurage massage than others. The average sample size was 30 per group. The sample size was calculated using the Epi-Info program at a 95% level of confidence, with an expected frequency = of 50%. Accepted error is = 5%. So, a convince sample of 90 women was recruited in the study and randomly assigned to cases (G1 & G2) and control (G3) as G1: which comprised 30 women upon whom heat pad was applied by the researcher; G2: which comprised 30 women upon whom effleurage massage was applied by the researcher and G3: which comprised 30 women who left for routine pain management in the hospital. Each of the 90 women was asked to pick a piece of paper containing a number (1, 2, or 3), those who selected number 1 were assigned to G1, those who selected number 2 were assigned to G2, and those who selected number 3 were assigned to G3. This technique was used to avoid sample contamination and bias.

### Instruments for data collection:

Throughout the course of the present study, data was collected using instruments that were developed by the researcher and revised by qualified experts, and then tested for validity and reliability. Two instruments were developed and used by the researcher for data collection.

**Instrument I: A semi-structured interviewing questionnaire.** It was developed by the researcher after reviewing related literature to collect the necessary data about participants. It will include the following parts:

**Socio-demographic data** (age, residence, occupation, and level of education), **Menstrual history** (Age, frequency, amount, duration, and interval), **Obstetrics history** (gravidity, parity, and abortion), **basal characteristic of current Gynecological laparoscopic operation** (purpose and duration), **basal characteristics of shoulder pain** (site of pain, factors that aggravate pain, and factors that decrease pain).

### Validity of Instrument I:

The validity of the instrument was established by five qualified experts (three experts from the Maternal and Newborn Health Nursing department at the Faculty of Nursing and two physicians from the Obstetrics and Gynecology department at the Faculty of Medicine). They reviewed the instrument for content accuracy and internal validity. Also, they were asked to judge the items for completeness and clarity (content validity). Suggestions were incorporated into the instrument, and modifications will be made.

### Reliability of Instrument I:

The reliability of the instrument was tested by the researcher for testing the internal consistency of the instrument, using Cranach's Alpha test. This method took place through the administration of the same instrument to the same participants under similar conditions on one or more occasions. Results from repeated testing were compared.

**Instrument II: Physiologic and behavioral response to pain sheet (PBRPS).** It was adopted by Deborah (1984) and Walsh (2001) to measure physiological and behavioral pain responses. It included two parts:

**Part 1- Physiologic response:** - It was used to measure the physiological response to pain. It consists of two parts: 1) vital signs (blood pressure, temperature, and pulse); and 2) gastrointestinal tract responses like nausea and vomiting. 3) Skin reactions like flushing, rash, and diaphoresis.

**Part 2-Behavioral response:** It was used to measure the behavioral response to pain. It includes four dimensions: posture, gross motor activity, facial expression, and verbalization. For each of these four major behavioral responses, one of three alternative choices is offered.

**The scoring system:**

Each of the 12 alternatives was scored as either absent (0), (1) for mild, or (2) for severe, for posture, the choice is between relaxed (0) or guarded (1) or tense posture (2). For gross motor activity, the choice is between quiet (0), slightly restless (1), and restless (2). For facial expression, the choice is between no frowning (0), some frowning (1), and constant frowning or grimacing (2). Finally, for verbalization, the choice is between normal no sound (0), groans/moans (1), and cries (2).

**Validity of Instrument II:**

The validity of the instrument was established by five qualified experts (three experts from the Maternal and Newborn Health Nursing department at the Faculty of Nursing and two physicians from the Obstetrics and Gynecology department at the Faculty of Medicine). They reviewed the instrument for content accuracy and internal validity. Also, they were asked to judge the items for completeness and clarity (content validity). Suggestions were incorporated into the instrument, and modifications will be made.

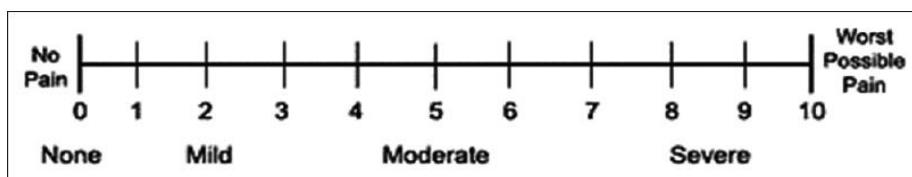
**Reliability of Instrument II:**

The reliability of the instrument was tested by the researcher for testing the internal consistency of the instrument, using Cranach’s Alpha test. This method took place through the administration of the same instrument to the same participants under similar conditions on one or more occasions. Results from repeated testing were compared.

**Instrument III: Numerical pain rating scale:** It was adopted from Williamson & Hoggart (2005). It will be used to assess pain intensity.

**The scoring system of the scale:**

Women were instructed to choose a number from 1 to 10 that best describes their pain. A score of 0 on the scale is as follows: There is no pain (0), mild pain (1-3), moderate (4-7), and sever pain (8-10)



**Validity of Instrument III:**

Experts (three experts from the Maternal and Newborn Health Nursing department at the Faculty of Nursing and two physicians from the Obstetrics and Gynecology department at the Faculty of Medicine). They reviewed the instrument for content accuracy and internal validity. Also, they were asked to judge the items for completeness and clarity (content validity). Suggestions were incorporated into the instrument, and modifications will be made.

**Reliability of Instrument III:**

The reliability of the instrument was tested by the researcher for testing the internal consistency of the instrument, using Cranach’s Alpha test. This method took place through the administration of the same instrument to the same participants under similar conditions on one or more occasions. Results from repeated testing will be compared.

**Administrative approval:**

On July 15, 2020, the Faculty of Nursing; Menoufia University received approval from the hearing and ethics committee. An official letter was taken from the Faculty of Nursing, Menoufia University Dean, and submitted to the directors of the study settings, chairperson of the obstetrics and gynecology departments of Menoufia University Hospital and Shebin El-Koom Teaching Hospital to carry out the study. Official permission was obtained from the directors of the above-mentioned settings to carry out the study. A full explanation of the rationale for the present study was provided to the directors of the study settings.

**Ethical Considerations**

Approaches to ensure the ethical issues were considered in the study regarding confidentiality and informed consent. The researcher introduced herself to the women after the laparoscopic gynecological operation and explained the purpose of the study and the nature of the research to obtain their acceptance to be recruited in the study as well as to gain their cooperation.

Confidentiality was achieved using locked sheets with the names of the participating women replaced by numbers. All participating women were informed that the information they provided during the study would be kept confidential and used only for statistical purposes. After finishing the study, the findings would be presented as a group data with no personal participants' information remaining. They were also informed that the findings would be presented as a group of data with no personal participants' information remaining.

After explanations prior to enrollment in the study, informed consent was obtained from all women. Each woman was informed that participation in the study was voluntary and that she could withdraw from the study whenever she decided to do so. Each woman was given the opportunity to freely refuse participation. They were free to ask any questions about the study details.

**Pilot study:**

A pilot study was conducted to test the applicability of the instruments, the feasibility of the study, and estimate the time needed for data collection. It was conducted on 10% of the total sample which equaled 9 women. Based on the pilot study results; the researcher rephrased some questions and sentences and then set the final fieldwork schedule as question what are the factors that decrease pain? & what are the factors that increase pain? The sample of the pilot study was excluded from the main sample size based on the changes done.

**Study Field Work:**

The data was collected in the obstetric ward over a 6-month period, beginning in September 2021 and ending in February 2022. All days of the week except Friday from 1.30 AM or 10.30 AM to 4.30 PM according to availability of participants in both hospitals (University Hospital and Teaching Hospital) and (1 or 2) women per day according to availability of women who met the inclusion criteria). This protocol was followed till the needed number was reached.

The current study was carried out in consecutive phases (Interview and assessment phase, implementation and evaluation phase).

**Interview and assessment phase:**

During the initial contact, which occurs in the first hours after the operation in the ward, the researcher greeted the women, introduced herself, and explained the purpose of the research in order to obtain their acceptance and recruit them in this research as well as to gain their cooperation. After taking verbal and written agreement from the women who met the inclusion criteria, each woman was interviewed to collect data related to socio-demographic data (age, residence, occupation, and level of education). Obstetric history (gravidity, parity, and abortion), basal characteristics of current gynecological laparoscopic operation (purpose and duration), basal characteristics of shoulder pain (site of pain, factors that aggravate pain, and factors that decrease pain).

The interview lasted about 30 minutes for each woman; the women were asked in Arabic and documented their answers with the instruments utilized.

Assess post-operation shoulder pain of the studied groups using a numerical pain rating scale in the first hours after the operation before intervention (1<sup>st</sup> time). Assess current pain, including (frequency pattern location, precipitating and relieving factors), as well as the impact of pain on physiological and behavioral responses. This took about 10 minutes.

**Implementation Phase: (for G1 & G2)**

Started immediately after assessment (pre-intervention) in the first 4 hrs after the operation.

**Nursing intervention for relieving shoulder pain: G1 (Heat pad)**

The researcher informed the women that shoulder pain is as a complication of laparoscopic surgery and explained to each woman the types and benefits of heat pads, as well as how to do apply heat pads on the shoulder to relieve pain cause by laparoscopic surgery by using cotton or clean towel with warm water (comfortably warm on the shoulder) for 15-20 minutes, then removed and reapplied after 2 hours. The researcher also explained how to prepare a heating pad at home to be put on the shoulder to relieve pain after hospital discharge. The researcher instructed the women to do it every 2 hours for 24-48 hours or until completely relieved.

**Preparation of the heat pad**

To prepare the heat pad, Soak a clean towel in water until it is completely wet. Use a water boiler to heat the water, then put the towel in a bowl and pour water on it, and then insert it into the plastic bag using a holder. Close the bag containing the towel.

Put the bag on the piece of cloth that was sewed as a pillow. The bag should not be used while it is too hot on the skin so that there is one layer that isolates the heat from your skin.

Apply the wrapped compress to the skin. If the temperature is uncomfortable, allow the compress to cool slightly. Be sure to give the skin a break from the heat every ten minutes, and do not leave the compress on for longer than 20 minutes.



The researcher instructed the women to do this technique every 2 hours after evaluating shoulder pain until completely relieved.

The instructions were through visual pictures of both techniques, a demonstration by the researcher, which took 20 minutes; and instructing women on how to prepare a heating pad with other techniques at home through, Cut the fabric to the desired size and fold it in half, making sure all edges match each other. Start sewing the edges on both sides, leaving the third side open. Pour the rice into a bowl and add a few drops of essential oil, then mix them together. Use the funnel to fill three-quarters of the fabric pillow with rice. Sew the left side. When using it, put it in the microwave for a minute or two (roll the pillow in aluminium foil and preheat the oven to 180 degrees). The temperature should be appropriate so that you do not feel uncomfortable, and the pillow remains warm for 30-45 minutes. If a woman doesn't have a microwave, put the pillow in a bowl and then in the oven. Put the pillow on the painful area (the shoulder) and it can be fixed with a long belt for a period of 15-20 minutes. This session lasted about 60 minutes.

At the end of the sessions, each woman was given a booklet with illustrations (indications of laparoscopic operation; complications of laparoscopic operation, especially shoulder pain; types; benefits of heat pad, and how to apply it at home). The researcher evaluates shoulder pain before and after the intervention and measures physiological and behavioral pain responses using Instrument III.

**Nursing intervention for relieving shoulder pain (Effleurage massage)**

The researcher explained the benefits of effleurage massage and how to do it or have it done by a family member on the shoulder to relieve pain caused by a laparoscopic procedure to each woman. The woman should lie in supine as this is a comfortable position for the woman. Maintaining a good posture is beneficial to both the researcher and the woman. The researcher used a wide surface area of the palmar surfaces of the hands and fingers, either with both hands, simultaneously or by alternating hands to massage the affected shoulder. The researcher pours the oil onto his own hands, never directly onto the woman. The researcher warms the oil and hands before applying it to the naked skin. The researcher began with a light touch at the start of the session. This should build up to deeper pressure with slower movements for increased circulation and stretching of the tissues. Pressure is always toward the heart to encourage venous return. The researcher should massage the shoulder for 30 minutes.

The instructions were done through visual pictures of techniques of effleurage massage, a demonstration by the researcher which took 30 minutes and encouraged family members to massage at home as a method for relieving shoulder pain. This session took about 30 minutes.

At the end of the sessions, each woman was given a booklet and trained on how to assess shoulder pain after the intervention.

**Group 3:**

The women who were assigned to the control group were also interviewed in the first 4 hours after the laparoscopic operation. The researcher provided information to the women about the definition of laparoscopic operation and its indications, advantages, and complications, especially shoulder pain. The researcher did not provide any intervention from the researcher, and they received the routine hospital intervention for relieving pain.

**Evaluation Phase**

- Evaluation of the implementation phase was accomplished by determining the pain score before and after intervention (heat pad and effleurage massage). It started four days after the laparoscopic operation and continues every two hours.
- Evaluate the effectiveness of the intervention on the reduction of pain intensity. This post-assessment consumed about 15-20 min for each woman.

**Statistical Analysis:**

Data was entered and analyzed by using the SPSS (Statistical Package for Social Science) statistical package version 26. The graphics were done using the Excel program.

Quantitative data was presented by mean (X) and standard deviation (SD). It was analyzed using the Student t-test for comparison between two means and the ANOVA (F) test for comparison between more than two means.

The qualitative data was presented as frequency distribution tables, numbers, and percentages. It was analyzed by the chi-square ( $\chi^2$ ) test. However, if the expected value of any cell in the table was less than 5, the Fisher Exact test was used (if the table had 4 cells), or the Likelihood Ratio (LR) test (if the table had more than 4 cells). The level of significance was set as a P value <0.05 for all significant tests.

### 3. RESULTS

**Table (1)** showed that there were no significant differences between the three studied groups regarding all items of sociodemographic characteristics ( $P > 0.05$  for each). 40% of the women in the heat pad group were between the ages of 35 and 40; 50% of the women in the Effleurage massage group were between the ages of 26 and 34; and nearly half (43.3%) of the women in the control groups were between the ages of 26 and 34 years. The mean age among the three groups was:  $32.3 \pm 3.1$  Y,  $31.2 \pm 2.4$  years, and  $33.7 \pm 2.9$  years, respectively, and the difference was not significant statistically ( $P=0.08$ ).

**Table (2)** highlights the efficacy of the heat pad on the physiological responses to shoulder pain pre and post intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each of the physiological responses among the heat pads. The post-heat pad program's temperature range of 37-37.5 was decreased from 73.3% pre-intervention to 20% post-intervention and the difference was highly significant ( $P<0.0001$ ). The post control program's temperature 37-37.5 was decreased from 46.7% pre intervention to 40% post intervention and the difference was highly significant ( $P < 0.0001$ ).

**Table (3)** clarified the efficacy of the heat pad on the behavioral responses to shoulder pain pre and post intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each of the behavioral items either among the heat pad or control groups. The post heat pad and control groups' verbalization (groans or moans) was 86.7%, 23.3%, and 36.7 % respectively, pre intervention, post intervention and the difference was highly significant ( $P<0.0001$ ).

**Table (4)** showed that the intensity of shoulder pain after 8 hours of gynecological laparoscopic operations among the heat pad and control groups demonstrated moderate shoulder pain with (3.3 %, 20%, respectively) before intervention and 0%, 20% respectively after intervention, and the difference was highly significant statistically ( $P < 0.0001$ ). This result supported the first hypothesis of this study, which stated, women who use heat pads after gynecological laparoscopic operations will have less shoulder pain than those who don't.

**Table (5)** highlights the efficacy of effleurage massage on the physiological responses to shoulder pain pre and post intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each item of the physiological responses among the effleurage massage groups and control. The post effleurage massage & control group GIT symptoms were decreased from 23.3%, 23.3% respectively pre intervention to 10 %, 20%, respectively post intervention and the difference was highly significant ( $P<0.0001$ ).

**Table (6)** highlights the efficacy of the Effleurage massage on the behavioral responses to shoulder pain pre and post intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each of the behavioral items among, the effleurage massage and control groups. The post-effleurage massage and control groups' posture (tense posture) decreased from 73.3%, 3.3%, respectively, pre-intervention to 0 % and 3.3% post-intervention, and the difference was highly significant ( $P<0.0001$ ).

**Table (7)** showed that, among the effleurage massage and control groups, the intensity of shoulder pain after 8 hours of gynecological laparoscopic operations, demonstrated moderate shoulder pain with 16.7%, and 20%, respectively, pre-intervention and 0%, and 20%, respectively, post-intervention. This result supported the second hypothesis of this study, which stated women who use effleurage massage after gynecological laparoscopic operations will have less shoulder pain than those who don't.

**Table (8)** highlights the efficacy of the heat pad, as well as effleurage massage, on the behavioral responses to shoulder pain pre and post intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each item of the behavioral responses, either among the heat pad, effleurage massage, or control groups. The post-heat pad, effleurage massage and control groups' facial expression (some frowning) decreased from 46.7%, 26.7% and 26.7%, respectively, pre-intervention to 36.7 %, 16.7%, and 43.4% post-intervention and the difference was highly significant ( $P<0.0001$ ).

**Figure(1)** highlights the efficacy of the heat pad, as well as effleurage massage on the physiological responses to shoulder pain pre and post-intervention. The post-intervention program revealed a highly significant improvement ( $p<0.0001$ ) in each item of the physiological responses either among the heat pad or effleurage massage groups. The post-heat pad, effleurage massage, and control group pulse 81 – 100 pm was decreased from 53.3% 36.7%, and 46.7% respectively pre intervention to 13.3%, 0%, and 13.3% respectively post-intervention and the difference was highly significant ( $P<0.0001$ ).

**Figure (2)** showed that women who used Effleurage Massage revealed a higher efficacy than both heat pad and control groups in post intervention (76.7% vs. both 46.7% (heat pad group) and 30% (control group) respectively), and the



difference was highly significant statistically ( $P < 0.0001$ ). This finding supported the study's third hypothesis, which stated that women who use effleurage massage after gynecological laparoscopic surgery will have less shoulder pain than women who use heat pa

**Table (1): Socio-demographic characteristics of the studied women in the three studied groups (cases and controls) (N = 90)**

Socio-demographic characteristics	Heat pad Group (No=30)		Effleurage massage group (No= 30)		Control group (No= 30)		P value
	N0.	%	N0.	%	N0.	%	
<b>Age (Years):</b>							LR =4.6 P=0.59
<25 years	1	3.3	1	3.3	0	0	
26-34 years	9	30	15	50	13	43.3	
35 – 40 Y	12	40	10	33.3	13	43.3	
> 40 years	8	26.7	4	13.3	4	13.4	
<b>Mean ± SD</b>	<b>32.3 ± 3.1 Y</b>		<b>31.2 ± 2.4 Y</b>		<b>33.7 ± 2.9Y</b>		<b>F=1.4,p=0.08</b>
<b>Educational Level</b>							LR =4.1, P=0.26
Illiterate/Read & Write	9	30	6	20	13	43.3	
2ry school or technical diploma	10	33.3	16	53.3	12	40	
University	11	36.7	8	26.7	5	16.7	
<b>Occupation:</b>							$X^2 =3.4,$ P=0.69
Employee	9	30	5	16.7	5	16.7	
Housewife	21	70	25	83.3	25	83.3	
<b>Residence:</b>							$X^2 =.08,$ P=0.77
Rural	20	66.7	24	80	25	83.3	
Urban	10	33.3	6	20	5	16.7	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

Answer to Research hypothesis No 1 (tables 2-4)

**Table (2): Physiological responses to shoulder pain pre and post intervention among heat pad and control groups (N=90)**

Physiological responses	Pre- intervention				Post- intervention				* $\chi^2$ /LR P value
	Heat pad group (No= 30)		Control group (No= 30)		Heat pad group (No= 30)		Control group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Temperature:</b>									$\chi^2 = 19.7$ P<0.0001
< 36.5°C	0	0	0	0	0	0	0	0	
36.5-37 °C	8	26.7	16	53.3	24	80	18	60	
37 – 37.5°C	22	73.3	14	46.7	6	20	12	40	
<b>BP:</b>									$\chi^2 = 17.6$ P<0.0001
<100/70	0	0	0	0	0	0	0	0	
100/70 – 110/80	6	20	16	53.3	24	80	23	76.7	
120/80 – 130/90	24	80	14	46.7	6	20	7	23.3	
<b>Pulse:</b>									$\chi^2 = 23.5$ P<0.0001
< 60pm	0	0	0	0	0	0	0	0	
60 – 80 pm	14	46.7	16	53.3	26	86.7	26	86.7	
81 - 100 pm	16	53.3	14	46.7	4	13.3	4	13.3	
<b>GIT symptoms:</b>									$\chi^2 =15.7$ p<0.0001
Yes	9	30	7	23.3	4	13.3	6	20	
No	21	70	23	76.7	26	86.7	24	80	
<b>Skin response</b>									NA
No	30	100	30	100	30	100	30	100	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

NA=Not Applicable

Table (3): Pre and post intervention behavioral responses in heat pad and control groups (N=90)

Behavioral responses	Pre- intervention				Post- intervention				* $\chi^2$ /LR P value
	Heat pad Group (No= 30)		Control Group (No= 30)		Heat pad Group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Posture:</b>									
Relaxed	0	0	20	66.7	0	0	14	46.7	$\chi^2=23.1$ P<0.0001
Guarded	13	43.3	9	30	10	33.3	15	15	
Tense posture	17	56.7	1	3.3	20	66.7	1	3.3	
<b>Gross motor activities</b>									
Quiet	1	3.3	22	73.3	0	0	11	36.7	$\chi^2=39.4$ P<0.0001
Slightly restless	12	40	8	26.7	4	13.3	18	60	
Restless	17	56.7	0	0	26	86.7	1	3.3	
<b>Facial expression:</b>									
No frowning	0	0	22	73.3			16	53.3	$\chi^2 =51.3$ P<0.0001
Some frowning	14	46.7	8	26.7	11	36.7	13	43.4	
Grimacing	16	53.3	0	0	19	63.3	1	3.3	
<b>Verbalization:</b>									
Normal(no sound)	0	0	23	76.7	1	3.3	19	63.3	$\chi^2 =24.6$ P<0.0001
Groans or moans	26	86.7	7	23.3	20	66.7	11	36.7	
Cries	4	13.3	0	0	9	30	0	0	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

P value= Post intervention comparison between in heat pad and control groups

Table (4): Shoulder pain rating scale, pre and post intervention among the heat pad and control groups (N = 90)

Shoulder numerical pain rating scale	Pre- intervention				Post- intervention				* $\chi^2$ /LR P value
	Heat pad Group (No= 30)		Control Group (No= 30)		Heat pad Group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Intensity of shoulder pain after 4 hours:</b>									
No	0	0	0	0	5	16.7	0	0	LR=57.8 P<0.0001
Mild	4	13.3	2	6.7	13	43.3	3	10	
Moderate	12	40	7	23.3	11	36.7	7	23.3	
Sever	14	46.7	21	70	1	3.3	20	66.7	
<b>Intensity of shoulder pain after 6 hours:</b>									
No	1	3.3	7	23.3	12	40	7	23.3	LR=14.9 P<0.02
Mild	19	63.4	15	50	16	53.3	15	50	
Moderate	9	30	6	20	2	6.7	6	20	
Sever	1	3.3	2	6.7	0	0	2	6.7	
<b>Intensity of shoulder pain after 8 hours:</b>									
No	11	36.7	9	30	14	46.7	9	30	$\chi^2 =23.9$ P<0.0001
Mild	18	60	15	50	16	53.3	15	50	
Moderate	1	3.3	6	20	0	0	6	20	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

Answer to Research hypothesis No 2 (tables 5-7)

**Table (5): Physiological responses to shoulder pain pre and post intervention among Effleurage massage and control groups (N=90)**

Physiological responses	Pre intervention				Post- intervention				* $\chi^2$ /LR P value
	Effleurage massage group (No= 30)		Control Group (No= 30)		Effleurage massage group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Temperature:</b>									
< 36.5°C	1	3.3	0	0	0	0	0	0	$\chi^2= 19.7$ P<0.0001
36.5-37 °C	14	46.7	16	53.3	29	96.7	18	60	
37 – 37.5°C	15	50	14	46.7	1	3.3	12	40	
<b>BP:</b>									
<100/70	1	3.3	0	0	0	0	0	0	$\chi^2= 17.6$ P<0.0001
100/70 – 110/80	14	46.7	16	53.3	29	96.7	23	76.7	
120/80 – 130/90	15	50	14	46.7	1	3.3	7	23.3	
<b>Pulse:</b>									
< 60 pm	1	3.3	0	0	0	0	0	0	$\chi^2= 23.5$ P<0.0001
60 – 80 pm	18	60	16	53.3	30	100	26	86.7	
81 - 100 pm	11	36.7	14	46.7	0	0	4	13.3	
<b>GIT symptoms:</b>									
Yes	7	23.3	7	23.3	3	10	6	20	$\chi^2=15.7$ P<0.0001
No	23	76.7	23	76.7	27	90	24	80	
<b>Skin response</b>									
No	30	100	30	100	30	100	30	100	NA
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

**Table (6): Pre and post-intervention behavioral responses in the effleurage massage and control groups (N = 90).**

Behavioral responses	Pre- intervention				Post- intervention				* $\chi^2$ /LR P value
	Effleurage massage group (No= 30)		Control Group (No= 30)		Effleurage massage group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Posture:</b>									
Relaxed	0	0	20	66.7	24	80	14	46.7	$\chi^2=23.1$ P<0.0001
Guarded	08	26.7	9	30	6	20	15	15	
Tense posture	22	73.3	1	3.3	0	0	1	3.3	
<b>Gross motor activities</b>									
Quiet	0	0	22	73.3	24	80	11	36.7	$\chi^2=39.4$ P<0.0001
Slightly restless	3	10	8	26.7	6	20	18	60	
Restless	27	90	0	0	0	0	1	3.3	
<b>Facial expression:</b>									
NoFrowning	0	0	22	73.3	25	83.3	16	53.3	$\chi^2=51.3$ P<0.0001
Some frowning	8	26.7	8	26.7	5	16.7	13	43.4	
Grimacing	22	73.3	0	0	0	0	1	3.3	
<b>Verbalization:</b>									
Normal(no sound)	1	3.3	23	76.7	28	93.3	19	63.3	$\chi^2=24.6$ P<0.0001
Groans or moans	22	73.3	7	23.3	2	6.7	11	36.7	
Cries	7	23.4	0	0	0	0	0	0	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

P value= Post intervention Comparison of effleurage massage and control groups

Table (7): Shoulder pain rating scale pre and post intervention in the effleurage massage and control groups (N = 90)

Shoulder numerical pain rating scale	Pre intervention				Post- intervention				* $\chi^2$ /LR P value
	Effleurage massage group (No= 30)		Control Group (No= 30)		Effleurage massage group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	
<b>Intensity of shoulder pain after 4 hours:</b>									
No	0	0	0	0	8	26.7	0	0	LR=57.8 P<0.0001
Mild	1	3.3	2	6.7	10	33.3	3	10	
Moderate	9	30	7	23.3	12	40	7	23.3	
Sever	20	66.7	21	70	0	0	20	66.7	
<b>Intensity of shoulder pain after 6 hours:</b>									
No	9	30	7	23.3	18	60	7	23.3	LR=14.9 P<0.02
Mild	14	46.7	15	50	11	36.7	15	50	
Moderate	7	23.3	6	20	1	3.3	6	20	
Sever	0	0	2	6.7	0	0	2	6.7	
<b>Intensity of shoulder pain after 8 hours:</b>									
No	14	46.7	9	30	23	76.7	9	30	$\chi^2$ =23.9 P<0.0001
Mild	11	36.6	15	50	7	23.3	15	50	
Moderate	5	16.7	6	20	0	0	6	20	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

Answer to Research hypothesis No 3 (table 8, Figure 1 & 2)

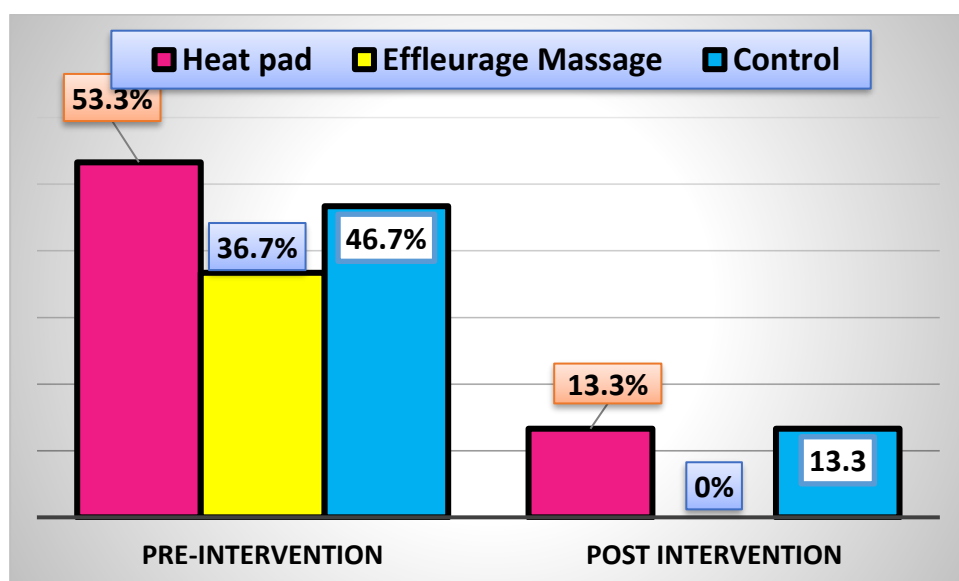


Figure (1): Percentages of pulse among studied groups pre and post-intervention (N=90)

Table (8): Behavioral responses of the studied women before and after intervention (N=90)

Behavioral responses	Pre- intervention						Post- intervention						* $\chi^2$ /LR P value
	Heat pad Group (No= 30)		Effleurage massage group (No= 30)		Control Group (No= 30)		Heat pad Group (No= 30)		Effleurage massage group (No= 30)		Control Group (No= 30)		
	N0	%	N0	%	N0	%	N0	%	N0	%	N0	%	
<b>Posture:</b>													
Relaxed	0	0	0	0	20	66.7	0	0	24	80	14	46.7	$\chi^2=23.1$ P<0.0001
Guarded	13	43.3	08	26.7	9	30	10	33.3	6	20	15	15	
Tense posture	17	56.7	22	73.3	1	3.3	20	66.7	0	0	1	3.3	
<b>Gross motor activities</b>													
Quiet	1	33	0	0	22	73.3	0	0	24	80	11	36.7	$\chi^2=39.4$ P<0.0001
Slightly restless	12	40	3	10	8	26.7	4	13.3	6	20	18	60	
Restless	17	56.7	27	90	0	0	26	86.7	0	0	1	3.3	
<b>Facial expression:</b>													
No Frowning	0	0	0	0	22	73.3			25	83.3	16	53.3	$\chi^2 =51.3$ P<0.0001
Some frowning	14	46.7	8	26.7	8	26.7	11	36.7	5	16.7	13	43.4	
Grimacing	16	53.3	22	73.3	0	0	19	63.3	0	0	1	3.3	
<b>Verbalization:</b>													
Normal(no sound)	0	0	1	3.3	23	76.7	1	3.3	28	93.3	19	63.3	$\chi^2 =24.6$ P<0.0001
Groans or moans	26	86.7	22	73.3	7	23.3	20	66.7	2	6.7	11	36.7	
Cries	4	13.3	7	23.4	0	0	9	30	0	0	0	0	
<b>Total</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

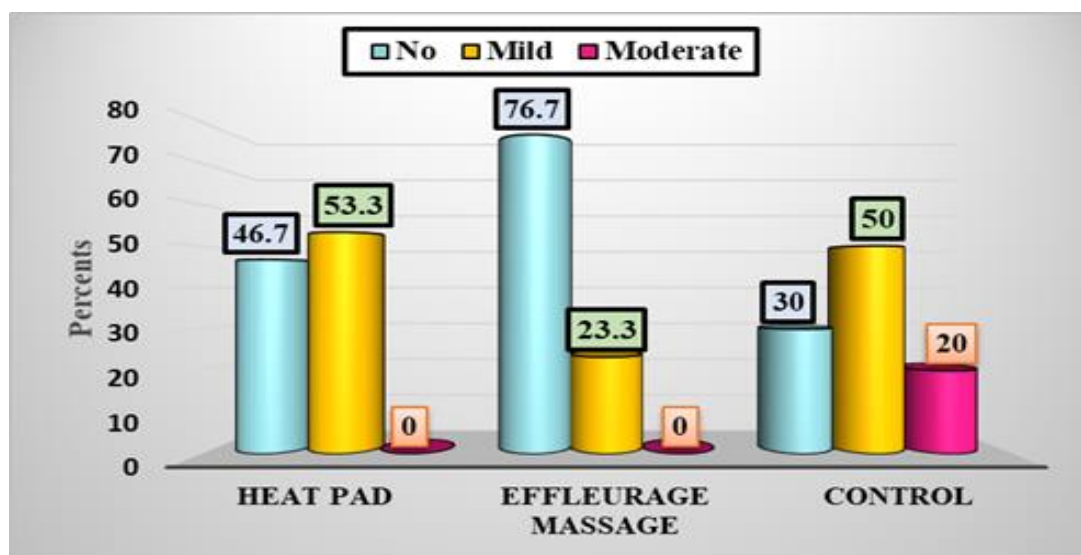


Figure (2): Effect of the heat pad, effleurage massage, and control group on the post-intervention total score of shoulder pain after 8 hours of gynecological laparoscopic operations (N=90)

#### 4. DISCUSSION

Laparoscopic operation is quickly shifting into the gold standard for treatment of uncomplicated symptomatic abdominal pathologies. Gynecological laparoscopic surgeries are associated with shoulder pain that may be more discomfort to women than pain at site of incision (Ibrahim & Kamal, 2020). Relieving of shoulder pain is a vital role of a gynecological nurse. Among non-pharmacological pain management are use of heat pad and effleurage massage.

Discussion encompasses distribution of the studied women according to their socio-demographic characteristics, answered the research hypothesis and finally relation between the study variables

### Socio-demographic characteristics

Before discussing the results, the light should be directed to socio-demographic characteristics of the studied groups which have been answered in table (1). The result of the present study showed that there were no significant differences between the three studied groups regarding all items of socio-demographic characteristics in terms of age, educational level, residence, occupation. ( $p > 0.05$  for each). The mean ages among three groups are:  $32.3 \pm 3.1$  Y,  $31.2 \pm 2.4$  Y, and  $33.7 \pm 2.9$  Y respectively. These findings are in the same line with Fouad et al. (2017) who conducted a study; The role of local Anesthesia Instillation in Pain Alleviation Post Laparoscopy, they pointed out that non statistically significant between group A and group B as regarding age when  $p$ -value  $> 0.05$ . Regarding education, residence and occupation, majority of studied groups were secondary education, housewives and from rural areas. That result comes in agreement with study conducted in Egypt by Ibrahim Aziza, Mohammed Rehab (2016) who investigated heating pads and early mobilization for reducing Postoperative Shoulder Pain and enhancing Recovery of Women undergoing Gynecological Laparoscopic Surgery. As all groups were secondary education, housewives and live in rural areas.

Concerning menstrual and obstetric history, the result of the present study showed that there were no significant differences between the three studied groups regarding all items of menstrual history (age of menarche, amount, duration, and interval). As they have a regular menstrual cycle. As regards the amount and interval of time, they have moderate amounts with 21-35 day intervals. The present result is similar to that of a study by Ibrahim & Kamal (2020), who investigated the effects of effleurage massage versus warm application on shoulder pain among postoperative women with gynecological laparoscopic surgery and found that age of menarche was  $11 < 16$ , the amount of menstruation was moderate among 70% and 65% of both groups, and the interval of menstruation was 21-35 days. This harmony helps in understanding forthcoming results in this present study. It gives a logical rationale for the positive effect of heat pad and effleurage massage on shoulder pain intensity.

Regarding obstetric history (gravidity, parity, abortion, and type of previous labor), the majority of the effleurage massage group were 1-2 gravida, and this result was rationalized by the fact that the majority of them were under diagnostic laparoscopy for infertility. The findings of the present study were similar to those of a study conducted by Ibrahim & Kamal, (2020). Their findings showed that there were no significant differences between the reproductive histories of the two groups. Also, this was in the line of study that was conducted by Coulibaly et al. (2020) in Mali, who conducted a role of laparoscopic surgery in the management of female infertility at the department of gynecology of the hospital du Mali. Their findings revealed that 63.11% were primiparous. This rate was high.

In contrast, Ibrahim & Kamal (2020) in Egypt investigated the effect of effleurage massage on shoulder pain among postoperative women with gynecological laparoscopic surgery. Their findings revealed that the majority of the studied groups were nullipara.

### Basal characteristics of the current laparoscopic operation

The current study revealed that nearly half of the group's infertility was the current cause of operation in terms of basal characteristics of current laparoscopic surgery. This was supported by Mahran et al. (2017) who investigated whether laparoscopy still has a role in modern fertility practice. The study included 600 women who underwent laparoscopy and hysteroscopy during the study period. The causes of infertility were identified by laparoscopy and hysteroscopy.

On the other hand, this disagreed with Leonardo Vieira et al. (2019) in Brazil, who conducted the study "The role of laparoscopy in the propaedeutics of gynecological diagnosis" and found that Laparoscopy contributed to diagnosis in 59.6% of infertility cases ( $P > 0.05$ ), in 93.7% of chronic pelvic pain of undetermined origin ( $P < 0.01$ ) and conclusively elucidated the diagnosis of acute abdomen and the ruling out of tubo-ovarian abscess ( $P < 0.05$ ).

Furthermore, the current finding revealed that the majority of the studied groups were undergoing diagnostic laparoscopic surgery as a purpose of operation; this may be explained by the fact that one of the most common reasons for surgery was infertility. The findings are also in line with a study conducted in Auckland by Kaloo et al. (2019), who conducted interventions to reduce shoulder pain following gynecological laparoscopic procedures. Their findings revealed that the indications for gynecological laparoscopy are diverse, with some laparoscopies being purely diagnostic, with no operative procedure taking place.

This is also supported by Rowbotham (2019), who examined the laparoscopic diagnosis and treatment of nontraumatic acute abdominal pain in women, and found that in 70% of the cases, the preoperative diagnosis was confirmed by diagnostic laparoscopy.

The investigator's point of view is that the purpose of laparoscopic operation is diagnostic as laparoscopy is more accurate for unknown diagnosis as it allows more visualization of internal organs and tissue. The majority of the studied women had infertility, so their purpose was to identify certain causes of infertility.

The present study revealed that nearly half of the studied group had pain in both shoulders after a laparoscopic operation. The findings of the present study were similar to those of a study conducted in Egypt by Ibrahim & Mohammed (2016) to investigate the effects of heating pads and early mobilization for reducing postoperative shoulder pain and enhancing recovery of women undergoing gynecological laparoscopic surgery, which revealed that studied women reported pain in both shoulders. Also it was similar to the study conducted by Ibrahim and Kamal (2020), who revealed that the site of pain was in both shoulders.

Also, this matches with the study of Li & Li (2021) in China, who investigated whether the risk of shoulder pain after laparoscopic surgery for infertility is higher in thin patients and found that half of the patients (92/186, 49.4%) had bilateral shoulder pain.

This may be rationalized due to an irritative effect of carbonic acid on the peritoneum and diaphragm that results in tearing of blood vessels, traction of nerves (phrenic nerve), which is a bilateral nerve. It arises in the neck and descends vertically through the thorax to end in the diaphragm.

#### **Answer to Research hypothesis No. 1 (physiological response to shoulder pain (heat pad))**

The finding of the present study represented a highly significant improvement in each item of physiological responses among heat pad groups. The post-heat pad program's blood pressure 120/80-130/90 was decreased from 80% pre-intervention to 20% post-intervention and the difference was highly significant ( $P < 0.0001$ ) as both pain intensity and its physiological parameters are two sides of one coin. This is rationalized as the stimulation of the central nervous system due to pain is accompanied by physiological changes.

Kim et al. (2018) examined the effects of a heating pad on anxiety, pain, and distress during a urodynamic study in female patients with stress urinary incontinence and reported that heating treatments improve psychological and physiologic parameters.

Also, this finding is similar to that of Sukkwon (2022) in Asia, who conducted a study of Effects of Heating Therapy on Pain, Anxiety, Physiologic Measures, and Satisfaction in Patients Undergoing Cystoscopy and the results revealed that decreased systolic and diastolic blood pressure (BP) and pulse rate after the procedure were significantly higher in the experimental group than in the control group.

This matches with the study of Brunt et al. (2016), who conducted a study of passive heat therapy improves endothelial function, arterial stiffness, and blood pressure in sedentary humans and found that it reduced or improved aortic pulse wave velocity from  $7.1 \pm 0.3$  to  $6.1 \pm 0.3$  m s<sup>-1</sup> ( $P = 0.03$ ), and mean arterial blood pressure from  $83 \pm 1$  to  $78 \pm 2$  mmHg ( $P = 0.02$ ).

Heating therapy could reduce the resting heart rate and noradrenaline release and also decrease the BP by improving the endothelium-dependent dilatation, arterial stiffness, and intima media thickness. In addition, heating therapy showed positive effects on the cardiovascular system (Brunt et al., 2016).

In contrast, Kim et al. (2019), who examined the use of a heating pad to reduce anxiety, pain, and distress during cystoscopy in female patients at Korea University Guro Hospital, reported that no significant differences were noted between the two groups regarding pre-procedural parameters, including systolic and diastolic BP, and pulse rate.

#### **Behavioral response to shoulder pain (heat pad)**

The findings of the present study represented highly significant improvement in each item of behavioral responses among the heat pad groups as the post-heat pad and control groups' verbalization (groans or moans) was 86.7%, and 23.3%

respectively pre-intervention to 66.7 %,36.7% post-intervention, and the difference was highly significant ( $P<0.0001$ ). This study was supported by Sukkwon (2022), who carried out a study in Asia revealing that heating therapy during cystoscopy is a convenient and effective nursing intervention that decreases pain and anxiety and enhances patient satisfaction.

Also, these results agreed with Ibrahim & Mohammed (2016), who observed that postoperative quality of recovery, including emotional state, was higher among heat pad groups compared with control, with a highly statistically significant difference and consequently behavioral state.

From the investigator's point of view, it may be that a noxious stimulus induces a behavioral response, but a heat pad induces blood supply and promotes relaxation and so feels comfortable that and improves behavioral response .

#### **Intensity of shoulder pain after a gynecological operation (heat pad)**

The present study revealed that the difference between the intensity of pain before and after intervention was highly significant as heat pad and control groups, demonstrated moderate shoulder pain with (3.3 %, and 20%, respectively) before intervention and 0%, 20% respectively after intervention and the difference was highly significant statistically ( $P<0.0001$ ).

This finding is similar to a study conducted in Egypt by Ibrahim & Mohammed, (2016) to investigate the use of heating pads and early mobilization for reducing postoperative shoulder pain and enhancing recovery of women undergoing gynecological laparoscopic surgery who evaluated the score of shoulder pain at time intervals and showed that there was reduced among heat pads and the early mobilization group.

It was supported by a similar study conducted in Europe by Ron Clijisen et al. (2022). Who investigated Local Heat Applications as a Treatment of Physical and Functional Parameters in Acute and Chronic Musculoskeletal Disorders or Pain? Their findings revealed that local heat application (LHA) had a pain relieving effect immediately after the intervention compared with pharmacologic therapy in acute and chronic conditions.

Also, Kaur et al. (2020) in India evaluated the effectiveness of warm compression on the lumbo-sacral region in terms of labor pain intensity and labor outcomes among nulliparous women: an interventional study. Their findings revealed that after 30 minutes of second and third time warm compression, the experimental group's mean labor pain intensity score (6.34, 8.30) was lower than the control group's (7.20, 8.89), which was statistically significant at the 0.05 level of significance. These results signify that warm compression was effective to reduce labor pain. Further, both groups did not differ in terms of the duration of the first stage of labor ( $P=0.51$ )

This matches with a study of the use of a heating pad to reduce anxiety, pain, and distress during rigid cystoscopy in female patients by Kim et al. (2019), who found that the mean pain scores for the experimental group ( $3.8 \pm 1.6$ ) were significantly lower than those for the control group ( $6.4 \pm 1.9$ ,  $p < 0.001$ ) and showed remarkable and statistically significant beneficial effects of using a heating pad to reduce female patients' anxiety, pain, and distress during rigid cystoscopy. This is rationalized as warm application has a sedative effect. It causes vasodilatation of the blood vessels, increasing blood flow, promoting relaxation and consequently reducing pain intensity.

Also, the physiological effects of heat application increase metabolism and elasticity of connective tissue. Neural transduction of heat is mediated by Transient Receptor Potential Vanilloid 1 (TRPV1) receptors, as they are ion channels activated by noxious heat. The TRPV1 receptors are present in primary afferent neurons, the spinal cord, and the brain. Activation of TRPV1 receptors within the brain also modulates antinociceptive descending pathways (Palazzo et al., 2016).

#### **Answer to Research hypothesis No 2: Physiological response to shoulder pain (Effleurage massage)**

This study represented the efficacy of effleurage massage on the physiological response to shoulder pain, and the difference was found before and after intervention. This is due to pain considered as indication of discomfort and instability of vital physiologic signs and, consequently, patients' hemodynamics. The physiological parameters stand out as the most important to be observed and recorded as pain signs. Also, uncontrolled pain results in respiratory, hemodynamic, and metabolic changes. Massage in the direction of the heart has an effect on the nervous system causing dilation in the blood vessels and decreasing blood pressure.



The current study is in harmony with the study of Nourian et al. (2016). Their findings revealed that massage reduced hospitalization anxiety, pulse rate, and blood pressure. They recommended that nurses can use massage to reduce anxiety in school-age children at the hospital as it has no side-effects and can be done easily.

Also, it similar to a study conducted by Aslani et al. (2019) who investigated the effects of a hand massage on the physiological changes induced by intravenous line insertion in children, whose revealed that the increase in heart rate in response to the pain is significantly lower in the massage group.

Also, this agrees with the study investigating the efficacy of massage therapy and breathing techniques on pain intensity and physiological responses to labor pain.

Kamalifard et al. (2016) found that the mean (SD) of systolic blood pressure at 6 cm dilatation in the M2 (who received massage) and M1 (who did not receive massage) groups were 104.68 (8.8) and 115.00 (10.8), respectively. The difference between the two groups was significant ( $t = 2.63$ ;  $df = 15$ ;  $p = 0.01$ ). Therefore, massage reduced systolic blood pressure at 6 cm of dilatation.

Such findings may provide evidence for the possible effect of massage on the reduction of shoulder pain. The rational for this is based on the physiological link between pain and the blood pressure. Whereas pain stimulates the sympathetic nervous system, resulting in an increase in the secretion of catecholamine. Such stimulation causes vasoconstriction and a subsequent rise in blood pressure. Accordingly, when the pain decreases, blood pressure also decreases. Furthermore, massage provides relaxation and therefore is able to reduce blood pressure through decreasing sympathetic activity and increasing parasympathetic activity.

These results may provide evidence for the possible effect of massage on the reduction of shoulder pain. The rational is based on the physiological link between pain and blood pressure. Whereas pain stimulates the sympathetic nervous system, resulting in an increase in the secretion of catecholamine. The stimulation causes vasoconstriction and a rise in blood pressure. When the pain decreases, blood pressure also decreases. So, massage provides relaxation and is able to reduce blood pressure through decreasing sympathetic activity and increasing parasympathetic activity (Ibrahim & Kamal, 2020).

#### **Behavioral response to shoulder pain (Effleurage massage)**

The finding represented the efficacy of effleurage massage on the behavioral response to shoulder pain, and the difference was found before and after intervention. Effleurage massage and control groups. The post effleurage massage, and control groups' posture (tense posture) was decreased from 73.3%, and 3.3% respectively, pre intervention to 0%, and 3.3% post-intervention, and the difference was highly significant ( $P < 0.0001$ ).

This is in line with a study conducted by Wu et al. (2017) who investigated the effectiveness of massage and touch on behavioral and psychological symptoms of dementia. Their findings revealed that massage and touch intervention are positively associated with the improvement of behavior in patients.

Crawford et al. (2016) also evaluate The Impact of Massage Therapy on Function in Pain Populations—A Systematic Review and Meta-Analysis of Randomized Controlled Trials: Part I, Patients Experiencing Pain in the General Population. Their finding revealed massage therapy was also beneficial for treating anxiety (SMD = 0.57) and health-related quality of life (SMD = 0.14) as anxiety due to pain, so massage enhanced behavioral response. This is due to massage involving skin as the largest organ of the body, and stimulation improving adaptive behavior and psychological status.

#### **Intensity of shoulder pain after a gynecological operation (Effleurage massage)**

The present study revealed that the difference in intensity of pain before and after intervention was highly significant. The intensity of shoulder pain after 8 hours of gynecological laparoscopic operations demonstrated moderate shoulder pain with (16.7%, and 20% respectively) pre-intervention, and 0%, 20%, respectively, post-intervention. The current study is in harmony with the study of the effectiveness of lavender oil treatment using effleurage massage technique towards dysmenorrhea intensity of female students at the Midwifery Academy of Kartini Bali, which was conducted by Adiputri et al. (2018), in this research result, it was proven that lavender oil therapy using effleurage massage technique effectively decreases the intensity of dysmenorrhea.

The present study is in agreement with Maru & Deepak (2020), who evaluated the effectiveness of lavender oil massage on labor pain reduction and level of satisfaction among parturient in selected hospitals in Udaipur, Rajasthan. It is reported that there is a significant relationship between the effect of lavender oil massage, on labor pain & and level of satisfaction, and that lavender oil massage was effective on labor pain reduction and increased the level of satisfaction.

Youssef, (2018) in Egypt, who evaluate effect of effleurage massage on labor pain intensity in parturient women, reported a statistically significant decrease in pain intensity after massage, where the mean pain scores in the control group was 6.55, and the effleurage group was 6.64, with a p-value of 0.504 ( $>0.05$ ), which indicated that there were no significant differences at the baseline assessment. The posttest results, on the other hand, revealed that the P-value had decreased by 0.022 (0.05), indicating a significant difference in pain level in the studied group. The study findings revealed that the pain level in the intervention group was lower than that in the control group two hours after massage ( $p > 0.003$ ).

This matches with the study of Choudhary et al. (2021), who conducted a study about the effect of back massage on relieving pain during labor and found that there was a statistically highly significant ( $p < 0.05$ ) difference in the level of pain in the experimental and control group.

This is rationalized as effleurage massage causes improvement of circulation, relaxation of muscles, stimulation of the lymphatic system, helps digestion, improves sleep, enhances mental, and physical relaxation, and encourages the release of emotional tension that encourages communication and enhances a woman's ability to cope with pain.

### Response to Research hypothesis No. 3

Both pain intensity and its physiological parameters are two sides of one coin.

#### (Intensity of shoulder pain post-intervention (heat pad & effleurage massage))

The present study revealed that women who used Effleurage Massage revealed a higher efficacy than both heat pad and control groups in post intervention (76.7% vs. both 46.7% (heat pad gr., and 30% (control gr.) respectively), and the difference was highly significant statistically ( $P < 0.0001$ ). The present study is in agreement with Ibrahim & Kamal (2020), whose study can be reported that although the massage had reduced pain intensity among a sizeable proportion of the massage group (70%) compared to only 25% of the warm application group.

It is due to massage and heat pads leading to an increase in blood flow to the area and vasodilatation. In addition, it reduces pain by affecting the central nervous system. It causes the release of endorphins, which abolishes pain sensations in the brain. Stimulation of the mechanical receptors by massage and heat pads enhance relaxation and reduce pain (Kozak et al., 2017).

The finding is similar to the study conducted by Kaçar et al. (2021), who conducted a study comparing of the effects of mechanical massage and warm mechanical massage application on perceived labor pain and childbirth experience: A randomized clinical trial found that mechanical massage application was more effective in reducing labor pain than warm mechanical massage application.

Allam, (2017), who investigated the effects of lumbo-sacral massage versus warm application on pain intensity during the active phase of the first stage of labor. This study reported that the application of lumbo-sacral massage had a more statistically significant difference in decreasing labor pain than warm bag application.

On the other hand, Türkmen & TunaOranb, (2021) evaluate massage and heat application on labor pain and comfort. Their findings revealed that the mean post-intervention pain score during 4–5 cm cervical dilation in labor was lower in the heat application group than in the massage ( $p = 0.032$ ). The mean post-intervention pain score during 6–7 cm of cervical dilation in labor was lower in the heat application group than in the massage.

This result may be due to the fact that the duration of massage in this study was probably enough to stimulate the secretion of endorphins and can decrease pain severity in women.

Based on the present findings, three hypotheses of this study were answered. Women who use heat pads after gynecological laparoscopic operations will have few shoulders pain, women who use effleurage massage after gynecological laparoscopic operations will have less shoulder pain than those who don't, and women who use effleurage massage after gynecological laparoscopic operations will have less shoulder pain than women who use heat pads.

## 5. CONCLUSION

### According to the study findings, it was concluded that:

There was no statistically significant difference between the three studied groups regarding all items of socio-demographic characteristics. The majority of participants were under diagnostic laparoscopic surgery. Most of the study group had pain in both shoulders.

There was highly significant improvement in each item of physiological and behavioral response among the heat pad group. The intensity of pain before and after heat pad intervention was highly significant and this answered hypothesis one.

There was highly significant improvement in each item of physiological and behavioral response among the effleurage massage groups. The intensity of pain before and after effleurage massage intervention was highly significant and this answered hypothesis two. Also, effleurage massage had a higher efficacy than both heat pad and control groups in post-intervention and the difference was highly significant statistically, so this answered hypothesis three.

## 6. RECOMMENDATIONS

### Based on the findings of the present study, the following recommendations were suggested:

- The nursing education curriculum should be updated to include non-pharmacological management methods for shoulder pain after laparoscopic surgery.
- Encourage women to implement effleurage massage regularly after discharge to promote more comfort.
- Effleurage massage and heat pads should be recommended in the hospital routine.
- Training programs should be provided to maternity nurses regarding the implementation and benefits of effleurage massage.

### Further research is needed to explore

- Assess women's satisfaction regarding the use of effleurage massage for relieving shoulder pain after a laparoscopic operation.
- Maternity nurses will use non-pharmacological shoulder pain management methods following a laparoscopic procedure.
- Effleurage massage and heat pads for relieving shoulder pain and enhancing recovery among women undergoing laparoscopic surgery.
- Replication of the current study in various settings and with different samples

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