

# Effect of effleurage massage versus water immersion with exercise on physiological foot edema among primigravidae

Afaf Hassan Ahmed<sup>1</sup>, Nemat Ismail Abdel Aziz Ismail<sup>2</sup>, Noha Mohamed Mahmoud Hassan<sup>3</sup>

(1) lecturer of Obstetrics and Gynecologic Nursing Faculty of Nursing, Alexandria University.

(2) Assistant professor of Obstetrics and Gynecologic Nursing Faculty of Nursing, Damanhour University,

(3) Assistant professor of Obstetrics and Gynecologic Nursing, Faculty of Nursing, Alexandria University. Egypt.

E-mail of the corresponding author: drnohahassan@alexu.edu.eg

## Abstract

**Introduction:** Leg edema is a prevalent problem during pregnancy causing activity limitations for pregnant women. The study **aimed** to compare the effect of effleurage foot massage versus water immersion with exercise on physiological foot edema among primigravidae. **Study design:** A quasi experimental, comparative study was utilized. **Setting:** study was conducted at the outpatient clinic of antenatal unit at El Shatby Maternity Hospital. **Subjects:** The subjects of the study included 90 primigravida women who attended to antenatal unit. **Tools:** Three tools were used to collect the data: **Tool 1:** Pregnant women basic data structured interview schedule, **Tool 2:** Assessment Chart for Pitting Edema and **Tool 3: Anon-elastic tape measure.** **Results:** there was statistically significant decreased in mean circumferences of left and right (Ankle, Instep and MP joint) foot among the massage and immersion groups, compared to the control group immediately and After 5 days of intervention. Additionally +3 & +4 degrees of edema didn't observe among the massage and immersion groups, while they were observed among 56.7% and 23.3% respectively of the control group. There was statistically significant improvement in the degree of edema among both massage and immersion groups in favor of the massage group compared to the control group immediately after intervention ( $p=0.003$ ), and after 5 days of intervention ( $P < 0.001$ ). **Conclusion:** the effleurage foot massage and water immersion exercise was significantly improved foot edema, when compared to control group. However, the effleurage foot massage was more effective than water immersion exercise in this respect. **Recommendations:** Effleurage massage and water immersion with exercise should be recommended in hospital protocols for management of physiological foot edema.

**Keywords:** effleurage massage, water immersion, physiological edema, late pregnancy

## Introduction

Leg edema is a prevalent problem during pregnancy causing activity limitations for pregnant women. Anatomic and physiologic changes caused by pregnancy result in a group of symptoms affecting the lower extremity. The most common symptom of dependent physiological lower leg edema is the experience of pain, night cramps, numbness, heaviness and tingling. Leg edema can affect up to 80% of pregnant women (Cunningham et al., 2014; Watanabe, Koshiyama, & Yanagisawa, 2017 and Navaee & Rakhshkhorshid, 2020).

Physiological lower leg edema can be owing to the increased venous congestion in the legs caused by the mechanical pressure of gravid uterus on the inferior vena cava and iliac

veins so it inhibits venous return as well as increased body fluids to accumulate in the tissues. Prostaglandin also induced vascular relaxation and reduced plasma colloid osmotic pressure that endorses movement of fluid from the vascular to the extravascular space (Alden, Lowdermilk, Cashion, & Perry, 2013; Akkoca et al., 2014). Lymphedema progresses through four stages (stage 0: known as latent stage or subclinical stage of lymphedema, stage I: pitting or reversible edema, stage II: spontaneously-irreversible edema, stage III: lymphostatic elephantiasis. Treatment intervention in early stages (stage 0 and stage I) has been shown very good treatment outcomes if managed appropriately (Tanveer & Shahid, 2015; Pomero et al., 2017; Watanabe et al., 2017).

Recently, there has been an increased approval regarding the use of complementary therapies to complement modern technological medicine especially among nurses and midwives. Non – pharmacological approaches for management of edema include wide variety of methods such as massage therapy, essential oils, exercise, water soak and herbal application. All of these approaches can result in diuresis (Mitchell, 2014).

Massage has been a vital part of prenatal and postnatal care across different cultures in countries. Massage can be defined as “a mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being. There are many benefits of massage therapy, such as relaxing& relieving muscle spasms and improve circulation. It also helps a healthier lifestyle free from discomfort and pain associated with swelling. Studies indicate that massage therapy performed during pregnancy may reduce symptoms of depression, ease joint pains, and improve labor outcomes and newborn health, (Guo et al., 2017). Massage therapy focuses on the specific parts of the body where the swelling occurs, such as feet, ankles, or legs. There are different types of manual massage which have different function such as Reflexology, Russian, Shiatsu and Swedish massage. It can be used in different illness according to the specific aspect of disease and the patient's treatment plan. Swedish massage use system long gliding strokes as well as kneading and friction technique on the more superficial layers of the muscles. It consists of three main categories of techniques: Effleurage, Petrissage and Taputment. The term effleurage (ef-flur-ahzh) originates from the French verb effleurage, meaning “to flow ”and “to glide. Effleurage refers to application of gliding movements that are repeated and follow the contours of the body. These movements may be linear or circular. Pressure may be superficial (light) or deep. Variations include one-handed, two-handed, alternate hand, and nerve stroke (Arazi, Asadi, & Hoseini, 2012; Kalpana, 2015; Thomson, Gupta, Arundell, & Crosbie, 2015; Kerautret, Di Rienzo, Eyssautier, & Guillot, 2020).

While as water immersion is another non pharmacological method that may be used by midwives to relieve leg edema. Water therapy has been used to produce different physiological therapeutic effects to pregnant women on different part of the system for retaining health, preventing, and treating the diseases. The diuresis that occurs with immersion is secondary to the hydrostatic force of water. The hydrostatic force is proportional to the depth of immersion, acting on the fluid in the extravascular spaces (Mooventhan & Nivethitha, 2014; Watanabe et al., 2017).

### Significance of the study

In Egypt, studies about use of alternative therapies among pregnant women are very few. Moreover no studies have examined effect of effleurage massage or water immersion with exercise on physiological foot edema resulting from pregnancy. Therefore, **this study was aimed** to determine effect of effleurage massage versus water immersion with exercise on physiological foot edema among primigravidae. The results of the current study may provide evidence that can help in updating as well as enhancing the body of knowledge for the nursing field and improving nursing practices which will ultimately contribute to the optimum woman's health.

### Research hypothesis:

1. H0: Primigravidae who receive effleurage massage or water immersion with exercise for their foot exhibit similar foot edema during late pregnancy as those who receive routine care.
2. H1: Primigravidae who receive water immersion with exercise for their foot exhibit improved foot edema than those who receive routine care.
3. H2: Primigravidae who receive effleurage massage for their foot exhibit improved foot edema than those who receive routine care.
4. H3: Primigravidae who receive effleurage massage or water immersion with exercise for their foot exhibit improved foot edema than those who receive routine care.

## Operational definition:

**Effleurage massage:** in this study it means light or deep stroke by using a flat surface of hand or forearm starting by massaging the feet only - in an upwards motion go from the toes up to the ankle.

## Materials and Method

### Materials

**Study design:** A quasi experimental, comparative study was utilized.

**Setting:** study was conducted at the outpatient clinic of antenatal unit at El Shatby Maternity Hospital. It receives clients from Alexandria as well as adjacent governorates such as Elbehera Governorate.

**Subjects:** A purposive sample of 90 primigravidae who attended to antenatal unit was recruited. They were randomly distributed to one of three groups every group included 30 primigravida as follows:

**Study group (1):** primigravida women who received the foot water immersion with exercise.

**Study group (2):** primigravida women who received the foot effleurage massage.

**Control group (3):** primigravida women who received the routine care.

The Epi info program was used to estimate the sample size based on 10% acceptable error, 95% confidence coefficient, 50% expected frequency and a population size of 1500. The program revealed that the minimum sample size is 78. **The inclusion criteria** were 18–35 years of age, primigravida, normal singleton pregnancy, with a gestational age of 30 to 40 weeks, agreed to participate in study, has pitting edema in feet as well as free from any underlying diseases or history of them e.g. diabetes, hypertension, preeclampsia, thrombophlebitis, existence of wound and skin lesions at the massage site.

**Tools:** three tools were used to collect the data:

**Tool 1: Pregnant women basic data structured interview schedule:**

This was developed by the researchers after review of literature. It was composed of two parts as follow:

1. Socio-demographic characteristics such as: the subjects' age, level of education and occupation. In addition to her marital status, residence and family type.
2. Profile / nature of current pregnancy including: whether it was planned or not, weeks of gestation, and number of antenatal visits

### Tool 2: Assessment Chart for Pitting

**Edema:** This tool adopted from **Brodevicz et.al. (2009)**. This tool was used to assess the degree of physiological foot edema. Edema is evaluated on its ability to pit. The researcher's thumb or forefinger is pressed into a dependent area of the mother's foot against a bony prominence for five 5 seconds. If pitting edema is present the finger will sink into the tissue and leave a depression after removing the finger. **Brodevicz et al., (2009) estimated that:**

Edema graded on a scale of 1+ to 4 +

- **Grade 1+ edema:** depth of indentation (<6mm) disappear rapidly.
- **Grade 2+ edema:** depth of indentation 6 to 12 mm; disappears in 10 to 15 seconds.
- **Grade 3+ edema:** depth of indentation 1 to 2.5 cm; disappears in 1 to 2 minutes.
- **Grade 4+ edema:** depth of pitting >2.5cm and disappears in 2 to 5 minutes.

### Tool 3: A non-elastic tape measure:

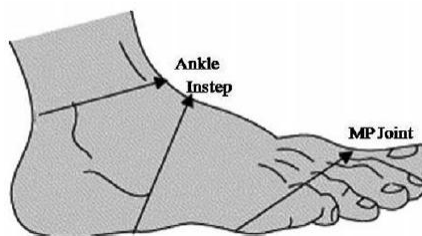
This tool was used to assess the circumferences of participants' ankles, insteps and foot/toe junctions.

### Method:

1. Ethical consideration was maintained by obtaining the agreement of Ethic Research Committee of Alexandria Faculty of Nursing before conducting the research. The informed consent and assuring the participants that their decision to be included or not in the study will not affect their care in any means at that they are free to withdraw at any point of time in the study. Their privacy and confidentiality were maintained.
2. Written permissions to conduct the study were obtained from the medical director of El-Shatby Maternity University Hospital after explaining the purpose of the study.

3. Tool 1 was developed by the researchers after extensive review of literature for needed history. Its content validity was assured by a jury of 5 experts in the field.
4. Tool 2 **assessment Chart for Pitting Edema** was adopted from Brodovicz et.al. (2009).
5. Tool 3 was a **non-elastic tape measure**. It was checked for the clarity of the numbers and the integrity of the tape.
6. Tool 2&3 reliability were confirmed by inter observer method, where  $r = 0.872$ .
7. Researchers attended a training program on therapeutic massage for 3 days (18 hours) at Arab African Union , supreme body for complementary medicine affiliated to ministry of culture and investment at Alexandria governorate and accreted certificate was obtained
8. A pilot study was carried out on 3 primigravida of each group to ensure the applicability of the study tools.
9. The primigravida were reviewed for inclusion criteria. The first 30 women who met the inclusion criteria were assigned to the control group. The next 30 women who met the inclusion criteria were assigned to the study group (1) and the next 30 women were assigned to the study group (2). The researchers started with the control group until the required number was reached and then was followed by the study groups to avoid contamination of the sample. The data were collected over a period of four months starting at the first of October 2019 and ending of January 2020.
10. First assessment was done for all groups through interviewed individually to collect the basic data through using tool 1.
11. Then the extent of foot edema was determined for all groups by pressing index and middle fingers on foot for 5 to 10 seconds and estimating the depth of the created troughs using tool 2.
12. After that, circumferences of three parts of each foot including the ankle, instep, and foot/toe junction (as shown in Figure 1) were measured by tool 3 (a non-elastic

tape measure) for each group when the subjects were in sitting position. Ankle circumference was measured medially and laterally above the malleoli, where the diameter was the smallest. The instep circumference was measured over the cuneiform and cuboid bones distal to the heel, and the third circumference was measured on the distal end of the foot, at the metatarsal– phalanges joint (the MP joint; where toe joins the foot).



**Figure 1:** lower leg circumferences

13. The intervention sessions were held at the antenatal clinic in private room, to preserve participants' privacy.
14. **For the control group:** They were received the routine care for primigravida in the presence of the researchers which included procedures as history taken, physical examination, routine investigations taking circumferences measurement and health education about leg edema such as avoid hanging the legs during the day and when resting, hold the feet above the ground.
15. **For the study group (1)** They were received water immersion with exercise:
  - The water immersion was performed through putting women's foot in bowel filled with 3literswater, and water temperature of 30–32 °C. i.e. water level must be cover the whole woman foot up to her ankle.
  - During immersion researchers ask woman to perform foot exercise into water e.g. in which they had to initially sit with their legs well supported, then flex and stretch each ankle 30 times alternatively, followed by which they had to circle their each feet at ankle in

both clockwise and anti-clock wise direction, 30 times each.

- Each water immersion session included (30 min) for 5 consecutive days.

16. **For the study group (2):** They were received effleurage massage:

- Effleurage massage was done for 20 minutes for 5 consecutive days for each woman.
- Baby oil was used during the foot massage to prevent friction and possible resultant discomfort. The study used a standard massage.
- Before each massage, the researcher washed her hands and made them warm by rubbing them together. The researchers started massaging following five movements: The massage started with 4 min of effleurage, which is a light stroking technique that was delivered with a pressure on the entire foot from the toes to the ankle along the top of the foot using the whole hand and returning under the foot. The next 4 min involved a firmer, kneading the foot from the toes to the ankle using thumbs while supporting the foot with the fingers underneath. The next 4 min of the massage protocol involved striking the skin surface between each tendon on the top of the foot one after another using thumbs. The next 4 min of the massage involved grasping the foot with both hands and gently manipulating from side to side. The final 4 min utilized effleurage techniques delivered with moderate pressure by holding the toes with one hand while the other hand supported the foot and the toes were gently bent backward and forward. Each of these movements was performed 10 times in the same order for each foot in turn in each session. Once the massage was completed, the foot was wiped clean, (Fontaine, 2015).
- The massage began from the right foot on the first day and from the left foot on

the second day and continued in the same way until the fifth day.

17. **Follow up:** Measurements included foot circumferences and degrees of pitting edema were measured on the first and fifth day after intervention for the three groups.
18. **Statistical analysis:** Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. Quantitative data were described using mean, and standard deviation. Significance of the obtained results was judged at the 5% level. **The used tests were Chi-square test** for categorical variables, to compare between different groups. **Fisher's Exact or Monte Carlo correction** for chi-square when more than 20% of the cells have expected count less than 5. **F-test (ANOVA)** For normally distributed quantitative variables, to compare between more than two groups **and ANOVA with repeated measures** for normally distributed quantitative variables, to compare between more than two periods or stages. **Mc Nemar and Marginal Homogeneity Test** used to analyze the significance between the different stages.

## Results

**Table (1)** exhibits more than two-thirds (70%, 73.4% & 66.6%) of the massage, immersion and control groups were 20 to 24 years old. Concerning, **education** half and more (56.7%, 50% & 60 %) of the massage, immersion and control groups were able to read and write. In relation to **occupation and marital status**, 83.3%, 66.7% & 76.7% and 66.7%, 83.3% & 76.7% of the studied groups were housewives and married respectively. In addition, **original residence and type of family** the majority of the massage, immersion and control groups (80%, 86.7% & 73.3%) and (76.75, 80% & 70%) were urban dwellers and had extended family, respectively. No statistically significant differences were found between the studied groups in relation to socio-demographic data.

**Table (1):** Number and the percent distribution of the studied groups according to their socio-demographic characteristics

Socio-demographic data	Massage group (n = 30)		Immersion group (n = 30)		Control group (n = 30)		$\chi^2(p)$
	No.	%	No.	%	No.	%	
<b>Age (years)</b>							
• 20 – 24	21	70.0	22	73.4	20	66.6	1.491 (0.475)
• 25 – 29	3	10.0	4	13.3	5	16.7	
• 30 – 39	6	20.0	4	13.3	5	16.7	
<b>Education</b>							
• Read and write	17	56.7	15	50.0	18	60.0	2.231 (0.715)
• Primary	7	23.3	11	36.7	9	30.0	
• Secondary	6	20.0	4	13.3	3	10.0	
<b>Occupation</b>							
• House wife	25	83.3	20	66.7	23	76.7	4.741 ( <sup>MC</sup> p=0.323)
• Employee	2	6.7	7	23.3	6	20.0	
• Former	3	10.0	3	10.0	1	3.3	
<b>Marital status</b>							
• Married	20	66.7	25	83.3	23	76.7	2.286 (0.319)
• Divorced	10	33.3	5	16.7	7	23.3	
<b>Residence</b>							
• Rural	6	20.0	4	13.3	8	26.7	1.667 (0.435)
• Urban	24	80.0	26	86.7	22	73.3	
<b>Type of family</b>							
• Nuclear	7	23.3	6	20.0	9	30.0	0.842 (0.656)
• Extended	23	76.7	24	80.0	21	70.0	

 $\chi^2$  (P): Chi square test & P for  $\chi^2$ 

MC (P): Monte Carlo test &amp; P for MC

**Table (2)** represents more than one half (66.7%, 66.7% & 56.7%) of the massage, immersion and control groups respectively were at 30 to 32 weeks of gestation, while 20%, 23.3% & 30% of them respectively were at 33 to 36 weeks of gestations. More than one half (53.3%, 50% & 63.3%) of the massage, immersion and control groups respectively had regular antenatal visits, and 53.3%, 63.3% & 70% of them respectively had 4 or more antenatal visits. In addition, the majority of the massage, immersion and control groups (76.7%, 70% & 83.3% respectively) had planned pregnancy. No statistically significant differences were found between the studied groups in relation to their profile of the current pregnancy.

**Table (2):** Comparison between the studied groups according to their Profile of the current pregnancy

Profile of the current pregnancy	Massage group (n = 30)		Immersion group (n = 30)		Control group (n = 30)		$\chi^2(p)$
	No.	%	No.	%	No.	%	
<b>Weeks of gestation</b>							
• 30-32	20	66.7	20	66.7	17	56.7	1.134 ( <sup>MC</sup> p=0.889)
• 33-36	6	20.0	7	23.3	9	30.0	
• 37-40	4	13.3	3	10.0	4	13.3	
<b>Antenatal visits</b>							
• Regular	16	53.3	15	50.0	19	63.3	1.17 (0.557)
• Irregular	14	46.7	15	50.0	11	36.7	
<b>No of visits</b>							
• 4 and more	16	53.3	19	63.3	21	70.0	1.796 (0.407)
• Less than 4	14	46.7	11	36.7	9	30.0	
<b>Pregnancy planned</b>							
• Yes	23	76.7	21	70.0	25	83.3	1.491 (0.475)
• No	7	23.3	9	30.0	5	16.7	

 $\chi^2$  (P): Chi square test & P for  $\chi^2$ 

MC (P): Monte Carlo test &amp; P for MC

**Table (3)** compares the mean scores of left and right foot circumferences in three time periods among the massage, immersion and control groups. **Before the intervention**, there were no statistically significant differences between the studied groups in relation to the mean circumferences of left and right foot in all measurements of (ankle, Instep and MP joint). On the other hand, **immediately after the intervention**, there was a significant decreased trend in the mean circumference of left Ankle  $25.36 \pm 1.12$  &  $25.45 \pm 1.24$  among the massage and immersion groups respectively, while the control group remains unchanged  $26.38 \pm 1.63$ . As well as the mean circumference of right Ankle was significantly decreased trend  $24.10 \pm 2.31$  &  $25.02 \pm 3.40$  among the massage and immersion groups respectively, while the control group remains unchanged  $26.33 \pm 1.72$ . In addition, the mean circumference of left Instep was significantly decreased trend  $24.31 \pm 1.18$  &  $24.40 \pm 1.14$  among the massage and immersion groups respectively, while the control group remains unchanged  $25.95 \pm 1.70$ . Also the mean circumference of right Instep was significantly decreased trend  $24.82 \pm 1.95$  &  $24.95 \pm 1.55$  among the massage and immersion groups respectively, while the control group remains unchanged  $25.96 \pm 1.75$ . Moreover, the mean circumference of left MP joint was significantly decreased trend  $23.13 \pm 1.33$  &  $23.19 \pm 1.42$  among the massage and immersion groups respectively, while the control group remains unchanged  $23.95 \pm 1.41$ . The mean circumference of right MP joint was significantly decreased trend  $23.01 \pm 1.33$  &  $23.12 \pm 1.41$  among the massage and immersion groups respectively, while the control group remains unchanged  $23.92 \pm 1.81$ .

**After 5 days of intervention**, there was a significant decreased in the mean circumference of left Ankle  $22.83 \pm 2.28$  &  $23.90 \pm 4.20$  among the massage and immersion groups respectively, while the control group slightly increased  $26.77 \pm 1.70$ . As well as the mean circumference of right Ankle was significantly decreased  $22.80 \pm 1.92$  &  $23.35 \pm 1.93$  among the effleurage massage and water immersion groups respectively, while the control group slightly increased  $26.65 \pm 1.98$ . In addition, the mean circumference of left Instep was significantly decreased  $23.35 \pm 1.76$  &  $23.49 \pm 1.32$  among the effleurage massage and water immersion groups respectively, while the control group slightly increased  $26.19 \pm 2.36$ . Also the mean circumference of right Instep was significantly decreased  $23.29 \pm 1.66$  &  $23.76 \pm 1.73$  among the massage and immersion groups respectively, while the control group slightly increased  $25.99 \pm 1.73$ . Moreover, the mean circumference of left MP joint was significantly decreased  $22.01 \pm 1.21$  &  $22.35 \pm 1.43$  among the effleurage massage and water immersion groups respectively, while the control group slightly increased  $24.34 \pm 2.36$ . The mean circumference of right MP joint was significantly decreased  $22.00 \pm 1.22$  &  $22.29 \pm 1.37$  among the effleurage massage and water immersion groups respectively, while the control group slightly increased  $24.01 \pm 1.77$ . Finally, there was highly statistically significant decreased within the massage and immersion groups in relation to circumference of left and right (Ankle, Instep and MP joint) over the three time periods, where ( $P < 0.001$ ) respectively. On the other hand, there were no statistically significant differences within the control group in relation to the same measures.

**Table (3):** Comparison between the studied groups according to their foot circumferences

Foot circumferences		Massage group (n = 30)	Immersion group (n = 30)	Control group (n = 30)	F(p <sup>1</sup> )
Left Foot	<b>Before</b>				
	• Ankle	26.28 ±1.63	26.21±1.62	26.38 ± 1.63	0.083(0.921)
	• instep	26.40 ±2.18	26.32±2.18	25.95± 1.70	0.418(0.659)
	• MP joint	23.96±1.29	23.91±1.39	23.95± 1.41	0.011(0.989)
	<b>Immediate</b>				
	• Ankle	25.36±1.12	25.45±1.24	26.38±1.63	5.267 (0.007*)
	• Instep	24.31±1.18	24.40±1.14	25.95± 1.70	6.316 (0.005*)
	• MP joint	23.13±1.33	23.19±1.42	23.95± 1.41	3.257 (0.043*)
	<b>After 5days</b>				
	• Ankle	22.83 ± 2.28	23.90 ± 4.20	26.77± 1.70	14.520 (<0.001*)
	• Instep	23.35±1.76	23.49±1.32	26.19 ± 2.36	13.209 (<0.001*)
	• MP joint	22.01±1.21	22.35±1.43	24.34± 2.36	15.704 (<0.001*)
	<b>F(p<sup>0</sup>) for Ankle</b>	31.532(<0.001*)	15.722(0.001*)	0.556 (0.575)	
	<b>F(p<sup>0</sup>) for Instep</b>	17.656(<0.001*)	11.640(0.001*)	0.152(0.859)	
	<b>F(p<sup>0</sup>)for Mp joint</b>	17.600(<0.001*)	9.154(<0.001*)	0.478(0.622)	
Right Foot	<b>Before</b>				
	• Ankle	26.28 ± 1.95	25.97± 1.72	26.33 ± 1.72	0.352(0.704)
	• Instep	25.93 ± 1.88	25.85± 1.75	25.96± 1.75	0.030(0.970)
	• MP joint	23.99± 1.25	23.96± 1.90	23.92± 1.81	0.129(0.952)
	<b>Immediate</b>				
	• Ankle	24.10 ± 2.31	25.02 ± 3.40	26.33 ± 1.72	5.693 (0.005*)
	• Instep	24.82±1.95	24.95±1.55	25.96 ± 1.75	3.622(0.038*)
	• MP joint	23.01±1.33	23.12±1.41	23.92 ± 1.81	3.738(0.042*)
	<b>After 5 days</b>				
	• Ankle	22.80±1.92	23.35±1.93	26.65± 1.98	34.437 (<0.001*)
	• Instep	23.29±1.66	23.76±1.73	25.99± 1.73	21.422 (<0.001*)
	• MP joint	22.00±1.22	22.29±1.37	24.01± 1.77	68.264 (<0.001*)
	<b>F(p<sup>0</sup>) for Ankle</b>	21.699(<0.001*)	8.679(<0.001*)	0.312 (0.733)	
	<b>F(p<sup>0</sup>) for Instep</b>	15.669(<0.001*)	7.877(0.001*)	0.003 (0.997)	
	<b>F(p<sup>0</sup>)for Mp joint</b>	11.193(<0.001*)	7.557(0.001*)	0.528 (0.581)	

F (p): ANOVA test & p for ANOVA test \*: Statistically significant at  $p \leq 0.05$

(P1): between-studied group at each time point (P0): within each group over time period.

**Table 4** exhibits a comparison between the studied groups according to their degree of foot edema. **Before intervention**, there was no statistically significant differences between the studied groups regarding degree of edema ( $p=0.521$ ). Where, less than one forth(20%, 23.3 % & 20%) of the massage, immersion and control groups respectively experienced +4 degree of edema, compared to as much as 66.7 %, 46.7 % & 53.3 % of them respectively experienced +3 degree of edema. **Immediately after intervention**, more than one-half (53.3% & 56.7%) of the massage and immersion groups respectively, had +2 degree of edema compared to 26.7 % of the control group. While only 26.7% & 30% of the massage and immersion groups respectively had +3 degree of edema compared to as much as 53.3% of control group. **After 5 days of intervention** all the massage and immersion groups had +1 degree of edema, compared to no one of the control group. On the other hand, +3 & +4 degrees of edema didn't observe among the massage and immersion groups, while they were observed among 56.7% and 23.3% respectively of the control group. There was statistically significant improvement in the degree of edema among both massage and immersion groups in favor of the massage group compared to the control group immediately after intervention ( $p=0.003$ ), and after 5 days of intervention ( $P < 0.001$ ).



**Table (4):** Comparison between the studied groups according to their degree of foot edema

Degree of foot edema	Massage group (n = 30)		Immersion group (n = 30)		Control group (n = 30)		$\chi^2(p1)$
	No.	%	No.	%	No.	%	
<b>Before intervention</b>							
• Grade 2+ edema	4	13.3	9	30.0	8	26.7	3.225 (0.521)
• Grade 3+ edema	20	66.7	14	46.7	16	53.3	
• Grade 4+ edema	6	20.0	7	23.3	6	20.0	
<b>Immediate after intervention</b>							
• Grade 1+ edema	6	20	4	13.3	0	0.0	16.916* ( <sup>MC</sup> p=0.003*)
• Grade 2+ edema	16	53.3	17	56.7	8	26.7	
• Grade 3+ edema	8	26.7	9	30.0	16	53.3	
• Grade 4+ edema	0	00.0	0	00.0	6	20.0	
<b>After 5 days</b>							
• Grade 1+ edema	30	100.0	30	100.0	0	0.0	96.116* ( <sup>MC</sup> p<0.001*)
• Grade 2+ edema	0	0.0	0	0.0	6	20.0	
• Grade 3+ edema	0	0.0	0	0.0	17	56.7	
• Grade 4+ edema	0	0.0	0	0.0	7	23.3	
MH P <sub>0</sub>	<0.001*		<0.001*		0.51(0.998)		

 $\chi^2$  (P): Chi square test& P for  $\chi^2$ 

MC (P): Monte Carlo test&amp; P for MC. MH: Marginal

Homogeneity Test

\*: Statistically significant at  $p \leq 0.05$  P1: between-studied group. P0: within each group over time period.

## Discussion

Edema is one of the cutaneous appearances and normal physiological changes in late pregnancy. Leg and foot edema is caused by fluid retention in the tissues. It occurs mainly in the lower extremities due to the effects of gravity. Medications are usually contraindicated during pregnancy as they may interfere with the fetus development. Common interventions to reduce edema include foot massage, leg exercise and immersion in water which represents potential interventions to eliminate or minimize some of the functional limitations associated with leg edema during pregnancy. (Cunningham et al., 2014; Smyth, Aflaifel, & Bamigboye, 2015)

The present study proved that the mean circumferences of feet as well as degrees of foot edema were significantly decreased among the effleurage massage and the water immersion groups immediately and on 5<sup>th</sup> day after intervention, compared with the control group. On evaluating effect of effleurage massage on foot edema, the present study revealed that mean circumferences of feet as well as degrees of foot edema were significantly decreased after the intervention among the massage group. Meanwhile, such a

decrease was not observed among the control group after received routine care (table 3&4). This could be contributed to the fact that effleurage massage stimulates blood flow, fluid movement and lymphatic system function (detoxifying our bodies) as well as it moves extra vascular fluid without disturbing the intravascular fluid. Moreover, effleurage or deep stroking has an effect on blood flow in the veins that have internal valves to prevent recurrent blood flow that in turn reduce leg edema. (Field, 2016).

This result is relatively coincides with Iranian randomized clinical trial conducted by Navaee, & Rakhshkhorshid, (2020), who concluded that foot massage with appropriate oils can be used as a useful technique to reduce foot circumferences among pregnant women. The results also are in line with the findings of Dona Sara (2018) who concluded that there was a significant difference in the Pretest and posttest I and II degree of physiological lower leg edema after leg massage, so the leg massage was highly effective in reducing degree of physiological lower leg edema. In addition, the finding of this study is in consonance of Rahimikian, et.al (2015a) who confirmed the effectiveness of massage in reducing feet edema. Their results indicate a

statistically significant difference between the average of the feet circumferences (around the ankle, instep and MP joints) in both treatment and control groups ( $P < 0.001$ ). In another study conducted by **Rahimikian.et.al (2015b)** regarding the effectiveness of massage and foot elevation in physiological edema. They found that there were significant differences among studied groups in the mean rate of the circumferences and they added that the massage has greater impact on pregnancy edema. Moreover, the current finding is relatively in harmony with the Egyptian study done by **AbouRomia (2012)** who concluded that foot massage may be an effective intervention for relief of lower leg edema in late pregnancy. Furthermore, **Rajeswari(2012)** concluded that foot massage was effective on reduction of physiological lower leg edema among primigravida mothers. Turkish study conducted by **Çoban, Şirin (2010)** also found that foot massage have a positive effect on decreasing normal physiological lower leg edema in late pregnancy as the study group had a significantly smaller lower leg circumference (right and left, ankle, instep and metatarsal–phalanges joint) after 5 days of massage.

On evaluating effect of water immersion with exercise on foot edema, the present study revealed that means circumferences of feet as well as degrees of foot edema were significantly decreased after the intervention among the water immersion with exercise group. Meanwhile, such a decrease was not observed among the control group after received routine care (table 3&4). This is may be due to that water pressure is given uniformly from all sides and pushes the extracellular fluid into the intravascular chamber, resulting in an increase in the central blood volume that can lead to increased uterine blood flow so it decreases leg edema.(Aulia, Saadah, & Rismawati, 2020).

The present results are congruent with the results of at least three other researches. *First*, **Vasaiya & Tiwari (2020)** who found that there was statistically significant effect in relieving of foot edema among warm water foot soak group ( $p$  value  $< 0.001$ ). *Second*, **Vasaiya & Tiwari (2019)** who reported in their literature review that several studies recommended that there is significant

association between warm water foot soak and foot exercise on foot edema among antenatal women. Third, **Khedr & Hemida (2016)** who revealed that marked reduction of lower limb edema in water immersed group. They also reported that the degree of leg edema was decreased significantly ( $p < 0.001$ ) immediately & after 2 weeks of intervention.

In this respect **Aulia et.al (2020)** performed a study titled effect of foot massage and soak warm water on leg edema during late pregnancy. They found that there is significant influence of foot massage and water soak on leg edema among women. Finally, the results of the present study shows that the two methods for intervention of foot edema namely (effleurage massage & water immersion with exercise) have eventually lead to reducing leg edema. However, effleurage massage has achieved recovery faster and earlier than water immersion with exercise.

## Conclusion

Based on the findings of the present study, it can be concluded that hypothesis (H3) is accepted and H0, H1 and H2 are rejected as evidenced by the effleurage foot massage and water immersion exercise was significantly improved foot edema, when compared to control group. However, the effleurage foot massage was more effective than water immersion exercise in this respect.

## Recommendations

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

- The curricula of basic nursing education as well as continuing education should entail the non-pharmacological management of physiological foot edema.
- Effleurage massage and water immersion with exercise should be recommended in hospital protocols for management of physiological foot edema.
- Implement in service training for the nurses especially in non-pharmacological method to relieve physiological foot edema during pregnancy.

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