

Effect of Leg Elevation versus Water Immersion on Leg Edema in Third Trimester of Pregnancy

Dr. Nahed Fikry Hassan Khedr, N.F¹, Dr. Reda Hemida,²

Department Woman's Health and Midwifery, Faculty of Nursing¹

Obstetrics and Gynecology Department, Faculty of Medicine²

Mansoura University^{1,2}

Abstract: Background: lower extremities edema is a common complain during pregnancy and associated with daily activity limitations. Common intervention to reduce edema includes leg elevation and immersion in water which represents potential interventions to eliminate or minimize some of the functional limitations associated with legs edema during pregnancy. Aim of study: this study aimed to evaluate effect of leg elevation versus water immersion on leg edema in third trimester of pregnancy. Setting: This study was conducted in Antenatal Clinics of the Obstetrics and Gynecology Department in Mansoura University Hospital. Study Design: A quasi experimental, comparative study has been utilized. Sample: purposive sample of 80 pregnant women was randomly chosen and divided into two equal groups for sitting upright in a chair with legs elevated or immersed their legs in water for 20 minutes, Changes in leg volume of edema were assessed by pitting edema techniques immediately pre- and post-intervention" immediately and after two weeks". Results: the findings of this study revealed that highly significant variations between pre- and post-interventions for both groups and equal, non significant differences between both interventions (leg elevation and water immersion). Conclusions: leg elevation and water immersion are necessary to alleviate edema in lower extremities during pregnancy.

Keywords: Edema, water immersion, third trimesters, leg elevation

I. Introduction

oedema in lower limbs, Unilateral or bilateral, is described Leg edema .An expansion of interstitial fluid volume may not be discovered readily , but an excess of numerous liters sources visible and palpable swelling. Lower limb and foot swelling is known as peripheral edema(Rachel Nall 2013). Pitting edema provide way on palpation, leaving persistent impressions in the skin; brawny edema offers resistance but leaves no impressions (Goro&Mulley,2009;Stems,2013). It can be very normal for leg to swell during pregnancy as release hormones causes the body to retain fluid and salt. The face may swell, as can the legs(Irion, jean m. 2011). In addition dependent physiological lower limbs oedema which means water retention in the interstitial space of the lower extremities is a frequent unpleasant accompaniment to pregnancy. Additionally, Peripheral edema is associated with a numeral activity restrictions. (Akkoca1 et al., 2014).

Edema is usually evident early in the morning and lost during the day. It is important to differentiate this edema from renal, cardiac, or pre-eclamptic edema (Akkoca1 et al., 2014). Edema is a common discomfort during late pregnancy. it typically involves the lower limbs but occasionally appears as swelling or puffiness in the face or hands(Phillips, et al, 2013).Pregnancy is presumed to be a major contributory factor in the increased incidence of varicose veins in women, which can in turn lead to venous insufficiency and leg oedema (Smyth , Aflaifel, Bamigboye.2015).

Leg oedema from venous insufficiency is not risky but it can cause women symptoms such as pain, feelings of heaviness, night cramps and paraesthesiae. (Young, Jewell . 2007 &Bamigboye , Hofmeyr 2006).Also (Smyth , Aflaifel, Bamigboye 2015)added another symptoms of oedema such as numbness, tingling, achy, and possibly be unsightly. While this condition is not painful, it can be uncomfortable and swelling may make it difficult to put on socks or shoes for them to fit properly. This swelling can be caused by prolonged periods of sitting or standing and pregnancy (RachelNall 2013).

Pregnancy is one of the most important periods in human life with hormonal, psychological, vascular, metabolic and immunologic changes. It occurs as a result of the enlarged uterus intermittently apply pressures on the inferior vena cava during recumbency, which impedes venous return; prostaglandin-induced vascular relaxation; and reduced plasma colloid osmotic pressure.(Akkoca1 et al., 2014).Leg oedema could be a benign inconvenience with unknown etiology. Leg edema is a frequent presenting complaint that demands diagnostic and referral strategies (seller & Symons, 2011).

In recent years, there has been utilize of non-pharmacological interventions to complement modern technological medicine it is establish popular among nurses in clinical practice.(Ayden Çoban 2010).Non-pharmacological interventions of leg oedema comprise mostly symptom reduction rather than cure (Smyth , Aflaifel, Bamigboye 2015).Non – pharmacological approaches includes bed rest with leg elevation is often

suggested as a possible treatment. Leg edema can be enhanced by elevating the legs above heart level for 20 minutes three or four times per day. Elevating the leg may be sufficient to diminish or eliminate edema for people with mild venous disease, but severe cases require other measures. In addition, it may not be practical for those who work to elevate their legs several times per day. (Richard H Sterns., et al. 2015)

Hydrostatic pressure during water immersion assists the return of fluid from the muscles into the blood. If plasma volume increases due to a fluid transfer from the interstitial space, the translocation of metabolic waste may be due to blood dilution and enhanced diffusion gradients (Wilcock et al., 2006). Water therapy is used for health promotion or treatment for a variety of diseases, water therapy has been used to produce different physiological therapeutic effects to pregnant woman on different part of the system for retaining health, preventing, and treating the diseases. Water pressure is exerted uniformly from all sides and drives the extravascular fluid into the intravascular space, producing an increase in central blood volume that may lead to increased uterine blood flow. The increase in blood volume is proportional to the woman's edema (Nivethitha 2014). Also it lessens the effects of gravity, facilitates heat dissipation, and offers support for the gravid uterus (Hartmann and Huch 2005).

Aim of study:

This study aimed to evaluate effect of leg elevation versus water immersion on leg edema in third trimester of pregnancy.

Significant of the study

Lower extremities oedema is found in about 80% of all pregnancies, occurring in late pregnancy. Leg edema can be a symptom of serious underlying problems. It notes that leg edema can be managed by nurses through accurate assessment, history taking and diagnostic tests to determine presence of leg edema by performing pitting edema technique (elizabeth , simon,2014). It has been reported that applying non-pharmacological interventions such as leg elevation or water immersion were not a routine option of care provided to women and no protocol had been established for the use of water immersion. However, use of water for various treatments of water therapy is probably as old as mankind; water therapy is one of the basic methods of treatment widely used in the system of natural medicine. (Mooventhan&Nivethitha 2014). Also most of the time swelling can be relieved by elevating the legs above the heart level (David C. Dugdale, 2013). It also emphasizes that a comprehensive discussion on the different types of edema and its etiology can equip nurses in its management (elizabeth , simon,2014). So, this study aims to evaluate effect of applying leg elevation versus water immersion on leg edema in third trimester of pregnancy, in order to introduce such evidence in our health care system in Antenatal Clinics of the Obstetrics and Gynecology Department in Mansoura University Hospital.

Hypothesis of the study:

Water immersion will have positive effect on reducing grade of leg edema than leg elevation for pregnant women in third trimester

II. Subjects and Methods

Study design : A quasi experimental, comparative study has been utilized.

Type of sample: purposive sample.

Study Setting

This study was conducted at Antenatal Clinic of the Obstetrics and Gynecology Department in Mansoura University Hospital.

Subjects of the study:

A purposive sample of 80 healthy pregnant women was used to recruit the participants based on the inclusion criteria during the period from August 2015 to January 2016. The eligible 80 pregnant women were equally divided into two groups: The first 40 eligible pregnant women who were attended the previously mentioned study setting between of August 2015 to October 2015 were served as the water immersion group, pregnant women asked to immerse their leg to the knee in container filled by tap water for 20 minutes., while the second 40 pregnant women were represented the leg elevation group between of November 2015 to January 2016 woman sitting upright in a chair with leg elevated for 20 minutes above level of the heart.

Inclusion Criteria:-

Participants recruited in this study fulfilled the following criteria:

- Single healthy pregnancy
- Maternal age ranged from 20 years to 35 years of age.

- 34- 36weeks of gestation
- Physiological edema in lower extremities
- Normal blood pressure
- Women come regularly to follow-up
- Free from any medical and obstetrical diseases

Sample size:

Given that the number of the patients who seek treatment for ankle edema is 100 cases per year and as we chose a specific margin of error of 5% and a with a confidence level of 95%, approximately a total number of 80 patients were needed for our survey. The patients were divided into two groups, 40 patients in each group.

Administrative Design: After clarifying the aim of the study, approval to carry out the study was gained from the concerned authorities including the head of Obstetrics and Gynecology Department .

Operational Design:

This design included the preparatory phase description, the pilot study and the fieldwork. The study was implemented through three phases:

Phase I: Preparatory Phase:

Based on reviewing the literature the tools of data collection were prepared.

Tools of data collection:To achieve the aim of this study, three tools were used for data collection:

Tool I:Astructured Interviewing Questionnaire: - It designed by the researcher based on reviewing the related literatures. It entails two parts:

Part 1: - It was designed to assess the general characteristics of the pregnant women (such as age, educational level, occupation, residence, marital status and socioeconomic status.

Part 2: - It was designed to assess the obstetrical history of the pregnant women (such as gravidity, parity, gestational age.

Tool II: This questionnaire was designed to assess and record blood pressure, grade of edema, pre – post interventions.

Phase II: Pilot Study

After preparing the tools, a pilot study was carrying out on 8 pregnant women (4 per each group). The results of the pilot indicated that the statements of the questionnaire were clear and relevant, and few words and items were modified. The pilot sample excluded from the study based on the modifications that done.

Phase III: Field Work

- During the study period (six months), the researcher attended the Antenatal Clinic of Mansoura University Hospital from 9 am to 12 pm for three days per week.
- The researcher interviewed with the eligible participants, introduced herself to each one, a full explanation about the aim and the scope of the study was given to obtain pregnant women acceptance and informed consent.
- Changing in leg volume for both groups were assessed (immediately pre, post-interventionsand after 2weeks of follow up) by pitting edema techniques by palpating over tibia, ankles and feet. Pitting edema is manifested by a depression that remains after one's finger is pressed over an edematous area and then removed.
- Grade edema trace, indicating barely perceptible, to 4, which indicates severe edema. Measurement of an extremity with a measuring tape is another method of following edema. Press edematous area firmly with thumb for 5 to 10 seconds. Remove thumb; note extent of groove and how long it lasts.
- Determine grade of edema on a scale of 1+ to 4+ edema..
 - A. 1+ edema = 2 mm in depth.
 - B. 2+ edema = 4 mm in depth.
 - C. 3+ edema = 6 mm in depth.
 - D. 4+ edema = 8 mm in depth.



- All participants were instructed to continue in applying intervention method (leg elevation or water immersion) twice per day “in the Morning and at Night” for two weeks, after that the researcher will evaluate the effect of intervention in antenatal clinic during follow up visit.

Ethical Considerations

- Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing, Mansoura University.
- Official permissions were obtained from the head of the Obstetrics and Gynecology department and the Director of Mansoura University Hospital.
- The aim of the study was explained to the studied groups and informed consents were obtained.
- Ethical issues were considered in dealing with the obtained information.
- Women had the right to withdraw from the study at any time, and their data were confidential.

Limitation of study

This study experienced lack of references as we use to elevate leg or immersion in water to relief edema in lower limbs as an anecdotal evidence or based on the basic theoretical references.

Statistical Design:

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). All data were categorical data and were expressed in number and percentage. The differences between two groups or more were determined using chi-square test for variables containing. Statistical significance was set at $p < 0.05$.

III. Results

This study was carried out to comparison of leg elevation and water immersion on edema of the leg in late pregnancy. The collected data were analyzed statistically and the results were categorized into 3 tables and 2 figures:

Table 1) demonstrates the frequency distribution of socio-demographic characteristics of the pregnant women in the two groups. As regards the maternal age, 12.5% and 17.5% of the mothers are of age of 25 years or less, the age of 50% and 32.5% of the mothers in the leg elevated group and leg immersed group ranged from 26 to 30 years while 37.5% and 50% of the mothers in the leg elevated group and leg immersed group respectively ranged from 31 to 35 years. Regarding the level of education, graduate mothers form the majority of the participants in this study (60% and 62.5% of the mothers in the leg elevated group and leg immersed group respectively are graduated). Our results also revealed that 85.0 % and 80% of the mothers in the leg elevated group and leg immersed group respectively are working. Moreover, 75% and 77.5% of the mothers were living in urban areas. The differences between the two groups as regards the maternal age, level of education, working status and residence did not differ significantly between the two groups (Table 1).

Table 2) shows that Frequency Distribution of obstetric history of the pregnant women of the two groups is demonstrated in Table 2. As regards gravidity, in the leg elevated group and leg immersed group respectively 25% and 20% of the women were primigravidas, 32.5% and 30% had two pregnancies, 37.5% and 37.5% had three pregnancies and 5% and 12.5% had four pregnancies. Regarding parity, in the leg elevated group and leg immersed group respectively 25% and 20% of the women were Nullipara , 32.5% and 30% had

one delivery, 37.5% and 37.5% had two deliveries and 5% and 12.5% had three deliveries. Considering the gestational age, of the pregnant women in the leg elevated group and leg immersed group respectively, 22.5% and 35% were in 34th week of pregnancy, 27.5% and 37.5% were in the 35th week, 40% and 22.5% were in the 36th week and 10% and 5% were in the 37th week. The gravidity, parity and the gestational age did not differ significantly between the two groups.

Table 3, Figure 1&2) Revealed that at baseline evaluation and post-intervention, the grades of lower limb edema did not differ significantly between the two groups. However, in the leg elevated group, more than two thirds of the women had lower limb edema of grade 3 and 4, whereas post intervention 85% of the women in this group had no edema. This reduction of the edema in the lower limb in the leg elevation group post intervention in comparison to the baseline was significant ($p<0.001$) (Table 3, Figure 1). Similarly, in the women in the leg immersed group, while the majority of the women had lower limb edema of grade 3 and 4, post intervention 75.5% and 10% of the women in this group had no edema and edema grade 1 respectively. This reduction of the edema in the lower limb in the leg immersed group post intervention in comparison to the baseline was significant ($p<0.001$) (Table 3, Figure 2).

Table 3) Regarding frequency distribution for grade of leg edema in pre and post interventions(immediately & after 2 weeks of follow up), shows that at baseline evaluation and post-intervention, the grades of lower limb edema did not differ significantly between the two groups. However, in the leg elevated group, more than two thirds of the women had lower limb edema of grade 3 and 4, whereas post intervention 85% of the women in this group had no edema. This reduction of the edema in the lower limb in the leg elevation group post intervention in comparison to the baseline was significant ($p<0.001$). At the post intervention 2, more reduction had been reported in the leg elevated group where 95% of the cases had no edema, 2.5% had grade 1 edema and 2.5% had grade 2 edema. The reduction of the edema at post intervention in comparison to the baseline edema is significant ($p<0.001$) (Table 3, Figure 1).

Similarly, in the women in the leg immersed group, while the majority of the women had lower limb edema of grade 3 and 4, post intervention 75.5% and 10% of the women in this group had no edema and edema grade 1 respectively. This reduction of the edema in the lower limb in the leg immersed group post intervention in comparison to the baseline was significant ($p<0.001$). At the post intervention 2, more reduction had been reported in the leg immersed group where 92.5% of the cases had no edema, 5% had grade 1 edema and 2.5% had grade 2 edema. The reduction of the edema at post intervention in comparison to the baseline edema is significant ($p<0.001$) (Table 3, Figure 2)

Table 1.Frequency Distribution of Socio-Demographic Characteristics of the Pregnant Women among Both Groups

	G1(n=40) Leg Elevated		G2(n=40) Leg Immersed in Water		Chi square test	
	No.	%	No.	%	X ²	p
Maternal age (years)						
<25	5	12.5	7	17.5	2.532	0.282
26 – 30	20	50.0	13	32.5		
31 – 35	15	37.5	20	50.0		
Level of education						
Primary level	3	7.5	5	12.5	0.912	0.634
Secondary Level	13	32.5	10	25.0		
Graduate	24	60.0	25	62.5		
Occupation						
Housewife	6	15.0	8	20.0	0.346	0.556
Working	34	85.0	32	80.0		
Residence						
Rural	10	25.0	9	22.5	0.069	0.793
Urban	30	75.0	31	77.5		

Table 2.Frequency Distribution of Obstetric History of the Pregnant Women among Both Groups

	G1(n=40) Leg Elevated		G2(n=40) Leg Immersed in Water		Chi square test	
	No.	%	No.	%	X ²	p
Gravidity						
1	10	25.0	8	20.0	1.548	0.671
2	13	32.5	12	30.0		
3	15	37.5	15	37.5		
4	2	5.0	5	12.5		
Parity						

Nullipara	10	25.0	8	20.0	1.548	0.671
1	13	32.5	12	30.0		
2	15	37.5	15	37.5		
3	2	5.0	5	12.5		
Gestational age (weeks)						
34	9	22.5	14	35.0	4.329	0.228
35	11	27.5	15	37.5		
36	16	40.0	9	22.5		
37	4	10.0	2	5.0		

Table 3. Frequency Distribution for Grade of Leg Edema Pre and Post Interventions in the first interview with women

	G1: Leg Elevated (n=40)		G2: Leg Immersed (n =40)		Significance test	
	No.	%	No .	%	X ²	p
Pre-intervention						
Grade 1	5	12.5	8	20.0	0.844	0.839
Grade 2	7	17.5	6	15.0		
Grade 3	13	32.5	12	30.0		
Grade 4	15	37.5	14	35.0		
Post-intervention						
No edema	34	85.0	30	75.5	1.45	0.835
Grade 1	2	5.0	4	10.0		
Grade 2	2	5.0	3	7.5		
Grade 3	1	2.5	2	5.0		
Grade 4	1	2.5	1	2.5		
Comparison pre vs post intervention						
X ²	60.599		50.641			
p	<0.001		<0.001			

Figure 1. Frequency of leg edema grades pre versus post interventions in the leg elevation group

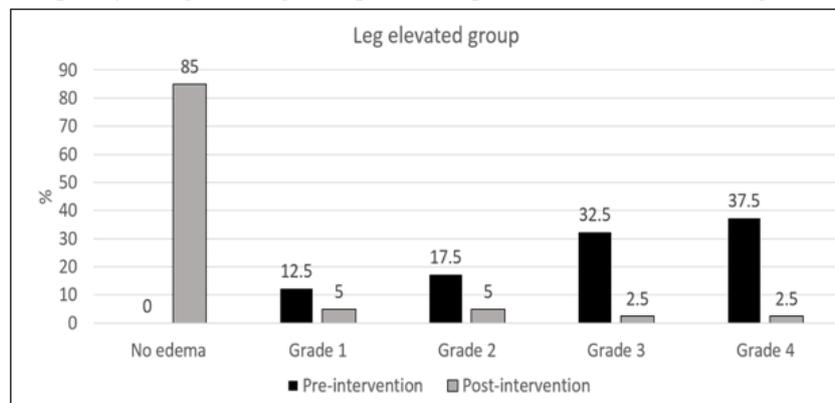


Figure 2. Frequency of leg edema grades pre versus post interventions in the leg immersion group

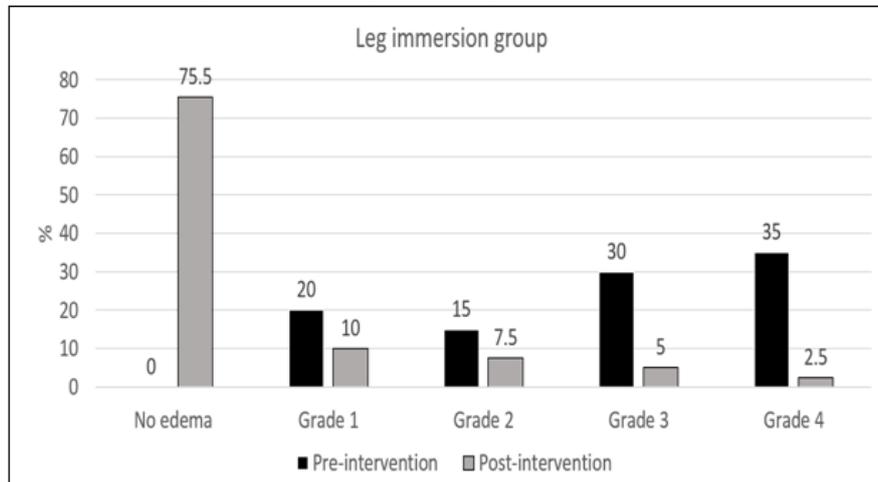


Figure 1. Comparison of the grades of edema at baseline versus post intervention in the leg elevated group

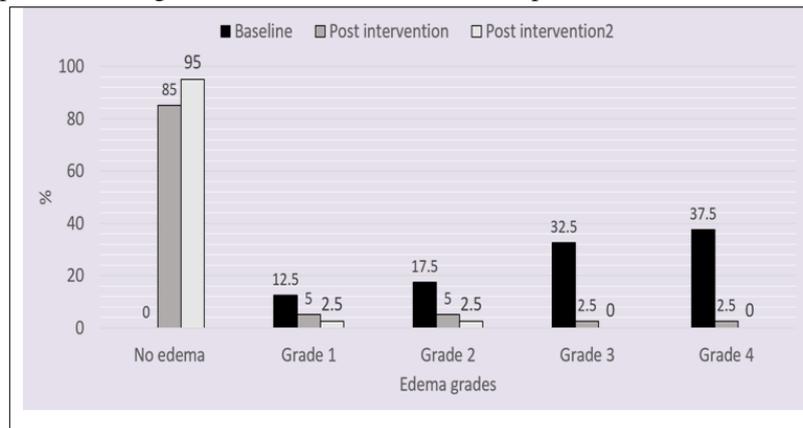


Figure 2. Comparison of the grades of edema at baseline versus post intervention in the leg immersed group

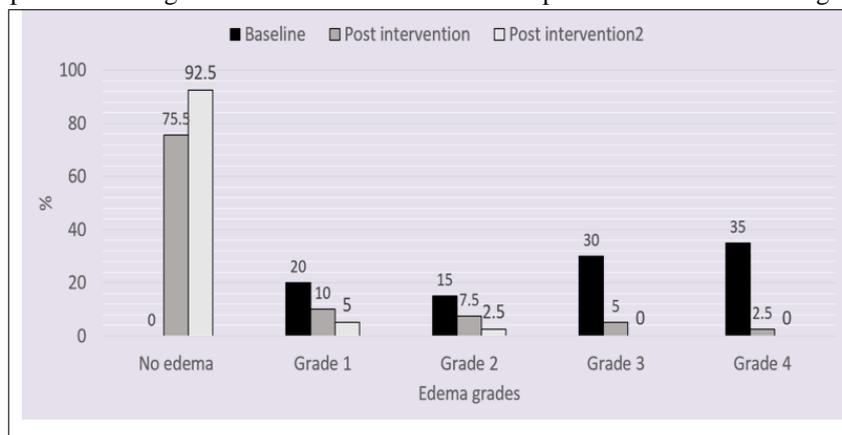


Table 3. Frequency Distribution for Grade of Leg Edema in Pre and Post Interventions

	(G1) leg elevated (n =40)		(G2) leg immersed (n =40)		Significance test	
	No.	%	No.	%	X ²	P
Pre-intervention						
Grade 1	5	12.5	8	20.0	0.844	0.839
Grade 2	7	17.5	6	15.0		
Grade 3	13	32.5	12	30.0		
Grade 4	15	37.5	14	35.0		
Post-intervention (1st interview)					1.45	0.835
No edema	34	85.0	30	75.0		
Grade 1	2	5.0	4	10.0		
Grade 2	2	5.0	3	7.5		
Grade 3	1	2.5	2	5.0		
Grade 4	1	2.5	1	2.5		
Comparison pre vs post intervention						
X ²	60.599		50.641			
P<0.001	<0.001					
Post intervention : 2nd interviewing (after 2wks of follow up)						
No edema	38	95.5	37	92.5	0.347	0.841
Grade 1	12.5		2	5.0		
Grade 2	12.5		1	2.5		
Grade 3	0	0.0	0	0.0		
Grade 4	0	0.0	0	0.0		
Comparison pre vs post intervention2						
X ²	73.167		70.171			
P	<0.001		<0.001			

IV. Discussion

The current study aimed to evaluate effect of leg elevation versus water immersion on leg edema in third trimester of pregnancy. The aim was significantly supported with the present study hypothesis. The present study has been conducted on 80 healthy pregnant women who divided into two equal groups and both were almost similar regarding the general characteristics (the gravity, parity and the gestational age) did not differ significantly between the leg elevated group and leg immersed group.

The study finding showed marked reduction of lower limb edema in the group with water immersed compared to their baseline data. Regarding to the frequency distribution for the grade of leg edema in pre and post interventions (immediately & after 2 weeks of follow up), the reduction was significant ($p < 0.001$). Accordingly, the study hypothesis is accepted.

The study findings are in consistent with a trial by **Irion (2011)** who found that immersion, standing in water versus sitting upright in a chair with legs elevated for 20 minutes more women in the water immersion group experienced reduction of leg oedema compared to women in the leg elevation group. Parallel with this study finding, **Hartmann and Huch (2005)** observed that single session of immersion exercise significantly decreased the volume of both leg edema. Also, **Engelberger et al. (2011)** reported that water immersion is a simple and cost-effective method of treating and preventing the unpleasant symptom of pregnancy such as leg edema.

Also, **Young and Jewell (2007)**, agreement with the present study finding, as they assessed effects of different modalities relieving the symptoms to reduce leg oedema. In the same line, **Mollart L, (2003)** conducted a blind randomized controlled trial to explore the differential effects of two different techniques with a period of rest on oedema-relieving effects and symptom relief in healthy pregnant women with foot oedema. Study performed on Fifty-five women in the third trimester who were randomly assigned to one of the three groups, their results indicated that there was a statistically significant differences in reduction for symptoms associated with oedema (less swelling/tightness, less pain/soreness, more mobility, and comfortable/relaxed) when two different techniques were compared with rest alone.

On other hands recent studies by **Nivethitha (2014)** who reported that immersion initiates a diuresis faster than bed rest and is more effective per hour as a treatment for the edema of pregnancy. The previous findings are different from the current study, which indicated that immersion initiates a diuresis faster than bed rest and is more effective per hour as a treatment for the edema of pregnancy, this study findings found that no significant differences among both interventions which means that both interventions was highly significant to diminish leg edema.

V. Conclusion

The leg elevation and water immersion are safe, comfortable and effective in reducing leg edema during third trimester of pregnancy. Women develop edema of pregnancy, water immersion and leg elevation should be used as a potential management. Meanwhile, lead to a decreased necessity for medical interventions. Our study results suggest that regular leg elevation and water immersion are beneficial in terms of decreasing physiological lower leg oedema in healthy women without obstetric complications.

VI. Recommendations

In the light of this study finding, the following are recommended:

- Appropriate guideline should be designed and distributed among health team members in maternity health facilities to improve their knowledge about the importance of leg elevation and water immersion in reducing grade of leg edema.
- In managing edema in healthy pregnant women, the nurse needs to rule out preeclampsia, recommend water immersion and leg elevation that will diminish lower limb edema.
- There is a need for further researches to find out other benefits from water immersion for women and fetus.

References

- [1]. Anderson FWJ, Johnson CT. (2005): **Complementary and alternative medicine in obstetrics**. International Journal of Gynaecology and Obstetrics; **91**: 116–124.
- [2]. Bamigboye A & Hofmeyr (2006): **interventions for leg edema and varicosities in pregnancy: what evidence**. Eur J Obstet Gynecol Reprod Biol.; 129(1) PP3-8.
- [3]. Çoban Ayden (2010): **Effect of foot massage to decrease physiological lower leg oedema in late pregnancy: A randomized controlled trial in Turkey**. International Journal of Nursing Practice; 16: 454–460.
- [4]. David C. Dugdale, (2013): **Foot, leg, and ankle swelling**. Available at <http://www.pennmedicine.org/encyclopedia/em>.
- [5]. Engelberger R, Blazek C, Amsler F, Keo H, Baumann F, Blättler W, Baumgartner I, and Willenberg (2011): **Reproducibility and day time bias correction of optoelectronic leg volumetry: a prospective cohort study**. BMC Medical Research Methodology, 11: 138. Available at <http://www.biomedcentral.com/1471-2288/11/138>.
- [6]. Goroll A, H., & Mulley, A. G. (2009): **Primary care medicine: Office evaluation and management of the adult patient**. Philadelphia, PA: Lippincott Williams and Wilkins.

- [7]. Gun Ohlsson (2001): **warm tub bathing during labor : maternal and neonatal effects** ,ActaObstetGynecolScand 80 ,PP311-314.
- [8]. Hartmann.S&Huch.R(2005): **Response of pregnancy leg edema to a single immersion exercise session**,ActaObstetGynecolScand , 84: 1150–1153.
- [9]. Ian M. Wilcock,John B. Cronin and Wayne A. Hing.(2006):**Physiological Response to Water Immersion A Method for Sport Recovery?** Med 2006; 36 (9) 747-765.
- [10]. Irion JM, Irion GL. (2011):**Water immersion to reduce peripheral edema pregnancy**. Journal of Women's Health Physical Therapy2011;**35**(2):46-9.
- [11]. John W. Jerome A. Osheroff, Lee Chambliss, Mark H. Ebell, (2006):**Approach to Leg Edema of Unclear Etiology** . J Am BoardFam Med vol. ,19 no. 2 148-160.
- [12]. Mandal AK (2008):**Edema: a systematic approach to diagnosis and management**.ComprTher. Summer;34(2):77-88.
- [13]. Mollart L. (2003):**Single-blind trial addressing the differential effects of two reflexology techniques versus rest, on ankle and foot oedema in late pregnancy**. Complementary Therapies in Nursing and Midwifery 2003;**9**:203-8.
- [14]. Mooventhan a, nivethitha (2014):**scientific c evidence-based effects of hydrotherapy on various systems of the body**,North American Journal of Medical Sciences ,Volume 6 | Issue 5 |
- [15]. O'Brien JG, Chennubhotla SA. (2005):**Treatment of edema**. AmericanFamilyPhysician ;71: 2111–2117. 9
- [16]. Rachel Nall (2013): **How-to-reduce-swollen-legs-feet**Available at <http://www.livestrong.com/article/260770->.
- [17]. Rebecca MD Smyth,NasreenAflaifel,Anthony A Bamigboye (19 October 2015) :**Interventions for varicose veins and leg oedema in pregnancy**.Cochrane Pregnancy and Childbirth Group.Available <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001066.pub3/full>.
- [18]. Richard H Sterns, Michael Emmett, John P Forman (2015) :**Patient information: Edema (swelling) (Beyond the Basics)**; available at <http://www.uptodate.com/>
- [19]. Sabin Ehartmann and Renate Huch (2005):**Response of pregnancy leg edema to a single immersion exercise session**.ActaObstetGynecolScand; 84: 1150–1153.
- [20]. Schroth BE. (2005):**Evaluation and management of peripheral edema**. JAAPA: Official Journal of the American Academy of Physician Assistants 2005; **18**: 29–34.
- [21]. Shaun Cho, & Edwin Atwood (2002) : **peripheral edema**, the American Journal of Medicine volume 113.
- [22]. Smyth RM¹, Aflaifel N, BamigboyeAA(2015):**Interventions for varicose veins and leg oedema in pregnancy**.Cochrane Database Syst Rev. 2015 Oct 19;10:CD001066. doi: 10.1002/14651858.CD001066.pub3.
- [23]. Stems, R.H.(2013) : **Pathophysiology and etiology of edema in adults** . Available at <http://www.uptodate.com/contents/pathophysiology-and-etiology-of-edema> .
- [24]. Silveira et al. (2010):**FetalCardiotocography before and after Water Aerobics during Pregnancy**, reproductive health 7:23 <http://www.reproductive-health-journal.com/content/7/1/23>.
- [25]. Vallim et al. (2011): **water exercises and quality of life during pregnancy reproductive health**, reproductive health journal8:14.
- [26]. Young GL¹, Jewell D.(2007):**Interventions for varicosities and leg oedema in pregnancy**. [Cochrane Database Syst Rev. 2007]