

# Impact of the manual lymphatic drainage on symptoms related to lower-extremity edema in pregnant women

*Impacto da drenagem linfática manual nos sintomas relacionados ao edema de membros inferiores de gestantes*

*Impacto del drenaje linfático manual sobre los síntomas relacionados con el edema de miembros inferiores en mujeres embarazadas*

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**ABSTRACT** | This article aims to analyze the effects of manual lymphatic drainage on symptoms related to gestational edema in the lower limbs, such as a sensation of heaviness, pain, swelling, and tingling, as well as on perimetry. The sample consisted of 23 pregnant women with gestational age above 26 weeks, who were submitted to 35 sessions of drainage based on Leduc's method upon the authorization of their physicians. Participants with blood pressure above 140/100 mmHg at the time of drainage and presenting with skin continuity wound, heart disease, dermatological disease, lymphatic disease, infections, and voluminous or symptomatic varicose veins were excluded from the study. Symptoms were evaluated immediately and two hours after drainage by means of questionnaires. Improvements in pain ( $p=0.001^*$ ), tingling ( $p=0.01^*$ ), sensation of heaviness ( $p=0.000^*$ ), and swelling ( $p=0.000^*$ ) showed statistically significant differences before, immediately after, and two hours after intervention. Most perimetry measurements also presented a decrease after treatment. The technique of manual lymphatic drainage is very important to provide well-being and a better quality of life in pregnant women. The benefits arising from such a method are essential to decrease anxiety, enduring up until childbirth.

**Keywords** | Physical Therapy Specialty; Massage; Pregnant Women; Women's Health.

**RESUMO** | O objetivo deste artigo é analisar os efeitos da drenagem linfática manual sobre os sintomas de sensação de peso, dor, edema e formigamento nos membros inferiores de gestantes, assim como na redução da perimetria. A amostra foi composta por 23 voluntárias, e foram realizados 35 atendimentos. Foram incluídas gestantes com idade gestacional acima de 26 semanas, que apresentavam sensação de peso, dor, edema e formigamento nos membros inferiores, com autorização escrita do médico obstetra para que fossem submetidas a drenagem linfática manual utilizando o método Leduc. Foram excluídas gestantes que apresentaram pressão arterial superior a 140/100mmHg no momento da realização da drenagem linfática manual, lesão de continuidade da epiderme, doenças dermatológicas, linfáticas e cardíacas, infecções e varizes volumosas e/ou sintomáticas. As avaliações foram realizadas imediatamente após a aplicação da drenagem linfática manual e duas horas depois, por meio de questionário estruturado pelas pesquisadoras. Diferenças estatisticamente significativas foram encontradas antes, imediatamente após e após duas horas da intervenção no que se refere à melhora da dor ( $p=0,001^*$ ), do formigamento ( $p=0,01^*$ ), da sensação de peso ( $p=0,000^*$ ) e do inchaço ( $p=0,000^*$ ). Em relação à perimetria antes e após o tratamento, houve diminuição na maioria das mensurações realizadas. A técnica de drenagem linfática

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manual tem papel fundamental na melhora da qualidade de vida da gestante devido ao relaxamento e bem-estar proporcionado, componentes considerados essenciais para redução da ansiedade e com benefícios que podem perdurar até o parto.

**Descritores** | Fisioterapia; Massagem; Gestantes; Saúde da Mulher.

**RESUMEN** | El objetivo de este estudio es analizar los efectos del drenaje linfático manual sobre los síntomas de pesadez, dolor, edema y hormigueo en miembros inferiores de mujeres embarazadas, así como sobre la reducción de la perímetría. La muestra estuvo conformada por 23 voluntarias, y se realizaron 35 consultas. Se incluyeron a mujeres embarazadas con edad gestacional superior a 26 semanas, que presentaban sensación de pesadez, dolor, edema y hormigueo en miembros inferiores, y que habían sido autorizadas por el obstetra para someterse al drenaje linfático manual con el método Leduc. Se excluyeron a mujeres embarazadas con presión arterial superior a 140/100mmHg en el

momento del drenaje linfático manual, lesión de continuidad de la epidermis, enfermedades dermatológicas, linfáticas y cardíacas, infecciones y varices grandes y/o sintomáticas. Las evaluaciones se realizaron tras aplicar el drenaje linfático manual y dos horas después, por medio de un cuestionario estructurado por las investigadoras. Se encontraron diferencias estadísticamente significativas antes, inmediatamente después y después de dos horas de la intervención en relación a la mejoría del dolor ( $p=0,001^*$ ), hormigueo ( $p=0,01^*$ ), sensación de pesadez ( $p=0,000^*$ ) e hinchazón ( $p=0,000^*$ ). La perímetría antes y después del tratamiento disminuyó en la mayoría de las mediciones realizadas. La técnica de drenaje linfático manual juega un papel fundamental en la mejora de la calidad de vida de mujeres embarazadas por provocar relajación y bienestar, componentes claves para reducir la ansiedad, con beneficios que pueden durar hasta el parto.

**Palabras clave** | Fisioterapia; Masaje; Mujeres Embarazadas; Salud de la Mujer.

## INTRODUCTION

Women undergo numerous physical and hormonal changes during the gestational period, resulting in several complaints<sup>1</sup>. About 80% of pregnant women, for example, present with gestational edema, 50% of which are located in the lower limbs (LLLL)<sup>2</sup>.

Edema refers to the excess accumulation of fluid within the tissues and, in cases of sudden manifestation, attention to pregnant women should be redoubled<sup>3</sup>. The rise in progesterone levels during pregnancy promotes systemic vasodilation, allowing for greater blood flow and venous pressure and inducing an overload in the pelvic veins and inferior vena cava. This leads to an increase in the venous pressure of the LLLL, possibly triggering varicosities and edema – which, when associated, may cause deep vein thrombosis and thrombophlebitis. Thus, a medical team should monitor gestational edema to take prophylactic measures regarding arterial hypertension (AH) or preeclampsia<sup>2</sup>.

Edema causes discomfort, pain, sensation of heaviness, nocturnal cramps, tingling in LLLL, aesthetic changes, and pinched nerve, which may induce paresthesia, muscle weakness, and functional disabilities, deteriorating quality of life<sup>2</sup>. The management of gestational edema is focused on treatment rather than cure, including both pharmacological and

non-pharmacological methods<sup>2</sup>. Physiotherapy stands out in conservative management with manual lymphatic drainage (MLD) techniques, guidelines on compression stockings use, rest associated with LLLL elevation, metabolic exercises, and hydrotherapy<sup>2</sup>. Among these, MLD is the most used for treating edema<sup>2,3</sup>.

Created by the Vodder couple in 1936 and later adapted by other scholars, the technique maintains water balance and allows a greater elimination of metabolic residues<sup>4</sup>. With that, it aims to promote the displacement of lymph and interstitial fluid towards the lymph nodes to relocate them in the blood stream<sup>1</sup>, assisting in nutrients exchange and range of motion improvement in the lymphatic and immunological system, thus enabling activities of daily living (ADLs) and improving quality of life<sup>3</sup>. MLD can promote hemodynamic changes, interfering in blood pressure (BP) and heart rate (HR) and, consequently, in cardiac output (CO)<sup>2</sup>. Several studies report on its benefits regarding physical and mental relaxation<sup>3</sup>. Gentle glide massage stimulates a generalized relaxation response in the parasympathetic system, favoring the circulation of body fluids and providing muscle relaxation<sup>5</sup>.

This study hypothesizes that the application of the MLD technique will increase tissue pressure and lymph transport capacity, besides reducing volume and thus discomfort, such as sensation of heaviness and pain, improving quality of life and promoting well-being

in pregnant women<sup>6</sup>. Despite the lack of scientific evidence on MLD application in gestational edema, especially regarding related signs and symptoms, this technique is widely recommended for the treatment of the public in question in physiotherapy clinics. This study aims to evaluate the impacts of MLD on symptoms associated with LLLL gestational edema, such as sensation of heaviness, pain, swelling, and tingling, as well as its effects on perimetry and BP.

## METHODS

This is a non-randomized clinical trial conducted between October 2017 and August 2018 at the Faculty of Physical Education and Physiotherapy of the Universidade Federal de Uberlândia, in Uberlândia (MG). The number of visits was calculated based on the number of MLD sessions – that is, each pregnant woman could be attended more than once. Thus, although the sample consisted of 23 volunteers, 35 visits were performed.

Pregnant women with gestational age (GA) above 26 weeks, presenting a sensation of heaviness, pain, swelling and/or tingling in LLLL, with written authorization from their obstetrician to undergo MLD were included in the study. Volunteers diagnosed with AH should have the condition controlled.

Exclusion criteria consisted of BP greater than 140/100 mmHg at the time of MLD; skin continuity wound; dermatological, lymphatic, and cardiac diseases; infections; and voluminous and/or symptomatic varicose veins.

After extensive dissemination of the research, volunteers were recruited through social networks and indications from health professionals. Once the participants were contacted and received explanations about both the study relevance and the used technique, they were invited to participate and sign the free and informed consent form.

## Outcomes evaluated

Initially, anamnesis was performed by means of an evaluation form covering personal information, obstetric history, history of current disease, main complaint area, associated diseases, physical examination, and perimetry. Then, volunteers received the Initial Satisfaction Questionnaire structured by the researchers to classify sensation of heaviness, pain, tingling and swelling,

as well as to collect data on previous MLD and discomfort, with the aid of the Borg scale and an image to indicate the edema region (Figure 1).

For enabling the evaluation of subjective data<sup>7</sup>, the Borg scale was used to quantify signs and symptoms from 0 to 10 – indicating absence or excess, respectively.

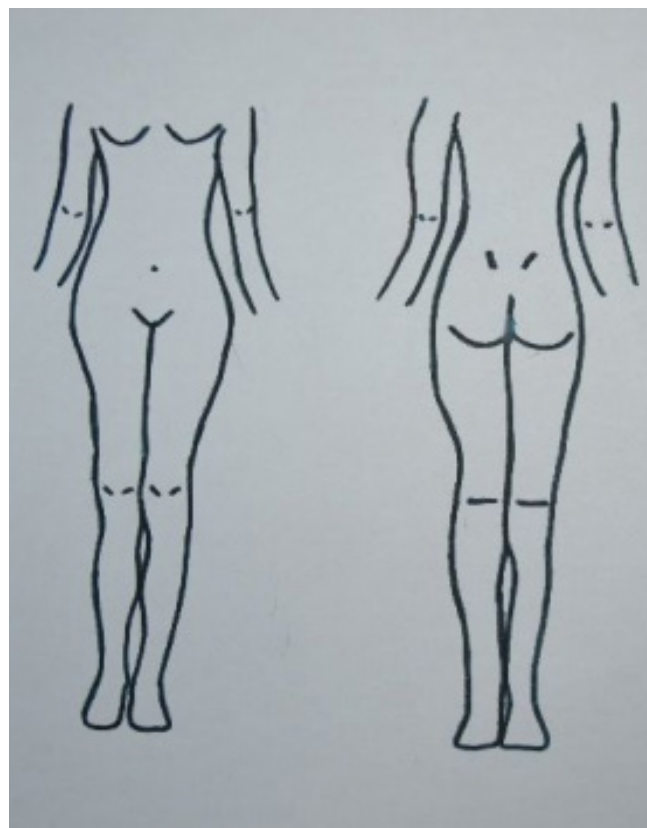


Figure 1. Image used to indicate edema region  
Source: Personal archive.

After completing the questionnaire, patients were referred to LLLL perimetry, which was based on the limbs circumference. Performed with a malleable measuring tape with 7-mm width and 1-mm accuracy before and after MLD application, perimetry allows for the easy identification of changes in limbs dimension and the evaluation of body volume<sup>8</sup>.

Adopting the popliteal fossa (PF) as the initial landmark, the points located 10 and 20 centimeters above and below the landmark, ankles, midfoot, and forefoot were marked using a dermatograph pencil. Measurement was performed by a previously trained evaluator positioned laterally to volunteers, who in turn were in supine position, with the trunk slightly flexed, LLLL slightly abducted, and with a roller positioned in the knees and ankles, allowing for a slight flexion and support, respectively.

Immediately after MLD application and two hours after the procedure, the volunteers were invited to answer the Final Satisfaction Questionnaire and the Satisfaction Questionnaire After Two Hours, respectively, using a messaging application, answering questions about MLD, benefits related to the technique, and symptoms quantification.

Before, during, and shortly after the intervention, a single evaluator measured participants' BP in the brachial artery using a Premim sphygmomanometer and a Riester stethoscope.

### Manual lymphatic drainage technique

MLD was performed according to the methodological principles of Leduc, through proximal-to-distal movements in the limb. In the thigh region, for example, it started in the proximal portion of the femur and went to the distal. Each segment was subdivided into four quadrants, and the technique was applied in each of them until completing the whole body segment. Movements were performed with a desired pressure of 44mmHg, in a centripetal direction, slowly, superficially, constantly, and undulating while respecting the lymphatic system physiology<sup>9</sup>.

The technique was performed with participants in supine position, with the trunk slightly inclined and LLLL elevated by rollers positioned in knees and ankles for the comfort of the volunteer. Participants were instructed to alert the evaluator if they experienced any discomfort during drainage, in which case the BP would be remeasured and the volunteer would be positioned in left lateral decubitus. Three main maneuvers were used for lymph transport, each performed five to seven times in each quadrant, focusing on the chief-complaint region and in the most swollen site.

The maneuvers<sup>9</sup> used are described below: (1) evacuation: pumping movement on the lymph node chains – inguinal, popliteal, and malleolar – to drain and decongest the track; (2) uptake: slow and rhythmic movements performed in regions close to lymph nodes, with relatively superficial pressure; (3) resorption: stamping the lymph from more distal regions to lymph nodes. The evacuation maneuver was performed five to seven times in the region of inguinal lymph nodes, followed by uptake in the proximal quadrants and resorption in the distals. The same procedure was performed on legs, ankles, and feet,

concluding with bracelet movements on the drained limb – which consists of involving the perimeter of the limb and sliding from distal to proximal direction along its entire length.

Sessions were performed with at least 48 hours intervals and lasted twenty minutes, with each limb being submitted to MDL for ten minutes – approximately four minutes on the thigh region, and the remaining seven on the leg, ankle, and foot regions. However, as therapists were focused on the region with the most complaint and edema, such a time distribution was susceptible to alterations. A Dermyrat vegetable oil with grape seed and sesame without active ingredients was used to enable slide. To ensure the effectiveness of the results, a qualified professional duly trained the evaluator to perform MLD.

This study was primarily focused on evaluating the symptoms reported by the volunteer following MLD, so that the number of sessions with pregnant women was considered in data analysis. As participants often requested more sessions, the number of visits per volunteer did not follow a strict pattern.

### Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS V21, Chicago, IL) software. Data on perimetry were tested for normality using the Shapiro-Wilk test, presenting normal distribution. Thus, difference in the perimetry of the lower limb before and after intervention for paired samples was verified using the t-test.

BP and the reported symptoms did not present normal distribution, so that BP before and after intervention were compared using the Wilcoxon nonparametric test and reported symptoms using the Kruskal-Wallis test. All tests were performed using a 5% significance level ( $p < 0,05$ ).

## RESULTS

Forty-five women in the third trimester of pregnancy were invited to participate in this study, but only 23 underwent intervention and completed the protocol, totaling 35 visits. Women with GA less than 26 weeks, voluminous varicose, and unavailability of schedules were not included in the study.

Table 1 presents data on sample characterization.

Table 1. Sample characterization

	Mean (SD) (n=23)	
Age (years)	31.4 (4.0)	
Gestational age (weeks)	33.2 (3.5)	
	Yes (%)	No (%)
LLLL elevation	10 (43.5)	13 (56.5)
Physical activity	14 (60.9)	9 (39.1)
Lost of ability in ADLs	12 (52.2)	11 (47.8)

SD: standard deviation; LLLL: lower limbs; ADLs: activities of daily living.

Table 2 presents data on the symptoms reported by the volunteers before, immediately after (D1), and two hours after the MDL (D2).

Table 2. Symptoms reported by the volunteers before and after intervention using the Borg scale

	(n=35 sessions)			
	Before Mean (SD)	D1 Mean (SD)	D2 Mean (SD)	p-value
Pain	3.5 (2.9)	0,8 (1.6)	0 (1.7)	0.001*
Sensation of heaviness	6 (3.3)	1,1 (1.9)	0 (1.7)	0.000*
Tingling	2.8 (3.5)	0.4 (1.2)	0.3 (0.9)	0.01*
Swelling	6.6 (2.9)	1.2 (1.8)	1.8 (2.2)	0.000*

SD: standard deviation; D1: immediately after the procedure; D2: Two hours after the procedure. \*Kruskal-Wallis test.

As shown in Table 3, most perimetry measurements decreased after treatment.

Table 3. Perimetry before and after intervention

Site	Right lower limb (n=35 sessions)			Left lower limb (n=35 sessions)		
	Before Mean (SD)	After Mean (SD)	p-value	Before Mean (SD)	After Mean (SD)	p-value
20cm above PF (cm)	57.1 (6.3)	55.7 (6.3)	0.000*	57.1 (6.2)	56 (6.1)	0.000*
10cm above PF (cm)	47 (5.3)	46.6 (5.4)	0.07	48.4 (5.8)	47.6 (5.8)	0.000*
FP (cm)	46.2 (7.3)	45.4 (7.3)	0.000*	46.5 (6.8)	45.5 (6.8)	0.000*
10cm below PF (cm)	37.3 (4)	36.3 (3.9)	0.000*	36.8 (3.9)	36 (3.9)	0.002*
20cm below PF (cm)	35.5 (4)	34.7 (3.8)	0.001*	35.2 (4)	35.1 (4)	0.874
Ankle (cm)	22.9 (2.1)	22.2 (1.8)	0.01*	23 (2.3)	22.5 (2)	0.02*
Midfoot (cm)	24.1 (1.7)	23.6 (1.6)	0.02*	26.7 (3.3)	25.8 (4)	0.000*
Forefoot (cm)	23 (1.6)	22.5 (1.5)	0.07	22.8 (1.5)	22.4 (1.5)	0.07

SD: standard deviation; PF: popliteal fossa.

\*T-test for paired samples.

Table 4 shows data on systolic and diastolic BP before and immediately after intervention. The results indicate

a decrease or maintenance in systolic and diastolic BP, but no variation as to its increase.

Table 4. Systolic and diastolic blood pressure before and immediately after intervention

	Systolic BP (mmHg)			Diastolic BP (mmHg)		
	Before Mean (SD)	After Mean (SD)	p-value	Before Mean (SD)	After Mean (SD)	p-value
Sessions (n=35)	105.4 (11)	104.8 (11.3)	0.759	74.5 (11.5)	73.4 (8.3)	0.547

BP: blood pressure; SD: standard deviation.

\*Wilcoxon nonparametric test.

## DISCUSSION

MLD provides a series of physical and physiological benefits, thus being widely incorporated into several professionals' clinical practice and for the

treatment of pregnant women, especially in the last trimester<sup>2</sup>. Our results indicate a decrease in signs and symptoms of pain, sensation of heaviness, tingling, and swelling, as well as a reduction in perimetry and maintenance of BP.



The literature addressing these symptoms among pregnant women is scarce, but some studies have reported on the benefits of MLD associated or not with other techniques<sup>10</sup>. We found MLD to achieve positive outcomes among pregnant women, thus indicating the safety and effectiveness of such a method for treating gestational edema in LLLL.

MLD also provides physical and mental relaxation<sup>3</sup>. Skin pressure promotes mechanical stimulation through touch, compressing and tensioning soft tissues and consequently stimulating cutaneous nerve receptors. Electrochemical reactions allow its conduction to the posterior horn of the medulla, to the hypothalamus, and to the post-central gyration of the cortex. Tactile stimulation rises faster to the spinal cord, inhibiting painful fibers, as they contain greater concentrations of myelin than nerve fibers. This process also releases endorphins and enkephalins, whose mechanism of action is similar to that of morphine as to hypothalamus stimulation. The hypothalamus is associated with the limbic system, which regulates visceral functions and mediates emotions, intervening in the autonomic nervous system (ANS) and thus relieving stress and anxiety while generating pleasure<sup>11,12</sup>.

Parasympathetic ANS induces generalized relaxation, improves fluid circulation, and relaxes the musculature upon touch<sup>11,12</sup>. This system may interfere with cortisol levels, favoring sympathetic ANS maturation through massage<sup>12</sup>.

Touch promotes neurological, glandular, muscular, and mental changes, thus influencing both physical and emotional aspects. These factors allow us to affirm that MLD improves BP patterns, sleeping quality and anxiety, besides promoting relaxation, pain relief, and body and emotional awareness<sup>11,12</sup>. The nervous and endocrine systems establish a dynamic interaction with the skin, enabling emotional response and interfering with proprioceptive and psychoemotional development<sup>12</sup>.

Thus, trust plays a key role in this process, strengthening professional–patient bond and boosting treatment benefits<sup>12</sup>. In this study, the volunteers reported that the maneuver performed during MLD application was relaxing. Therapeutic touch is believed to provide well-being for this population and reduce anxiety, which can provide benefits even for the moment of delivery.

We found very few articles addressing the relief of the sensation of heaviness and tingling through MDL. In a literature review conducted by Muller et al.<sup>6</sup>, the authors verified that, when combined with MLD, the use of

complex decongestive therapy (CDT) for treating breast cancer-related lymphedema optimized therapy by reducing limb perimetry, promoting well-being, and relieving pain, sensation of heaviness, and skin tension. Regarding well-being, our results suggest that the maneuver may be related to the relaxation of pregnant women, improving well-being and quality of life at the end of pregnancy<sup>6</sup>.

Perimetry reduction is a well-know benefit arising from MLD, significantly reducing the circumference of the measured site, especially in swollen or lymphedema regions<sup>13</sup>. According to Machado et al.<sup>2</sup>, MLD does not increase perimetry, but rather promotes the maintenance and attenuation of its measurements during intervention<sup>2</sup>. Instead of directly evaluating edema, perimetry evaluates body volume. Being a low-cost technique, easily accessible, and widely used in clinical practice, we opted by using this method.

Women undergo numerous biomechanical and hormonal changes during the gestational period<sup>1</sup>, which are often associated with a high prevalence of gestational edema, especially during the third trimester<sup>2</sup>. These changes lead to an emotional impact, generating anxiety and insecurity with the approach of the baby's arrival. Thus, by treating gestational edema with MDL, the professional will also be assisting in the woman's relaxation. According to the literature, therapeutic touch promotes neurological, glandular, muscular, and mental changes, thus influencing both physical and emotional aspects. These factors allow us to affirm that MLD improves BP patterns, sleeping quality and anxiety, besides promoting relaxation, pain relief, and body and emotional awareness<sup>11,12</sup>.

Ramos et al.<sup>4</sup> report that MLD promotes lymph influx through pressure differentials that induce the contraction and relaxation of smooth muscle and blood vessels. The authors also found no significant cardiovascular responses to the point of classifying the conduct as contraindicated in relation to HR and BP parameters. Similar results were found as to BP maintenance, whereby BP showed no significant increase, but was maintained or reduced in relation to initial patterns.

We analyzed BP during MLD for suspecting that the technique might trigger its increase, thus being contraindicated in some cases. When investigating the effects of MLD on LLLL in patients with congestive heart failure, Leduc et al.<sup>13</sup> found hemodynamic parameters to show no significant changes during and after intervention. In a study conducted by Cardoso,

Sousa and Souza<sup>3</sup>, the authors found that women with gestational edema in the third trimester of pregnancy submitted to MLD presented significant reduction in edema and relief of symptoms of pain, tingling, sensation of heaviness, and swelling. They also verified that MLD had no effect on BP, which remained stable during and after intervention.

Before MLD intervention, most of our study sample was unable to elevate LLLL (56.5%) and had lost ability in ADLs (52.2%). Although primarily associated with rehabilitation, the physiotherapist must also act on prevention and health promotion, offering guidelines as to the prevention of gestational edema, such as LLLL elevation and the practice of physical activity – crucial to improve lymphatic return<sup>14</sup> and avoid physical disabilities.

Besides relieving symptoms, MLD allows for the clarification of doubts regarding GA, thus enabling the formation of professional–patients bonds. Moreover, these sessions provide a calm and pleasant environment that, added to the physical and mental relaxation upon touch, may distract women from their daily worries and tasks.

These factors indicate the effectiveness of such a technique in the treatment of gestational edema, providing beneficial and significant results. When an interdisciplinary team is intervening in the woman care, she should be referred to the physiotherapist at the beginning of her complaints to receive better instructions as to habits she should continue or acquire to reduce gestational edema-related symptoms according to her history. With regard to the economic aspect, MLD requires no equipment, thus being considered accessible. Moreover, the touch is not invasive, which favors adherence.

The reported symptoms were evaluated immediately and two hours after the procedure, enabling a better understanding of the benefits arising from MLD in the treatment of gestational edema. To the best of our knowledge, we are the firsts to investigate these variables at two periods, thus comprising a strength of this study. As the physical and hormonal changes experienced by pregnant women have a direct influence on the baby, MLD should be implemented in the treatment of gestational edema to promote well-being and a higher quality of life.

Our results also indicate a reduction in LLLL perimetry and BP. However, we have not evaluated hemodynamic parameters such as HR, late monitoring of BP behavior, and the method

repercussions on the fetus, so that further studies with longer follow-up periods should be performed to assess the reported symptoms.

## CONCLUSION

MLD application enabled a reduction in symptoms of pain, swelling, sensation of heaviness, and tingling in LLLL, besides promoting a decrease in perimetry and the maintenance of BP in pregnant women.

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