# Effect of Foot Reflexology and Meditation Training on Blood Pressure in Premenopausal Women in EL Minya Governorate, Egypt

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**Abstract:**

**Background:** Hypertension is a predominant cause of mortality and morbidity globally. The World Health Organization reports that 1.3 billion individuals suffer from hypertension. Hypertension can be controlled with therapies other than drugs, such as foot reflexology as well as meditation. **Purpose:** To assess the impact of foot reflexology as well as meditation training among hypertensive premenopausal women.

**Methods:** Fifty clinically diagnosed hypertensive premenopausal women, aged 40 to 47 years, with a body mass index (BMI) ranging from 25 to 29.9 kg/m² along with blood pressure between 140/95 mmHg, took part in this study. They were randomly allocated into two equal groups (A and B). Group A participants were given foot reflexology alongside meditation training techniques, whereas Group B participants were given simply meditation training techniques. The treatment program was conducted three times each week for eight weeks. Evaluations of all subjects for blood pressure in both groups (A and B) were conducted pre- and post-treatment.

**Results:** Both groups (A and B) demonstrated a substantial reduction ($P<0.005$) in blood pressure measurements following the completion of the 8-week training program. Participants in the foot reflexology combined with meditation training group (A) demonstrated a more substantial reduction in blood pressure levels.

**Conclusion:** The combination of foot reflexology in addition to meditation had a more beneficial results in decreasing both systolic and diastolic blood pressure in premenopausal women complain from elevation of blood pressure.

**Keywords:** Hypertension, foot reflexology, meditation training, premenopause.

## 1. Introduction

Hypertension (HTN) is a condition characterized by a systolic blood pressure (SBP) of 140 mmHg or higher as well as a diastolic blood pressure (DBP) of 90 mmHg or higher (Yonata & Pratama, 2016). Hypertension is a predominant cause of mortality as well as morbidity. globally. The World Health Organization estimates that 1.3 billion people have hypertension, which causes more than 10 million deaths yearly. However, only 54% of adults with hypertension receive a diagnosis, 42% receive treatment, and 21% manage their condition, highlighting the fact that hypertension is a serious public health concern (WHO 2023).

High blood pressure (BP) is classified into two categories: primary (or essential) HTN and secondary HTN. Approximately 90-95% of patients are diagnosed with primary HTN, or elevated BP without an apparent medical cause. Secondary HTN affecting the kidneys, arteries, heart, or endocrine system accounts for the remaining 5-10% of cases (Mahmoud et al., 2022). Premenopausal women have a higher prevalence of HTN compared to males and women pre menopause. HTN significantly raises the risk of cardiovascular diseases (CVDs), kidney disease, aortic aneurysm, heart failure, peripheral artery disease, as well as stroke (Ahmed et al., 2024).

CVDs are a significant concern due to their global mortality as well as morbidity. Numerous risk factors associated with the development of CVDs include HTN, hyperlipidemia, diabetes mellitus, as well as diet high in salt, which significantly contributes to HTN and coronary heart disease (CHD) and stroke (Tarek et.al., 2022).

Foot reflexology has a number of mechanical benefits, including better circulation, elimination of waste products, increased mobility of joints, alleviation of pain, and relaxation of muscles. Relaxation is one of the psychological benefits. Other beneficial effects of reflexology on baroreceptor reflex sensitivity, sinus arrhythmia (Lu, et al., 2011) and exert a beneficial influence on the physiological parameters, i.e. SBP, DBP and heart rate (HR) (Moeini, et al., 2011). A substantial difference was observed in SBP, DBP, HR, general tiredness, along with mood state following the reflexology session (Mehdi, et al., 2016).

Foot reflexology is a non-invasive therapy that has been traditionally practiced in Thailand. The Department of Thai Traditional and Alternative Medicine, under the Ministry of Public Health, recommends it to enhance health in older people, noting its potential utility as an adjuvant treatment for patients with HTN. In this carefully monitored, randomized study, the impacts of foot reflexology on office SBP, DBP, along with HR among patients with stage 2 HTN were investigated (Kotruchin et al., 2021).

As a non-pharmacological treatment option for hypertension, meditation can help reduce blood pressure by training the body to relax and calm the mind. It's also a mental exercise that affects the body's functions and can help one become more self-reliant by teaching them to regulate their attention, focus, intentions, and choices rather than letting them be dictated by their surroundings (Subekti et al., 2024). Meditation has several advantages, such as lowering anxiety and depression and relaxing the brain (Thibodeaux & Rossano, 2018). substantially reducing BP and enhancing the body's immunological response. Regular meditation can reduce BP, enhance the immune system, boost sleep quality, as well as increase bodily vitality (Gathright et al., 2019).

The current study was conducted to investigate the effects of foot reflexology combined with meditation training among premenopausal women complain from elevation of blood pressure.

## 2. Subjects and methods

### Subjects

In the months of January 2024 to July 2024, 50 pre-menopause hypertensive cases between the ages of 40 to 47 and BMI was ranged from 25 - 29.9 kg/ $m^2$ and blood pressure elevated the systolic blood pressure more than 140 mmHg while the diastolic blood pressure more than 95 mmHg were randomly chosen from were selected from El Minya Health Insurance outpatient clinic, duration of HTN (1-2years), the cause of HTN was limited to behavioral and environmental factors, and were not participated in any previous exercise training program for at least 3 months prior to the study.

All the subjects were asked to avoid using any medical treatments for hypertension during the study period. A comprehensive medical history was taken from all participants to identify any additional pathological conditions. Women with tumors, renal, liver, or cardiac diseases, cardiopulmonary complications, diabetes, lesions in higher centers, hypo- or hyperthyroidism, thrombotic diseases of the lower extremities, foot infections or ulcers, or those who had previously had foot surgery were excluded from the study.

The participants were divided into two equal groups at random. Group A, comprising twenty-five women, engaged in foot reflexology with meditation training approaches. Group B, comprising twenty-five women, engaged solely in a meditation training technique. Three times weekly for eight weeks straight, the therapy procedure was executed. The form received approval from the ethical committee of scientific study at Deraya University's Faculty of Physical Therapy, with the reference number (NO.P. T/REC/230008). All patients with ischemic heart diseases, autonomic neuropathy, chest diseases, renal diseases and endocrinal disorders were excluded from this study. Each participating woman completed a consent form.

### Methods

The design of this research was pre-experimental with a two-group design with pretest-posttest design. The evaluation of all participants in the two groups, group A and group B, were conducted by specialists, they were unaware of the research objective. Evaluation was conducted prior to then following the end of the study by evaluation blood pressure with a mercury sphygmomanometer. Systolic blood pressure was measured at the moment when two or more noises were heard for the first time, and diastolic blood pressure was measured just before the sounds stopped. The clinical BP was measured in the left arm of seated subjects following a 5-minute rest, utilizing a mercury sphygmomanometer. Blood Pressure measurements were conducted at 2 PM for all participants in group A and group B. All women in both groups encourage optimal performance.

### Evaluation procedures:

**Standard weight and height scale** (Health scale made in China) was utilized to determine the body mass index (BMI) by taking the patients' height and weight. BMI (kg/$m^2$) and height (m) were computed from the patients' physical parameters using a weight and height scale. Evaluation performed according to the following formula, which is based on the defined anthropometric protocol: In kilograms divided by square meters, it is the body mass index (Elsisi et.al., 2019).

**Physiological Measurement:** The stethoscope and sphygmomanometer were used to measure the patients SBP, and DBP from the left arm.

**Foot reflexology technique**

Foot reflexology was administered to all subjects in group (A) the session time was half hour for both feet (equal time for right foot fifteen minute and also left foot have the same session time). Each participant was instructed to dress comfortably and light-weight, and to lie down in a quiet room in a calm supine position with her feet resting on the plinth. Before beginning therapy, the patient requested to take off her shoes and socks. examination of the patient's feet for any wounds or broken skin. The feet were thoroughly cleansed with a disinfectant wipe. Aligning both feet closely together and imagine the body's map (El-Refaye et al., 2017).

**Foot reflexology procedures**

As a first step in warming up, wash the entire sole with warm water. In addition to calming the mind and feet, this technique helps to balance the energy throughout the body. The next step in foot massage is to apply a combination of gentle pressure and light stroking on the dorsal and plantar surfaces of each foot for five minutes. This will help relax the foot and the patient.

Each subject was instructed to close their eyes while lying on the examination bed in a silent room. To secure their body in the lateral position, two pillows were positioned behind and in between their legs. In addition, a minute-long relaxation massage with the massage oil was applied to each sole, followed by "metatarsal kneading" foot reflexology.- The right hand's fingers were put on the dorsum of the foot from the medial side, with the thumb resting vertically in the medial edge of the foot and the index finger placed just below the base of the toes, to perform metatarsal kneading. Form a fist with the left hand, pressing the flat portion against the metatarsal area, or plantar surface, directly across from the right hand.Keep both hands in contact with the foot at all times, first press the fit against the metatarsal pad, then knead with the holding hand, release some pressure with the fist,and repeat multiple times(Harfoush et al., 2024).

**Meditation technique**

All participants in the two groups, group A and group B were got meditation training from only one person specialized in the technique. Before commencing study procedure, all women were instructed the best state to achieve greater relaxation as they should be entering the bathroom before starting the session, also all women should not wear any tight clothing. The session was conducted in a temperature between 25 to 28Co using air-condition.

The subjects were all asked to lie down in a comfortable half-lying position, with their backs supported and their arms relaxed at their sides. After supporting and accommodating her body curves with soft pillows and little cushions, the subject was instructed to listen to and monitor her own normal breathing—in, out, and pause in between—for five minutes in order to induce mental relaxation. Then, start imagining an object in her thoughts. This thing need to be enjoyable and uncomplicated for her. It may be the moon, the sea, the sky, or similar things. Slow music is one example of a preferred sound for some people. No matter which one you pick, attempt to picture the word object or something that stands for the sound. Following a gentle instruction to close her eyes, the woman was instructed to inhale deeply through her nose, slowly inflate her abdomen, count to four, and then exhale with a sigh.

This procedure was repeated four times of deep breaths to a count of four and expired to a count of four. Then repeated four times the pattern of deep breath, and expired to a count

of four each, brought her breaths down to a calm and rhythmic pattern. She took herself through the imagination in somewhere she felt more relaxed as in the river or in the beach in the summer, where she sit and hear the soothing sound of the running water, and watch the beautiful scene, and smell the fresh breath of air (Lansky and Louis 2006).

**Statistical analysis**

Statistical analysis was conducted using an unpaired t-test for comparing the mean values of various variables among the two groups, group A and group B. For comparisons between variables in the same group, paired t tests were employed. Data were reported as means and SD, as well as the percentage of change was computed. It was deemed significant with a P value of less than 0.05. Two metrics, the Minimum Detectable Change (MDC) along with the Standard Error of Measurement (SEM), were utilized to assess the intra- and inter-rater agreement. To determine the SEM, which accounts for instrument error. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 25 for Windows (IBM SPSS, Chicago, IL, USA).

## 3. Results

Statistics were used to compare and analyze the data collected from both groups on SBP and DBP.

**General characteristics of both groups, group A and group B .**

There was no statistically substantial difference among the two groups when comparing at the participants' general characteristics, such as their age, weight, height, in addition BMI $p > 0.05$). (table 1)

**Table 1.** General characteristics of both groups

| | Group A | Group B | MD | t- value | p-value | Sig |
|---|---|---|---|---|---|---|
| | $\overline{X}$ ±SD | $\overline{X}$ ±SD | | | | |
| **Age (years)** | 43.50 ± 3.25 | 42.45 ± 3.23 | 0.99 | 1.0005 | 0.320 | NS |
| **Weight (kg)** | 80.22 ± 7.19 | 79.89 ± 7.52 | 0.31 | 0.22 | 0.69 | NS |
| **Height (cm)** | 168.31 ± 7.4 | 168.11 ± 7.67 | -0.20 | -0.17 | 0.79 | NS |
| **BMI (kg/m²)** | 28.11 ± 1.23 | 28.02± 1.19 | 0.09 | 0.81 | 0.33 | NS |

$\overline{X}$: Mean SD: Standard deviation MD: Mean difference
t value: Unpaired t value p value: Probability value NS: Non significant

**Comparison between mean values of SBP measured pre and post-treatment in the two studied groups, group A and group B.**

Statistically substantial reduction (P=0.001) in SBP was seen when comparing prior to and following treatment mean values for the two groups, group A and group B were utilizing a paired t-test. BP in both groups, group A and group B as Shown in (Table 2).

**Table 2.** Comparison between mean values of SBP measured pre and post-treatment in the two studied groups, group A and group B .

| | **Study group(A) (n=25)** | **Control group(B) (n=25)** |
|---|---|---|
| Pre-treatment | 164.55±13.25 | 160.70±12.33 |
| Post—treatment | 149.50±11.20 | 154.50±12.35 |
| Mean Difference | 13.05 | 6.20 |
| Percentage of improvement | 9.08 | 4.53 |
| t-value | 8.564 | 6.089 |
| P-value | 0.001** | 0.001** |

$\bar{X}$: Mean SD: Standard deviation MD: Mean difference t value: Unpaired t value p value: Probability value NS: Non significant S: Significant

**Comparison between mean values of DBP measured pre and post-treatment in the two studied groups, group A and group B.**

DBP for both groups the two groups, group A and group B were compared prior to and following treatment utilizing a paired t-test, which revealed a substantial reduction (P=0.001) in DBP as presented in (Table 3).

**Table3.** Comparison between mean values of DBP measured pre- and post-treatment in the two studied groups. group A and group B.

| | **Study group(A) (n=25)** | **Control group(B) (n=25)** |
|---|---|---|
| Pre-treatment | 98.50±8.72 | 99.75±7.49 |
| Post—treatment | 86.25±6.57 | 95.50±7.52 |
| Mean Difference | 12.25 | 3.25 |
| Percentage of improvement | 11.21 | 3.48 |
| t-value | 8.156 | 4.185 |
| P-value | 0.001** | 0.001** |

$\bar{X}$: Mean MD: Mean difference p value: Probability value SD: Standard deviation t value: Unpaired t value NS: Non significant S: Significant

**Comparison between mean values of pre-treatment and difference in SBP in the two studied groups, group A and group B.**

A comparison of mean values of SBP prior to treatment among the two examined groupsthe two groups, group A and group B, assessed utilizing an unpaired t-test, revealed a statistically substantial improvement in the mean difference in SBP in group A in comparing with group B , with a p-value of 0.001 (Table 4).

**Table 4.** Comparison between mean values of pre-treatment and difference in SBP in the two studied groups, group A and group B.

| | Study group(A) (n=25) | Control group(B) (n=25) | t-value | P-value |
|---|---|---|---|---|
| Pre-treatment | 164.55±13.25 | 160.70±12.33 | 1.165 | 0.218(NS) |
| Mean Difference | 13.05 | 6.20 | 4.034 | 0.001** |

$\bar{X}$: Mean MD: Mean difference p value: Probability value
SD: Standard deviation t value: Unpaired t value NS: Non significant S: Significant

Comparison of mean DBP values prior to treatment among the two studied groups (A, B) assessed utilizing an unpaired t-test. A statistically substantial increase in the mean difference of DBP was observed in group A in comparing with group B, with a p-value of 0.001 (Table 5).

**(Table 5)** Comparison between mean values of pre-treatment and difference in DBP in the two studied groups, group A and group B.

| | Study group(A) (n=25) | Control group(B) (n=25) | t-value | P-value |
|---|---|---|---|---|
| Pre-treatment | 98.50±8.72 | 99.75±7.49 | 1.165 | 0.623(NS) |
| Mean Difference | 12.25 | 3.25 | 4.034 | 0.001** |

$\bar{X}$: Mean MD: Mean difference p value: Probability value
SD: Standard deviation t value: Unpaired t value NS: Non significant S: Significant

## 4. Discussion

Hypertension is a primary contributor to significant cardiovascular incidents along with disability-adjusted life years across numerous populations (Kotruchin et al., 2021). Worldwide, hypertension impacts approximately 1.39 billion individuals aged 30 to 79 years, with two-thirds residing in low- and middle-income nations where healthcare systems frequently face challenges in diagnosing and managing hypertension efficiently (Mills et al., 2020) (WHO 2023). The objective of our findings were to investigate the effect of foot reflexology combined with meditation training among premenopausal women complain from elevation of blood pressure.

The findings of our study demonstrated that the incorporation of foot reflexology into meditation training (group A) resulted in a substantial decrease in BP values when compared with (group B) following two months of treatment, indicating that the combination of foot reflexology as well as meditation training is more effective in lowering BP among premenopausal women than meditation training alone.

Foot reflexology has an impact on hypertensive individuals' BP reduction because the 10 zones Extending from the apex of the head to the toes, all internal components of the ten zones are interconnected and encapsulated within the soles of the feet. Consequently, applying pressure to the zones along with nerve points on the soles of both feet induces comfort and relaxation in the body, thereby facilitating the regulation of BP with minimal

side effects. Blood vessels will enhance, resulting in a soothing impact on rigid muscles, while vasodilation will reduce both SBP and DBP (Lestari et al., 2023).

Our findings align with those of Kotruchin et al. (2021), who determined that foot reflexology effectively reduced HR in stage-2 hypertension patients and was partially beneficial in lowering BP. It can be completed quickly and is noninvasive as a supplemental treatment. Our work aligns with the findings of El-Refaye et al. (2017), which demonstrated that the combination of foot reflexology and transcendental meditation training have efficient treatment for lowering blood pressure between postmenopausal women (Lu et al., 2011) who directed a study about the autonomic nerve regulation among patients with coronary artery disease is assessed using HR variability analysis. Research indicates that foot reflexology can serve as an effective complement to therapeutic interventions for reducing BP and enhancing vagal modulation in both healthy individuals as well as those with coronary artery disease was a result from foot reflexology.

These results are in line with (Lestari et al., 2023) who found that that there is an effect of foot reflexologblood pressure in hypertension sufferers in Community Health Center II Petang. Foot reflexology is important y on to be given to hypertensive patients to reduce the impact of increasing blood pressure. Other research Peper (2019) corroborates our findings by demonstrating that relaxation phases in meditation, characterized by the regulation of deep breathing, self-calming, thought control, or mental focus, can induce relaxation within 15 minutes and diminish emotional stimulation in the sympathetic nerves of the brain. A reduction in sympathetic nerve stimulation during relaxation leads to less norepinephrine secretion, causing a minor drop in cardiac contractility and a reduction in vascular pressure, ultimately leading in lowered SBP and DBP. This occurred in the meditation-treated group (Ooi et al., 2017).

## 5. Conclusion

The combination of foot reflexology in addition to meditation had a more beneficial results in decreasing both systolic and diastolic blood pressure in premenopausal women complain from elevation of blood pressure.

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## 7. Funding

None to report.

## 8. Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## 9. Competing Interests

The authors declare that they have no financial or non-financial competing interests concerning this study. Specifically:

## 10. Ethics statement

This study was approved by the ethical committee of scientific research at Deraya University's Faculty of Physical Therapy (NO.P.T/REC/230008). Written informed consent was obtained from all study participants.

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