



## Effect of Foot Refelexology on Preeclampsia

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### Abstract

**Purpose:** This study was conducted to investigate the effect of foot reflexology on mean arterial blood pressure, Serum Cortisol level, proteinuria and quality of life in pregnant women suffering from mild preeclampsia. **Subjects and Methods:** Sixty mild preeclamptic pregnant women were selected randomly from Out Patient Clinic of Obstetrics Department in Minia University Hospital in Minia to participate in this study. Their ages were between 20-36 years old. Their body mass index less than 35 kg/m<sup>2</sup>. They were divided randomly into two equal groups (A & B); Group A (control group): It comprised thirty pregnant women with mild preeclampsia who were treated by antihypertensive drugs only while group B (study group): It comprised thirty pregnant women with mild preeclampsia who were treated by antihypertensive drugs and foot reflexology sessions (25 minutes, 2 sessions weekly for 8 weeks).

**Assessment:** Mean arterial blood pressure (MABP), Serum Cortisol level and proteinuria were assessed before and after treatment for all patients in both groups (A&B), as well as quality of life was evaluated through World Health Organization quality of Life Questionnaire (WHOQOL).

**Results:** revealed that, between groups; pretreatment, there was insignificant difference between both groups A & B in MABP, serum cortisol level, proteinuria and WHOQOL questionnaire scores. While post treatment, there was significant difference between both groups A & B in MABP, serum cortisol level, proteinuria and WHOQOL questionnaire scores [in favor of group B (more decrease in MABP, serum cortisol level and proteinuria; and more increase in WHOQOL questionnaire scores)].

**Conclusion:** Foot reflexology is an effective modality in decreasing MABP, serum cortisol level and proteinuria, as well as enhancing the quality of life of mild preeclamptic pregnant women.

**Key words:** Foot reflexology – Blood pressure -Proteinuria -. Cortisol level-quality of Life -Preeclampsia.

## 1. Introduction

Preeclampsia is characterized by the emergence of elevated blood pressure after the 20th week of pregnancy, coupled with the presence of proteinuria [1]. Mild preeclampsia is identified by having blood pressure measuring 140 mmHg or above in the systolic phase, or measuring 90 mmHg or above in the diastolic phase, in two distinct measurements with a time interval of at least 4 to 6 hours, occurring after 20 weeks pregnancy in individuals with no pre-existing hypertension. Additionally, the woman must have proteinuria, a condition characterized by the presence of a minimum of 300 mg of protein detected in a full-day urinary sample [2]. This disorder's pathophysiological mechanisms involve two distinct stages. The initial stage is marked by diminished placental perfusion, potentially linked to abnormal placentation involving inadequate invasion of the uterine wall by trophoblasts and insufficient remodeling of the uterine spiral arteries. The subsequent stage involves systemic maternal manifestations, including inflammatory, metabolic, and clotting reactions, which collectively affect vascular function and lead to impairment of the function of multiple organs [3].

There are many risk factors for preeclampsia as: High blood pressure, diabetes, obesity, proteinuria, family history, nulliparity, carrying twins or more, contraceptive usage, conceiving at an advanced age (more than 40 years) and thrombotic vascular disease. Edema, impaired kidney function, compromised liver function, and HELLP syndrome exacerbate the clinical state [4]. In terms of mortality and morbidity preeclampsia poses considerable risks to the mother and her fetus. It complicates 2–3% of pregnancies. There is high risk for complications of preeclampsia when the disease is severe as cerebrovascular hemorrhage, detached retina, HELLP syndrome and eclampsia [5], preterm birth before 37 weeks of gestation [6].

Management of preeclampsia generally falls into three main approaches: prevention, early detection, and treatment. Women identified as high-risk for preeclampsia, including those having chronic hypertension, concurrent kidney condition, or antiphospholipid syndrome, should undergo pre-gestational counseling to pinpoint risk factors that can be modified. This approach may encompass smoking cessation, providing dietary guidance, modifying medications for optimization of pre-existing medical conditions like kidney disease, and discontinuing potentially teratogenic substances like warfarin and angiotensin-converting enzyme (ACE) inhibitors. Attaining optimal pre-pregnancy health through baseline measures may lower the susceptibility to preeclampsia. High-risk women should receive small dose of aspirin starting before the 12th week of pregnancy and continuing until the 36th week of pregnancy. Additionally, calcium supplementation at a dosage of 1 gram or more per day has been linked to a decrease in preeclampsia risk for those with low dietary calcium intake [7].

Foot reflexology represents a technique that uses foot massage on certain points. This practice is known to alleviate pain, enhance blood circulation, improve endurance, alleviate muscle tension, induce relaxation, offer a comfort sense, and reduce stress [8]. It operates on the premise that the hands and feet contain reflex points that mirror various glands, organs, and structures in the body. Massaging these reflex areas prompts stimulation of the corresponding organs within that zone [9].

Foot reflexology exerts mechanical effects that enhance blood circulation, flush out bodily toxins, increase flexibility in the joints, alleviate pain, and minimize muscular tension. Additionally, it confers psychological advantages by inducing relaxation and reducing stress levels. It positively affects the physiological indicators like blood pressure and heart rate. Research indicates significant reductions in blood pressure, pulse rate, general fatigue, as well as an improvement in mood following sessions of foot reflexology [10]. Foot reflexology reduces blood pressure if it is done regularly and reduces the levels of the cortisol hormone and decreases anxiety so that it has an effect on reducing blood pressure and improving body function [11]. Foot reflexology reduces blood pressure levels in hypertensive persons [12]. So, this study was conducted to examine the effect of foot reflexology on mean arterial blood pressure, Serum Cortisol level, proteinuria and quality of life in pregnant women suffering from mild preeclampsia.

### **Subjects and Methods:**

The study was designed as a randomized controlled trial employing a pre-test post-test design with two groups. Participants were selected randomly from outpatient clinic of obstetrics and gynaecology department, El Minya University Hospital, in El Minya. This study received ethical approval from the Institutional Review Board of the Faculty of Physical Therapy, Cairo University, prior to commencement [No: P.T. P.T.REC/012/003568]. It was registered on ClinicalTrials.gov [NO: NCT05888896]. Each participant received a thorough explanation of the study protocol and provided informed consent before the commencement of the study. This work adhered to the principles outlined in the Declaration of Helsinki for the ethical conduct of human subject's research. It was carried out from June till October 2023.

#### **Participants:**

A sample of 60 pregnant women in the six month of pregnancy and diagnosed with mild preeclampsia was recruited from Out Patient Clinic of Obstetrics Department in Minia University Hospital. The inclusion criteria include All women were diagnosed with mild preeclampsia. Their age was 20 to 36 years, and their body mass index (BMI) was below 35 kg/m<sup>2</sup>. Primipara and multipara were included. Any woman with fractures in foot, foot ulcer & infection, open skin wound in foot, history of stroke, severe preeclampsia, chronic hypertension before pregnancy, diabetes mellitus and heart conditions were not included in the study.

### **Sample Size Calculation:**

Sample size determination was conducted by calculating sample size for both study groups using G\*POWER software (version 3.1). Based data of blood pressure and proteinuria derived from ELShamy and ELSaftey, [13] & Awad et al, [14], the calculation revealed that the required sample size for this study 30 patients per group. Calculation with an  $\alpha$  error probability of 5% and a power of 80% and effect size 0.87 and allocation ratio N2 to N1=1 then carried out, resulting in a sample size of 30 patients in each group.

### **Randomization:**

Sixty participants were randomly divided into two equal groups (control group and study group). The randomization process was conducted by an independent research assistant who was blinded to the study, and involved opening sealed envelopes containing computer-generated randomization cards indicating the group assignment for each participant.

### **Interventions**

Group (A) comprised 30 pregnant women with mild preeclampsia who received antihypertensive drugs daily for 8 weeks. While Group (B) comprised 30 pregnant women with mild preeclampsia who received antihypertensive drugs daily with foot reflexology for 2 sessions weekly for 8 weeks.

### **Medical treatment:**

All patients in both groups (A & B) followed the same medical treatment (Antihypertensive drugs) as prescribed by obstetrician for 8 weeks.

### **Foot reflexology:**

All patients in group B were treated by foot reflexology for 25 minutes per session, bi-weekly sessions for an 8-week duration. Prior to commencing the treatment session, each participant received instructions to clean her foot and empty her bladder then she lied in comfortable half lying position with back support and feet out the plinth. The therapist was sitting facing the patient feet then applying pressure by thumb on specific reflex points including: Solar plexus point which is situated beneath the ball of each foot in the center and it has connections to entire neurological system so its stimulation can reduce stress and anxiety, Pituitary reflex point which is situated in the bottom of the central area of the big toe and it represents pituitary gland so its stimulation can regulate whole endocrine system, Heart reflex point which is situated on the undersurface of the big toe on the sole of both feet and its stimulation can regulate heart pump and improve health, Adrenal reflex point which is situated in the base of the 2nd and 3rd metatarsals on both feet and its stimulation can regulate fluids and electrodes in body, and Kidney reflex point which is situated along the medial arch of both feet near the base of the second metatarsal bone and its stimulation help support kidney function, the pressure was sustained for 30 seconds then released, each point received 5 times repetitions for each feet [15].

### **Outcome measures:**

All outcome measures were assessed for each patient in both groups (A & B) before and after the treatment by the same investigator

#### **1- Mean arterial Blood pressure assessment:**

Blood pressure was evaluated using mercury sphygmomanometer (Mercury blood pressure machine ALPK2 Japanese made) and stethoscope. Patient was asked to lay in relaxed supine lying position and blood pressure was measured first then mean arterial blood pressure was determined according to the subsequent equation: Mean arterial blood pressure (MABP)= systolic blood pressure (SBP)+2 diastolic blood pressure (DBP)\3 [16].

#### **2- Proteinuria assessment:**

Urine reagent strip devices (dipsticks) was used to detect the presence or absences of proteinuria [17].

#### **3-Blood cortisol level assessment:**

Blood samples were taken by collecting 5 mL of blood from the antecubital vein in the forearm of each participant in both groups in the evening. Then they were collected in sterilized tube and it was centrifuged. Serum was stored at -20°C to assess cortisol level [18].

#### **4-Quality of Life Assessment:**

It was done by World Health Organization Quality of Life Questionnaire-BREF 2021. It encompasses physical, psychological, social, and environmental domains. Each patient in both groups (A&B) responded to all questions for 4 domains then the following formula was used to calculate questionnaire scores:

(Sum of answered points\ number of questions for each domain) x 4 for each domain then (Result of this formula for each domain – 4) x 6.25 for each domain in the questionnaire. Finally, the four domains' scores are converted into a scale from 0 to 100. When results increase from 0 toward 100, quality of life increases and vice versa. Sum results of four domains to calculate overall quality of life. The 100 points mean high quality of life and 0 points mean low quality of life [19].

**Statistical analysis:**

Results are displayed as mean ± standard deviation or number (%). The Chi-square test was utilized to compare categorical data, expressed as number (%). The distribution of pre-treatment data was assessed for normality via the Kolmogorov-Smirnova test. An unpaired t-test was employed to compare normally distributed variables between the two groups. Analysis of covariance (ANCOVA) test was utilized to compare both the pre-treatment values between the two groups and, concurrently, the post-treatment values while controlling for the influence of pre-treatment values. The same-group comparison between pre- and post-treatment data was conducted through a paired t-test. Data underwent analysis by the Statistical Package for Social Sciences (SPSS) computer program, version 19 for windows. A p-value of ≤ 0.05 denoted statistical significance.

**Results:**

Figure 1 presents flow diagram of patients throughout the study. There were no reported instances of patients experiencing adverse effects or lodging complaints during or following the treatment.

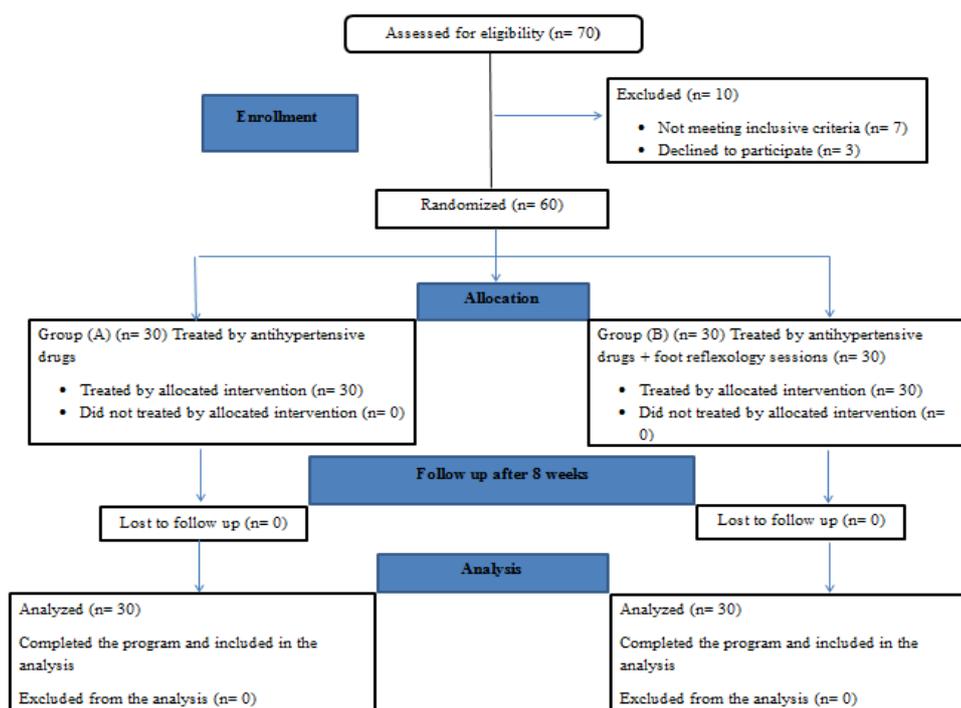


Figure 1. Flow diagram for participants within the study.

Table (1): Comparison of subject characteristics between group A and B:

Items	Group A	Group B	Comparison	
	Mean ± SD	Mean ± SD	t-value	P-value
Age (yrs.)	25.00 ± 3.43	26.20 ± 4.96	-1.089	0.281 (NS)
Weight (Kg)	67.07 ± 8.57	65.84± 10.47	0.498	0.620 (NS)
Height (m)	160.50± 4.78	159.53± 5.35	0.738	0.463 (NS)

BMI (Kg/ m <sup>2</sup> )	26.06 ± 3.38	25.88 ± 4.18	0.183	0.855 (NS)
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Data are presented as mean ± SD, NS= p> 0.05= not significant.

Table (1) represents mean ±SD of the pregnant women's baseline characteristics in both groups as well as, comparison between groups before treatment, there were statistically insignificant differences in the mean values of age, weight, height and BMI between the two groups.

Table (2): Mean arterial blood pressure, WHOQOL questionnaire scores, Serum cortisol and Proteinuria between and within groups:

		Pre treatment	Post treatment	% of change	p- value	t-value
		Mean± SD	Mean± SD			
Mean arterial blood pressure (mmHg)	Group A	111.26 ± 2.45	104.03 ± 4.48	6.50 ↓↓	0.001	8.805
	Group B	111.50 ± 3.04	100.82 ± 6.32	9.58 ↓↓	0.001	8.947
	p- value	0.741	0.021			
	F- value	0.110	5.605			
WHOQOL questionnaire scores (%)	Group A	41.76 ± 16.76	58.91 ± 18.87	41.07 ↑↑	0.001	-7.262
	Group B	42.93 ± 11.58	72.42 ± 13.98	68.69 ↑↑	0.001	-11.220
	p- value	0.754	0.001			
	F- value	0.099	13.890			
Serum cortisol (PM) (Mg\dl)	Group A	17.62 ± 1.73	14.66 ± 2.27	16.80 ↓↓	0.001	7.569
	Group B	17.34 ± 1.61	12.16 ± 2.19	29.87 ↓↓	0.001	11.503
	p- value	0.528	0.001			
	F- value	0.402	18.648			
Proteinuria (%) Yes or No	Group A	Yes 30 (100%) No 0 (0.0%)	Yes 20(66.7%) No 10 (33.3%)	33.3%		
	Group B	Yes 30 (100%) No 0 (0.0%)	Yes 8 (26.7%) No 22 (73.3%)	73.3%	0.002	
	p- value	.....	0.002			
	Chi square value	.....	9.643			

The findings from this study, as presented in Table 2, indicate a statistically significant reduction within both groups for mean arterial blood pressure, Serum cortisol level and Proteinuria level while there was a statistically significant increase in the mean scores of WHOQOL questionnaire at post treatment compared to the corresponding pre-treatment value in both groups (A & B).

Between groups; pretreatment, there was insignificant difference between both groups A & B in mean value of mean arterial blood pressure, serum cortisol level, proteinuria and WHOQOL questionnaire scores. While post treatment, there was significant difference between both groups A & B in mean value of mean arterial blood pressure, serum cortisol level, proteinuria and WHOQOL questionnaire scores [in Favor of group B (more decrease in mean arterial blood pressure, serum cortisol level and proteinuria; and more increase in WHOQOL questionnaire scores)].

## Discussion

Preeclampsia, a pregnancy-specific multisystem syndrome, impacts approximately 2%–10% of pregnancies. It represents a significant source contributor to maternal and foetal illness and death, playing a substantial role in foetal prematurity and contributing to the maternal risk of long-term cardiovascular disease (CVD) [20]. Foot reflexology is a gentle, cost-effective, and non-invasive technique known for its safety and relaxation benefits, suitable for all populations [21]. This study aimed to investigate the effect of foot reflexology on mean arterial blood pressure, Serum Cortisol level, proteinuria and quality of life in mild preeclamptic pregnant women.

This study's results found that, there was significant difference between both groups A & B post treatment in mean arterial blood pressure, serum cortisol level, proteinuria and WHOQOL questionnaire scores [in Favor of group B (more decrease in mean arterial blood pressure, serum cortisol level and proteinuria; and more increase in WHOQOL questionnaire scores)].

Results can be explained by various theories related to the mechanism of touch, particularly in the context of therapeutic massage. Previous research has demonstrated that therapeutic massage has the ability to decrease the levels of stress-related hormones like cortisol while simultaneously enhancing mood-enhancing elements like serotonin. This dual effect leads to stress reduction, promotes relaxation, and ultimately leads to a decrease in blood pressure [22]. Also, some theories have shown that massage therapy (massage or reflexology) reduces blood pressure if it is done frequently and reduces the levels of the hormone cortisol, decreases anxiety and aiding relaxation [23].

Findings of this study aligned with ELShamy and ELSaftey, [13] who found that 30-minute foot reflexology session twice a week for four weeks can reduce blood pressure and improve quality of life of patients with hypertension at Mansoura university hospitals. Also, our findings agreed with Ermiaati et al., [24] who demonstrated that, the foot reflexology for 20 minutes daily for one week can reduce blood pressure in pregnant women with preeclampsia.

Additionally, EL-Abd et al., [25] found that, foot reflexology for 30 min for 3 months has a significant decrease on blood pressure and heart rate & improve quality of life in individuals suffering from essential hypertension. Moreover, in a study conducted by Arockiamary, [26] He revealed that foot reflexology reduced blood pressure and improved quality of life in hypertensive persons. Furthermore, Suryaningsih et al., [27] who stated that foot reflexology for 15-20 minutes reduced blood pressure in hypertensive patients.

Regarding foot reflexology impact on serum cortisol level, Results of this study confirmed by Kim et al., [18] who studied the influence of foot reflexology for 30 minutes on blood pressure, heart rate and circulating cortisol levels. They stated that foot reflexology has shown effectiveness in reducing blood pressure, heart rate and circulating cortisol levels.

In contrast, our findings disagreed with Eshghizade et al., [28] who studied the effect of 30 minutes of foot reflexology on blood pressure in hypertensive elderly individuals. Their findings demonstrated foot reflexology efficacy in reducing systolic but not diastolic blood pressure. They also found no significant alterations in heart or respiratory rates post-treatment.

### **Conclusions**

It can be concluded that foot reflexology is an effective modality in lowering mean arterial blood pressure, serum cortisol level, proteinuria and improving quality of life of mild preeclamptic pregnant women.

### **Author contributions**

The authors listed have significantly contributed to the intellectual content of the work and have provided their approval for its publication.

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### **Declaration of conflicting interests**

The author(s) have no conflict of interest to declare.

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