

## Impact of foot reflexology combined with dietary modification on premenstrual syndrome: A randomized controlled trial

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### ABSTRACT

**Purpose:** This investigation was intended to know the impact of reflexology of the foot on premenstrual syndrome management. **Methods:** Fifty single female subjects diagnosed with premenstrual syndrome (PMS), aged 18 to 25 years old and BMI  $\leq 30\text{kg/m}^2$ , participated in this study. They were divided into two groups of equal numbers, A and B. Group (A) got the therapeutic reflexology of the foot in addition to the dietary modification, 3 sessions weekly for eight weeks. The group (B) got only the diet modification for eight weeks. All subjects in the two groups were assessed for pain by the visual analogue scale (VAS), and the PMS related symptoms were assessed by the Premenstrual Daily Symptoms Questionnaire, in addition to the beta-endorphin level in the blood. **Results:** The results showed significant improvement of pain level, beta-endorphin level in blood and premenstrual related symptoms in both groups when comparing pre and post treatment values ( $p < 0.05$ ). There was significant difference between both groups post treatment in favor of the study group (A) ( $p < 0.05$ ). **Conclusion:** Reflexology of the foot in addition to dietary modification is an efficacious technique for decreasing the premenstrual symptoms.

## **KEYWORDS**

Premenstrual syndrome; Dietary modifications; Foot Reflexology

## **1. INTRODUCTION**

Premenstrual syndrome (PMS) greatly influences many women during their reproductive years. The syndrome is depicted by the cyclic repetition of manifestations during the luteal period of the menstrual cycle (Moline & Zendell, 2000). Premenstrual syndrome, regular cyclic disorder of youthful and moderately aged ladies, is portrayed by emotional and somatic side effects that reliably happen during the luteal time of the period. Ladies with more serious emotional indications are more susceptible to have premenstrual dysphoric disorder. In spite of the fact that the etiology of these issues stays obscure (Dickerson et al., 2003).

PMS is the cyclic event in the luteal time of the menstrual cycle with a mix of troubling somatic, mental and conduct alterations of adequate seriousness to bring about disintegration of relational connections, scholastic capacities and obstruction with typical exercises which dispatch upon beginning or following monthly cycle (Tsegaye & Getachew, 2019). Days before menstruation, women may develop symptoms of physical exhaustion and/or mood fluctuation. Common symptoms of PMS include emotional symptoms such as: depression, irritability, angry, crying spells, anxiety, confusion, social withdrawal, and insomnia. Physical symptoms including thirst, food cravings, breast tenderness, bloating, headache, fatigue, abdominal pain, skin problems and gastrointestinal tract problems are also common (Ryu & Kim, 2015).

Ordinarily, manifestations transmit within a couple of days after the beginning of menses. Around 10 % of women with PMS experience an exceptionally extreme phenomenon called premenstrual dysphoric disorder (PMDD) (Hartlage et al., 2012). The etiology of PMS and PMDD is to a great extent idiopathic. Since PMS symptoms are firmly identified with the menstruation cycle and just influence ladies during the reproductive age, sex hormones have been recommended to assume a causative job. Notwithstanding, an enormous assemblage of proof shows that ladies who are helpless against premenstrual temperament changes don't have strange degrees of sex hormones (Epperson et al., 2012).

Women with mild-to-moderate PMS symptoms frequently don't require treatment. However, treatment is regularly administered for women with PMDD, as it hugely effects social working life of

those women. Treatment options vary and might be conservative, medical, hormonal, psychological, relaxation, surgical, complementary, physical therapy, and also alternative therapy<sup>7</sup>. Dietary supplement is one of the treatment options in which it may have a good impact in diminishing side effects of PMS. Regular vitamins intake such as A, B6, and E, calcium, mineral supplements, magnesium, and evening primrose oil all can contribute positively to promote the symptoms<sup>8</sup>. Reducing the amount caffeine intake has been also suggested as caffeine has a potential relationship with premenstrual irritability and sleep deprivation (Dickerson et al., 2003).

On other hand, reflexology is characterized as a touch treatment in which incorporates a proper strain to the reflexes of the feet and hands via a professional person to achieve a physiological and mental change invigorating unobtrusive energy (Whatley et al., 2022).

Reflexology is an ancient treatment art, encompassing noninvasive pressure and a touch treatment, is a massage technique dependent on the principle that there are reflex points on the feet, ears, and hands, that reflects to each part, and the organ of the body. The circulatory framework which thusly take into account more blood stream, an expanded feeling of prosperity, it has more to do with invigorating the lymphatic framework to deliver substantial poisons and animated the sensory system considers better vitality (Blunt, 2006):

Reflexology encourages homeostasis and loosens up the body, brain, and soul. It is powerful in assisting with lessening an assortment of unfavorable manifestations, for example, stress, exhaustion, torment, and pressure and assists with nervousness and misery (Xavier, 2007). Touch, basically as therapeutic massage, has been appeared to decrease the degrees of stress hormones, cortisol, and noradrenaline (norepinephrine), and increment the "vibe great elements", serotonin and dopamine adequately lessening pressure, supporting calming and actuating rest (Field et al., 2008).

When reflexology is associated with massage and skin contrast, endorphins and enkephalins are emitted, and they can lessen the nervousness and agony. This method can achieve the feeling of prosperity and sound. Also, the absence of pain might be built up by pressure on the particular reflex focuses (Tiran, 2006). The nerve motivation hypothesis reason that incitement applied to explicit reflex emphasis on the feet improves nervous association with the corresponding body parts (McCullough et al., 2014). Meanwhile, the hypothesis of the advantages of reflexology in which it is accomplished through guideline of autonomic sensory system (ANS). The ANS is promising coordinates body systems that are under insensible control, for example, breathing, pulse, and circulatory strain. These

boundaries are touchy to stressors and vary as per the physical or mental alterations experienced by an individual (McCullough et al., 2014).

Reflexology is safe, minimal effort and a non-obtrusive method of adapting to PMS. Reflexology is a type of integral medication that includes utilizing massage to reflex zones in the feet, invigorating and applying strain to specific regions to expand blood course and advance explicit substantial and strong capacities (Lu et al., 2011). Therefore, we aim to understand the effect of reflexology combined with dietary modification plan on the symptoms of PMS among single women. Reflexology diminished agony of PMS due to the increment of the circulating blood in the body lastly a profound feeling of comfort and psyche balance is made, and the manifestations of stress are decreased. Additionally, endorphins or enkephalins, which are natural painkillers of the body and improve the mood, are delivered because of reflexology (Morey, 2005).

## **2. METHODS**

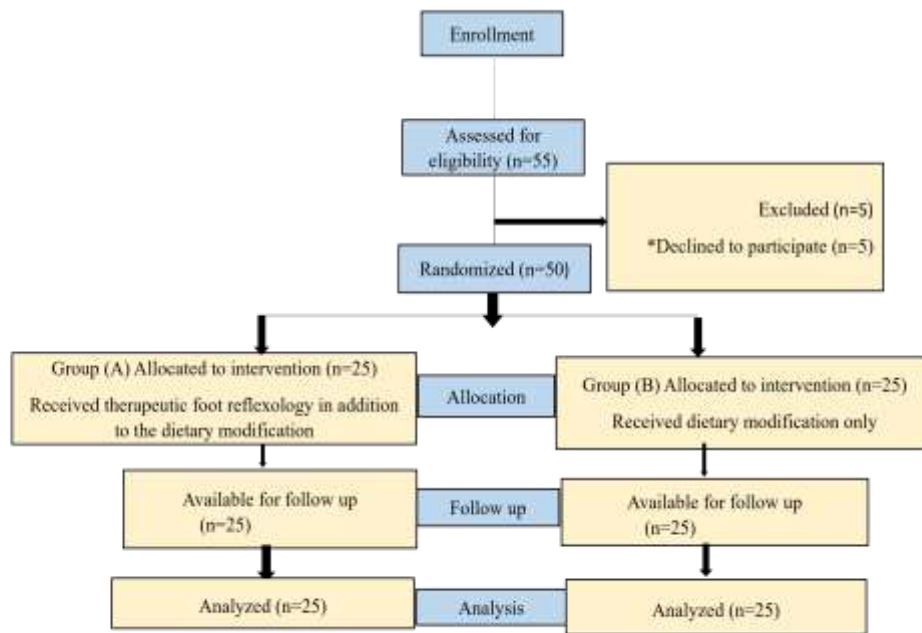
The study is a randomized controlled trial was authorised by Cairo University's Faculty of Physical Therapy's Institutional Review Board (no: P.T.REC/012/002742) and it is registered at Clinicaltrial.gov with identifier number NCT04348201. The study also followed the Declaration of Helsinki's rules for conducting human research. All study participants gave their informed consent before any data were collected.

### **2.1. Participants**

The study included 50 single women aged between 18 to 25 years. Women who were diagnosed clinically by physician as having premenstrual syndrome (PMS) with regular menstruation were enrolled in this study. Body mass index should be less than  $30\text{kg}/\text{m}^2$  to be included in this study. Recruitment was done through contacting the outpatient clinic of gynecology and obstetrics, at Faculty of Medicine, Cairo University. Women were excluded from the study if they were having rheumatoid arthritis, mental health problems, women who were with BMI exceeding  $30\text{kg}/\text{m}^2$  or who have migraines and chronic fatigue syndrome, skin disease interferes with foot reflexology application were also excluded. Moreover, women with irregular or infrequent menstrual cycle or those who are having any metabolic diseases, or family history of hormonal disorders were excluded. The participated females were assigned randomly into two equal number groups, group (A) which received reflexology of the foot with dietary modification, 3 sessions weekly for 8 weeks; and group (B) which received dietary modification for 8 weeks. All participants were informed about the study intervention and filled

the informed consent form before the study begins. This study was conducted from May to October of 2020.

*Eligibility:* 55 single females were assessed for eligibility and 5 women were excluded from the study (declined to participate), so 50 women were randomly assigned to the study groups and completed the intervention, and their data were taken further into analysis (Figure 1).



**Figure 1.** Consort flow diagram of participants’ recruitment and retention.

## 2.2. Randomization

Randomization was applied to all participants to be allocated either in group A (n=25) or group B (n=25). Randomization was ensured through choosing a number from a closed envelope, using permuted blocks randomization technique.

## 2.3. Outcome measures

At baseline, study outcomes were assessed for the subjects in the two groups. Pain level was assessed by visual analogue scale (VAS), PMS related symptoms were assessed by premenstrual daily symptoms questionnaire in addition to blood level of beta-endorphin. All assessments were repeated after eight weeks of the treatment program.

1. *Visual analogue scale (VAS):* measures the pain level for all women in the two groups by using a 10 cm calibrated line with 0 (zero) indicating no pain and 10 indicating worst pain, each woman in

both groups was asked to indicate the point on the line which represented her pain level (Delgado et al., 2018).

2. *Premenstrual daily symptoms questionnaire*: each woman in both groups should answer all questions in the questionnaire to determine the severity of symptoms. the rate of severity of symptoms was from 0 to 4; where 0 (zero) representing no symptoms and 4 representing severe symptoms. All women in the groups were asked all the questions in the questionnaire (20 symptoms) then the total points were calculated by following the equation of: numbers of symptoms / numbers of days of menstrual cycle. The lower the points, the lower the symptoms, e.g. 1: no symptoms, 2: mild, 3: moderate, and 4: severe (Dickerson et al., 2003).
3. *Endorphin level*: It was assessed pre and post treatment for both groups using a quantitative Sandwich Elisa kit to determine the level of beta- endorphin in the blood through 1.5 pg/ml, which was taken from each patient in both groups. Storage of the plate and all reagents was at 2°C-8°C. Preparations and storage should be done before assay procedures.

## 2.4. Study groups

### Group A

Patients of group (A) received reflexology of the foot in addition to dietary modification. They were given diet rich in vitamins, low in fat and with high fiber. Examples of food they had include fish, beans, milk, cheese and all types of vegetables and fruits with restriction of caffeine (Yonkers et al., 2008). The session of reflexology of the feet was about 20 minutes (each foot 10 minutes) during which the female was positioned in a relaxed comfortable supine lying position in a calm room and the therapist took the position of sitting at the level of the female feet. Initially, warm water was used to cleanse the entire foot sole before the massage procedure began, which comprised 5 minutes of light stroking and light pressure applied to the dorsal and plantar sides of every foot. A mixture of finger pivot and thumb walking techniques were used to apply reflexology to the toes and the base of the foot that relate to reflex sites. The reflexology session was done on both feet at four points (Williamson et al, 2014) as follow (Figure 2).

1. *Uterine and ovarian reflexes points* are located beneath the medial and lateral malleoli, respectively, on both feet.
2. *The fallopian tubes reflex point* starts on the inner portion of the foot (medially), which travels through the top of the ankle on the outer side of the foot (laterally).

3. *Pituitary reflex point* corresponds to the pituitary gland, which is located precisely in the hallux (big toe) centres of both feet's plantar aspects. The pituitary gland, also known as the master gland, controls the entire endocrine system. This reflex point will efficiently relax and/or revitalise the body because the pituitary gland regulates any internal abnormalities.
4. *The solar plexus point* is situated in the midline, right below the balls of both feet. This location has connections to the entire neurological system, which can induce profound relaxation and reduce tension and anxiety. Stress has a strong impact on the solar plexus, hence relaxing this reflex point has been shown to lower stress levels and raise the body's tolerance for stress.



**Figure 2.** Reflexology Points

*Group B:*

Women in this group were controls and followed the same dietary modification as in group (A) for 8 weeks. No reflexology sessions were provided for women in this group.

**2.5. Statistical analysis**

Data analysis was performed using SPSS Statistics Software version 19. To assess the data's assumed normality, the Kolmogorov Smirnov test was used. Unpaired t test was used to compare variables in the two groups for the baseline demographic data. Analysis of covariance (ANCOVA)

was performed to compare the post-treatment values of the two groups while controlling for the impact of the pre-treatment value. To assess pre- and post-treatment differences within groups, the Bonferroni correction test was performed. Data were reported as means and standard deviation, and the Mann Whitney test was used to compare variables between the two groups when the data were not normally distributed. The Wilcoxon Sign Ranks test was used to compare pre- and post-treatment data from the same group. Statistical significance is defined as a P value of 0.05 or lower. Information was displayed as a median and range (minimum-maximum).

### 3. RESULTS

#### 3.1. Demographic characteristics of the women in both groups

The findings showed that there were no significant differences in terms of age, weight, height, and BMI (at the beginning of the study), as it can be observed in Table 1 (P=0.456, 0.643, 0.870, and 0.695, respectively).

**Table 1.** Demographic characteristics in both groups.

<b>Variables</b>	<b>Group A</b>	<b>Group B</b>	<b>t</b>	<b>P</b>
	<b>25</b>	<b>25</b>	<b>value</b>	<b>value</b>
<b>Age</b> (yrs.)	21.12 ±2.21	20.70 ±1.90	0.750	0.456 (NS)
<b>Weight</b> (kg)	64.30 ±9.21	63.15 ±8.45	0.463	0.643 (NS)
<b>Height</b> (cm)	160.65 ±4.35	160.63 ±4.05	0.161	0.870 (NS)
<b>BMI</b> (kg/m <sup>2</sup> )	24.42 ±3.12	24.45 ±3.34	0.392	0.695 (NS)

Data are expressed as mean ± SD. NS= p> 0.05= not significant.

#### 3.2. Visual Analogue Scale (VAS) and Premenstrual Daily Symptoms Questionnaire

##### *Within and between group comparison*

It is noted a significant decrease in median value of VAS measured and PMS questionnaire at post-treatment when compared with its corresponding value measured at pre-treatment within both groups; favoring group A (p < 0.05). There was no significant difference between groups A and B in the median value of VAS and PMS questionnaire before treatment (p > 0.05). (Tables 2 and 3).



**Table 2.** Intra and inter-group comparison between median values of VAS pre- and post-treatment.

Date of assessment	Group A	Group B	Z	P
	25	25	value	value
Pre-treatment	6.0 (4.0-6.0)	6.0 (4.0-6.0)	-0.281	0.779 (NS)
Post-treatment	1.0 (0.0-1.0)	4.0 (3.0-4.0)	-6.274	0.001* (S)
Z <sup>##</sup> value	-5.000	-4.899		
p value	0.001 (S)	0.001 (S)		

Data are expressed as median (minimum-maximum). NS=  $p > 0.05$ = not significant. S=  $p < 0.05$ = significant.  
 Z<sup>#</sup>= Mann Whitney test. Z<sup>##</sup>= Wilcoxon Sign Ranks test.

**Table 3.** Intra and inter-group comparison between median values of PMS questionnaire pre- and post-treatment.

Date of assessment	Group A	Group B	Z	P
	25	25	value	value
Pre-treatment	4.0 (3.0-4.0)	4.0 (3.0-4.0)	-0.306	0.760 (NS)
Post-treatment	2.0 (1.0-2.0)	3.0 (2.0-4.0)	-5.086	0.001 (S)
Z <sup>##</sup> value	-4.914	-4.796		
p value	0.001 (S)	0.001 (S)		

Data are expressed as median (minimum-maximum). NS=  $p > 0.05$ = not significant. S=  $p < 0.05$ = significant.  
 Z<sup>#</sup>= Mann Whitney test. Z<sup>##</sup>= Wilcoxon Sign Ranks test.

### 3.3. Beta-endorphin

#### *Within group comparison*

A significant increase in beta-endorphin mean value was showed in post-treatment compared to pre-treatment within both groups; favoring group A ( $p < 0.05$ ). Before treatment non-significant difference between groups mean value ( $p > 0.05$ ). The percentage of increase beta-endorphin level in both groups A and B were 97.0% and 12.03%, respectively.

#### *Between groups comparison*

ANCOVA test was used to compare the post-treatment values of the two groups on controlling the effect of pre-treatment value. The results of beta-endorphin revealed that there was a statistically significant increase in its level in group A ( $78.88 \pm 8.03$ ) when compared with its corresponding level in group B ( $F= 378$  &  $p= 0.001$ ) (Table 4).

**Table 4.** Comparison between mean values of beta-endorphin pre- and post-treatment.

<b>Date of assessment</b>	<b>Group A</b>	<b>Group B</b>	<b>F</b>	<b>P</b>
	<b>25</b>	<b>25</b>	<b>value</b>	<b>value</b>
<b>Pre-treatment</b>	40.04 ± 4.45	37.42 ± 5.40	3.530	0.066 (NS)
<b>Post-treatment</b>	78.88 ± 8.03	41.92 ± 5.05	378.188	0.001 (S)
<b>Mean difference</b>	38.84	4.500		
<b>% Change</b>	97.00 ↑↑	12.03 ↑↑		
<b>p value</b>	0.001 (S)	0.001 (S)		

Data are expressed as mean ± SD. F value= ANCOVA test. NS=  $p > 0.05$ = not significant.

#### 4. DISCUSSION

Reflexology, which is a special technique of compression, is applied by pressure on specific reflex points on the feet, where every point is responsible for a certain part of the body. The application of reflexology with massage and skin contact reduces the anxiety and pain through secretion of encephalins and endorphins and improve the sense of wellbeing. Generally, reflexology technique leads to the perception of pain relief through the control gate as it stops the pain neural transmission (Tiran, 2006).

This study aimed at studying the effect of reflexology combined with dietary modification plan on the symptoms of PMS among single women. The study showed that group A who received the intervention demonstrated better in study outcome after 8 weeks of following up. In the study results, it was noted that a significant reduction in median value of VAS measured and PMS questionnaire at post-treatment favoring group A ( $p < 0.05$ ) followed dietary modification and foot reflexology sessions.

Several studies have, however, been undertaken (Kim & Chi, 2002) successfully concluded that foot reflexology improves the side effects of the premenstrual condition and dysmenorrhea in female college students. After utilization of the foot reflexology, there was a significant reduction of lower stomach pain (30%), insomnia (40%), constipation (30%), fatigue (50%) and stomach pain (35%).

Consequently, the result of the intervention by dietary modification and foot reflexology sessions received by group A was upheld by (Baghdassarians & Bagheri, 2013) who analyzed the impact of

dietary and reflexology over premenstrual condition side effects alleviation. Study intervention program in this examination done for two months over 100 students. The subsequent result of this program that dietary and reflexology influence the premenstrual syndrome manifestations relief. Because of the pain-relieving impact of manual pressure on the reflex foot points, this alleviates the premenstrual disorder indications. It affirmed that there was huge impact of dietary and reflexology on premenstrual syndrome.

Additionally, cutting back on high fat, high calorie, fat, sugar, and salty foods may lessen PMS symptoms by turning estrogen into its inactive form. In a recent study by (Isgin-Atici et al., 2020), adolescent girls with PMS reported consuming more high energy and low-nutrient-density foods, which supported this.

Furthermore, Dastegheib Shirazi et al. (2013) noted the impact of foot reflexology on premenstrual disorder through the investigation of 120 students with PMS, who were isolated into two groups of actual and false therapy. Considering the result, symptoms of PMS decreased which were seen in 25.26% of cases in the reflex actual zone therapy and 3.8% of cases in the false reflex zone. Foot reflexology enhances the progress of blood stream, the hypothesis that reflex focuses are nerve receptors whose incitement diminished muscular or mental strain instigating deep relaxation.

Additionally, Fard et al. (2013) studied the impact of foot reflexology on the improvement of the physical and mental manifestations in females with premenstrual syndrome. The investigation of 90 students suffering from premenstrual syndrome. They were divided into two groups of the foot reflexology and the control. The normal decrease of general severity of PMS manifestations was 23.39% in the foot reflexology group while it was -9.68% in the control group. It has beneficial outcome on wellbeing, personal satisfaction, stress, nervousness, and torment, so there was critical contrast between the normal of somatic and mental in the reflexology group contrasted with the control group ( $p < 0.0001$ ).

The investigation of Hasanpour et al. (2019), who conducted a systematic review and meta-analysis, inspected the influence of reflexology on adult female with premenstrual syndrome. This study established that the reflexology could diminish signs of PMS, so that generally scores, somatic and psychological PMS side effects diminished by way of utilizing the reflexology mediation. So, reflexology can be utilized as a powerful mediation in the patient treatment program. Additionally, increasing the time of reflexology in the session expanded its effectiveness.

Contradictory to the previous results, Ansari et al. (2014) concluded that there is no significant difference between the two treatment groups (intervention and control). They recorded their assessment in 120 volunteer students, having PMS and separated into two groups of the real and the unreal reflex zone treatment (the intervention and the control groups), and received the treatment program once every week for thirty minutes, for eight continuous weeks.

Regarding to beta-endorphin analysis result in this study, there is a significant increase in beta-endorphin mean value that was showed in post-treatment compared to pre-treatment within both groups, favoring group A ( $p < 0.05$ ); group A was 97.0% and group B was 12.03%. In addition, there was a statistically significant increase in the level of beta-endorphin in group A ( $78.88 \pm 8.03$ ) compared with group B ( $F= 378$  &  $p= 0.001$ ).

These results are supported by Kim & Chi (2002), who determined that foot reflexology empowered secretion of endorphins and encephalins (pain killers), which led to improve the premenstrual syndrome (PMS) symptoms and dysmenorrhea.

Also, our results are in accordance with those of Kapıkıran & Özkan (2021), who showed that patients who got foot reflexology saw greater raises in beta endorphin and comfort levels, as well as greater reduction in pain, contrasted to patients who did not get reflexology. Reflexology could be utilized as a non-pharmacological therapy alternative.

The results of this study should be interpreted in light of its limitations. First, follow-up period was required, and we do not know about long-term health benefits of foot reflexology program for PMS women. The second limitation was the sample size. Future studies should address these limitations.

## 5. CONCLUSION

The results of this study revealed that foot reflexology with dietary modification is an effective non-invasive technique in the management of premenstrual syndrome among single women.

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The authors declare no conflict of interest.

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