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**Original Article**

# Comparison of Reflexology and Connective Tissue Manipulation in Participants with Primary Dysmenorrhea

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## Abstract

***Objective:*** The aim of this interventional correlational study is to compare the effects of foot reflexology (FR) and connective tissue manipulation (CTM) in subjects with primary dysmenorrhea.
***Design:*** A total of 30 participants having primary dysmenorrhea completed the study. Data, including demographics (*age, body–mass index*), menstrual cycle (*age at menarche, menstrual cycle duration, time since menarche, bleeding duration*), and menstrual pain characteristics (*intensity and duration of pain, type and amount of analgesics*), were recorded. Effect of dysmenorrhea on participants' concentration in lessons and in sports and social activities was assessed by using the visual analog scale. Participants rated their menstruation-related symptom intensity through the Likert-type scale. FR was applied to 15 participants for 3 days a week and CTM was performed on 15 participants for 5 days a week. Treatments were performed during one cycle, which started at the third or fourth day of menstruation and continued till the onset of next menstruation. Assessments were performed before treatment (first menstruation), then after termination of the treatment because of the next menstruation's onset (second menstruation), and $\sim$1 month after at the consecutive menstrual period (third menstrual cycle).
***Results:*** Time-dependent changes in duration and intensity of pain along with analgesic amount show that both treatments provided significant improvements ($p < 0.05$) and no superiority existed between the groups ($p > 0.05$). A similar result was obtained in terms of time-dependent changes in concentration in lessons and difficulty in sports and social activities due to dysmenorrhea. Menstruation-related symptoms were found to be decreased after treatment and in the following cycle with both treatments ($p < 0.05$) where no difference existed between the groups ($p > 0.05$).
***Conclusion:*** Both FR and CTM can be used in the treatment of primary dysmenorrhea and menstruation-related symptoms as these methods are free from the potentially adverse effects of analgesics, noninvasive, and easy to perform.

## Introduction

Dysmenorrhea, painful menstruation, is a common problem of the female population in the reproductive age that causes school absenteeism or loss in work hours and obviously worsens the quality of life and daily activities.[1,2] It is divided into two categories as *primary* and *secondary* dysmenorrhea, where primary dysmenorrhea means the existence of recurrent, crampy lower abdominal pain that occurs during menses in the absence of an underlying pathology.[3,4]

Prevalence of primary dysmenorrhea is estimated in more than 50% of menstruating women and decreases with the advancing age.[5,6] Subjects may have menstruation-associated symptoms such as nausea, vomiting, headache, or backache. The pain originating from uterine contractions is the result of excessive endometrial prostaglandin production.[7] Hypercontractility of the uterus and an increase in uterine basal pressure, followed by diminished flow in both large and small uterine vessels, are the consequences of prostaglandin excess, which leads to ischemia and pain.[3,8]

Familial tendency, early menarche, smoking, and stress are some of the etiologic factors.[6] Patients are diagnosed clinically due to their expression of a recurrent, crampy midline pelvic pain that starts just before or with the onset

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of menstrual bleeding, which gradually decreases over 12–72 h. Signs and symptoms of a suggestive pelvic pathology may require further examinations, such as laboratory tests and imaging techniques.[3]

The treatment aims to relieve pain and comprises pharmacological and nonpharmacological pain management strategies. Pharmacological treatment involves administration of prostaglandin synthesis inhibitors, which should be taken the day before or at the onset of pain, and patients continue to take drugs at intervals throughout the painful period to prevent the formation of prostaglandin by-products.[9,10] Oral contraceptives constitute the other choice as well.[11] However, in cases where the individual cannot have medication because of the side-effects or ones not willing to take drugs, they are seeking nonpharmacological methods.

There are many nonpharmacological methods used for primary dysmenorrhea treatment. Physiotherapy applications (heat, massage, transcutaneous electrical nerve stimulation, etc.),[12–14] psychological interventions, and complementary and alternative therapies (herbals, reflex therapies, acupuncture, acupressure, etc.) form a great majority of them.[3,14–17]

Foot reflexology (FR) is a noninvasive therapy that involves application of direct topical pressure to specific points and areas on the feet believed to correspond to specific somatic organs. According to one reflexology theory, malfunction of an organ or body system leads to deposits of uric acid or calcium crystalline, which in turn would impinge on the nerve endings on the feet and obstruct lymph flow. Massaging these areas would break down and eliminate the crystalline deposits.[18,19] Although the underlying physiologic mechanisms are not fully understood, the effectiveness of reflexology treatment may be explained in existing scientific concepts such as peripheral vasodilatation to remove local toxin accumulation and neural pathways related to the gate theory to explain the reduction of pain perception.[18–20]

Connective tissue manipulation (CTM) is a soft tissue manipulative technique used by physiotherapists whose stimulus is directed at the fascial interfaces and forms general body relaxation, reduces muscle spasm and connective tissue tenderness, and increases circulation and plasma $\beta$-endorphins through reflex ways.[21–24] The technique aims to stimulate the autonomic nervous system to rebalance the parasympathetic and sympathetic systems usually by means of moving in a parasympathetic direction.[25,26]

Both methods are performed in many painful conditions in clinical settings, including dysmenorrhea or premenstrual symptoms; however, limited scientific results appear in literature about their use in dysmenorrhea.[27–29] In addition, no study has compared these two reflex therapies in any condition; thus, the aim of this study arose.

## Materials and Methods

### *Participants and setting*

This study complied with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee at Gaziosmanpasa University, Faculty of Medicine (Project No: 13 KAEK 09).

Forty-five students were recruited from the Gaziosmanpasa University, Tokat School of Health, Midwifery Department, between September 2013 and December 2014. A written informed consent was obtained after all procedures had been fully explained before any student participated in this study.

Volunteers were initially referred to the Obstetrics and Gynaecology Department of the same University Hospital for examination. A gynecologist performed pelvic ultrasound screening after having medical and gynecologic histories of the participants. The ones ($n=5$) who had irregular menstrual cycles or secondary dysmenorrhea were excluded from the study.

Participants were randomly divided into FR and CTM treatment groups according to the order of their attendance at the study. As the study progressed, 1 student in the FR group and 9 students in the CTM group quit participation; so finally, with 15 participants in each group, the study was completed.

Data, including demographics (*age, body–mass index [BMI]*), menstrual cycle (*age at menarche, menstrual cycle duration, time since menarche, dysmenorrhea duration, bleeding duration*), and menstrual pain characteristics (*intensity and duration of pain, type and amount of analgesics*), were recorded.

The purpose of the study was not to offer causation, so a correlational design is used. As the authors wanted to see the effect of the treatments on analgesic usage, participants were not prohibited to take analgesics for the next menstrual cycles. The data about duration and intensity of pain were those which reported to exist in spite of using analgesics.

Participants indicated their pain intensity of the previous period on a 0–10 cm visual analog scale (VAS); where 0 cm means no pain and 10 cm represents unbearable pain.

VAS is also used to reveal the impact of dysmenorrhea on participants' concentration in lessons (*0 cm: no difficulty in concentration, 10 cm: great difficulty to concentrate*) and on sportive and social activities, on which 0 cm referred to no difficulty in activities and 10 cm represented great difficulty in activities.

Students rated their menstruation-related symptoms (cramps, nausea, vomiting, loss of appetite, headache, backache, leg ache, dizziness, weakness, diarrhea, hot flushes, mood change, irritability, general aching, abdominal pain) on a form using a five-point Likert scale (0, none; 1, mild; 2, moderate; 3, severe; 4, very severe). Higher scores indicate more reported symptomatology.[30]

### *Intervention*

As the applications would enhance the bleeding on the initial intensive days, both treatments began at the third or fourth day of menstruation, depending on the intensity of bleeding and duration of each individual's menstruation. Treatments lasted till the first day of the following menstruation.

Reflexology was applied by a certificated midwife (Z.E.Y.). Participants received the therapy sitting in a comfortable position. After a neutral olive oil had been applied, the reflexologist started with gentle mobilization of the foot. The solar plexus point was pressured to stimulate the whole body. Afterward, (1) thumb walking in hypothalamus and pituitary gland fields, (2) pressing and thumb walking in spleen and thyroid zones, (3) friction with the thumb on the adrenal gland zone, (4) rotation on small and large intestine fields, (5) from top to bottom (T10–T12, L1–L5,), thumb walking in the

Table 1. Physical and Menstrual Characteristics of the Subjects

| | Groups | | | |
|---|---|---|---|---|
| | CTM Mean ± SD | FR Mean ± SD | t[a] | p |
| Age (year) | 19.93 ± 1.83 | 21.07 ± 1.91 | −1.66 | 0.108 |
| Height (m) | 1.65 ± 0.04 | 1.60 ± 0.05 | 2.404 | **0.023** |
| Body weight (kg) | 60.07 ± 11.63 | 53.67 ± 5.05 | 1.954 | 0.065 |
| Body–mass index (kg/m$^2$) | 22.09 ± 3.65 | 20.87 ± 1.77 | 1.172 | 0.255 |
| Age at menarche (year) | 13.53 ± 1.6 | 13.33 ± 1.45 | 0.359 | 0.722 |
| Time since menarche (year) | 6.4 ± 2.44 | 7.73 ± 2.89 | −1.364 | 0.183 |
| Menstrual cycle (day) | 26.93 ± 3.59 | 26.6 ± 3.38 | 0.262 | 0.795 |
| Menstrual bleeding (day) | 6.27 ± 1.22 | 6.4 ± 1.45 | –0.272 | 0.788 |

Boldface indicates significant value.
[a]Independent samples *t*-test.
CTM, connective tissue manipulation; FR, foot reflexology.

medulla spinalis field, (6) friction to the uterus, vagina, ovaries, fallopian tube zones, and (7) butterfly and bird's beak movement in breast fields were performed, respectively. On finishing, the solar plexus is stimulated again. The same procedure was repeated for the other foot. The therapy sessions lasted 30 min and were conducted 3 days a week.[31]

CTM was applied by a physiotherapist (F.D.) daily for 5 days a week. During the sessions, the participants sat at 90° of hip and knee flexion and feet were supported, arms relaxed on the thighs, and back unclothed and straight, allowing optimal tension of the connective tissue. The procedure started from the basic region (lumbosacral area) and progressed gradually to lower thoracic, scapular, interscapular, and cervico-occipital regions through weeks.

The short and long manipulative strokes were performed using the middle finger of the right or left hand to the defined zones. The duration of the sessions was 5–20 min, depending on the extent of the treated area.

Frequency and duration of the techniques may differ due to the diagnosis, the goals of the therapist, or the patient's needs.[20,32–35] In this study, FR was performed 3 days in a week, whereas CTM was performed daily. Rather than an application with longer intervals that continues for 2 or 3 cycles (e.g., *once a week*), the authors chose to perform the techniques in a more frequent manner in this study, with the intention of receiving quicker responses and providing similar improvement as reported previously.

All of the assessments were performed before treatment (first menstruation), then after termination of the treatment because of the next menstruation's onset (second menstruation), and ∼1 month after at the consecutive menstrual period (third menstrual cycle).

### *Statistical analysis*

Continuous data are expressed as mean ± standard deviation. Independent Sample *t* test was used to compare the normal continuous data between groups. Time factor over pain duration, pain intensity, and amount of analgesic discrepancy between groups were investigated with repeated measures ANOVA. Categorical variables were presented as a count and percentage. Chi-square tests were used to compare the categorical variables between CTM and FR groups. A $p$-value $< 0.05$ was considered as significant. Analyses were performed using SPSS 19 (IBM SPSS Statistics 19, SPSS Inc., an IBM Co.).

## Results

Mean age of the participants was 19.93 ± 1.83 years in the CTM group and 21.07 ± 1.91 years in the FR group ($t = -1.66$, $p = 0.108$).

Participants in the CTM group were significantly taller than the ones in the FR group ($p = 0.023$), but both groups had similar body weights ($p > 0.05$). BMI of the participants was 22.09 ± 3.65 and 20.87 ± 1.77 kg/m$^2$ in CTM and FR groups, respectively ($t = 1.172$, $p = 0.255$). Groups were homogeneous in terms of mean age, values of BMI, time since menarche, length of menstrual cycle, and duration of menstruation (Table 1).

Of all 16 participants, 7 in the CTM group (46.7%) and 9 in the FR group (60%), it was indicated that they had dysmenorrhea since menarche ($p = 0.714$). A total of 14 students (46.7%) reported about their dysmenorrhea that started a few years ago.

Duration (h) and intensity of menstrual pain and the amount of analgesics used were found similar between the groups before the treatment ($p > 0.05$) (Table 2).

All of the participants, except three in the CTM group, indicated that they use nonsteroid anti-inflammatory drugs (NSAIDs) for dysmenorrhea ($p = 0.224$). None of the participants were using oral contraceptives.

Table 2. Menstrual Pain Intensity, Amount of Analgesics, and Impact of Dysmenorrhea on Concentration, Sportive, and Social Activities of Cases Before the Treatment

| | Groups | | | |
|---|---|---|---|---|
| | CTM Mean ± SD | FR Mean ± SD | t[a] | p |
| Amount of analgesics | 3.27 ± 2.66 | 2.07 ± 1.94 | 1.411 | 0.169 |
| Pain duration (h) | 44.93 ± 23.51 | 36.03 ± 27.11 | 0.961 | 0.345 |
| Menstrual pain intensity (cm) | 8.37 ± 1.48 | 8.39 ± 2.01 | –0.031 | 0.975 |

[a]Independent samples *t*-test.

Table 3. Impact of Dysmenorrhea on Sportive and Social Activities and Concentration in Tasks According To VAS Before The Treatment

| | Groups | | | |
|---|---|---|---|---|
| *VAS value (cm)* | *CTM Mean ± SD* | *FR Mean ± SD* | t[a] | p |
| Concentration in tasks | 8.66 ± 1.95 | 7.8 ± 2.08 | 1.169 | 0.252 |
| Sports activities | 8.65 ± 1.73 | 7.99 ± 2.03 | 0.959 | 0.346 |
| Social activities | 8.03 ± 2.38 | 8.05 ± 1.82 | –0.017 | 0.986 |

[a]Independent samples *t*-test.
VAS, visual analog scale.

Comparing two groups by independent *t* test before the interventions showed that there were no differences between groups in terms of difficulty in sports and social activities and in concentration ($p > 0.05$) (Table 3).

Time-dependent changes in duration and intensity of pain along with analgesic amount show that both treatments provided significant improvements ($p < 0.05$) and no superiority existed between the groups ($p > 0.05$) (Tables 4–6).

A similar result was obtained in terms of time-dependent changes in concentration situation and performance of sports and social activities due to dysmenorrhea. Both treatments were found to decrease the negative impact of dysmenorrhea on the conditions mentioned above in a similar way (Tables 7–9).

Both treatments decreased menstruation-related symptom severity ($p < 0.05$) and the relief was maintained after one more cycle. The groups were not different in terms of total symptom scores at the post-treatment menstrual period and the next menstruation cycle 1 month after ($p > 0.05$) (Table 10).

No adverse effects occurred during the treatments.

## Discussion

This study compared the effects of connective tissue manipulation and foot reflexology in participants with primary dysmenorrhea and found that both methods were effective in relieving dysmenorrhea or menstruation-related symptoms and there was no superiority between these two approaches.

Besides the application of physiotherapy as a part of the nonpharmacological approach, complementary and alternative therapies gained popularity in recent years and it is reported that they were used by women more than men. Premenstrual symptoms and dysmenorrhea constitute common problems for which young and adult women seek alternative ways to cope with.

Kim and Cho in their studies performed FR during two consecutive cycles for a total of 12 sessions and found that FR was effective on premenstrual symptoms and dysmenorrhea.[31]

Valiani et al. compared FR with ibuprofen among university students ($n = 68$) with primary dysmenorrhea and found that FR performed during two cycles was superior to ibuprofen in terms of pain intensity and duration, and the treatment effect continued even after ceasing the intervention in the third cycle. They suggested that FR could replace anti-inflammatory drugs to avoid their adverse side-effects.[27]

Oleson and Flocco searched for reflexology therapy and whether the application of manual pressure to reflex points on the ears, hands, and feet that somatotopically correspond to specific areas of the body may significantly reduce premenstrual symptoms compared with placebo treatment or not. They performed reflexology once a week for 8 weeks and stated that a significantly greater decrease was observed in

Table 4. Time-Dependent Changes in Menstrual Pain Duration

| | Groups | | | |
|---|---|---|---|---|
| *Pain duration (h)* | *CTM Mean ± SD* | *FR Mean ± SD* | d | $p_1$ |
| Before treatment | $44.93 \pm 23.51^{a}$ | $36.03 \pm 27.11^{a}$ | 0.351 | 0.345 |
| After treatment | $11.15 \pm 18.22^{b}$ | $16.1 \pm 20.78^{ab}$ | 0.253 | 0.494 |
| One month after treatment | $3.77 \pm 5.91^{b}$ | $14.75 \pm 20.92^{b}$ | 0.714 | 0.068 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.667$, $\eta_p^2 = 0.007$; Time effect: $p < 0.001$, $\eta_p^2 = 0.502$; Group × Time effect: $p = 0.086$; $\eta_p^2 = 0.084$.
For time factor, different super scripts (a, b, c) in the same column
d, Cohen's d; $p_1$, independent samples *t*-test; $p_2$, repeated measures ANOVA test; $\eta_p^2$, partial Eta squared.

Table 5. Time-Dependent Changes in Menstrual Pain Intensity According to VAS

| | Groups | | | |
|---|---|---|---|---|
| *VAS value (cm)* | *CTM Mean ± SD* | *FR Mean ± SD* | d | $p_1$ |
| Before treatment | $8.37 \pm 1.48^{a}$ | $8.39 \pm 2.01^{a}$ | 0.011 | 0.975 |
| After treatment | $3.42 \pm 3.48^{b}$ | $4.71 \pm 3.91^{b}$ | 0.349 | 0.349 |
| One month after treatment | $3.15 \pm 2.91^{b}$ | $4.43 \pm 3.22^{b}$ | 0.417 | 0.263 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.312$, $\eta_p^2 = 0.037$; Time effect: $p < 0.001$, $\eta_p^2 = 0.577$; Group × Time effect: $p = 0.470$, $\eta_p^2 = 0.027$.
For time factor, different super scripts (a, b, c) in the same column.

Table 6. Time-Dependent Changes in Analgesic Amount

| | Groups | | | |
|---|---|---|---|---|
| *Analgesic amount* | *CTM Mean ± SD* | *FR Mean ± SD* | d | $p_1$ |
| Before treatment | $3.27 \pm 2.66^{a}$ | $2.07 \pm 1.94^{a}$ | 0.515 | 0.169 |
| After treatment | $0.93 \pm 1.22^{b}$ | $0.53 \pm 0.74^{b}$ | 0.396 | 0.288 |
| One month after treatment | $1.27 \pm 1.39^{b}$ | $0.53 \pm 0.74^{b}$ | 0.665 | 0.082 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.084$, $\eta_p^2 = 0.103$; Time effect: $p < 0.001$, $\eta_p^2 = 0.416$; Group × Time effect: $p = 0.500$; $\eta_p^2 = 0.024$.
For time factor, different superscripts (a, b, c) in the same column.

Table 7. Time-Dependent Changes in Difficulty in Concentration

| | Groups | | | |
|---|---|---|---|---|
| VAS value (cm) | CTM Mean ± SD | FR Mean ± SD | d | $p_1$ |
| Before treatment | 8.66 ± 1.95[a] | 7.80 ± 2.08[a] | 0.427 | 0.252 |
| After treatment | 2.84 ± 3.46[b] | 3.74 ± 3.88[b] | 0.245 | 0.508 |
| One month after treatment | 2.45 ± 3.11[b] | 3.31 ± 3.03[b] | 0.280 | 0.453 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.734$, $\eta_p^2 = 0.004$; Time effect: $p < 0.001$, $\eta_p^2 = 0.653$; Group × Time effect: $p = 0.233$; $\eta_p^2 = 0.051$.
For time factor, different superscripts (a, b, c) in the same column.

Table 9. Time-Dependent Changes in Difficulty in Social Activities

| | Groups | | | |
|---|---|---|---|---|
| VAS value (cm) | CTM Mean ± SD | FR Mean ± SD | d | $p_1$ |
| Before treatment | 8.03 ± 2.38[a] | 8.05 ± 1.82[a] | 0.010 | 0.986 |
| After treatment | 2.93 ± 3.81[b] | 4.09 ± 4.20[b] | 0.289 | 0.435 |
| One month after treatment | 2.35 ± 3.20[b] | 3.50 ± 3.33[b] | 0.352 | 0.342 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.650$, $\eta_p^2 = 0.023$; Time effect: $p < 0.001$, $\eta_p^2 = 0.617$; Group × Time effect: $p = 0.538$; $\eta_p^2 = 0.022$.
For time factor, different superscripts (a, b, c) in the same column.

premenstrual symptoms for the women given true reflexology treatment than for the women in the placebo group.[36]

Physiotherapy of dysmenorrhea generally focuses on electrotherapy, exercise, and spinal manipulation,[12–14] and the use of CTM in dysmenorrhea is very rare somehow. When literature was reviewed, it was seen that this technique is usually performed in painful conditions such as fibromyalgia or migraine[37–40] or in vascular problems.[41]

Reis et al. applied lumbar region connective tissue massage twice weekly during the three menstrual cycles following admission while the cases were not menstruating. They indicated that pain intensity, pain medication, and systemic symptoms reduced over time with the treatment.[28]

These findings were similar to the results of the studies mentioned above. Significant improvement in pain intensity, analgesic usage, and menstruation-related symptoms was achieved over time with both treatments. However, different from the common methodology in related literature, in this study, participants were treated during just one menstruation cycle, but with a more frequent manner. The treatment effect was found to be maintained after one more cycle too. Performing the therapies in a more frequent manner, as in this study, is thought to be adequate to obtain benefits and to have a quick response.

Another difference in this methodology existed in the treated area. Distinct from the usual manner, the authors not only involved the lumbar region but also progressed through the whole back. Connective tissue changes associated with the specific visceral functions were found in certain locations on the back area, known as connective tissue or reflex zones. For example, for headache, reflex zones are located in a small area in the sacral region, in subcostal, interscapular, and cervical regions.[22] As the treatment was performed for one menstruation cycle and to create an effect on the reflex zones that are thought to be related with the menstruation-related symptoms, the whole back region is included in this study.

Physiologic mechanisms lying underneath these methods seem to work in similar ways. Correlations between reflexology points on the feet and affected organs have also been shown as it has been done in CTM.

Mur et al. found increased intestinal blood flow during stimulation of corresponding reflex points compared with subjects who received reflex stimulation on unrelated points.[42] Similarly, Sudmeier et al. also demonstrated increased renal blood flow, measured with Doppler sonography, with reflexology on the foot points related to the kidney compared with individuals given placebo reflexology at points not associated with the kidney.[43]

Improvements achieved in all parameters with the treatments are thought to depend on the physiologic mechanisms mentioned above. Unfortunately, assessments, including blood samples for endorphin release and Doppler findings of uterine artery blood flow, were absent in this study. To make a more robust interpretation about the effect mechanism, these parameters must be assessed.

Students in the CTM group were taller than the ones in the FR group ($p < 0.05$), but both groups were similar in

Table 8. Time-Dependent Changes in Difficulty in Sports Activities

| | Groups | | | |
|---|---|---|---|---|
| VAS value (cm) | CTM Mean ± SD | FR Mean ± SD | d | $p_1$ |
| Before treatment | 8.65 ± 1.73[a] | 7.99 ± 2.03[a] | 0.350 | 0.346 |
| After treatment | 2.94 ± 3.89[b] | 4.11 ± 4.30[b] | 0.285 | 0.440 |
| One month after treatment | 2.71 ± 3.24[b] | 3.36 ± 3.20[b] | 0.202 | 0.583 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.679$, $\eta_p^2 = 0.006$; Time effect: $p < 0.001$, $\eta_p^2 = 0.619$; Group × Time effect: $p = 0.311$; $\eta_p^2 = 0.041$.
For time factor, different superscripts (a, b, c) in the same column.

Table 10. Time-Dependent Changes in Total Scores of Menstruation-Related Symptoms

| | Groups | | | |
|---|---|---|---|---|
| | CTM Mean ± SD | FR Mean ± SD | d | $p_1$ |
| Before treatment | 29.13 ± 9.76[a] | 30.13 ± 8.63[a] | 0.109 | 0.768 |
| After treatment | 11.60 ± 10.60[b] | 13.33 ± 10.58[b] | 0.163 | 0.657 |
| One month after treatment | 10.53 ± 9.28[b] | 13.73 ± 10.19[b] | 0.328 | 0.376 |
| $p_2$ | < 0.001 | < 0.001 | | |

Group effect: $p = 0.470$, $\eta_p^2 = 0.019$; Time effect: $p < 0.001$, $\eta_p^2 = 0.627$; Group × Time effect: $p = 0.863$, $\eta_p^2 = 0.005$.
For time factor, different superscripts (a, b, c) in the same column.

terms of BMI values ($p > 0.05$). As body weight and BMI values are essential in menstrual pain rather than the height,[44] this difference did not constitute any importance.

NSAIDs are reported to be the first line of treatment for primary dysmenorrhea as they offer substantial pain reduction. Despite their effectiveness, NSAIDs are associated with many adverse reactions, such as neurologic adverse reactions (headache, drowsiness, dizziness, and dryness) and gastrointestinal adverse reactions (nausea and indigestion), which become more apparent and severe with long-term use.[15]

On the other hand, it is reported that for reasons that are not well understood, about 10% of women with primary dysmenorrhea do not respond to treatment with NSAIDs or oral contraceptives. In addition, some women have contraindications to these medications.[4]

A total of 16 participants reported that they had dysmenorrhea since menarche. The mean time since menarche was $7.07 \pm 2.72$ years (minimum: 1 year, maximum: 13 years). Women having long-lasting dysmenorrhea, as in this study, should consider nonpharmacological treatments to avoid adverse effects of the drugs.

It may be hard to perform a therapist blind study for this type of research, but the lack of a placebo group constitutes the limitation of this study. After all, the authors hope their inferences may be useful for practitioners and researchers, who want to bring out some advantages for applications and the treatment results.

Further studies investigating the effects of similar methods on a larger population, including long-term follow-up in diverse clinical conditions, may be helpful to address the efficacy of reflex therapies and resolve the conflicts.

## Conclusion

CTM and FR are found to be effective in alleviating menstrual pain and associated symptoms in young adults. They can be considered for treatment of dysmenorrhea as they are noninvasive, nonpharmacological, and easy to perform.

## Author Disclosure Statement

No competing financial interests exist.

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