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Yoga positively affected depression and blood pressure in women with premenstrual syndrome in a randomized controlled clinical trial

Ghafoureh Ghaffarilaleh[a,b], Vahid Ghaffarilaleh[c], Zeinab Sanamno[d], Mahin Kamalifard[a,*]

[a] Department of Midwifery, Faculty of Nursing and Midwifery, Tabriz University of Medical Science, Tabriz, Iran
[b] Students' Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran
[c] Department of Medical Bioscience, Faculty of Natural Science, University of the Western Cape, Bellville, Cape Town, South Africa
[d] Tabriz University of Medical Sciences, Tabriz, Iran

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ABSTRACT

Women with premenstrual syndrome (PMS) often complain about depression when their menstrual cycle begins. This study investigated the effects of yoga on women with PMS suffering from depression during menstrual cycle.

Methods: This randomized controlled clinical trial was conducted from April to October 2015 in Tabriz, Iran. All subjects (20–45 years old), who were frequently referred to the private obstetrics and gynecology clinics, were initially monitored for PMS and depression. Subjects completed the demographic and Beck Depression Inventory-II (BDI-II) questionnaires before and after intervention. In addition, subjects were monitored for eligible and ineligible criteria. In this study 62 subjects were randomly selected for the yoga group and control groups. Subjects practiced yoga over two months in three sessions, the duration of each session was 60 min.

Results: The general score of the depression after yoga intervention was statistically significant compared to the control group ($P < 0.036$) and yoga group before intervention ($P < 0.001$). The diastolic pressure decreased significantly after yoga intervention ($P < 0.029$). Yoga decreased the state of depression and diastolic pressure of the subjects with PMS complaining from depression.

Conclusion: We conclude that yoga has strong effects on depression symptoms and blood pressure, therefore it can be used as a complementary or alternative remedy for PMS patients.

1. Introduction

A woman often tolerates emotional, physical and behavioral symptoms, 5 days before she gets her period, these symptoms will disappear in the first days of the period [1]. Women with premenstrual syndrome (PMS) often complain about depression with the symptoms including high anxiety, increase in appetite, sleep problems, emotional fragility and dramatic sedation when their menstruation is progressing [2]. On the other hand, this type of the depression should be clarified with major depression that male and females suffer which normally stands for more than two weeks. A population-based study has reported a prevalence of 11.3% and 24.6% major depression in women with moderate and sever PMS. Women with PMS during their reproductive lifetime tolerate 20%–76% depression. These rates fluctuate regarding to the family background of depression related to the PMS or premenstrual dysphoric disorder [3]. In a study 55% of women that met the criteria for PMS, showed that 30% of them did not have depression but 38%, 23% and 7% of them had mild, moderate and severe depression, respectively. Whereas, 60% of women with no PMS had no depression and just 20%, 17% and 2% had mild, moderate and severe depression, respectively which was significant in women with PMS [4]. Other study has shown that 26% of depressed women and 9% of women without depression were suffering from PMS [5]. There are factors that can induce depression or change the severity of depression. These factors can be internal or external. Externals such as changing of relationship status, losing a job or beloved one, and having problems in the school or work. However, internal factors can be because of fluctuating hormones specifically during menstrual cycle of women with PMS [6]. Several studies have revealed that depression plays an important role in women with PMS, however further investigation and review of this condition is required.

Internal and external factors in women with PMS have been found to affect blood pressure during the second half of the luteal phase. Patients with severe PMS and depression have shown indications that

* Corresponding author. Nursing & Midwifery Faculty, Tabriz University of Medical Science, Shariaty st. 5138947977, Tabriz, Iran.
E-mail address: kamalifardm@tbzmed.ac.ir (M. Kamalifard).

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the sympathetic autonomic activity has been affected because of stress and increased blood pressure [7]. Another study has shown that diastolic pressure was higher in women with PMS than women with no PMS (72.3 vs. 69.1 mmHg), whereas systolic pressure was not affected by the severity of PMS [8]. Therefore, it is necessary to decrease PMS symptoms associated with depression and blood pressure. Several remedies such as diet control and supplements [9,10], medical remedies [11], exercise [12], herbal remedies [13], counseling and changing lifestyle [14] have been used to decrease depression and blood pressure in women with PMS. Recently we have shown that yoga exercises can relieve and decrease symptoms of PMS and improve life quality of the patients [1]. The present study considered the effects of yoga on women with PMS and depression plus diastolic and systolic pressures during menstrual time.

2. Materials and methods

Women were asked to fill the demographic questionnaire and premenstrual symptoms screening tool (PSST). Afterwards, women with regular menstrual cycle were selected for the study according to the PSST. All subjects were passed through eligible and ineligible criteria such as age range between 20 and 45 years old, non-alcohol consumer for at least 120 days, not to be under prescription of any medication either chemical or herbal, not to be user of the contraceptives, not to be consumer of the cigarettes, tobaccos, caffeine or illicit drugs. Additionally, women needed to be healthy without any reproductive track, joint or rheumatoid diseases. Furthermore, women with any surgery, which could cause them problems during yoga exercises were excluded. Finally, all women needed to have willing to participate in the present trial. However, ineligible criteria included not having willingness to attend in the study or becoming pregnant during the present study. Importantly if they had problem in continuing yoga exercises they would be excluded from the present study. An initial sample of 150 women that were referred to the 20 randomly selected private obstetrics and gynecology clinics were chosen for the clinical controlled trial from April to October of 2015 in Tabriz, Iran.

Thereafter, subjects were requested to complete the self-reporting Beck Depression Inventory-second edition (BDI-II) questionnaire for the assessment of the severity of the depression. BDI-II questionnaire is a 21-item, self-rated scale that evaluates key symptoms of the depression. It is about sadness, pessimism, past failure, loss of pleasure, guilty feelings, punishment feelings, self-dislike, self-criticalness, suicidal thoughts, crying, agitation, loss of interest, indecisiveness, worthlessness, loss of energy, changes in sleeping patterns and irritability [15,16]. Each item of the questionnaire has four-point scale from zero to three. The final Beck scores could be sorted in 0–9, 10–14, 15–19, 20–28 and 29–63 for minimal or none, mild, moderate, moderately severe and sever, respectively [17]. The psychometric properties of BDI-II questionnaire on 94 people of Iranian population were as follows: alpha coefficient was 0.91, the test-retest coefficient was 0.94 per week, correlation coefficient between split-half was 0.89 [18]. Other study from Iran on 128 high school children which were completed BDI-II twice with a 2-week interval, the reliability and correlation coefficients were obtained for 0.55 and 0.83 from test-retest and Cronbach's alpha methods, respectively [19].

The number of the subjects were calculated accordingly from Kanojia et al. [20] by considering 95% interval confidence and 80% of power for 25 cases for yoga and control groups (-46.72 ± 20.75; -13.52 ± 55.53, respectively). Moreover, a possibility of 20% dropout was estimated therefore, 31 subjects were considered per group. The allocation was carried out considering 4 and 6 blocks randomly for both groups. Researchers used opaque envelopes labelled 1 to 62 to make the random selection of the names making up each group. Then the first eligible subject received the first envelope labelled 1. Therefore, from 62 women with PMS, 31 women were randomly assigned for yoga and 31 for the control groups.

Yoga group exercised under a skilled yoga coach for over two months, in three sessions per week, for 60 min. The yoga group prepared for exercising by doing Release for five minutes (Shaw asana: two minutes breathing and 3 min release) then the main exercises followed for 45 min accordingly for 10 weeks. The last ten minutes of the sessions was for relaxation. Yoga exercises were chosen according to the recommendations of yoga coach provided [1,21–23]. The first 2 weeks of yoga exercises were for physiological adaptations. All subjects could consult with researchers any time telephonically. However, researchers followed up with subjects twice telephonically for completing the forms. Researcher except preparation of envelops, has carried out the enrolling and assigning participants to interventions. The researcher, analyzer and subjects were blind about the envelopes as those were prepared by a non-involved colleague.

2.1. Statistical analyzes

All data were analyzed using IBM SPSS statistic for windows, version 23.0 (IBM Corp. Armonk, NY, USA). All data were checked for normality by K−S and the Shapiro–Wilk test. Results were reported as Mean ± SD for demographic and depression variables. The ANCOVA and T-test Paired Samples were used for total scores of Beck scores and blood pressure. The Mann-Whitney Test and Wilcoxon Signed Ranks Test were used for before and after yoga intervention of depression variables.

3. Results

Of the 62 subjects that entered the present study in the yoga group, five of the subjects failed to follow up, three of them got pregnant, two of them cancelled their interest to be involved in the present study and finally 26 of the subjects completed the journey. In the control group, three of the subjects failed to follow up, two of them got pregnant and one of them cancelled her interest to be involved further in the present study so finally 28 subjects completed the journey (Fig. 1). There was not a significant difference for marital status, number of children, education status, body mass index however job status was significant for yoga and control groups ($P < 0.05$) (Table 1).

Comparison of general scores of depressions before and after intervention for yoga group analyzed by ANCOVA was significant ($P < 0.036$), and comparison of yoga vs control group analyzed by T-test Paired Samples after intervention were statistically significant ($P < 0.001$) (Table 2).

Variables of BDI-II including mood, pessimism, sense of failure, self-dissatisfaction, punishment, self-dislike, self-accusation, suicidal ideas, crying, indecisiveness, work difficulty, fatigability, weight loss and loss of libido analyzed by Mann-Whitney Test were changed significantly ($P < 0.05$) when they were compared to the control group after yoga intervention. Variables of BDI-II including guilt, irritability, social withdrawal, body image change, insomnia, loss of appetite and somatic preoccupation were not changed significantly (Table 3).

Additionally, sadness, pessimism, past failure, loss of pleaser, punishment feelings, self-dislike, self-criticalness, suicidal thoughts, crying, indecisiveness, loss of energy, irritability, concentration difficulty and loss of interest in sex, in the yoga group after intervention analyzed by Wilcoxon Signed Ranks Test were significantly changed ($P < 0.05$). Whereas guilty feelings, agitation, loss of interest, worthlessness, changes in sleeping patterns, changes in appetite, tiredness or fatigue were not significantly changed (Table 3).

According to the Beck scoring after yoga intervention the severity of the depression in subjects of the yoga group after yoga intervention decreased compare to the control group (minimal or none depression: 65.4 vs. 26.9, mild: 15.4 vs. 26.9, moderate: 19.2 vs. 11.5, moderate severe: 0.00 vs. 26.9, severe: 0.00 vs. 7.7) (Table 4a).

Besides the assessment of the severity of the depression before and after yoga intervention BMI, heartbeat, systolic and diastolic pressures

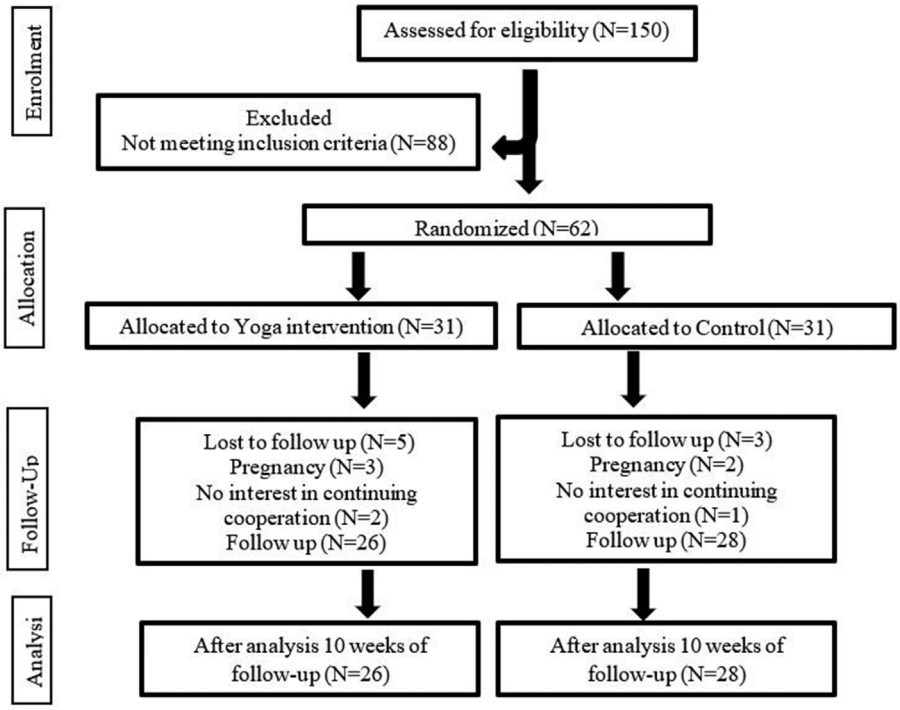

Fig. 1. Flow diagram of the progress through the phases of a parallel randomized trial of Yoga and control groups (that is, enrolment, intervention allocation, follow-up, and data analysis).

were considered. There was no significant difference in BMI, heartbeat and systolic pressure however diastolic pressure was statistically significant ($P < 0.05$) in yoga group after yoga intervention compared to the before intervention and improved (Table 4b).

4. Discussion

The present randomized controlled clinical trial study showed that yoga positively affected depression and diastolic pressure in women with PMS.

Recently we have shown that yoga relived emotional, behavioral

Table 2
Comparison of general score of depression before and after intervention for yoga and control groups.

Groups	Before intervention (Mean ± SD)	After intervention (Mean ± SD)	P Value**
Control (n = 28)	15.07 ± 9.775	17.96 ± 12.735	0.187
Yoga (n = 26)	15.15 ± 8.240	7.46 + ± 6.426	**< 0.001**
P value*	0.461	**0.036**	

P value* ANCOVA.
P Value** T-test Paired Samples.

Table 1
This table shows the demographic information of the subjects in both yoga and control groups.

Variables		Control n (%)	Yoga n (%)	P value*
Job statement	**Housekeeper**	4(14.3)	11(42.3)	0.033
	Practitioner	24(85.7)	15(57.7)	
marital status	**Single**	11(39.3)	12(46.2)	0.574
	Married	15(53.6)	14(53.8)	
	Divorced	2(7.1)	0(0)	
Number of children	**0**	16(57.1)	15(57.7)	0.642
	1	9(32.1)	6(23.1)	
	2	3(10.7)	5(19.2)	
Education statement	**Diploma**	5(17.9)	3(11.5)	0.473
	Associate degree	3(10.7)	1(3.8)	
	Bachelor	18(64.3)	17(65.4)	
	Master	2(7.1)	5(19.2)	
BMI	**< =25**	20(74.1)	15(57.7)	0.399
	25.1–30	5(18.5)	9(34.6)	
	30.1 <	2(7.4)	2(7.7)	
Variables		**Control (Mean ± SD)**	**Yoga (Mean ± SD)**	**P Value ******
Reproductive status	**Age of first period (years)**	13.357 ± 1.747	13.115 ± 1.306	0.570
	Age (years)	30.179 ± 6.290	34.462 ± 5.368	0.010
	Period Time (days)	28.821 ± 2.539	29.923 ± 2.799	0.135
	Period duration (days)	6.214 ± 1.371	6.692 ± 2.074	0.319

*P value was obtained from Chi-Square Tests.
**P value based on Independent T-test.

Table 3
Comparison of the averages and standard error of subdomains of Beck depression inventory-II (BDI-II) of yoga and control groups before and after yoga intervention.

Variables	Groups	Before intervention Average (SE)	After intervention Average (SE)	P Value**
Sadness	Control	0.57(0.573)	0.93(0.900)	0.134
	Yoga	0.63(0.496)	0.38(0.496)	0.083
	P value*	0.225	**0.019**	
Pessimism	Control	0.82(1.056)	0.93(1.016)	0.582
	Yoga	0.69(1.050)	0.50(0.812)	0.346
	P value*	0.971	**0.002**	
Past failure	Control	0.71(0.897)	1.37(0.428)	0.967
	Yoga	0.77(0.202)	0.35(0.562)	**0.527**
	P value*	0.185	**0.003**	
Loss of pleasure	Control	1.07(0.813)	1.39(0.916)	0.115
	Yoga	0.92(0.845)	0.54(0.706)	0.072
	P value*	0.298	**< 0.001**	
Guilty feelings	Control	0.82(0.863)	0.86(0.201)	0.808
	Yoga	0.54(0.706)	0.31(0.618)	0.130
	P value*	0.210	0.094	
Punishment feelings	Control	0.61(1.100)	0.82(1.090)	0.388
	Yoga	0.46(0.859)	0.31(0.736)	0.506
	P value*	0.768	**0.001**	
Self-dislike	Control	0.43(0.742)	0.68(0.905)	0.203
	Yoga	0.35(0.562)	0.08(0.272)	**0.035**
	P value*	0.209	**0.004**	
Self-criticalness	Control	1.18(1.156)	0.93(0.900)	0.285
	Yoga	0.85(0.967)	0.23(0.652)	**0.004**
	P value*	0.285	**0.028**	
Suicidal thoughts	Control	0.25(0.645)	0.29(0.810)	0.832
	Yoga	0.15(0.464)	0.04(0.196)	0.257
	P value*	0.558	**0.023**	
Crying	Control	0.89(1.100)	0.89(0.166)	0.895
	Yoga	1.00(1.131)	0.15(0.464)	**0.002**
	P value*	0.325	**0.016**	
Agitation	Control	0.71(0.713)	0.79(0.738)	0.614
	Yoga	0.92(1.055)	0.08(0.272)	**0.001**
	P value*	0.508	0.119	
Loss of interest	Control	0.68(0.983)	0.75(0.799)	0.816
	Yoga	0.92(1.017)	0.46(0.706)	**0.030**
	P value*	0.673	0.183	
Indecisiveness	Control	0.54(0.693)	0.79(0.768)	0.197
	Yoga	0.73(1.002)	0.23(0.430)	**0.026**
	P value*	0.867	**0.011**	
Worthlessness	Control	0.43(0.690)	0.64(0.911)	0.253
	Yoga	0.35(0.629)	0.27(0.667)	0.713
	P value*	0.616	0.178	
Loss of energy	Control	1.04(0.744)	1.21(0.833)	0.494
	Yoga	1.15(0.967)	0.62(0.752)	**0.013**
	P value*	0.867	**0.011**	
Changes in sleeping patterns	Control	0.96(0.693)	1.11(0.832)	0.329
	Yoga	0.96(0.720)	0.50(0.583)	**0.014**
	P **value***	0.616	0.178	
Irritability	Control	0.64(0.731)	0.64(0.826)	**1**
	Yoga	0.54(0.811)	0.19(0.402)	**0.029**
	P value*	0.867	**0.011**	
Changes in appetite	Control	0.50(0.577)	0.75(0.701)	0.071
	Yoga	0.69(0.828)	0.65(0.892)	0.971
	P value*	0.616	0.178	
Concentration difficulty	Control	0.71(0.763)	0.86(0.932)	0.464
	Yoga	0.1.12(0.864)	0.42(0.758)	**0.003**
	P value*	0.867	**0.011**	
Tiredness or fatigue	Control	0.96(0.881)	1.14(0.705)	0.335
	Yoga	0.92(0.796)	0.54(0.761)	0.077
	P value*	0.616	0.178	
Loss of interest in sex	Control	0.54(0.793)	0.89(1.133)	0.074
	Yoga	0.85(1.008)	0.62(0.941)	0.271
	P value*	0.867	**0.011**	

P value* Mann-Whitney Test **P Value**** Wilcoxon Signed Ranks Test.

and physical symptoms of PMS [1] and furthermore, yoga was significantly improved sleep latency and effiviency, concluding that yoga was reduced discomfort of the women with PMS and consequently the quality of life was improved [23]. Results from present study showed that general score of depression before and after yoga intervention positively were affected as well as variables of Beck depression inventory scale. These results are in accordance with the other studies such as using yoga on women with metastatic breast cancer [24], women suffering from PMS [1], pregnant women with depression symptoms [25] and women suffering from low blood pressure [26]. Investigations have shown that yoga might affect depression by two possible approaches of mindfulness and biological. The first approach can be explained through the contacts; that participants in yoga classes concentrate to the present time thoughts, sensation from environment, and body reactions in a non-judgmental atmosphere. This approach probably is helping participants to concentrate on the present exercises rather than outside concerns so subsequently affects self-criticism [27]. On the other hand, yoga has been shown to regulate the autonomic nervous system (CNS) which has an association with depression [28]. Additionally, yoga might affect through the primary peripheral pathway which increases the activity of the parasympathetic nervous system (PNS) and GABA systems triggering vague nerves. Yoga by increasing the activity of the PNS and enhancing the level of the GABA in the thalamus, improves the mood [29]. Another description of biological approach includes impacts of yoga on brain activity through alpha-brain waves correlated to the releasing of serotonin, therefore patients feel relaxed following yoga exercises [30].

In the present study, yoga decreased diastolic pressure while systolic pressure did not change after yoga intervention. In a study researchers have found that PMS has potential to cause futuristic risk of high blood pressure where women with moderate to severe PMS have shown 40% more risk to high blood pressure over next 20 years in comparison to women that have experienced less PMS symptoms [8]. In a study from Nigeria on 273 women with PMS, researchers have observed higher systolic and diastolic pressure during the luteal phase compared to the 174 women without PMS [7]. Similarly, enhanced peripheral and central systolic pressure, pulse pressure, and mean arterial pressure during the luteal and menstrual phases were recorded in 21 women with PMS compared to the 15 women without PMS [31]. These changes in systolic and diastolic pressure are also observed in women after postmenopausal who were experienced at least seven or more symptoms of PMS. Among enhances in mean systolic and diastolic pressures in the second luteal phase, the activity of the aldosterone-renin were also increased [32]. These evidences show that changes in systolic and diastolic pressures in women with PMS can cause cardiovascular problems in later stages of their life [8]. Importantly prescribing chemical medications have shown to change blood pressure during menstrual of women. For instance, serotonin-norepinephrine reuptake inhibitors with tricyclic antidepressants have shown to enhance blood pressure which consequently increases the risk of high blood pressure and even during pregnancy it increased the risk of preeclampsia [33]. For instance, a dysfunction of renin-angiotensin aldosterone system (RAAS) has been described to be associated with high blood pressure through adjusting of sodium levels, blood pumping amount, and contractions of the arteries [34]. It seems that dysfunction of RAAS is associated with PMS symptoms such as edema, flatulence, swelling of body and breast tenderness [7]. On the other hand, kidney with regulating hypertensive state plays an important role in the body. When blood pressure during menstrual cycle of female gender increases the arterial stiffness and endothelial dysfunction can increase the sustaining of the high blood pressure [35]. From hormonal view, progesterone and estrogens have a direct effect on RAAS performance, which might have effects on aldosterone secretion in premenopausal women as well. In a study authors observed an association of diastolic pressure with nausea, palpitations, forgetfulness, dizziness, hot flushes/night sweats, insomnia, and depression which diastolic pressure was more than 5 percent compared to women that considered in the moderate and severe group [36]. Moreover, food supplements have also shown to be related to the high blood pressure during second luteal phase of PMS such as consuming vitamins of B, D, potassium, calcium [8].

Table 4a
Shows that diastolic blood pressure has significantly decreased by practicing yoga ($P < 0.02$) besides the improvement of heart beats that after yoga intervention has decreased to the control group ($P < 0.69$).

Variables	Groups	Before intervention N (%)	After intervention N (%)
9-0 (minimal or none)	Control n = 28	11(39.3)	6(21.4)
	Yoga n = 26	7(26.9)	17(65.4)
10-14 (Mild)	Control n = 28	3(10.7)	7(25)
	Yoga n = 26	7(26.9)	4(15.4)
15-19 (Moderate)	Control n = 28	5(17.9)	7(25)
	Yoga n = 26	3(11.5)	5(19.2)
20-28 (Moderately sever)	Control n = 28	6(21.4)	2(7.1)
	Yoga n = 26	7(26.9)	0(0)
29-63 (Sever)	Control n = 28	3(10.7)	6(21.4)
	Yoga n = 26	2(7.7)	0(0)

P value* ANCOVA.
P Value** T-test Paired Samples.

Table 4b
Shows that the percentages of the severity of the depression has decreased after yoga intervention compare to the control group.

Variables	Groups	Before intervention Average (SE)	After intervention Average (SE)	P Value**
Systolic	Control	102.61(11.41)	103.21(10.62)	0.54
	Yoga	109.77(9.55)	103.31(20.28)	0.10
	P value*	0.13	0.05	
Diastolic	Control	69.86(9.34)	70.64(8.13)	0.57
	Yoga	76.73(9.07)	72.62(6.06)	**0.02**
	P value*	0.16	0.19	
Heart beats	Control	79.07(8.49)	80.96(7.33)	0.05
	Yoga	87.19(9.14)	83.15(10.52)	0.059
	P value*	**0.04**	0.69	
Body mass index	Control	62.55(8.78)	62.25(8.76)	0.1
	Yoga	63.02(10.50)	61.72(9.30)	0.23
	P value*	0.94	0.95	

P value* ANCOVA.
P Value** T-test Paired Samples.

4.1. Conclusion

Yoga in women with PMS positively affected the general scores of the depression calculated from depression parameters from Beck depression inventory scale. Furthermore, diastolic pressure significantly decreased in the yoga group after intervention while systolic pressure, BMI and heartbeat were not changed before and after yoga intervention.

4.2. Limitations

All the participant's responses in the current study considered honest and right. Detection of the accuracy and untruth of the responses collected from participants were beyond the researcher's capacity. Authors in the questionnaires were not included an item about monitoring of the side effects of the practicing yoga.

4.3. Trial registration

The ethics committee of the Medical Science University of Tabriz (Approval 93184) approved and then it was submitted in Iranian Registry of Clinical Trials (IRCT, IRCT201501216582N9).

4.4. Generalizability of the trial findings

The results from present study can be used for Iranian population in the northwest of Iran as subjects were chosen randomly from 20 private obstetrics and gynecology clinics.

Conflicts of interest

The authors have no conflicts of interest to disclose.

Ethical approval

This study was approved by ethics committee of the Medical Science University of Tabriz (Approval 93184).

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Clinical trial registry and registration number

This study was submitted in Iranian Registry of Clinical Trials (IRCT, IRCT201501216582N9).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ctcp.2018.11.007.

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