International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067; Impact Factor: RJIF 5.24
Received: xx-02-2019; Accepted: xx-03-2019
www.sportsjournal.in
Volume 4; Issue 3; May 2019; Page No. 00-00

The effect of yoga therapy on premenstrual syndrome.

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Abstract
Objective: To study the effect of 12 weeks of yoga programme on cardiac autonomic functions and psychological parameters in subjects of premenstrual syndrome (PMS).
Method: This is randomised control study and was approved by Institutional Ethics Committee. Age and BMI matched sixty diagnosed cases of PMS were randomized into two groups: study group (n=30) who practiced yoga and control group (n=30) was without yoga intervention. Following parameters were recorded in both pre and postmenstrual phase at baseline and after 12 weeks: Resting Heart Rate, Resting blood Pressure, parasympathetic reactivity tests, sympathetic reactivity tests and psychological parameters (depression, anxiety and stress). Paired t-test and unpaired t-test were used for statistical analysis.
Results: At baseline there was significantly higher sympathetic activity, blunting of parasympathetic activity and increase in negative affect of psychological health in premenstrual phase as compared to postmenstrual phase in subjects with PMS. After 12 weeks, study group (with yoga intervention) during premenstrual phase showed significant decrease in resting heart rate, resting SBP (p-value 0.025, 0.001 respectively) significant rise parasympathetic reactivity as measured by E:I and 30:15 ratio (p-value <0.001, <0.001 respectively), significant fall in sympathetic activity as measured by cold pressor test (p value < 0.001) and fall in negative affect of psychological health (p-value 0.049) as compared to control group (which was without yoga intervention).
Conclusion: Regular practice of yoga has beneficial effects on premenstrual symptoms by achieving balance between parasympathetic and sympathetic activity. YOGA can be considered as therapeutic intervention for PMS.

Keywords: premenstrual syndrome, E:I ratio, 30:15 ratio, Handgrip test, cold pressor test, psychological health, Yoga therapy.

1. Introduction

Introduction: In this modern day fast life, women have to perform many duties like housekeeping, children upbringing and professional work. It is really stressful for them to maintain the balance between personal, family and professional life. In addition, she has to deal with stress related with physiological changes occurring in and around monthly menstrual cycle. According to Mishell majority of women experience a "cacophony of mind and body" in late luteal phase that is characterised by premenstrual syndrome [1]. Premenstrual syndrome (PMS) also called as premenstrual tension is a cluster of physical, psychological as well as behavioural changes in the luteal phase of menstrual cycle, which in severe cases affects woman's personal, familial, professional & social life [2]. The pooled prevalence of PMS overall world is 47.8% and in India it is 67%, highest being in Iran which is almost 98% [3].

Alterations in hormones and neurotransmitters including endorphins, γ amino butyric acid (GABA), and serotonin have been implicated in premenstrual symptomatology. Autonomic nervous system which plays a vital role in orchestrating homeostasis of body gets altered during different phases of menstrual cycle [4]. Sympathetic activity is supposed to be increased in females with PMS in late luteal phase i.e. premenstrual phase of a menstrual cycle [5].

No treatment is beneficial up to the mark since the aetiology of PMS is not clear [6] and multifactorial aspects are hypothesized. Simple ways like YOGA and meditation may ease the physical changes and psychological swings associated with PMS. Yoga and meditation are supposed to be relaxing routes that are natural to the body and mind as well as easy to integrate in a day.

Materials and methodology

Study Design

This study is a randomized control study. The synopsis of study protocol was submitted to the Institutional Ethics Committee and approval was obtained. Students of medical and nursing colleges were enrolled as subjects. They were diagnosed applying American College of Obstetricians and Gynaecologists (ACOG) [7] criteria for premenstrual syndrome and selected by certain inclusion and exclusion criteria.

Selection of Subjects

Inclusion Criteria

1. Subjects in age group: 18-35 years.
2. Females with regular menses every 28 to 32 days for 3-5 days
3. Non-obese (BMI between 18.5 to 24.99)

Exclusion criteria

1. Irregular menses
2. BMI <18.5/ and ≥25
3. Smokers and/or Alcoholic
4. Subjects practicing yoga or any aerobic exercise
5. Major illness like Diabetes mellitus, Hypertension, Ischemic Heart Disease, renal disease, Endocrine disorder, Psychiatric illness
6. On Medication affecting autonomic functions
7. Any joint disorder/ deformity which is contraindication for yoga therapy.

Based upon these criteria, subjects were thoroughly interviewed and clinically examined. All the participants were explained verbally in detail about the purpose and basic steps in the study.

Equipments and materials

After taking informed consent from the subjects detailed menstrual history was noted. Menstrual phases are labelled as - Premenstrual phase (luteal phase / secretory phase) 1-7 days before menses and Postmenstrual phase (follicular phase / proliferative phase) as 5 days after menstruation. Detailed clinical examination was done. Height was measured using a scale inscribed on the wall to nearest centimetre. The height was measured without footwear. Weight was measured using Krup's weighing machine with subject wearing minimal clothing and without shoes to the nearest kilogram.

Body Mass Index (BMI) / Quetelet's index was calculated using following formula [8].

$$BMI = \frac{\text{(weight in kg)}}{\text{(height in meter)}^2}$$

All the subjects who were unable to perform yoga practices due to any reason and whose BMI was not satisfying the inclusion criteria were excluded from the study. Thus finally 60 diagnosed cases of PMS were chosen for the present study and a written consent regarding participation in the study was obtained from them.

Following cardiac autonomic functions were carried out in all 60 subjects.

- Resting heart rate
- Resting BP
- Tests for parasympathetic function: using *Maestros ECG Machine*

Effect of deep inspiration & expiration on heart rate (E:I ratio)

Change in heart rate immediately after standing (30:15 ratio)

- Tests for sympathetic function: using *digital OMRON sphygmomanometer*

Rise in Diastolic BP during isometric exercise (Handgrip test)

Rise in Diastolic BP on cold response (cold pressor test)

- Psychological status assessment:

Psychological status of all 60 subjects was assessed by using self-report DASS 21 (Depression anxiety stress scale) [9] for measuring psychological parameters. The questionnaire was developed by Lovibond and Lovibond (1995).

The DASS 21 is a self-report questionnaire considered to measure the severity of a range of symptoms for D (Depression), A (Anxiety) and S (Stress), in which an individual is required to mark the presence of a symptom over the previous week. Each item is scored from 0 (did not apply) to 3 (almost always). As the DASS 21 is a short form version of the DASS (the Long Form has 42 items), the final score of each item groups (Depression, Anxiety and Stress) needs to be multiplied by two (x2).

Mode of selection and sample size

The 60 subjects (diagnosed cases of PMS) were then randomly divided into two groups: Study group (n=30) consisted of subjects who practiced yoga. Control group (n=30) consisted of subjects without yoga intervention.

Duration of training was 50 minutes per day, for 6 days a week, for 12 weeks. During menstruation only pranayama and meditation was done and not the asanas. A trained and qualified yoga trainer from renowned institute gave training to study group subjects. Following yoga therapy was practiced daily.

- **Prayer** (2 minutes)
- **Yogic Posture** (20 minutes)
- Jumps (for warming up)
- **SURYANAMSKAR:** (12 Postures of sun salutation exercise) - 2 sets
- Asanas in Standing position:
  - ✓ TADASAN
  - ✓ UTTANASAN
  - ✓ ADHOMUKH SHVANASAN
  - ✓ URDHWAMUKH SHVANASAN
  - ✓ ADHOMUKH SHVANASAN
  - ✓ UTTANASAN
  - ✓ TADASAN
- Asanas in Sitting position:
  - ✓ VAJRASAN
  - ✓ GOMUKHASAN (LEGS)
  - ✓ BADDHAKONASAN
  - ✓ DANDASAN
- Asanas in Sitting position: Twisting of upper body
- Asanas in Prone position:
  - ✓ Alternate hand and legs up down
  - ✓ Hands, neck and shoulders up
  - ✓ Torso up
- Asanas in Supine position
  - ✓ Legs up & down
  - ✓ Torso up
  - ✓ Legs up & down 90 degree
  - ✓ NAUKASAN
- Resting asanas:
  - ✓ PADANGUSHTHASAN (or) lumbar rest
  - ✓ SHAVASAN – (10 minutes)
- **PRE-PRANAYAM** (4 minutes)
- **PRANAYAMA** (5 minutes)
- UJJAYI
- BHRAMARI
- ANULOM VILOM
- **MEDITATION** (3 minutes)
- **OMKAR -** 11 times (4 mins)
- **SHANTIMANTRA** (2 mins)

After 12 weeks, same tests for parasympathetic function, sympathetic function and psychological assessment were carried out in both study and control groups.

Method (Explanation of Individual Tests) [10]

1. Resting heart rate

The subject was lying comfortably for 5 mins with all Electrocardiograph leads attached [Maestros ECG Machine]. Resting ECG (Electrocardiogram) was recorded in lead II and baseline Heart Rate of the subject was calculated as HR (per min.) = 1 x 60 / R-R interval (in sec.)

2. Resting blood pressure

Subject was in supine position, lying comfortably for 5 min and then resting BP was recorded using digital OMRON sphygmomanometer.

In general, blood pressure (BP) changes are studied to assess integrity of the sympathetic functions and heart rate (HR) changes for those of parasympathetic functions.

Parasympathetic Function Tests

1. Heart rate variation during breathing (E: I ratio)

The subject was in supine position with all ECG leads attached. After breathing normally for 2 mins the patient was asked to perform 6 maximum deep breathings in one minute (so, total 6 inspirations & 6 expirations per minute, each one is lasting for 5 secs). We marked the point of inspiration and expiration on ECG paper. Continuous ECG record was obtained. The shortest RR interval during inspiration (I) & the longest RR interval during expiration (E) was measured and the E: I ratio was obtained.

$$\text{E: I ratio} = \frac{\text{Mean value of longest RR interval during expiration}}{\text{Mean value of shortest RR interval during deep inspiration}}$$

- Normal= > 1.21
- Borderline= 1.11-1.20
- Abnormal = <1.10

2. Heart rate response to standing (30:15 Ratio)

Each subject was asked to lie quietly for 3 minutes. She was then asked to stand up and remain motionless. A continuous ECG was recorded and a point was marked on ECG paper to identify the point of standing. The 30:15 ratio was calculated by taking the ratio of the R-R interval at 30th beat and at 15th beat after standing.

$$\text{30:15 ratio} = \frac{\text{RR interval at the 30th beat}}{\text{RR interval at the 15th beat}}$$

- Normal = > 1.04
- Borderline= 1.01-1.03
- Abnormal = <1.0

Sympathetic Function Tests

1. Blood pressure response to sustained handgrip (Hand Grip Test)

It is Blood Pressure Response to Static Exercise. The subject was asked to apply pressure on a handgrip dynamometer [Inco-Ambala] for 1 minute at 30% of maximal voluntary contraction and simultaneously the blood pressure changes were recorded from opposite arm. The difference between the diastolic blood pressure (DBP) just before the release of contraction and before handgrip began, was taken as a measure of the response.

- Normal = > 15 mmHg rise in DBP
- Borderline= 11-15 mmHg rise in DBP
- Abnormal = <10 mmHg rise in DBP

2. Rise in Diastolic BP on cold response (cold pressor test)

After recording baseline BP in sitting posture, subject was asked to immerse her hand in a tray of water (maintained at 4-6ºC). BP was recorded from the other arm at 30 sec intervals for a period of two minutes after which subjects removed their hand. The maximum rise in DBP was noted.

- Normal = > 16 mmHg rise in DBP
- Borderline= 11-15 mmHg rise in DBP
- Abnormal = <10 mmHg rise in DBP

All above mentioned tests for autonomic function and filling of DASS questionnaire was carried out during pre and post menstrual phases of each subject at baseline and after 12 weeks.

Statistical tests

Data analysis was done by using SPSS (Statistical package for social sciences) Version 20:0. Quantitative data variables expressed by using Mean and Standard deviation (SD). p-value < 0.05 was considered as significant. Intra group comparison was done by using paired t-test. Unpaired t-test was used to find the significant difference between Study and Control group.

Result

Table 1: Comparison of cardiac autonomic and psychological parameters between pre and post menstrual phase in cases with premenstrual syndrome (PMS).

	Pre M (n=60)		Post M (n=60)		p-value
	Mean	SD	Mean	SD	
Resting heart rate (per min.)	85.35	9.87	80.28	10.63	< 0.001*
Resting SBP (mmHg)	110.48	6.59	103.42	7.96	< 0.001*
Resting DBP(mmHg)	72.35	5.12	67.93	5.24	< 0.001*
E:I ratio	1.37	0.10	1.46	0.12	< 0.001*
30:15 ratio	1.07	0.03	1.12	0.08	< 0.001*
Increase in DBP by HGT(mmHg)	15.83	5.07	16.63	5.18	>0.05
Increase in DBP by CPT(mmHg)	16.20	3.27	16.77	3.52	>0.05
Depression	3.70	3.37	2.27	2.64	< 0.001*
Anxiety	5.47	3.25	3.90	3.07	< 0.001*
Stress	8.10	4.63	5.80	3.86	< 0.001*
Total score (DASS)	17.27	9.40	11.83	8.03	< 0.001*

p< 0.05= statistically significant*Pre M- premenstrual phase, Post M- post menstrual phase, SBP- systolic blood pressure, DBP- diastolic blood pressure, E:I ratio- expiration inspiration ratio, HGT- hand grip test, CPT- cold pressor test, DASS depression, anxiety and stress scale

Table 2: Comparison of cardiac autonomic and psychological parameters between study and control group during premenstrual phase after 12 weeks.

	Pre M After yoga intervention				P-value
	Study group (n=30)		Control group (n=30)		
	Mean	SD	Mean	SD	
Resting heart rate (per min.)	80.83	7.73	85.70	8.67	0.025*
Resting SBP (mmHg)	104.93	7.94	98.43	7.12	0.001*
Resting DBP(mmHg)	70.33	3.62	72.40	5.14	>0.05
E:I ratio	1.49	0.13	1.33	0.07	< 0.001*
30:15 ratio	1.14	0.09	1.06	0.03	< 0.001*
Increase in DBP by HGT(mmHg)	14.57	2.21	16.90	7.59	>0.05
Increase in DBP by CPT(mmHg)	14.27	2.61	18.87	3.20	< 0.001*
Depression	3.00	2.96	3.93	3.58	>0.05
Anxiety	4.13	3.36	5.60	3.30	>0.05
Stress	6.40	3.94	8.07	4.44	>0.05
Total score (DASS)	13.53	7.80	17.60	8.57	<0.05*

p< 0.05= statistically significant* Pre M- premenstrual phase, SBP- systolic blood pressure, DBP- diastolic blood pressure, E:I ratio- expiration inspiration ratio, HGT- hand grip test, CPT- cold pressor test, DASS depression, anxiety and stress scale

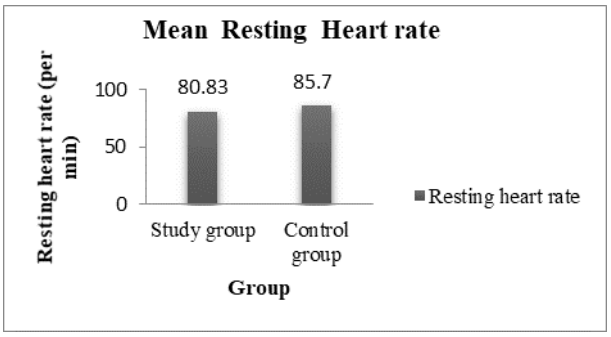

Fig 1: shows comparison of resting heart rate between study and control group during premenstrual phase after 12 weeks

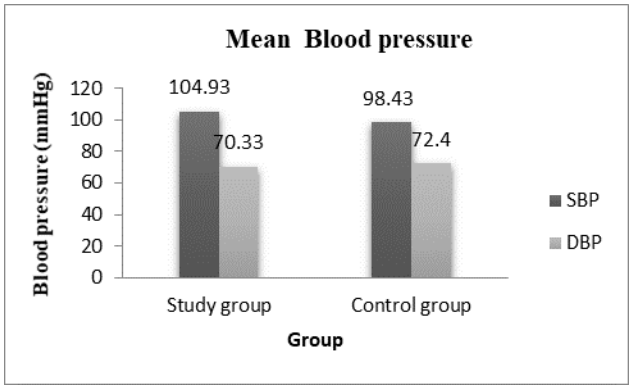

Fig 7.2: shows comparison of resting SBP and DBP between study and control group during premenstrual phase after 12 weeks

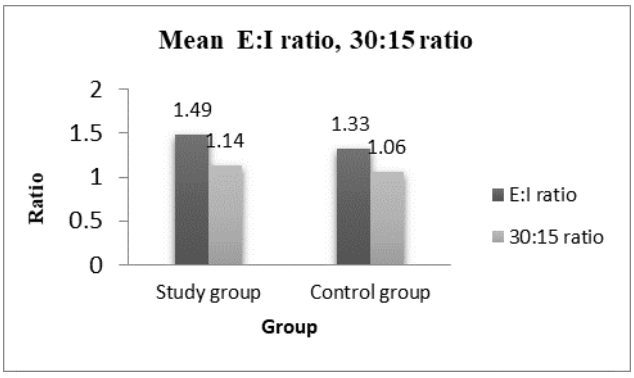

Fig 7.3: shows comparison of E: I ratio and 30:15 ratio between study and control group during premenstrual phase after 12 weeks

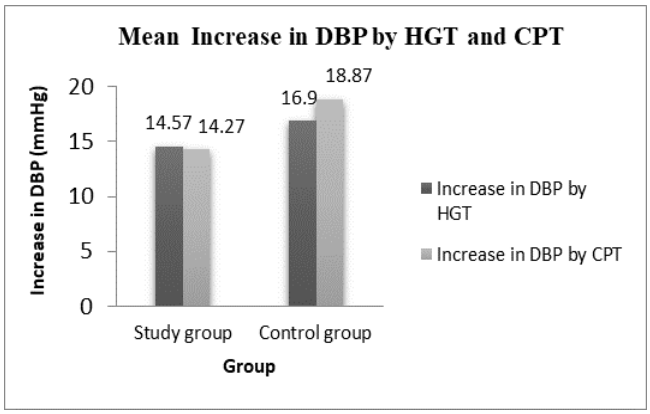

Fig 7.4: shows comparison of resting heart rate between study and control group during premenstrual phase after 12 weeks

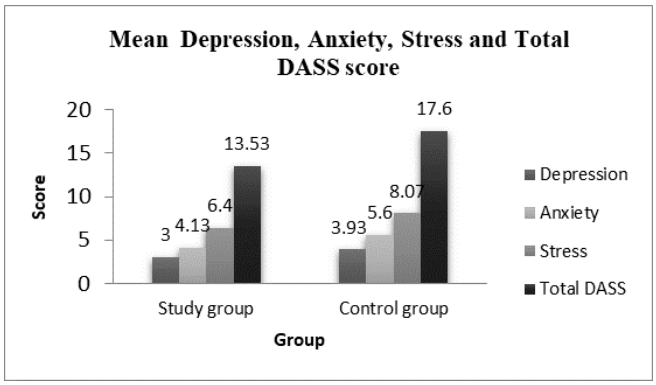

Fig 7.5: shows comparison of Depression, Anxiety, Stress and Total score between study and control group during premenstrual phase after 12 weeks

Discussion

RHR, resting SBP and resting DBP indicate balance between sympathetic system and parasympathetic system. In 1st table significant rise in RHR, resting SBP and resting DBP in premenstrual phase indicates rise in sympathetic activity and reduced parasympathetic activity in this phase in women having PMS. E:I ratio and 30:15 ratio were tested for parasympathetic function, Significant fall in E:I and 30:15 ratio in premenstrual phase indicates decrease in parasympathetic activity in this phase. Rise in DBP by HGT and CPT indicate activity of sympathetic system. Rise in

DBP by HGT and CPT was more in premenstrual phase as compared to post menstrual phase but this rise was not statistically significant. Also significant rise in depression, anxiety and stress scores indicate that there was increase in negative affect of psychological health in women having PMS in premenstrual phase.

As shown in 2nd table sympathetic activity was significantly reduced whereas parasympathetic activity was significantly improved during premenstrual phase in study group which received YOGA therapy as compared to control group who did not receive YOGA therapy. Even though premenstrual Scores of depression anxiety and stress were reduced in study group as compared to control group they were not statistically significant but fall in total score of DASS in control group was statistically significant. This shows improvement in psychological health during premenstrual phase of study group after yoga therapy.

Yogic exercise stimulates the release of endorphins which are natural pain killer [11]. It enhances production of alpha-brain waves which are associated with peace, relaxation, mood and secretion of serotonin helping patients to feel relaxed after meditation [12].

Yogasanas are low intensity usually non-strenuous exercises which affect HPA axis positively bringing down sympathetic stimulation and significantly decreasing the release of catecholamines. Yoga breathing while performing postures, especially relaxation postures (e.g. Shavasana) also has been shown to significantly reverse the physiologic effects of stress (i.e., increased HR and BP) [13]. Also, yoga-based practices correct the under activity of the parasympathetic nervous system and GABA systems in part through stimulation of the vagus nerves [14].

The intense stretching and muscle conditioning associated with attaining and holding yoga postures increases skeletal muscle oxidative capacity and decreases glycogen utilization, possibly caused by increased vascularization, increased intramuscular oxygen and glycogen stores, increased oxidative enzymes or by increased numbers of mitochondria. By these mechanisms, yogic postures may have effect on pelvic and uterine muscles thereby relieving certain symptoms of PMS like abdominal bloating.

Conclusion

Hence, from the study we conclude that structured YOGA therapy improves psychological health and autonomic imbalance in cases suffering from premenstrual syndrome. It should be considered as alternate treatment for women with premenstrual syndrome.

Applications of the study

- PMS is very common clinical condition causing very detrimental effects on woman's health for which any medical treatment is not up to the mark.
- Women with PMS should be guided and explained about personal hygiene, pathophysiology of PMS with its physical and psychological effects and available treatment.
- YOGA is safe, without any side effects, cost effective, once trained can be done at any time and any place as per one's convenience. It can be considered as therapeutic intervention for these women.
- YOGA therapy should not be restricted for short term duration but it should be continued in the form of lifestyle modification to experience its full potential.

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