



Progressive effects of practice of a structured module of yoga and pranayama on depression, anxiety, stress levels and cardiopulmonary efficiency of young adult females

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Abstract

Introduction: Practice of Yoga have shown to induce consistent benefits in several physiological parameters, both physical and psychological parameters. Study attempts to assess positive changes in above mentioned parameters during course of exercises consisting of Yoga.

Objectives: To assess and compare fitness Index, vO₂ max, 40 mm endurance time and stress, anxiety and depression levels, before starting yoga for 8 weeks in subjects and to assess and compare above parameters in subjects at intervals of two weeks during yoga.

Methods: Thirty healthy female nursing students were made to practice yoga designed and approved by certified yoga physician for 45 minutes for 8 weeks. Assessment of cardiopulmonary efficiency was done by calculating Fitness Index using Harvard's Step Test, VO₂ max and 40 mm Endurance Test. Depression Anxiety Stress Scale was used for assessment of psychological parameters. These parameters were assessed in 5 sessions throughout study before commencement then after intervals of 2 weeks each. All parameters were analyzed by ANOVA and Post hoc Bonferroni test.

Results: There was significant improvement in fitness index, and 40mm Endurance test and Stress, anxiety and Depression levels ($p < 0.01$) after YOGA. Increase in cardiopulmonary efficiency was more in later phases of training. Fall in depression, anxiety and stress levels was maximal in first phase of training.

Conclusion: Yoga improves exercise tolerance and cardiorespiratory endurance. Short term yoga training caused marked reduction in basal levels of depression, anxiety and stress. Yoga causes positive variation in various mental and physical parameters even when practiced for a short duration.

Keywords: yoga, VO₂max, stress

Introduction

Yoga makes use of different body postures (asanas), breathing exercises (pranayama), relaxation techniques and meditation. Practice of asanas and pranayama have shown to induce consistent variation in several physiological parameters, both physical and psychological [1, 2].

Cardiopulmonary efficiency tests are the most important parameters of physical fitness. The different variables representing cardiopulmonary efficiency of an individual that we studied, were Fitness index (indicative of exercise tolerance), vO₂max (indicative of maximal aerobic power) and 40 mm endurance timing (indicative of cardiorespiratory endurance). Murlidharan and Rangnathan [3] reported an improvement in Cardiac Recovery Index after 10 week yoga training, indicating increased levels of exercise tolerance. Madanmohan *et al.* [4] reported an increment in 40 mm endurance test timing following two months of yoga practice. Vinayak *et al.* [5] reported a significant improvement in vO₂ max between control and experimental groups after 12 weeks of yoga training.

Stress (a state of mental or emotional strain), anxiety

(presence of excessive worry, fear, and tension causing significant discomfort or clinically significant deterioration) and depression (feelings of despondency and dejection) levels of an individual are indicative of his or her mental fitness. It is now known that practice of intensive program of yoga, even for a short duration (12 weeks) can cause marked reduction in depression, anxiety and stress levels in depressed individuals, thus carrying the potential for an effective therapeutic tool [6]. Although both yoga training and physical exercises are beneficial for reducing examination stress, but effect of yoga practice is more pronounced [7]. In our study, the effect of short term yoga practice of 8 weeks on basal levels of depression, anxiety and stress in female Nursing Students was studied and analyzed using the DASS questionnaire [8]. The study was undertaken to assess the improvement in above parameters consequent to undergoing yoga exercises. The results were measured with reference to specific periodicity of 2 weeks. Such a comparative study would help in devising specific yoga course modules for practitioners as well as for structured yogic courses by clinical practitioners for therapeutic purposes.

Objectives

1. To assess the stress, anxiety and depression levels (by DASS questionnaire) before starting the yoga practice.
2. To assess the cardiopulmonary efficiency, i.e. Fitness Index, vO2 max and 40 mm endurance time before starting the yoga practice.
3. To assess the above parameters in the same subjects in terms of successive phases with specific reference to periodicity of two weeks.
4. To determine the phases of the training that show significant variation for each parameter, provide their gradation and note the phase which provides maximal physiological response for a given parameter.
5. To compare the above parameters obtained before and after the yoga practice.

Materials and methods

The present study was conducted on thirty healthy female volunteers, nursing students residing in college hostel. (a) Inclusion Criteria: Age group 18-20 years. BMI ranging between: 18.5 –22.9. (b) Exclusion Criteria: 1) Past or present history suggestive of history suggestive of any cardiovascular and respiratory illness or any other systemic illness 2) Past or present history suggestive of any psychiatric disorders 3) Family history of asthma or other allergic diseases 4) Previous experience of yoga training 5) History of active sports training 6) Any kind of joint pain

The participants had a uniform pattern of diet and activity. They were instructed not to undergo any form of sports training during duration of the research. The protocol was approved by the Institutional Ethics Committee. The participants were briefed about the study protocol and informed consent was obtained from them.

Yoga module: The subjects practiced the following yoga module designed and approved by a certified yoga physician.

The module included the following

1. Prayer
2. Yoga exercises: 20-30 min (including various postures in standing, sitting, prone and supine positions)
3. Pranayama breathing exercises: 8-10 min (techniques of Ujjayi, Bhramari, Anulom vilom)
4. Omkar chanting and meditation

Total duration: 40 – 50 min

The yoga sessions were conducted in the college hostel premises itself, for duration of 45 minutes daily for 8 weeks in the evening hours.

The following physical and mental parameters were assessed in 5 sessions throughout the study. All the procedures were thoroughly explained to the subjects and trial tests were conducted 2 days before the first assessment session. All tests for physical parameters were conducted in the Physiology Laboratory under the supervision of Doctors.

The following tests were conducted

1. Harvard’s Step Test ^[9]: Fitness index = (time of exercise in seconds) x 100 / 2 x (sum of pulse counts during recovery): Significance: Assessment of physical fitness and exercise tolerance.
2. VO2 max: calculated using Harvard’s step test and

Astrand’s Normogram ^[10]. Significance: Indicative of aerobic physical fitness of an individual.

3. 40 mm endurance test (Flack’s Air-force manometer test): Significance: Cardiorespiratory Endurance test.
4. Depression-Anxiety-Stress-Scale (DASS): for assessment of depression, anxiety and stress levels of the subjects.

Clean data was entered in Excel Worksheet. Mean and Standard Deviation were calculated. As the principal purpose of this study was to examine variation in certain physiological variables, at different stages in yoga training program, one way repeated ANOVA was used to analyze the data. After significant outcome from ANOVA, post hoc analysis by Bonferroni was carried out using SPSS for comparative assessment of response during different phases.

Results

Physical Fitness Parameters: Highly significant p values were obtained for 40 mm endurance test and fitness index (Harvard’s Step Test) after ANOVA treatment (p < 0.01) indicating that one or more of the pair of readings showed significant variation. To determine the same, post hoc Analysis by Bonferroni was performed the results of which are depicted in (Table: 01). As ANOVA for VO2 max did not show statistical significance (p >0.05); post hoc analysis was not performed.

Table 1

Treatments pair	Fitness Index	40 mm endurance
A vs B	Insignificant	** p<0.01
A vs C	** p<0.01	** p<0.01
A vs D	** p<0.01	** p<0.01
A vs E	** p<0.01	** p<0.01
B vs C	Insignificant	** p<0.01
B vs D	** p<0.01	** p<0.01
B vs E	** p<0.01	** p<0.01
C vs D	** p<0.01	** p<0.01
C vs E	** p<0.01	** p<0.01
D vs E	*p <0.05	** p<0.01

Mental Fitness Parameters: ANOVA analysis for all the mental fitness parameters assessed during the study (depression, anxiety, stress) showed high levels of significance (p< 0.01). Results of the post hoc analysis of the same is depicted in Table 02.

Table 2

Treatments Pair	Depression	Anxiety	Stress
A vs B	**p<0.01	**p<0.01	**p<0.01
A vs C	**p<0.01	**p<0.01	**p<0.01
A vs D	**p<0.01	**p<0.01	**p<0.01
A vs E	**p<0.01	**p<0.01	**p<0.01
B vs C	Insignificant	**p<0.01	Insignificant
B vs D	**p<0.01	**p<0.01	**p<0.01
B vs E	**p<0.01	**p<0.01	**p<0.01
C vs D	Insignificant	**p<0.01	**p<0.01
C vs E	**p<0.01	**p<0.01	**p<0.01
D vs E	Insignificant	Insignificant	Insignificant

*: p<0.05: Statistically significant.

***: p< 0.01: Statistically highly significant.

A: first reading recorded before beginning of yoga training

B: reading after 2 weeks of yoga training

C: reading after 4 weeks of yoga training

D: reading after 6 weeks of yoga training

E: reading after 8 weeks of yoga training

A vs B: improvement during first two weeks that is variation in the corresponding physiological parameter during the first phase of the yoga training.

Similarly, B vs C represents second phase, C vs D as third and D vs E as fourth phase.

Discussion

A) Fitness index (by Harvard's step test)

The 8 weeks yoga training has shown a mean increment in fitness index value by 13.26% ($p < 0.01$). These findings are in agreement with those of Murlidharan and Rangnathan^[3] who reported an improvement in Cardiac Recovery Index after 10 weeks of yoga training by the same test. Yoga training results in improvement in cardiovascular endurance and anaerobic threshold^[11]. Madanmohan *et al.*^[12] reported that 2 months of yoga training reduces rate pressure product and double product which are indices of myocardial O₂ consumption and load on heart. After yoga training, a given level of exercise leads to a minor cardiovascular response, suggesting better exercise tolerance. The physiological response during the course of study was as follows: phase 3 > phase 4. The response during phase 1 and phase 2 was statistically insignificant. A stronger response was obtained in the later stages, indicating that there is a significant response only after the yoga training has continued for a while.

B) 40 mm endurance test

The present study showed a 92.91% in the 40 mm endurance time over the course of yoga practice. These findings are similar to those of Madanmohan *et al.*^[4]; an improvement of 45.9% over 6 weeks ($p < 0.01$). Increases 40 mm endurance time by yogic exercises may be due to

- Decreased responsiveness of respiratory centre to pCO₂
- Increased development of respiratory musculature and delayed onset of fitness^[13].
- Improved cardiorespiratory endurance^[12].

The response during the course was as follows

Phase 4 > phase 1 > phase 2 > phase 3. Maximal increase is observed during the last phase, which can be anticipated as control over respiratory centre is expected to increase after increased duration of pranayama practice (controlled breathing exercise).

C) VO₂ max

VO₂max is the maximum aerobic power of an individual. The study undertaken did not show statistically significant rise in VO₂ max, even after 8 weeks. However, Vinayak *et al.*^[5] reported a significant improvement in VO₂ max in young adult males and females; after a yoga training of 12 weeks by bicycle ergometry test. The results obtained in the project undertaken may be attributed to

- Small sample size
- Short duration of project
- Harvard's step test might not be a submaximal exercise for all the subjects, and hence pulse rate might be lower as compared to that after submaximal exercise.
- Testing methodology was crude method.

D) Stress levels

The study undertaken showed a reduction in stress levels by 56.71%. Malathi and Damodaran^[14] showed a statistically significant reduction in stress levels in subjects performing yoga as compared to the control group medical students prior to the exams. This culminated in better performance of the subjects in the exam, when compared with that of control group. In stressful states with preponderance of sympathetic activity, yogic aasnas and pranayama can lead to reduces sympathetic activity shifting the autonomic balance towards parasympathetic dominance^[13]. Response: phase 1 > phase 3 > phase 2 > phase 1. Maximal response obtained during the first phase indicates that yoga is an essential tool to reduce stress levels on an immediate effect which causes a better response and performance of yogic practitioners to stressful situations.

E) Anxiety levels

The study has shown a reduction in anxiety levels by 64.43% (assessed by DASS). Malathi and Damodaran^[14] studied the effect of yogic practices on anxiety levels prior to exam in 1st MBBS students. A decreased anxiety status was observed (Spillberger's A scale). Increased attentiveness, lower irritability levels and an optimistic outlook in life were indicated as feedbacks. Response observed was as follows: phase 1 > phase 2 > phase 3. Phase 4 showed statistically insignificant response. Maximal response during phase 1 indicates that there is immediate alleviation of anxiety to due to parasympathetic dominance^[13].

F) Depression levels: The research has shown a significant decrease in depression levels by 69.48%. This is in correlation with the findings of Kozasa *et al.*^[15] who reported significant reduction in depression after one month yoga program. GABA levels are known to increase after yoga session which can be a contributory factor to decrease depression levels^[16]. The undertaken project highlights the importance of yoga as a practice to reduce basal depression levels for mental well being in day to day life.

Phase 1 > phase 4 > phase 3 > phase 2. Similar to anxiety and stress, the results indicate maximal physiological response during first phase (all phases statistically significant, first phase maximal variation).

Conclusion

- Short term yogic training for 45 min daily consisting of various prayers, aasnas and pranayama seems to improve cardiopulmonary efficiency (exercise tolerance and cardiorespiratory endurance); in spite of it not being a rigorous exercise.
- The study has shown that the increase in cardiopulmonary efficiency was more in the later phases of the training, indicating that there is a progressive increase in various parameters of the same and will yield increasingly better benefits when the techniques are practiced regularly.
- Even short term yoga training has caused a marked reduction in basal levels of depression, anxiety and stress which promote a state of mental wellbeing.
- As the response, i.e. fall in depression, anxiety and stress levels was maximal in first phase of the training, it can be concluded that yoga has an immediate effect on these

parameters, which renders it an effective tool to relieve a person from stressful situations.

5. As yoga is not a very exhaustive physical activity and causes a positive variation in various mental and physical parameters even when practiced for a short duration, it is an appropriate program for Medical Students to help them cope up with their hectic curriculum.

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