

Comparison between effects of yoga and aerobic exercise on pulmonary function and physical fitness among young healthy females

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Abstract

Background & Objective: Yoga, the ancient practice of postures, breathing and meditation is gaining attention from healthcare professionals in recent times, and thus, the postulated benefits of yoga over other forms of exercises must be scientifically explored. Several studies have examined the benefits of yoga and aerobics on pulmonary functions independently, but there is a paucity of research that have compared the effects of yoga and aerobics on fitness. This study, therefore aimed to assess and compare the effects of yoga and aerobics on pulmonary function and physical fitness.

Methodology: An experimental randomized control study was conducted on young college going female undergraduate students. 72 volunteers were randomly divided into a yoga and aerobics group. They received the intervention for 30-45 minutes a day, 6 days per week for three (3) weeks. All participants were assessed pre and post intervention, using standard anthropometric, pulmonary function and physical fitness measures.

Conclusion: The results of this study indicated that both groups showed a similar trend in improvement post intervention, however there were no significant differences in the parameters measured between the yoga group and the aerobics group. It is concluded that either or both forms of exercise may be done by young, asymptomatic females to improve pulmonary and physical fitness.

Keywords: Yoga, Aerobics, Pulmonary functions, Physical fitness.

Introduction

The twenty-first century has witnessed a land mark development in science and technology including space, defense, atomic energy, computer, internet service etc. With the internet we can collect required information within a fraction of second from any part of the world. Due to this advanced scientific technological inventions, the body movements of the human beings are being increasingly restricted. The continuous, systematic and regular practice of yoga and other physical activities are effective tools to maintain good health and counter the detrimental effects of sedentary lifestyles.

Yoga and aerobic training are considered to be more effective than other methods of training in developing physical fitness. It is long lasting and can be performed at different stations without apparatus. Yoga practice includes Asana and Pranayama and aerobic exercises include running, walking, swimming, bicycling and aerobic dance that improve physical fitness.¹

Yoga refers to a system of physiology established in India thousands of years ago. It helps to develop spirit of harmony through coordinating mind and body. Yoga is a form of physical activity which may assist in achieving recommended levels of physical fitness. Yoga is increasing in popularity with recent records suggesting that 15 million Americans have practiced yoga at least once in their lifetime.^{2,3}

Exercises in different forms, if performed regularly, have a beneficial effect on the various systems of the body. Aerobics is a form of group exercises that has been found to be beneficial for masses and has now become the topic of research.⁴ Conventional exercises (like walking, jogging,

running, etc.), which loads the cardiovascular and respiratory systems and test the responses of these systems, are also very popular. On the other hand, proponents of ancient yogic exercises, which claim to benefit human body on multiple fronts are also gaining popularity all over the world.⁵

In the present study, the focus is on the effect of yoga (asana and pranayama) and aerobic exercises on pulmonary function, which has been identified as a long-term predictor for overall survival rates; as well as is a tool in general health assessment.⁶ Both yoga and aerobic exercises have been reported to improve the pulmonary function and physical fitness as both the modalities involve physical activity as well as breathing exercise.^{7,8} Thus, the purpose of this randomized control study was to compare the effects of yoga and aerobics on pulmonary function and physical fitness in young, asymptomatic, college students.

Materials and Methods

Experimental randomized control study was conducted in an undergraduate college of physiotherapy. All female students of Physiotherapy, age between 18-23 years were included in this study. Students with any health related problems like musculoskeletal and lung disorders, were excluded from the study. 72 volunteers were randomly divided by envelop method into two groups: yoga (Group A) and aerobics exercise (Group B) (Table 1). The participants were assessed by studying their anthropometric parameters, breath holding time, physical fitness (YMCA test) and pulmonary functions (respiratory rate, FEV1, FVC, FEV1/FVC, FEF 25-75%, and PEFr) before and after training.

Pulmonary function tests were carried out in the the using portable instruments in the out-patient department of Pulmonary Medicine Subjects were individually instructed on how to correctly perform each maneuver, and the best two measures with less than 10% variation between them were recorded and one with higher value was selected. Physical fitness measures such as flexibility of hamstrings was measured with the YMCA Sit and reach test.⁹ The breath holding time (BHT) was measured using a stopwatch. Three trials were executed and the best breath holding time was selected.¹⁰

Please refer to table 1 for details on the individual interventions. Institutional Ethics Clearance was obtained for the study.

Results

The obtained data were analyzed by SPSS 16 software. A test of normality was performed on all dependent

variables so as to determine skewness and to determine appropriate statistical analysis. Variables showing skewed distribution were analyzed by non-parametric test and those following a normal distribution were analyzed using parametric test.

Both groups were identical in age, height and weight. So there were not statistical difference in these regards. Subjects reported that they had not participated in any physical activities 3 weeks prior to our study.

In the Yoga group, statistical analysis revealed that there was significant decrease in RR, increase in Breath Holding Time (BHT) and all pulmonary parameters (FEV₁, FVC, FEV₁ / FVC, FEF 25-75%, PEFR) and increase in Hamstrings’ flexibility post intervention. In Aerobics group, there were also improvements in RR, BMI, BHT, pulmonary capacities (FVC, FEV₁, FEV₁/ FVC, FEF 25-75%, PEFR) and Hamstrings’ flexibility at end of 3 weeks.

Table 1: Details of the training undergone by the two groups: Yoga group and aerobics group

Yoga group	Aerobics group
<ul style="list-style-type: none"> ➤ Subjects performed yoga for 30- 45 minutes a day, 6 times a week for 3 weeks. ➤ Yoga consisted of warm up, breathing exercises (i.e; pranayama) including voluntary inhalation, retention and then voluntary exhalation. Postural maneuvers generally consisted of 15-20 different postures and relaxation and dynamic suryanamaskar. ➤ Standing postures: <ul style="list-style-type: none"> ▪ Tadasana. ▪ Ardchchandrasana. ▪ Trikonasana. ➤ Sitting postures: <ul style="list-style-type: none"> ▪ Sasankasana. ▪ Paschimotanasana. ▪ Ustrasana. ▪ Yogmudrasana. ▪ Gaumukhasana. ➤ Lying postures: <ul style="list-style-type: none"> ▪ Savasana. ▪ Makarasana. ➤ Each of these asana were done twice and posture was held for 30 seconds. ➤ In pranayama <ul style="list-style-type: none"> ▪ Anulom-vilom. ▪ Kapalbhati. ▪ Breath watching and breathing with count. ➤ The pranayama were done for 7-10 minutes. ➤ And finally 5 repetitions of dynamic suryanamaskar with breathing was included. 	<ul style="list-style-type: none"> ➤ Subjects performed aerobics exercises for 30- 45 minutes a day, 6 times a week for 3 weeks. ➤ Aerobic training included warm up and activities such as jogging, jumping, stationary aerobics, strengthening, stretching and cool down. ➤ A defined circuit training programme. 2-3 minutes jogging was given followed by stretching exercises for upper and lower extremities and the trunk ➤ Then 2 different choreographed modules were performed simultaneously each for 8-10 min. ➤ Aerobic training ended with slow upper and lower extremity movements and stretching of few muscles.

Table 2: Showing comparison of weight, BMI and Breath Holding Time (BHT) between yoga group (n= 36) and Aerobics group (n=36) pre and post intervention

Outcome Measures		Yoga group	Aerobics group	Z value	p-value
Weight	Pre	52.0389±10.0419	49.1919±8.14423	-1.099	0.272
	Post	51.0972±9.42703	48.8432±7.74261	-0.928	0.354
BMI	Pre	20.5278±3.61946	19.5492±3.26055	-1.252	0.210
	Post	20.1814±3.44538	19.4170±3.07887	-1.181	0.238
BHT	Pre	26.4444±10.2579	24.1351±10.3660	-1.220	0.222
	Post	30.2778±9.41006	29.3514±8.67056	-0.541	0.588

Here, values are presented as mean ± standard deviation. (by shprio- wilk)

*significant if $p < 0.05$, **highly significant if $p < 0.001$

Previous table shows difference of mean and standard deviation of weight, BMI & BHT of each group at pre intervention and post intervention. Here, p value is >0.05 , suggestive of no significant difference in all parameters.

Table 3: Showing comparison of Hamstrings' tightness and Respiratory Rate between Yoga group (n= 36) and Aerobics group (n=36) pre and post intervention

Outcome Measures		Yoga group	Aerobics group	Z value	p-value
Hamstrings' tightness	Pre	12.0189±4.61819	10.1083±4.64883	-1.866	0.062
	Post	13.8459±3.84206	11.8222±4.20606	-2.202	0.028*
Respiratory Rate	Pre	17.4865±2.76508	18.0556±2.75623	-1.019	0.308
	Post	15.8919±2.20837	17.0278±2.00693	-2.28	0.023*

Here, values are presented as mean ± standard deviation. (shaprio- wilks)

*significant if $p < 0.05$, **highly significant if $p < 0.001$

Above table shows differences of mean (\pm sd) of Hamstrings' tightness and Respiratory Rate between Yoga group (n= 36) and Aerobics group (n=36) pre and post intervention. Here, p- value is >0.05 during pre-intervention and < 0.05 post intervention which is suggestive of significant improvement in Hamstrings' tightness and Respiratory Rate.

Table 4: Comparison of PFT values of volunteers between Yoga group (n= 36) and Aerobics group (n=36) pre and post intervention

Outcome Measures		Yoga Group	Aerobics group	Z value	p-value
FEV1	Pre	2.5184±0.30246	2.4900±0.31549	-0.392	0.696
	Post	2.6278±0.28851	2.6217±0.29257	-0.091	0.928
FVC	Pre	2.7697±0.34781	2.8389±0.40528	0.783	0.436
	Post	2.9646±0.36213	3.0292±0.36527	0.758	0.451
FEV1 / FVC	Pre	90.7297±7.29783	88.1389±6.96585	-1.551	0.125
	Post	89.0541±5.59239	86.7500±5.17342	-1.826	0.072
FEF 25 – 75%	Pre	3.2681±0.73556	3.1169±0.68423	-0.909	-1.093
	Post	3.4089±0.62518	3.2511±0.60758	0.367	0.278
PEFR	Pre	279.46±43.2015	283.33±41.7475	0.389	0.698
	Post	308.65±33.0120	308.06±35.5222	-0.074	0.941

Here, values are presented as mean ± standard deviation.

(by Independent t- test)

*significant if $p < 0.05$, **highly significant if $p < 0.001$.

Here, p- value is >0.05 in both pre and post intervention period suggestive of no significant differences in different PFT outcomes.

Discussion

The present study demonstrated that practicing yoga and aerobics for 30-45 min regularly six days in a week for three weeks had equitable effects on most pulmonary and physical fitness variables except for RR. Interestingly, the respiratory rate (RR) significantly decrease after yoga compared to aerobic exercises. Telles et al reported changes in autonomic and respiratory variables following two meditation and has been extensively described in texts of

yoga. It has been also reported that there are significant decreases in breath rate and heart rate and a significant increase in skin resistance level following yoga.¹¹ Similar changes in respiratory rate have been reported by Harinate et al.¹² Joshi showed that practicing pranayama for 8 weeks improved Pulmonary Function tests such as FEV1, FVC, PE, MVV (maximum voluntary ventilation) and decreased RR.¹³ Ahmed et al reported similar findings in the elderly.¹⁴ Similar beneficial effects were reported by Macwana et al.¹⁵ and Wisniewski et al.¹⁶

It was observed that both yoga and aerobic training significantly improved breath holding time (BHT). Similarly, Mandan Mahan *et al* have reported significant increases in respiratory pressure after six (6) weeks of Yoga. In another study they reported that 12 weeks of yoga training significantly improved breath holding time, and maximum inspiratory pressure.¹⁷ Telles *et al* have suggested that slow breathing in pranayama exercises improved the autonomic nervous system and increased the activation of parasympathetic system.¹¹

In this study we also found that both yoga and aerobic training significantly improved flexibility of hamstrings'. Vishav G. investigated the effects of yoga on physical fitness including agility, strength, power, cardiovascular endurance and speed. Their results indicated that these variables improved significantly except for cardiovascular endurance.¹⁶ Tracy *et al* reported the effects of Bikram yoga training and its effects on isometric dead lift, hand grip strength, lower back-hamstring and shoulder flexibility, blood pressure, resting heart rate, maximal O₂ consumption, lean and body fat mass. After training, all these variables improved significantly except hand grip strength and maximal O₂ consumption.²⁰ Similarly, several studies have reported the beneficial effects of a variety of yoga techniques on agility and flexibility.²²⁻²⁵

The regular practice of aerobic exercises improves strength of muscles involved in respiration and facilitate the flow of air in and out of lungs. It also improves strength and enlargement of heart muscles hence improves its pumping efficiency. Toning muscles throughout the body which can improve overall circulation. Increasing the total number of red blood cells in the body also facilitates transport of oxygen throughout the body. All these factors together are responsible for improvement in pulmonary functions and physical fitness. It also improves ability of muscle to use fats during exercise, preserving intramuscular glycogen which is responsible for weight loss and reduction in BMI.²⁶

Along similar lines the regular practice of yoga replenish energy stores, removes physiological and metabolic wastes from blood and body tissues, replenish oxygen reserve in the tissues. Improvement in oxygen supply aids muscle relaxation. It helps to restore a sense of well-being by dynamic activity facilitation. It also helps to regulate breath. These all factors together are responsible for improvement in pulmonary functions and physical fitness with regular practice of yoga.

Our finding suggests that yoga like physical activities, could be used to enhance some health aspects especially in people for whom ordinary physical activities seem hard to do. So it can be used as an alternative to aerobic exercises. We thought that practice of pranayama, may be useful in patients with chronic obstructive lung diseases; typically asthma. Yoga and aerobic exercises both put a significant improvement in hamstrings' flexibility and BHT. Thus this significant improvement in all the parameters suggests that yoga and aerobics can be used to improve respiratory fitness on daily bases.

Conclusion

The results of this study suggest that subjects in both, the yoga and the aerobic group improved their pulmonary function as well as their physical fitness. Thus, it is proposed that either method may be used on a daily basis for the purpose of improving physical fitness/wellbeing and pulmonary function.

Limitations

1. Sample size is small.
2. In addition, as the sample included only female participants the results cannot be generalized to males.

Conflict of Interest: Nil

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Ethical Clearance Certificate: Obtained

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