

« Short Communication »

Comparison eight weeks aerobic and Yoga training on Pulmonary function indices and maximal oxygen consumption in untrained women

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Abstract

Background: Maximal oxygen consumption (VO₂MAX) Forced Vital Capacity(FVC), Forced Expiratory Volume(FEV₁) and Maximum Voluntary Ventilation(MVV) are important indicators of Pulmonary functions that show physical health and physical activity of individuals. The aim of the present study was to examine the effects of yoga and aerobic trainings on Pulmonary functions parameters in untrained women.

Material and methods: Thirty (Healthy and untrained) women (Mean±SD;age:26.53±4.98yr, height:1.60±0.53m, weight:72.66±14.94kg, BMI:28.52±5.82kg/m²)volunteered to participate in this study. The subjects were randomly divided into three groups (yoga, aerobic and control) of 10 persons on basis of BMI of 10 persons. The training groups (yoga and aerobic) participated in their special exercise program during eight weeks, 3days in a week, a session in each day and every session lasted for 1 hour. Before and after training sessions, all Pulmonary function parameters (FVC, FEV₁and MVV) were measured by spirometer, and VO₂MAX were examined by Shuttle Run Test in all three groups. Descriptive statistics, analysis of covariate (ANCOVA) and Scheffe post hoc test were used for analyze the data.

Results: The results showed significant increases in Pulmonary indexes (FVC, FEV₁and MVV) and VO₂MAX in both yoga and aerobic groups compared to control group(p<0.05).

Conclusion: Overall the results showed that there is no significant differences between eight week yoga and aerobic exercise in indicators of Pulmonary function and VO₂MAX.

Keywords: Aerobic training, Yoga, VO₂MAX, FVC, FEV₁ and MVV

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Introduction

Today, advances in technology have led human activities from a physical state to an intellectual state, so quality of life, health promotion and prevention of various diseases are priorities of each community. Women as the vast part of societies more than all other groups are more prone to mobility deficiency sickness. Due to the important educational role that women have on future generations they should be a priority in educational and sport programs in order to ensure their own health and that of future generations.

One of the things that will be affected by mobility deficiency is respiratory capacity. Many studies have separately examined the effects of aerobic exercises or yoga on respiratory performance indicators, but few studies comparing the effectiveness of these training variables in an independent study to be able to compare and express their level of influence on these parameters (1).

Maximum oxygen consumption (VO_2MAX) is considered as the most important factor to evaluate fitness, public health and hygiene which it depends on the performance of various body systems (respiratory, cardiovascular and muscular) (2).

Forced Vital Capacity (FVC), forced expiratory volume in one second (Forced Expiratory Volume (FEV1)) and Maximum Voluntary Ventilation (MVV) are important indicators of lung health usually followed by a decrease in physical activity, experience a sharp decline (3).

Asha Yadav revealed that during a stage of Pranayama yoga exercise rehabilitation for patients with coronary heart disease in addition to an increase in peak oxygen consumption (VO_2max), FVC, FEV1 and MVV increased also has a positive impact on Forced Vital Capacity and maximum inspiratory flow rate (4). According to Shestopal, yoga has many physical and psychological benefits which in addition to

the improvement in breathing, is also effective in increasing flexibility and strength (5).

Aerobic exercise (aerobics) develops and enhances physical and motor fitness factors. Also, by increasing the levels of beta-endorphins improves depression in humans (6).

Anuradhajoshi (2008) showed an inverse correlation between the percentages of body fat and lung function tests in sedentary people. Also realized there is an inverse relationship between obesity in women and lung function tests (Maximum Voluntary Ventilation and Forced Vital Capacity) (7).

Given that participation in rhythmic activity programs can improve the function of all organs and systems of the body and according to undeniably effects of yoga in controlling the activity of the sympathetic system and its effects on health, we tried to examine and compare these two different types of training on mentioned physiological indices. Therefore, this study will investigate the impact of yoga and aerobic exercise, which recently has gained general acceptance, especially among women, on pulmonary parameters and VO_2MAX in the age range 22 to 35 years.

Material and methods

Through a call 100 people have volunteered to participate in this study. Finally, 30 healthy females (22 to 35 years) formed the statistical sample of this study which based on body mass index were randomly selected and paired and divided into three groups: aerobic (n=10), yoga (n=10) and control (n=10). Then for measuring the pulmonary indices, all subjects were evaluated by spirometer (Jager Model Rotatory Skop), also to assess VO_2MAX shuttle run pacer test was used.

Eight weeks aerobic exercise program was included three sessions per week (each session 60 minutes which started with a progressive intensity of 55% Maximum Heart Rate Reserve(HRR) and to 75% at the end of the sessions continued.Each training session consisted of 10 minutes of warm-up (jogging and stretching);40 minutes predetermined rhythmic and aerobic exercises, and 10 minutes recovery. Control of exercise intensity (heart rate) was performed manually and by palpation of the carotid artery.

Duration and time of the yoga sessions were similar to the aerobic group. Each session included 40 minutes Asana trainings (standing, sitting and lying) and 10 minutes Shavasana. Each session ended up with 10 minutes Pranayama (breathing training), that in performing movements subjects focused on their breathing. Levine's test was used to verify the homogeneity of variances and to compare different training methods the analysis of covariance and Scheffe's test were used. ($\alpha=0.05$)

Results

Descriptive characteristics of subjects in experimental and control groups including weight, VO₂MAX, FVC, FEV1 and MVV are presented as mean and standard deviation (M \pm SD) in Table1 along with the changes. Results from VO₂MAX averages showed that the experimental groups achieved a significant increase compared to the controls (P=0.001) ($\alpha=0.05$). (Table1) Also significant differences between the mean of indicators' changes were observed in the three aerobic, yoga and control groups after the training period (P=0.03, 0.008 and 0.004) ($\alpha=0.05$).

The Scheffe test showed, however, mean VO₂MAX in yoga and aerobic groups compared to the controls significantly increased, but did not show any significant differences between the two experimental groups. The mean FVC, FEV1 and MVV in the yoga group compared to the control group significantly increased. However, the two experimental groups were not significantly different ($\alpha=0.05$). Table2

Table 1. Description of anthropometric and physiological characteristics and comparison of subjects' changes in the three groups

Groups	Yoga		Aerobic		Control		F	Significant Value
	Pre-test Mean \pm SD	Post-test Mean \pm SD	Pre-test Mean \pm SD	Post-test Mean \pm SD	Pre-test Mean \pm SD	Post-test Mean \pm SD		
Body weight (Kg)	75.73 \pm 3.78	74.31 \pm 3.60	69.95 \pm 5.28	67.25 \pm 4.82	72.31 \pm 5.29	73.03 \pm 5.18	6.82	0.004 *
VO ₂ MAX (ml / kg. min)	28.7 \pm 2.02	31.1 \pm 2.12	28.4 \pm 2.1	32 \pm 2.37	27.5 \pm 1.45	27.8 \pm 2.1	13.59	0.001 *
FVC (liter)	2.92 \pm 0.42	3.24 \pm 0.23	2.7 \pm 0.31	2.89 \pm 0.28	2.62 \pm 0.47	2.62 \pm 0.48	6.89	0.004 *
FEV1(liter)	2.76 \pm 0.31	3.06 \pm 0.23	2.63 \pm 0.26	2.8 \pm 0.17	2.57 \pm 0.45	2.61 \pm 0.45	5.77	0.008 *
MVV (liter/min)	77.94 \pm 23.66	100.67 \pm 9.42	77.09 \pm 16.58	91.67 \pm 13.24	82.80 \pm 21.33	83.4 \pm 26.19	4.29	0.03 *

* Significant difference $p < 0.05$

Table 2. Scheffe test results related to VO₂MAX, Forced Vital Capacity, Forced Expiratory Volume in 1 second, and Maximum Voluntary Ventilation in experimental and control groups

Variables	Training Groups	Groups	Mean Differences	Deviation errors	Significance
Aerobic Power	Yoga	Aerobic	-1.169	0.25	0.245
		control	2.225	0.01	0.008 *
	Aerobic	yoga	1.169	0.25	0.245
		Control	3.393	0.01	0.001 *
Forced Vital Capacity	Yoga	Aerobic	0.213	0.116	0.236
		control	0.441	0.119	0.003 *
	Aerobic	yoga	-0.213	0.116	0.236
		Control	0.228	0.114	0.167
Forced Expiratory Volume in 1 second	Yoga	Aerobic	0.173	0.096	0.252
		control	0.331	0.098	0.007 *
	Aerobic	yoga	-0.173	0.096	0.252
		Control	0.158	0.095	0.325
Maximum Voluntary Ventilation	Yoga	Aerobic	8.600	6.69	0.629
		control	19.637	6.72	0.021 *
	Aerobic	yoga	-8.600	6.69	0.629
		Control	11.037	6.73	0.340

* Significant difference $p < 0.05$

Discussion

The results of this study showed a significant increase in FVC, FEV1 and MVV after a period of eight weeks aerobic training and yoga compared with the control group. In addition, FVC levels indicated increases of 10.96% in yoga group and 7.03% in aerobic group, also FEV1 respectively showed 10.87% and 6.46% increase in yoga and aerobic groups, as well as, MVV in yoga and aerobic groups respectively indicated 29.16% and 18.91% increase. In the three dependent variables has not been observed any significant differences between two aerobic and yoga training groups. This finding is consistent with investigations by Madanmohan (2003), Chanavirut (2006), and Austin (2005) based on a significant increase in pulmonary ventilation (8- 10).

Changes that happen in the lungs because of the training are gradual, and occur over 4-6 weeks, and can lead to more efficient ventilation. That means more efficient ventilation the amount of ventilated air in

the equal level of oxygen consumption is less than non-athletics (11). These results are consistent with research by Raju (1994) and Aslan (2012) (12, 13). In addition, these results are in agreement with the findings of Smith (2001), Maiorana (2003), George Kelley et al (2006) and Kostic (2007) based on increase in VO₂Max (14- 17).

According to available information, improvements of cardiorespiratory fitness occur by exercises that are performed continuous or periodic, 3 to 5 days per week, with intensity of 40-85% maximum reserved oxygen consumption, and at least for 20 to 60 minutes. As increase in VO₂MAX due to aerobic exercise or yoga leads to increase in cardiac output by increasing stroke volume and arterial-venous oxygen difference (a-VO₂dif) (18).

Many studies have also mentioned the effect of aerobic exercises on pulmonary function. Kalili and Elkins (2009) were evaluated exercises with different relaxations on

pulmonary function and similar results were obtained with this study. The researchers acknowledged that one of the factors leading to poor pulmonary function is reduction in abdominal muscle function (19). Ferdowsi (2011) in a similar study examined the effects of eight weeks of intense aerobic exercise with an intensity of 70 to 85% of maximum oxygen reserve (HRR) on pulmonary indices and VO_2 Max in 40 inactive overweight healthy men. According to the findings, in addition to increasing VO_2 MAX, pulmonary parameters (FEV1, FVC, FEV1/FVC and FEF25-75) were also increased (20). Gupta and Sawane (2012) examined the comparative effects of yoga and swimming on some indicators of pulmonary function (FVC, FEV1/FVC ratio, PEFR, FEF 25-75%, FEF 0.2-1.2, MVV) in sedentary individuals. Subjects exercised yoga or swimming, for a period of twelve weeks. The results showed that both types of exercises caused a significant increase in pulmonary indicators (21). Sodhi (2009) studied the effects of yoga on performance indicators of people with asthma and parameters such as FEV1, FVC, PEFR and FEF25-75 have considerably improved (22). The results of Yadav research (2009) showed that Yoga had no effect on lung function indices. Perhaps the most important reason for the lack of a significant increase in mentioned lung indexes in the subjects of these investigators' investigations can be cited short duration of training courses (two weeks), because duration of exercise as one of the important training variables could not establish appropriate adjustments in accordance with increases in respiratory indicators (4). Raju (1994) in his research which its subjects were elite athletes, obtained results inconsistent with findings of this study and many earlier investigations. It

appears that the main reasons for this lack of agreement are differences in conditions of the age, the level of physical fitness, social status, and the length and duration of the exercise (exercise variables) (12).

Madanmohan et al (2003) showed that a period of 6 months yoga for 45 minutes per session could increase the strength of respiratory muscles (intercostals) and respiratory volumes in children and had an increasing effect on lung capacity and the strength of such muscles (8). Similar investigations by Villien (2005) and Austin (2005) conducted that all pointed to similar conclusions about the role of yoga on the lung function indices (10, 23).

Although there are some limitations such as the lack of precise control of diet and stress levels of subjects during the training period also in this study, but according to the specific conditions of the study and the subjects it wasn't possible to control all aspects of this study. Seem appropriate training and regular aerobic exercise and yoga or both in which practice variables are considered properly, can in addition to meet the mental and physical needs, also enhance the physiological capacities of nerve-muscle associated with pulmonary indices and VO_2 MAX. Efforts of the large number of women and mothers to the sport and such joyful activities can put a lot of educational effects on children, and in addition to ensuring the physical and mental health of future generations, may also reduce many of the current and future medical expenses (24,25). It is hoped that those involved in health and hygiene and education to be able to use the results of this study, and make the necessary efforts for implementation of widespread of these results in planning their own organizations.

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