ORIGINAL ARTICLE

Effect of Yogic Exercises (Pranayama) on Pulmonary Function Tests

L Rajeshwar Reddy [1], Puli Sreehari [2], Mohd Inayatulla Khan [3]
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Assistant Professor [1], Associate Professor [2], Lecturer [3]
Department of Physiology, Rajiv Gandhi Institute of Medical Science (RIMS) Adilabad

Abstract

Background: *Yoga is an ancient Indian Philosophy. Recent interest in Yoga is due to its beneficial effects on the various systems of the body. Yogic exercises when practiced regularly have shown to improve health and well being. Pranayama involves mainly breathing control exercises therefore we decided to find beneficial effects of Pranayama on pulmonary function tests.* ***Methods****: The present study was conducted in Department of Physiology Osmania Medical College Hyderabad. Healthy male individuals n=50 were selected and divided into two groups randomly (Group I- after 9 weeks of regular yogic training, Group II (Control)- normal individuals. Pulmonary function tests such as Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow (FEF $_{25-75\%}$) and Maximum Voulntary Ventilation (MVV) were recorded with Medspiror.* ***Results****: FVC, PEFR and MVV were 74.04%, 78.8%, 78.6% respectively in control group while the values in study group were 81.21%, 97.1%, 97.42% respectively. 'P' values were significant for PEFR and MVV.* ***Conclusion****: Pranayama training helps in improvement of Respiratory function after regular training. This may be due to beneficial effect of Pranayama on respiratory system. Yoga has beneficial effects on respiratory and cardiovascular systems when practiced regularly.*

Keywords: *MVV, PEFR, Pranayama, Pulmonary Function Tests, FVC*

Address for correspondence: L Rajeshwar Reddy, Assistant Professor, Dept of Physiology, Rajiv Gandhi Institute of Medical Sciences (RIMS) Adilabad. Email: raju_radhi71@yahoo.co.in

Introduction

Yoga is a Sanskrit word which means "the unity of body and mind". It is a combination of breathing exercises, physical postures, and meditation, and has been practiced in eastern traditional medicine for over thousands of years [1]. It is claimed that practice of Ashtang yoga, especially 'Pranayam', improves both the physical and spiritual health. 'Pranayam' is a Yogic technique in which breathing is controlled voluntarily. There are various methods of Pranayam, the inhalation (puraka), exhalation (rechaka) and retention of breath called Kumbhaka (in or out). Complete Pranayama involves slow inhalation and exhalation accompanied by apnoea (breath-hold) at end inspiration and end expiration. The goals are to decrease the breathing rate from normal resting levels of 12 breaths per minute to approximately 6 breaths per minute, to achieve an approximate 1:2 ratio for duration of inspiration and expiration, and an end inspiratory breath hold of approximately two times the length of expiration. These breath maneuvers mobilize in sequence the abdominal muscles, diaphragm, the lower and upper intercostals muscles of chest wall and sternocleidomastoid muscles even back muscles are activated [2]. It is also said that when person practices pranayma his circulation gets accustomed to higher levels of CO_2 and this high levels of CO_2 stimulates cerebral and cardiac circulation [3]. Pulmonary function is a long term predictor for overall survival rates in both genders and could be used as tool in general health assessment [4]. With this background we decided to test pulmonary functions of the age and sex matched individuals divided in two groups in which one set acted as test who were given short term 9 weeks yoga practice and other acted as controls. Pulmonary function was assessed based on FVC%, PEFR, FEF $_{25-75\%}$, and MVV%.

Materials and Methods

This study compares the effect of Pranayama training on Pulmonary Functions in healthy untrained individuals. The present study was conducted in Department of Physiology Osmania Medical College Hyderabad. Healthy males (n=50) age 20-30 years who were non smokers and non alcoholic without previous history of significant illness, who were not taking any medications were included in the study. The selected individuals (n=50) were divided into two groups randomly, Group I (study group) (n= 25) who received yogic training for 45 minutes twice every day for 6 days a week, for 9 weeks under supervision of trained yoga teacher and Group II (control) (n = 25) acted as controls. The study group was subjected to training in yoga breathing exercises of different types of Pranayamas

1. Bhastrika Pranayama
2. Kapalbhathi
3. Anulom-Vilome Pranayama
4. Nadi Shodhana
5. Ujjayai Pranayama
6. Surya-bhedi Pranayama
7. Chandra Bhedi prayanama

Medspiror (Med systems Pvt Ltd Chandigarh) was used to record Pulmonary Function Tests. Best of three efforts was taken as the final reading. FVC%, PEFR, FEF $_{25\text{-}75\%}$, and MVV% were recorded. Data was analyzed using the SPSS (Statistical Package for the Social Sciences) 17 Version.

Ethical Clearance

The study was approved by Ethical Committee of Osmania Medical College Hyderabad. Written consent was obtained from all the participants who were willing voluntarily to participate in the study. The complete study design was explained to all the participants.

Results

Chart 1 shows the Forced Vital Capacity FVC % in Group I prior and post yoga training for 9 weeks. The mean values recorded prior to yoga training were 72.1% and post yoga training was 78.8%. Chart 2 shows the FVC% of the control group with initial and final values the initial mean values recorded were 69.32% and post 9 weeks values were 74.04%. Chart 3 shows Forced Expiratory flow 25-75% in group I pre and post training the mean values were 93.71% and 93.33% respectively. Chart 4 shows the FEF $_{25\text{-}75\%}$ in control group initial and final values the mean values were 79.04% and 82.32% respectively.

Chart- 1: Pre & Post Yoga FVC% (Group-I)

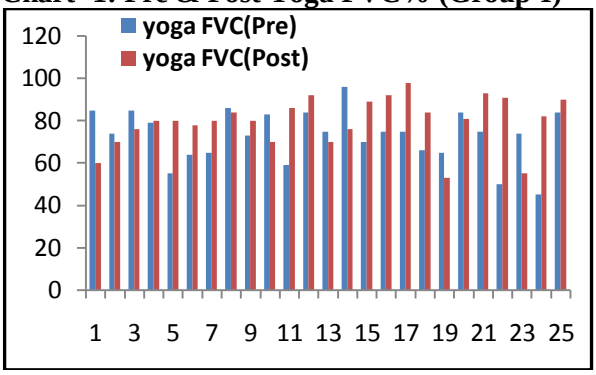

Chart- 2: Pre & Post Yoga FVC% (Group-II)

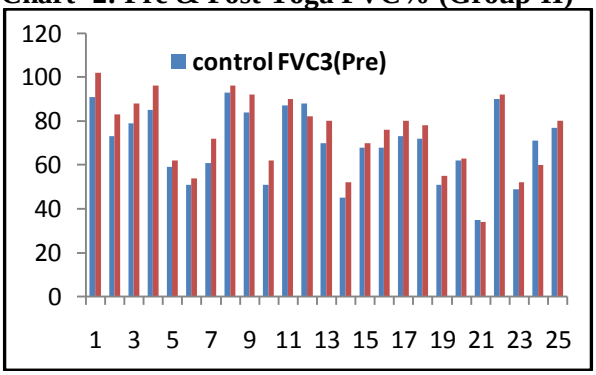

Chart-3: Pre/ Post Yoga FEF$_{25\text{-}75\%}$ (Group-I)

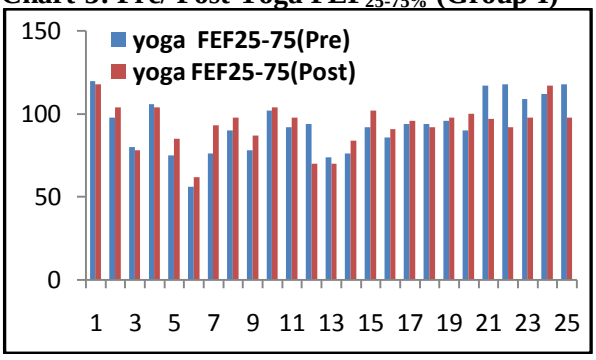

Chart- 4: Pre/Post Yoga FEF$_{25\text{-}75\%}$ (Group-II)

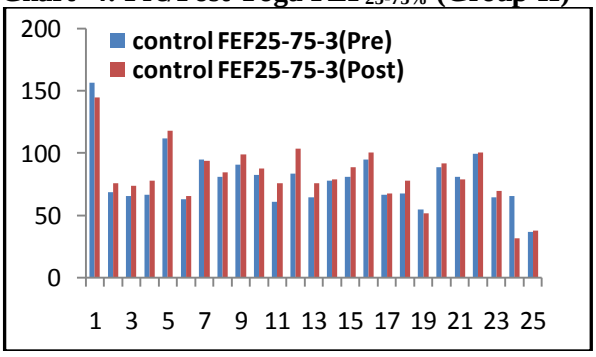

Table 1 shows the initial values of different parameters recorded in both the groups prior to any training. The calculated P values were not significant for any of the parameter. Table 2 shows mean values recorded in both groups after 9 weeks. The calculated p values were significant for PEFR and MVV.

Table- 1: Initial values in both the Groups

Parameters	Group-I (Mean±SD)	Group-II (Mean±SD)	p values
FVC%	72.1±2.66	69.32%±16.3	0.78 NS
$FEF_{25-75\%}$	93.71±2.66	79.04±23.3	> 1.0 NS
PEFR%	89.79±2.67	75.72±19.5	>1.0 NS
MVV%	91.71±2.67	72.64±20.75	>1.0 NS

Table- 2: Values after 9 weeks

Parameters	Group-I (Mean±SD)	Group-II (Mean±SD)	p values
FVC%	78.8±2.66	74.04±17.4	>1.0 NS
$FEF_{25-75\%}$	93.33±2.67	82.32±23.9	>1.0 NS
PEFR%	89.79±2.67	75.72±19.5	0.0012*
MVV%	91.71±2.67	72.64±20.75	0.004*

Discussion

In the present study we studied effects of short term yoga (Pranayama) on Respiratory Parameters like FVC%, FEF $_{25-27\%}$, PEFR%, MVV% of age and sex matched controls. We found a significant increase in PEFR% and MVV% post yoga training in the study group I. Our findings are similar to the findings of Udupa KN *et al;* and Gopal KS *et al*; who reported a significant increase in MVV, PEFR and FVC [5,6] however our FVC parameters prior to and after yoga training showed increase from 72.1 to 78.8 but the values were not significant. Early studies [7,8] reported improvement in some, but not all, measures of ventilation after breath control exercise alone, Joshi et al., (1992) [7] followed lung function in 75 males and females with an average age of 18.5 years during yoga breath-control exercises. After 6 weeks of practice, they reported significant increase in forced vital capacity (FVC), forced expiratory volume in 1 second (FVC1), peak expiratory flow rate (PEFR), Maximum Voluntary Ventilation (MVV), as well as a significant decrease in breathing frequency (fb), and prolongation of breath-holding time. Other studies reported similar improvement in lung function after practicing yoga postures alone or combined with other yoga techniques. Rai and Ram (1993) [9] compared an active Hatha yoga posture (Virasana or warrior pose) to chair sitting and to a resting, supine posture (savasana) in 10 healthy men, 25 to 37 years age. The active posture induced a hyper metabolic state, as indicated by increased minute ventilation, heart rate (HR), and oxygen consumption (VO_2), compared to either the chair-sitting or resting posture. In a similar study, the same authors (Rai et al., 1994) [10] compared an active-sitting posture (siddhasana) to chair-sitting and supine relaxation and found the same results, indicating the yoga 'activity' and not the body posture was important for cardiovascular "conditioning".

Telles et al., (2000) [11] reported that a combination of yoga postures interspersed with relaxation improved measures of cardiopulmonary status in 40 male volunteers to a greater degree than relaxation alone. Cyclic meditation (Stimulation plus calming), consisting of yoga postures and periods of supine relaxation, was better at decreasing VO_2 and increasing tidal volume than sessions of Savasana alone. Konar et al., (2000) [12] reported that the practice of Sarvangasana (shoulder stand) twice daily for 2 weeks significantly reduced resting HR and left ventricular end-diastolic volume in 8 male healthy subjects. Birkel and Edgren (2000)[13] reported that yoga postures, breath control, and relaxation techniques taught to 287 college students (89

male 198 women) in 50-minute class meetings for 15 weeks significantly improved FVC of the lungs measured by spirometry. In a similar study, 1hour of yoga practice each day for 12 weeks significantly improved FVC, FEV1, and PEFR in 60 healthy young women, 17 to 28 years of age (Yadav and Das, 2001) [14]

Finally, number of studies [15-17] has reported significant improvement in overall cardiovascular endurance of yoga subjects who were given varying periods of yoga training (months to years) and compared to a similar group who performed other types of exercise. Tran et al., [17] reported that regular Hatha yoga practice can improve overall physical fitness in untrained, young adult volunteers. The health related aspects of physical fitness, defined as isokinetic muscle strength and endurance, general flexibility, cardiopulmonary endurance, and body composition as well as pulmonary functions were evaluated before and after the 8 weeks of practice. Significant increases were found in all of the physical fitness variables except for body composition. There were no changes in pulmonary function which is against our findings. This study was well done and utilized direct measures of cardiopulmonary fitness; however, the sample size was small and predominantly female, the yoga training time was short, and the study lacked a control group could have affected the results.

Conclusion

Within the limitations of the present study it can be concluded that there is an increase in pulmonary function parameters like MVV% and PEFR% in individuals after short term yoga training (Pranayama). Thus practice of yoga seems to increase respiratory efficiency which was indicated in the present study and Yoga has beneficial effects on respiratory and cardiovascular systems when practiced regularly.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

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