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A STUDY OF THE EFFECT OF YOGA TRAINING ON PULMONARY FUNCTIONS IN PATIENTS WITH BRONCHIAL ASTHMA

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Abstract : The role of yoga breathing exercises, as an adjunct treatment for bronchial asthma is well recognized. One hundred twenty patients of asthma were randomized into two groups i.e Group A (yoga training group) and Group B (control group). Each group included sixty patients. Pulmonary function tests were performed on all the patients at baseline, after 4 weeks and then after 8 weeks. Majority of the subjects in the two groups had mild disease (34 patients in Group A and 32 in Group B). Group A subjects showed a statistically significant increasing trend ($P<0.01$) in % predicted peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV_1), forced vital capacity (FVC), forced mid expiratory flow in 0.25–0.75 seconds (FEF_{25-75}) and FEV_1/FVC% ratio at 4 weeks and 8 weeks as compared to Group B. Thus, yoga breathing exercises used adjunctively with standard pharmacological treatment significantly improves pulmonary functions in patients with bronchial asthma.

Key words : yoga bronchial asthma pulmonary functions

INTRODUCTION

Bronchial asthma besides being a chronic inflammatory disease of the airways also has psychosomatic imbalance and an increased vagal tone as its etiopathogenesis (1, 2). Yoga therapy readjusts the autonomic imbalance, controls the rate of breathing and thus alters various physiological variables (3, 4).

Studies by Nagarathna and Nagendra (5), Murthy et al (6), Kumar et al (7), Singh et al (8), Jain et al (9) and Singh (10), have reported improvement of the various disease parameters in asthmatics with the use of pranayama and controlled ventilation exercises. On the other hand, studies by Khanam et al (11), Cooper et al (12) and Vedanthan et al (13) have shown no additional benefit of pranayamic breathing. Singh et al (8) and Thomas (14) have concluded that the usefulness of controlled ventilation exercises in asthmatics should further be investigated. Thus the results of various studies on the efficacy of pranayama and other breathing techniques in asthmatics have been variable. In the light of these

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variable findings, the present study was conducted to assess the outcome of yoga training on pulmonary functions in patients with bronchial asthma.

MATERIALS AND METHODS

The present study included one hundred and twenty patients, of either sex, diagnosed with bronchial asthma. The study was conducted in the Departments of Medicine and Physiology, Christian Medical College & Hospital, Ludhiana. The patients were recruited from our hospital and from the yoga camps organized in Ludhiana. The Institutional Ethical Committee approved this study. Non-smokers in the age group of 17–50 years with mild to moderate grades of bronchial asthma as per National Asthma Education and Prevention Programme (NAEPP) [15] were included. All patients remained on their prescribed treatment during the study.

Patients with a history of tuberculosis, chronic obstructive airway disease (COPD), diabetes, renal failure, coronary artery disease and musculoskeletal chest deformities, respiratory tract infections within the previous 6 weeks and engagement in any regular exercise/training were excluded.

Patients were randomized into the following two groups :

Group A : Yoga training group.

Group B : Control group.

Yogic exercises used by the patients included pranayamas (deep breathing exercises), kapalabhati (cleaning breath), bhastrika (rapid and deep respiratory movements like that of the bellows), ujjayi (loud sound producing pranayama) and sukha purvaka pranayama (easy comfortable breathing). Each yoga training session was of 45 minutes duration per week with a trained instructor for a period of 8 weeks. Patients were instructed to practice at home, 45 minutes twice daily on all days of the week. The subjects also maintained a diary record of each day of the yoga practice.

Pulmonary function tests (PFT) were performed on patients of both the groups at baseline, after 4 weeks and again after 8 weeks. The tests were done on a computerized spirometer, MEDSPIROR (Medsystem Pvt. Ltd., Chandigarh).

The following pulmonary function test parameters were recorded: peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV_1), forced vital capacity (FVC), forced mid expiratory flow in 0.25–0.75 seconds (FEF_{25-75}) and FEV_1/FVC%. Spirometric tests were done 4 hours after the last dose of short acting bronchodilator and 12 hours after the last dose of long acting bronchodilator. The readings were taken thrice and the best of three readings was noted. The percentages of the predicted values, rather than the actual values were used for analyzing the data.

Data was collected, tabulated and analyzed using paired t-test for comparison of means and chi-square test for two-by-two tables. ‘P’ value of 0.05 was taken as cut off for the measure of significance.

RESULTS

The mean age of subjects in Group A was 38.77±9.92 years (range 20 to 50 years) and in Group B was 35.55±10.62 years (range 17 to 50 years). The number of male subjects was 34 in Group A and 37 in Group B. Majority of the subjects had mild disease (34, in Group A and 32, in Group B). Mean duration of disease was 7.70±5.54 years in Group A and 6.57±4.32 years in Group B.

The baseline parameters were comparable between the yoga and the control group (P>0.01 for all).

Percentage of predicted PEFR was higher in Group A subjects than in Group B at both periods of measurement, but the differences were statistically not significant. Group A subjects showed a statistically significant increasing trend in % PEFR over time: from 79.81±10.78 % at baseline to 80.75±10.17% at 4 weeks to 82.45±10.17% at 8 weeks (P<0.01) while Group B subjects showed variable change (Table I).

Percentage of predicted FEV_1 was higher in Group A subjects than in Group B, the differences being statistically significant at both periods of measurement (Table I).

TABLE I: Variations in pulmonary function tests in both the groups. Data are given as the mean±SD of percentages of the predicted values of all the parameters.

Parameter	*Group*	*Baseline*	*4 Weeks*	*8 Weeks*	*Comparisons between different time periods*	*Paired t-value*	*P-value*
Peak Expiratory Flow Rate	Yoga group	79.81± 10.78%	80.75± 10.17%	82.45± 10.17%	Baseline vs 4 weeks	3.27	<0.01
					Baseline vs 8 weeks	7.40	<0.01
					4 weeks vs 8 weeks	5.76	<0.01
	Control group	79.53± 8.29%	79.20± 8.09%	79.42± 8.26%	Baseline vs 4 weeks	1.20	>0.10
					Baseline vs 8 weeks	0.55	>0.10
					4 weeks vs 8 weeks	0.94	>0.10
Forced Expiratory Volume in the first second	Yoga group	79.63± 10.35%	81.03± 9.75%	83.16± 10.49%	Baseline vs 4 weeks	3.61	<0.01
					Baseline vs 8 weeks	6.28	<0.01
					4 weeks vs 8 weeks	4.60	<0.01
	Control group	77.48± 9.67%	77.38± 9.90%	77.26± 9.86%	Baseline vs 4 weeks	0.57	>0.10
					Baseline vs 8 weeks	0.77	>0.10
					4 weeks vs 8 weeks	0.57	>0.10
Forced Vital Capacity	Yoga group	84.33± 11.05%	85.33± 10.94%	86.67± 10.72%	Baseline vs 4 weeks	3.61	<0.01
					Baseline vs 8 weeks	6.19	<0.01
					4 weeks vs 8 weeks	5.00	<0.01
	Control group	83.52± 9.77%	83.56± 9.88%	83.37± 10.00%	Baseline vs 4 weeks	0.28	>0.10
					Baseline vs 8 weeks	0.51	>0.10
					4 weeks vs 8 weeks	0.85	>0.10
FEV_1/FVC ratio	Yoga group	94.15± 10.81%	96.33± 9.92%	96.60± 9.67%	Baseline vs 4 weeks	3.29	<0.01
					Baseline vs 8 weeks	3.06	<0.01
					4 weeks vs 8 weeks	0.38	>0.10
	Control group	93.67± 8.78%	93.41± 8.55%	93.13± 8.94%	Baseline vs 4 weeks	0.48	>0.10
					Baseline vs 8 weeks	0.88	>0.10
					4 weeks vs 8 weeks	0.72	>0.10
Forced Mid Expiratory Flow 25%-75%	Yoga group	75.41± 10.42%	76.88± 10.75%	79.50± 11.75%	Baseline vs 4 weeks	4.02	<0.01
					Baseline vs 8 weeks	5.42	<0.01
					4 weeks vs 8 weeks	4.17	<0.01
	Control group	75.88± 10.53%	75.99± 10.71%	75.56± 10.84%	Baseline vs 4 weeks	0.99	>0.10
					Baseline vs 8 weeks	1.32	>0.10
					4 weeks vs 8 weeks	2.23	>0.05

Note: P value for comparisons at baseline between the yoga and the control groups was >0.10 for all parameters.

Group A subjects showed a statistically significant increasing trend in % FEV_1 over time: from 79.63±10.35% at baseline to 81.03±9.75% at 4 weeks to 83.16±10.49% at 8 weeks ($P<0.01$ in all cases). Group B subjects on the other hand showed a decreasing trend.

Percentage of predicted FVC was higher in Group A subjects than in Group B at both periods of measurement, but the differences were statistically not significant (Table I). Group A subjects showed a statistically significant increasing trend in % FVC over time: from 84.33±11.05% at baseline to 85.33±10.94% at 4 weeks to 86.67±10.72% at 8 weeks ($P<0.01$ in all cases), while Group B subjects showed variable change in % FVC with an overall decrease which was statistically not significant.

Percentage of predicted FEV_1/FVC was higher in Group A subjects than in Group B at both periods of measurement but the difference was statistically significant only at 8 weeks (96.60±9.67% vs. 93.13±8.94%, $P<0.05$) (Table I). Group A subjects showed an increasing trend in % FEV_1/FVC over time: from 94.15±10.81% at baseline to 96.33±9.92% at 4 weeks to 96.60±9.67% at 8 weeks ($P<0.01$ from baseline to 4 weeks and to 8 weeks; $P>0.10$ from 4 weeks to 8 weeks), whereas Group B subjects showed a decreasing trend in % FEV_1/FVC.

Percentage of predicted FEF_{25-75} was higher in Group A subjects than in Group B at both periods of measurement, but the differences were statistically not significant (Table I). Group A subjects showed a statistically significant increasing trend in % FEF_{25-75} over time: from 75.41±10.42% at baseline to 76.88±10.75% at 4 weeks to 79.50±11.75% at 8 weeks ($P<0.01$ in all cases). Group B subjects showed variable changes in % FEF_{25-75}, including a statistically significant decrease between 4 weeks and 8 weeks.

DISCUSSION

Asthma is associated with increase in airway resistance, decrease in forced respiration volumes and flow rates, hyperinflation of the lungs and increased work of breathing (15, 16).

Apart from the conventional pharmacological modes of asthma management, various modalities currently categorized as complementary and alternative medicine (CAM), which includes the ancient practice of yoga are emerging as adjunct therapies for asthma (17). Breathing re-training is being increasingly used throughout the world by many patients with asthma (3, 18).

Pranayama may have psychophysiological benefits by increasing the patient's sense of control over stress and thus aids in reducing their autonomic arousal factors. Yoga stabilizes autonomic equilibrium with a tendency towards parasympathetic dominance rather than stress-induced sympathetic dominance. Yoga therapy readjusts the autonomic imbalance, controls the rate of breathing and relaxes the voluntary inspiratory and expiratory muscles, which results in decreased sympathetic reactivity (3, 4). Yoga increases respiratory efficiency, balances activity of opposing muscle groups and slows dynamic and static movements. Pranayama may be useful in patients of perennial bronchial asthma with mild to moderate symptoms (6).

This study was conducted with the purpose of finding out the outcomes of yoga training on pulmonary functions in patients with mild to moderate grade of asthma.

Nagarathna and Nagendra (5) reported a male to female ratio of 38:15. In the present study, the male to female ratio was 34:26 in Group A and 37:23 in Group B.

Various studies on the effect of yoga in asthmatics have considered varying grades of severity of the disease. Singh et al (8) and Sabina et al (19) in their study included patients with mild to moderate grades of asthma. In the present study patients with mild disease were (34, 56.67% in Group A and 32, 53.33% in Group B).

In the study by Murthy et al (6) the mean duration of disease was 7 years in males and 5 years in females. The mean duration of disease in our study was 7.70±5.54 years in Group A and 6.57±4.32 years in Group B. The mean duration of disease in this study was low probably due to the exclusion of severe asthmatics in which progression of disease may have caused the duration of disease to increase.

Murthy et al (6) in their study reported a statistically significant increase in PEFR. Similarly, in a study by Singh (10) a significant improvement in PEFR was noted in patients who used the Pink City Lung Exerciser (PCLE), a device which imitate pranayama breathing exercise. On the other hand, Kumar et al (7) found no statistically significant difference in PEFR after pranayama. In the present study, Group A subjects showed a steady and statistically significant increasing trend in % PEFR over time while Group B subjects showed an overall decrease that was statistically not significant.

Murthy et al (6) in their study reported a significant increase in $FEV_{1.}$ Similarly, Joshi et al (20) observed significant increase only in female subjects. In a study involving Belgian subjects performing hatha yoga, no significant difference in FEV_1 was found when compared with control subjects (21). In the present study, Group A subjects showed a steady and statistically significant increasing trend in % FEV_1 over time ($P<0.01$). Group B subjects on the other hand showed a decreasing trend in % FEV_1 over time which was statistically not significant.

Murthy et al (6) and Joshi et al (20) reported a significant increase in FVC. On the other hand, Kumar et al (7) reported no significant change. In the present study, Group A subjects showed a steady and statistically significant increasing trend in % FVC over time ($P<0.01$ in all cases). Group B subjects showed variable change with an overall decrease, which was statistically not significant.

In the study by Kumar et al (7) the % FEV_1/FVC was shown to significantly improve after pranayama training only in male subjects. On the other hand, Murthy et al (6) found no significant change. In the present study, Group A subjects showed an increasing trend in % FEV_1/FVC over time [baseline to 4 weeks and baseline to 8 weeks ($P<0.01$) and from 4 weeks to 8 weeks ($P>0.10$), whereas Group B subjects showed a decreasing trend in % FEV_1/FVC which was statistically not significant.

We also studied the forced mid-expiratory flow (% FEF_{25-75}) at the specified time periods

in the two groups. Comparing within the groups, Group A subjects showed a statistically significant increasing trend in % FEF_{25-75} over time whereas Group B subjects showed variable changes in % FEF_{25-75} which included a statistically significant decrease between 4 weeks and 8 weeks.

Conclusion

We conclude that yoga especially the pranayamic breathing exercises, when used adjunctively with standard pharmacological treatment can significantly improve pulmonary functions in non-smokers with mild to moderate grades of bronchial asthma.

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