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Original Research Paper

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EFFECTS OF YOGIC ASANAS, PRANAYAM & RELAXATION TECHNIQUES ON VENTILATORY FUNCTIONS, RESPIRATORY PRESSURES, BREATH HOLDING TIME AND RESPIRATORY ENDURANCE

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ABSTRACT

Background: The study about effects of regular practice of yoga on ventilatory functions is very important to better understand it's effect on health. **Method:** 100 healthy volunteers (M78:F22) from age group (17-26) years were included in the study. They practiced some yogic exercises including Asanas, Pranayam & relaxation techniques daily one hour for 3 months. Pulmonary function tests FVC, FEV1, FEV1/FVC, PEFR, FEF25%-75%, RR, TV, MV, MBC or MVV, BR, DI were recorded at start & end of the study. Apart from this maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), breath holding time (BHT) & 40mmHg respiratory endurance test were also recorded. **Result:** Yoga training for 3 months resulted in improved ventilatory functions in the form of increases in the FVC, FEV1, MVV, BR, DI, maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), 40 mm Hg respiratory endurance test and prolongation of breath holding time (BHT). **Conclusion:** 3 months training produces a significant improvement in respiratory pressures (MIP, MEP) and spirometric values.

KEYWORDS : Yoga, PFT, Respiratory Pressures, Breath holding time, respiratory endurance test.

INTRODUCTION:

Yoga is an ancient philosophic system that originated in India whose main objective is the development of the union of mind and body through exercise, respiration and meditation in order to achieve physical and mental well being.[1-2] The most popular branch of yoga is Hatha Yoga, which consists of a combination of postural exercises (Asanas), relaxation and voluntary breathing exercise (Pranayamas).

All over the world, Hatha Yoga has gained popularity as an alternative form of physical activity since it offers a different experience when compared to traditional physical exercise training and is less strenuous and more enjoyable.[3]

The study of the effect of regular practice of yoga on pulmonary functions, respiratory muscle function and respiratory pressures is important to better understand its effects on healthy individuals and to provide the basis for the possible use of yoga techniques as alternative therapy.

In this respect the present study evaluated the effect of regular practice of Hatha Yoga on pulmonary function tests and respiratory pressures.

MATERIAL AND METHOD:

This study was conducted on 100 healthy students and volunteers between age of 17-26 years of either sex (M78:F22) from Dr. S.N. Medical College, other academic colleges and yoga centres.

Subjects included in the study were non alcoholic, non smokers, not taking any type of medication and were having similar dietary habits.

Subjects involved in heavy physical exercise and previous experience of yoga training, history of any major medical illness and major surgery were not included in the present study.

Subjects were allocated to practice yoga for 3 months. The volunteers and students were briefed about the outcome of study and a written consent was obtained from them.

They were given yogic training for 1 hour under the guidance of qualified yoga instructor for 3 months regularly. The yogic schedule includes – asanas (postural exercise), relaxation techniques and pranayma (breathing exercise).

Asanas were performed for 40 min. duration. Each subject performed every asana 3 times. The asanas were followed by a meditation/ deep relaxation technique in shavasana (corpse posture) for 5 min. & pranayama (breathing exercise) were performed in the last 15 minutes. The set of asanas & pranayama included in the course are listed in Table -1

Table-1 Details of Yogic Practices

ASANAS
(A) Standing
1. Ardhakatichakrasana (lateral arc pose) 2. Padahastasana (forward bend pose)
(B) Sitting
Ardhamatsyendrasana (half-spinal twist pose) Pschimottanasana (back stretch pose)
(C) Lying on stomach (prone)
1. Makarasana (crocodile pose) 2. Bhujangasana (cobra pose) 3. Shalabhasanas (locust pose) 4. Dhanurasana (bow pose)
(D) Lying on back (supine)
1. Utthanpadasana (straight leg raising) 2. Ardhahalasana (plough pose) 3. Pavanmuktasana (wind relieving pose) 4. Setubandhasana (bridge pose)
(E) Deep Relaxation in Shavasana (Corpse Pose)
(F) Pranayama (Breathing Practices)
1. Kapalbhati Pranayama 2. Anulom-VilomPranayama (alternate nostril breathing) 3. Bhramari (honeybee sound during expiration)

Parameters:-

First anthropometric characteristics (body weight, height, and BMI) were evaluated using an anthropometric scale. (Table-2)

Table-2 Anthropometric Measurements Before And After Yoga Training

Parameter	Yoga	
	Pre	Post
Height	1.69±0.07	1.69±.07
Weight	60.63±8.91	60.29±8.61
BMI	21.24±2.72	21.07±2.58

Then before starting the training & after end of 3 months following parameters were measured.

Pulmonary Function Tests

Measured using a computerized spirometer (Helios 401, RMS Recorders & Medicare Systems, Chandigarh). For FVC test (FVC, FEV1, FEV1/FVC, PEFR, FEF25%-75%) subject was

instructed to take maximum inspiration and blow into the mouthpiece as rapidly, forcefully and completely as possible. It was ensured that a tight seal would maintain between the lips and mouthpiece of the spirometer.

For SVC test (Tidal volume (TV), respiratory rate (RR), minute ventilation (MV)) subject was instructed to breathe normally with a resting tidal pattern, next, the subject inspired maximally, then exhales as completely as possible with a slow, continuous smooth exhalation and returned to tidal breathing.

For MVV subject was instructed to breathe in and out as rapidly and deeply as he can with his maximum muscular efforts for a period of 15 seconds in the mouthpiece of the spirometer with both his nostrils closed.

Breathing Reserve (BR=MVV-MV), and Dyspnoeic Index (DI=MVV-MVx100/MVV) were calculated for each recording. Respiratory pressures: Maximum inspiratory pressure (MIP) and Maximum expiratory pressure (MEP) were recorded as follows. MIP was determined by asking the subject to perform maximum inspiratory effort against Aneroid manometer after breathing out fully. The maximum level at which the pressure could be maintained for about 3 seconds was noted. MEP was determined by asking the subject to blow against the Aneroid manometer after taking in a full breath. MEP that could be maintained for about 3 seconds was noted. It was ensured that the subjects did not use oral muscles to develop pressure or use their tongue to block the tubing.

For breath holding time (BHT) subjects were asked to take a deep inspiration after normal respiration and then to hold the breath as long as he could do it. The time of breath holding was calculated by stopwatch.

Respiratory endurance test (40mmHg test) was also determined. It includes maximum time for which subjects can maintain 40mmHg pressure in mercury manometer.

The above-mentioned parameters were measured before and after the 3-month study period. For each parameter, three trials at 3-minute intervals were given and highest of the three values was used for statistical analysis.

Analysis Of Data

Data obtained for various parameters were subjected to statistical analysis using the Microsoft Excel and OpenEpi software (version 2.3.1). Paired t test was used to compare the data's. P value <0.05 was considered statistically significant.

OBSERVATION AND RESULT:

FVC and FEV1, were increased after yoga training and shows significant appreciation ($p<0.05$).

FEV1/FVC%, PEFR, FEF 25-75% shows increasing trend but it was statistically not significant.

Table 3 of present study shows decrease in RR and improvement in TV after yoga training but it was statistically insignificant.

Study shows significant improvement in MVV, BR ($p<0.01$) and DI after yoga training ($p<0.05$).

Table-3 Pulmonary Functions Before And After Yoga Training

Parameter	Yoga Group	
	Pre	Post
FVC (L)	3.46±0.64	3.73±0.67*
FEV1 (L)	3.14±0.59	3.39±0.59*
FEV1/FVC (%)	91.08±4.87	91.1±5.26
PEFR (lit/sec)	7.04±1.48	7.16±1.28
FEF 25-75% (lit/sec)	3.85±0.94	3.93±0.77
R R (breaths/min)	17.5±3.21	16.85±2.61
TV (L)	0.43±0.08	0.45±0.07
MV (L/min)	7.43±1.31	7.51±1.26
MVV (L/min)	115.33±24.1	126.9±19.3**
B R (L/min)	107.90±23.8	119.46±19.2**
DI (%)	93.30±1.78	93.95±1.39*

*P<.05 on comparing pre and post yoga
** P<.01 on comparing pre and post yoga

There was a significant increase in post yoga MEP and MIP values as compared to pre yoga.

Yoga showed statistically significant rise in BHT after training ($P<0.01$). Timing of respiratory Endurance test was also significantly ($p<0.01$) raised post yoga from baseline data (pre yoga).

Table- 4 Changes In Respiratory Pressures, BHT & Endurance Test Before And After Yoga Training

Parameter	Yoga Group	
	Pre	Post
MEP (mmHg)	85.28±21.4	96.68±22.02**
MIP (mmHg)	117.42±22.8	129.32±18.6**
BHT (sec.)	51.66±12.62	60.41±9.78**
40 mm Hg Test (sec.)	34.67±9.1	42.47±9.23**

** P<.01 on comparing pre and post yoga

DISCUSSION:

Yoga training resulted in appreciable and statistically significant improvement in most of the parameters measured in this study.

Our results are also consistent with the findings of other workers who have reported beneficial effects of Yoga training on pulmonary functions.

Significant improvement in FVC and FEV1 indicates strengthening of respiratory musculature incidental to regular practice of pranayamic breathing. Joshi et al[4] have reported that pranayam training improves ventilatory functions in the form of increase in FVC and FEV1. Makwana et al[5] and Yadav and Das[6] also found a significant increase in these parameters after yoga training.

However, in present study yoga showed significant increases in FVC and FEV1, the ratio of FEV1/FVC % (a dynamic lung volume that indicates any impairment of airway resistance) did not change after yoga training due to similar increases in both variables.

In this study PEFR was increased but insignificantly after yoga training. Joshi et al[4] have reported that pranayam training improves ventilatory function in form of increase in FEV, FEV1 & PEFR.

The present study revealed an insignificant change in respiratory rate (RR), and minute ventilation (MV). Yoga training induced increase in tidal volume (TV) was also not significant, suggesting that yoga training given for duration of 3 months does not influence these parameters. Our findings corroborate with the observation of Agarwal and Gupta[7] and Harinath et al[8] and Chanavirut et al[2]. However Raichur RN et al[9] observed statistically significant increase in the tidal volume and statistically significant reduction in the respiratory rate and minute volume after twelve weeks of meditation practice.

The increase in MVV following yoga training of 3 months duration is in line with the studies done by Nayer HS[10], Bal BL[11] and Sayyed et al.[12] This suggests that the practice of yoga

can strengthen the respiratory muscles and increase the elastic properties of lungs and chest and thereby increase the MVV, breathing reserve and dyspnoeic index as last two parameters were calculated by using the values of MV and MVV.

Respiratory pressures are specific & sensitive indices of respiratory muscle strength & they are easy to measure and reproducible. Black &Hyatt[13] have demonstrated that their values are altered before there is alteration in other commonly used pulmonary function testes. Hence evaluation of respiratory muscle strength is important from physiological as well as clinical point of view.

In the present study yoga training significantly increases MIP and MEP (P<.01). This suggests that yoga training improves the strength of both expiratory & inspiratory muscles. The different postures of asanas involve isometric contraction and chest wall expansion which may be improving strength of intercostals muscles.

Our results do not agree with those of Gopal et al[14] who have reported lower MEP in yoga training. However the present findings are consistent with earlier work of Chen & Kno[15] who have reported that inspiratory muscle endurance is greater in physically active men then sedentary men.

Table 4 shows a significant increase in BHT after yoga training. Karmur KA et al[16], Ankad Roopa B et al[17] Lata M. Mullur et al[18] also found significant increase in BHT after short term Yoga practice. Improvement in BHT may be due to practice of Yoga which makes stretch receptors to withstand more stretching. Also the sensitivity of the respiratory center to carbon dioxide is reduced. Hence respiratory center can withstand higher carbon dioxide concentrations in the alveoli and the blood. With training subject can exercise voluntary control on the respiratory muscles overriding the excitatory stimuli to respiratory centres. In addition there is gradual acclimatization of receptors to the increased concentrations of carbon dioxide.[19]

In our study respiratory Endurance test shows significant increase in timing after yoga training. It is attributed due to increase in strength of respiratory muscles.

CONCLUSION:

The present study shows that 3 months yoga training produces a significant improvement in respiratory pressures and spirometric values.

REFERENCES:

1. Godoy DV, Bringhenti RL, Severa A, Gasperi RD, Poli LV. Yoga versus aerobic activity – Effect on spirometry results and maximal inspiratory pressure. J Bras Pneumol. 2006; 32(2): 130-135.
2. Chanavirut R, Khaidjapho K, Jaree P, Pongnaratorn P. Yoga exercise increases chest wall expansion and lung volumes in young healthy thais. Thai J PhysiolSci 2006; 19(1):1-7.
3. Hagins M, Moore W, Rundle A. Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness? BMC Complement Altern Med2007; 40(7):1-9.
4. Joshi LN, Joshi VD, Gokhale LV. Effect of short term pranayam practice on breathing rate and ventilatory functions of lung. Indian J Physiol Pharmacol 1992; 36: 105–108.
5. Makwana K, Khirwadkar N, Gupta HC. Effect of short term yoga practice on ventilatory function tests. Indian J Physiol Pharmacol. 1988 ; 32: 200-208.
6. Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. Indian J Physiol Pharmacol. 2001; 45: 493-496.
7. Agarwal V, Gupta B. Physiological effects of transcendental meditation and physical exercise. Indian Journal of Traditional Knowledge.2006; 5 (2): 181-183.
8. Harinath K, Malhotra AS, Pal K, Prasad R, Kumar R, Kain TC, Rai L, Sawhney RC. Effects of hatha yoga and omkar meditation on cardiorespiratory performance, psychologic profile and melatonin secretion. J Alternative complimentary medicine. 2004; 10(2): 261–268.
9. Raichur RN, Kulkarni SB, Rahul RR, Aruna GB, Sridevi RR. Effect of meditation training on pulmonary function tests. Recent Research in Science and Technology. 2010; 2(11): 11-16.
10. Nayer Hs, Mathur RM and Sampath Kumar R.Effect of Yogic exercise on human physical efficiency. Indian j Med Res.1975; 63:1369-76
11. Bal BL. Effect of anulome vilome and bhastrika pranayam on the vital capacity and maximum ventilatory volume. Journal of Physical Education and Sport Management. 2010; 1(1):11-15.Available online http://www.acadjourn.org/jpesm
12. Sayyed A,Patil J, Chavan V, Patil S, Charugulla S,Sontakke Aantak N. Study of lipid profile and pulmonary functions in subjects of lipid profile and pulmonary functions in subjects participated in Sudarshan Kriya Yoga. Al Ameen J Med Sci.2010; 3(1):42-49
13. Black LF, Hyatt RE. Maximal respiratory pressures : normal values and relationship to age and sex. Am Rev Respir Dis 1969; 99: 696–702.
14. Gopal KS, Bhatnagar OP, Subramanian N,Nishith SD. Effect of yogasanas and pranayamas on BP, pulse rate and some respiratory functions. Indian J Physiol Pharmacol 1973: 17:273–276.
15. Chen H, Kuo C. Relationship between respiratory muscle function and age, sex and other factors. J Appl Physiol 1989; 66: 943–948.
16. Karmur KA, Jani HA, Vala NH, Bhanderi PC. Effect of Yoga on pulmonary function tests. Int J Res Med Sci. 2015 Sep; 3(9):2357-2361
17. Ankad RB, Ankad BS, Herur A, Patil S, Chinagudi S, Shashikala GV. Effect of short term Pranayama and meditation on respiratory parameters in healthy individuals. Int J Collab Res Intern Med Public Health. 2011;3(6):429-37.
18. Mullur L, Bagali S, Khodnapur JP, Aithala M. Role of short term Yoga on pulmonary functions of young and middle aged healthy individuals. IJBAR. 2012; 3(4):252-5.
19. Mascarenhas JF. Autonomic responses to breath holding and its variations following Pranayama.Indian J Physiol Pharmacol Indian. 1988;32(4):257-64.