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Effect of Pranayama on Respiratory Parameters in Aged Person.

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ABSTRACT

Background: Body and mind work perfectly after yoga. To find out the effect of yoga (pranayama) on respiratory parameter a cross sectional study was conducted. **Methods:** Subjects selected are people (male and female) aged from 50-70 year without any active medical complain. Study is conducted in RMCH Bareilly U.P. **Results:** Respiratory parameters measured are FVC, FEV1, ratio of FVC/FEV1 and PEFR. These parameters are taken before and after 12 week of pranayama. **Conclusion:** 12 weeks of regular yogic training in elderly individuals showed definite improvement in their ventilatory functions, as observed from improvement in their FVC, FEV1 FEV1/FVC RATIO and PEFR.

Keywords: Aged person, FVC, FEV1, Ratio of FVC/FEV1, PEFR, Pranayama.

INTRODUCTION

Yoga is originated in India over thousands of years. Body and mind work perfectly after yoga[1], physiological changes can be explained by scientifically. It is said to help in increasing longevity and to have a therapeutic and rehabilitative effect. As the age increase the efficiency of respiratory system and ventilation declines due to various factors. In yoga pranayama is well known and has beneficial effects on respiratory efficacy. These exercises help to increase blood circulation and emptying in alveoli, leading to increased development of respiratory musculature, as is recorded in terms of Forced Vital Capacity (FVC). Similar ventilator training, even in elderly subjects (between 60 and 70 years), has been shown to improve lung volumes and capacities.[2] A study performed on a group of elderly people (aged 41 to 50 years) indicated that, a short term yoga practice (posture and pranayama) was beneficial and prevented development of primary respiratory problems by increasing the efficacy of respiratory muscles.[3] Joshi et al reported significant increase in FVC and Peak Expiratory Flow Rate (PEFR) following 6 weeks of Pranayama practice.[4] Makwana et al reported significant increase in FVC & Forced Expiratory Volume in one minute (FEV1) following 10 weeks of yoga training.[5]

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Vital capacity was measured before and after 17 weeks of regular practice of yoga postures and breathing exercises in a large group of college students in the USA, and the study showed statistically significant increase in vital capacity across all categories over time.[6] Bijlani and others have also reported similar observations.[7]

MATERIALS AND METHODS

The study was conducted in RMCH Bareilly with the help of yoga trainer. Study duration was October 2014 to April 2015. Forty subjects, including both male and female, of age group of 50 to 70 years, with no respiratory, cardiovascular or other medical disorders, were selected for the study. Sample was selected via simple random sample technique Pulmonary function test were carried out using MIER spirometer. The data collected was analyzed by SPSS v21.0.0.0 64 bit edition.

Exclusion criteria:

a) History of active sports training
b) Previous experience of yoga training
c) History of active medical illness e.g. tuberculosis, chronic lung disease, symptomatic ischemic heart disease.
d) History of major surgery in recent past
e) Smoker
f) Intake of regular medicines for hypertension or diabetes mellitus
g) Any vertebral deformities e.g. kyphosis or scoliosis

Each subject was separately explained about the study procedure and his / her consent was obtained. They were then taught different yogic exercises by a certified yoga trainer and advised to practice specifically those exercises in 30 minutes session

regularly for 12 weeks under supervision. Approval from the institutional ethics committee was obtained.
Before the actual yogic exercise training program commenced, measurement of the following parameters was done in each subject:
a) Forced Vital Capacity (FVC): After the patient has taken in the deepest possible breath, this is the volume of air which can be forcibly and maximally exhaled out of the lungs until no more can be expired. FVC is usually expressed in liters.
b) Forced Expiratory Volume in One Second (FEV1): This is the volume of air which can be forcibly exhaled from the lungs in the first second of a forced expiratory maneuver. It is expressed in liters. FVC & FEV 1. Values are critically important in the diagnosis of obstructive and restrictive diseases.
c) Ratio of FEV1/FVC
d) Peak Expiratory Flow Rate (PEFR): It is a simple test for the efficacy of respiratory system. It is the largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration, expressed in liters per minute (American Thoracic Society).
Bhramari pranayama: In this technique, the ears are closed with thumb, index finger is on forehead and rest three is on the base of nose touching eyes. The patient was asked to breathe-in and out through nose while humming "OM" like a bee for 10 min.
Suryanamaskar: Pretraining was given for 7 days by a yoga trainer and the performance of suryanamaskar was analyzed using performance chart. The participants were trained to perform suryanamaskar in a slow manner so that each of the 12 poses could be held for duration of 30 s. Each round took 6 min to complete and five rounds were performed in 30–40 min.
Anuloma-Viloma K/As Alternate Nostril breathing: (a) Inhale through left nostril, closing the right with the thumb, to the count of 4. (b) Hold the breath, closing both nostrils to the count of 16. (c) Exhale through the right nostril, closing the left with the ring and little finger to the count of 8. (d) Inhale through the right nostril, closing the left nostril with ring and little finger to the count of 4. (e) Hold the breath, closing both nostrils, to the count of 16. (f) Exhale through the left nostril, keeping the right closes with the thumb, to the count of 8.
Kapalbhati Yoga: Also known as breathe of fire is used as a 'Cleaning breathing exercise'. The technique uses a forced exhalation with the premise of ridding of lower lungs of stale air allowing the intake of O2 rich air, thereby purifying the body. All these yoga done in vajrasana or padmasana, keeping back straight and one or both hand in gyana mudra. In between or after practice, subject lie in shavasana for 1 -2 min, according to need.
Bhastika Pranayama: To take in deep breaths and then completely breathe out for 3 minutes.
Bahya Pranayama: To breathe air out, touch the chin to the chest, squeeze stomach completely and hold for a while; then release the chin, breathe in slowly for 5 times for one minute of each session.
Then we take respiratory parameter through spirometer after the end of session of yoga at end of first month, at end of second month and at end of third month. The following parameter will be recorded Forced Vital Capacity (FVC), Forced Expiratory Volume in Time (FEV1), Forced expiratory volume /Forced vital capacity ratio (FEV_1 /FVC) PEFR. The necessary information will be collected on final schedules and will be transferred on the standard predesigned classified tables as per objective. Statistical tests and other analysis for drawing inferences will be applied as per need.

RESULTS

The statistical method applied for analysis of the data from the study was Paired Samples t test. This procedure compares the, mean‟ of two variables for a single group. $P < 0.001$ was considered significant. This was a prospective study. Forty subjects (n=40) of both sexes of age between 50 and 70 years were chosen for the study. Each subject was separately explained about the study procedure and consent was obtained from them. The following parameters were measured in each subject twice during the study once at the onset of the study, i.e. before starting of yoga practice; and once after the completion of 12 weeks of yoga training and practice under supervision:
a) Forced Vital Capacity (FVC) expressed as liter
b) Forced expiratory volume in first second (FEV 1) expressed as liter
c) FEV_1/FVC ratio
d) Peak expiratory flow rate (PEFR) expressed as liter/minute.
Results showed that there was a significant increase in FEV 1, FVC FEV1/FVC ratio and PEFR [Table 1-4].

Table 1: Changes in FVC after duration of yoga

Parameter FVC	Study Group (Mean ± SD)	P value
At 1st Visit	77.4 ±5.22	0.420
After 4 week	90.68 ± 4.3	0.520
After 8week	98.6±5.63	<0.001
After 12 week	100.3±5.02	<0.001

Table 2: Changes in FEV1 after duration of yoga

Parameter FEV1	Study Group (Mean ± SD)	P value
At 1st Visit	56.63± 6.43	0.724
After 4 week	72.18± 6.42	0.514
After 8week	78.28± 5.25	<0.001
After 12 week	82.62± 5.33	<0.001

Table 3: Changes in FEV1/FVC RATIO after duration of yoga

FEV1/FVC RATIO	Study Group (Mean ± SD)	P value
At 1st Visit	71.55±5.63	0.012
After 4 week	81.02 ±6.25	0.121
After 8week	85.62 ± 6.25	0.011
After 12 week		<0.001

Table 4: Changes in PEFR after duration of yoga

PEFR	Study Group (Mean ± SD)	P value
At 1st Visit	68.5 ± 18.2	0.011
After 4 week	75.5 ± 19.5*	0.012
After 8week	80.3 ± 20.6‡	<0.001
After 12 week	84.0 ± 20.2	<0.001

DISCUSSION

Forty subjects of both sexes of age group 50 to 70 years with no active respiratory, cardiovascular and other medical illness were selected for the study. After taking pre-exercise recordings of FVC, FEV1, FEV1 /FVC and PEFR, subjects were made to undergo a 12 weeks yogic exercise training program and then recordings of the same parameters were obtained at the end of the program. Data analysis revealed that, there was a significant increase in all the three parameters. The Tables 1-4 show the comparison of results of FEV 1, FVC FEV1 /FVC and PEFR respectively performed before and after exercise training. Table 4 shows the comparative study of all the parameters, performed once before and then after yogic training for 12 weeks. The changes were significant in all the cases. The efficiency of respiratory system and ventilation declines as age advances.[1] This is a general observation and it may be due to decreased elasticity of the lung tissue and reduced muscular power and stiffness of the thoracic cage. A reduced mechanical efficiency decreases alveolar ventilation. In effect the oxygenation of the tissues will be less than that seen in the young healthy individuals. The loss of elastic recoiling prevents the closure of respiratory bronchioles during expiration. And further to this, the rate of deterioration of PEFR is more in the following decades. Thereafter the capacity of respiratory system becomes very low in the old age above 70 years. A compromised respiratory efficiency reduces the individual's stress tolerance which affects the quality of life. Pranayama, a yogic practice, has beneficial effects on respiratory efficiency. It includes various exercises which involve forceful inspiration to total lung capacity (TLC) and forceful exhalation to residual volume, and all maneuvers are done through nostrils, which offer resistance by means of decreased cross sectional area and turbulence. Breathing through one nostril in Anulom-vilom pranayama further increases the resistance. Higher peak expiratory flow rates and FEV1 could be explained due to better strengthening of respiratory muscles in yogis. By yoga practice respiratory apparatus is emptied and filled more completely and efficiently which is recorded in terms of increased forced vital capacity (FVC).[6-12] Yogic breathing creates more negative pressures in both abdominal and thoracic cavity during inspiration and moves the diaphragm more than its normal excursions and helps in efficient movement of diaphragm, intercostal and abdominal muscles. Thus the improvement in vital capacity is due in part to increased development of respiratory musculature incidental to regular practice of yogic exercise.[13] Skeletal muscles control many crucial elements of aerobic conditioning including lung ventilation.

Repeated inspirations to TLC and breath holdings as done during pranayama can lead to increase in the maximal shortening of the inspiratory muscles which has been shown to improve the lung function parameters.[14] Yoga postures involve isometric contraction which is known to increase skeletal muscle strength.[15] In addition to improved respiratory muscle performance, increased FEV1 in yogic practitioners may be because of improved patency of airways.[4,7] Yoga with its calming effect on the mind can reduce and release emotional stresses, hereby withdrawing the broncho-constrictor effect.[12,16,17] Lung inflation near to total lung capacity is a major physiological stimulus for the

release of lung surfactant and prostaglandins into alveolar space, which increases lung compliance and decreases bronchiolar smooth muscle tone, respectively.[4,14,17] Thus, the respiratory efficacy greatly improves after exercise even in the elderly, which go a long way in healthy living. Hence elderly people must be trained in systematic physical activity under suitable guidance to improve their quality of life.[18] It has also been reported that regular practice of yogic exercises in sedentary subjects was almost equivalent to swimming in improving their pulmonary functions when practiced for 12 weeks.[19] In light of these facts, yogic exercise can become the most important way of lifestyle intervention and physical activity for prevention of many diseases as prescribed by World Health Organization[20] especially in the elderly, where rigorous physical exercise is not always advisable.

CONCLUSION

The conclusion observed in our scientific study was as follows. 12 weeks of regular yogic training in elderly individuals aged between 50 to 70 years showed definite improvement in their ventilator functions, as observed from improvement in their FVC, FEV1 FEV1/FVC RATIO and PEFR. This may be due to regular slow and forceful inspiration and expiration during yoga practice, leading to strengthening of respiratory muscles; and increased release of surfactant too. Further study is needed to find out other causes.

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