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EFEECT OF PRANAYAMA (YOGA) ON PULMONARY FUNCTION TEST OF YOUNG HEALTHY STUDENTS.

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ABSTRACT

Several studies had been undertaken to prove the role of pranayama (yoga) for the improvement of pulmonary functions in various disease conditions as well as in healthy individuals. The main objective of this study was to assess the effect of pranayama on pulmonary function test in 75 medical students of both sexes (50males, 25 females) ranging in age from 18 to25 years. All the participants were given training for 15 days by certified trained yoga teacher and after that they were allowed to practice the pranayama for 30 minutes everyday for the duration of three months. Spirometry was done before and after completion of three months pranayama practice. The results were analyzed by 'paired t test'. There were significant improvement in tidal volume ($p<.0001$), vital capacity (VC) $p<.0001$, Maximum voluntary ventilation (MVV) $p<.001$, peak expiratory flow rate (PEFR) $p<.001$, forced expiratory volume in the first second (FEV1) $p<.001$, forced vital capacity (FVC), $p<.005$, forced mid expiratory flow in 0.25–0.75 seconds (FEF25- 75) $p<0.0001$. The present study indicates that pranayama has positive physiological benefits on respiratory system as evidenced by improvement of pulmonary function.

KEYWORDS: **pranayama, yoga, pulmonary function test.**

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INTRODUCTION

It is thought by many cultures that the process of breathing is the essence of being. The goal of these breathing techniques is to relax quickly and to improve the respiratory efficiency. Yoga breathing, or pranayama, is the science of breath control. Pranayama is derived from Sanskrit word 'prana' means breathe and 'ayama' means development or control (1). Among the many kinds of pranayama, anulom, vilom, Bhastrika and kapalbhati are considered as the significant types of the pranayama. Rapid forceful expulsion is a characteristic feature of bhastrika pranayama, whereas anulom vilom pranayama is slow inhalation from one nostril at one time and release the breath through the other nostril, while kapalbhati is the vigorous breathing technique(2). Several studies had been undertaken to prove the role of pranayama for the improvement of pulmonary functions in healthy individuals (3,4,5,6). It Improves respiratory functions and has a beneficial effect on respiratory diseases like asthma (7) plays an important role as preventive measures in many cardiovascular diseases and nervous system diseases (8, 9). The purpose of this study was to determine the effect of pranayama on pulmonary function test in healthy young volunteers.

MATERIAL AND METHODS

Subject selection

The study was conducted at physiology department S. S. Medical College Rewa (M.P.). After approval of Institutional ethical committee, Seventy five medical students (50 males, 25 females) between the age group of 18 to25 yrs participated in the study. After taking informed written consent from each participant & explaining the purpose of study, a detailed history was recorded and clinical examination was done keeping in mind following inclusion and exclusion criteria.

Inclusion criteria –

1. Healthy nonsmoker subject with no cardio respiratory diseases.
2. Subjects not doing any other type of exercise.

Exclusion criteria-

1. History of active sports training, previous experience of yoga,
2. History of major medical illness such as tuberculosis, hypertension, diabetes mellitus, Bronchial asthma,
3. History of major surgery in the recent past, smoking, alcohol consumption and non-vegetarian diet.

Method:

All participants were subjected to the 15 days pranayama training by certified yoga instructor at yoga lab in physiology department. Pranayama was practiced by the participants for a period of three months regularly, Monday through Saturday under supervision of yoga instructor. Then they were advised to perform the pranayama, every morning for three months duration.

Bhastrika pranayama -3-5 mints
Kapalbhati- 2-5Mints
Anuloma-viloma - 5-15 mints
Ujjayi pranayama- 3-5 mints

Pulmonary functions were recorded by using the "Cosmed PFT Suite calibration module version 7.49 2005 S.R.L." Pulmonary function parameter were tidal volume (TV), vital capacity (V C), Maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), forced mid expiratory flow in 0.25–0.75 seconds (FEF25- 75). The values of all tests were taken as % predicted as per age, sex and height of each subject. Minimum three readings were recorded of each test for every subject and the best performed test was selected for precise interpretation of the recorded test.

Statistical analysis of data

The data obtained were analyzed using MEDCALC software (Version12.1.3). Student's (paired) "t" test was used for analysis of comparison. The data were presented as mean ± standard deviation (SD). Probability value (P) of less than 0.05 was considered statistically significant.

RESULT

This study was conducted with the purpose of finding out the outcomes of pranayama training on pulmonary functions in healthy students. The collected data were analyzed by paired' *t* test and the values were expressed as Mean±SE. The age of the participants ranged from18 to 25yrs, the mean age of the subjects in the present study was 21.47±2.0 years. The mean height (mt) was1.62±0.12, the mean weight (kg) was 53.88±5.01 and the mean BMI (kg/m^2) was 20.0±1.65. Table 1 shows the Age & anthropometric parameters of the total subjects and table 2 shows Spirometry parameters of the participants before and after pranayama.

Table1

Age & anthropometric parameters of the total subjects

Parameter	**male (n=50)**	**female (n=25)**	**Total(n=75)**
Age (years)	21.96±2.10	20.99±1.73	21.47±2.00
Height (mt)	1.65±.14	1.59±.04	1.62±0.12
Weight (Kg)	56.75±3.55	49.37±4.42	53.88±5.01
BMI(kg/m2)	20.6±2.44	19.4±1.87	20±1.65

Anthropometric parameters of study group as per mean ± SD

Table 2

Spirometry parameters of the participants before and after pranayama

parameter	Pre yoga Mean± S.D.	Postyoga Mean± S.D	Paired t value	Stan. error	P value	signifi cant
TV(ml)	461.2±55.75	515.6±56.93	24.1988	2.248	<0.0001	S**
VC(liter)	3.52±0.58	3. 92±.64	14.2375	0.028	<0.0001	S**
MVV(lt/min)	96.65±12.32	104.02±13.06	20.7043	0.356	<0.01	S**
PEFR(lt/min)	455.03±102.8	468.73±99.98	11.3003	1.212	<0.01	S*
FEV1(lit)	3.01±.52	3. 32±.56	10.34	0.019	.001	S*
FVC(lit)	3.48±.73	3.73±.18	12.76	0.021	.003	S*
FEV.5/FVC(%)	64.24±6.34	65.13±5.93	5.0697	0.176	<0.0001	S*
FEV1/FVC (%)	84.01±3.05	85.03±1.83	4.5448	0.226	<0.01	S*
FEV3/FVC (%)	95.07±1.41	95.32±1.35	2.4660	0.101	<0.01	S*
MEF25%L/S	2.34±.35	2.50±.34	7.3524	0.021	=.001	S*
MEF75% L/S	5.41±.46	5.35±.42	2.9132	0.011	=.004	S*

Results are shown Mean±SD , S* significant ,S** very significant

There was significant increase in TV, VC, and MVV after three months of pranayama.

Force expiratory parameters FVC, FEV.5/FVC, FEV1/FVC, FEV3/FVC, PEFR, and MEF25-75% significant increase after three months of pranayama.

DISCUSSION

From the results it is evident that the three months of pranayama practice showed significant improvement in vital capacity and maximal ventilatory ventilation and Peak expiratory flow rate. The findings were supported by the study conducted by Mauch AD et al (6) , Upadhyay et al (8), Joshi LN, et al (3), Murthy et al (4) in their study reported a statistically significant increase in PEFR. On the other hand, Kumar et al (14) found no statistically significant difference in PEFR after pranayama. The probable reason for the observation in the present study could be explained as anuloma and viloma are deep breathing at slow rate causes decrease dead space and increase alveolar ventilation, as depth of breathing is far more effective in elevating alveolar ventilation. Thus increasing alveolar ventilation leads to increase maximum ventilation and vital capacity. In kapalbhati and Bhastrika as pulmonary pressure continue to increased resulting in an adequate driving force to propel the blood to the uppermost part of lung where oxygen is more, this results in more perfusion of lungs from top to bottom and improve the ventilatory functions of lungs. In this study after three months yoga practice significant increase in FVC ,FEV1, these finding are consistent with other studies Mauch AD, et al (6), Joshi LN, et al (3), Murthy et al (4) . On the other hand, Kumar et al (14) reported no significant change. By consistently performing a variety of *asana* muscles of the thoracic cavity are constantly being recruited. This recruitment may lead to greater musculature and thereby result in improved FVC Joshi et al (3). Similar observations were made by Upadhyay et al (8), they concluded that during pranayama, the compliance of the lung thoracic System increases and the airway resistance decreases. Hence forceful expiration becomes more efficient Anulom and vilom is characterized by slow and deep inhalation and prolong exhalation causes efficient use of intercostals and diaphragmatic muscle this trains the respiratory muscles to get emptied and filled more completely and efficiently, while kapalbhati and Bhastrika pranayama involve isometric contraction and expansion of abdominal and intercostals muscles, which improve the strength of the intercostals muscles. Thus lead to increased FVC and FEV1. Birkel DA (11) suggest that Pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors embedded in the smooth muscle of the airways, on activation causes inhibition of inspiratory neurons leading to inhibition of inspiration and alter blood flow through the lungs, thus improve ventilatory functions. In this study after three months yoga practice significant increase in FEV.5/FVC, FEV1/FVC, FEV3/FVC and MEF25-75%. The probable reason for the observation could be, during pranayama, the compliance of the lung thoracic system increases and the airway resistance decreases, hence forceful expiration becomes more efficient Also in pranayama exercise the efficient movement of diaphragm leading to improvement in forced expiratory volumes and capacities.

CONCLUSION

Pranayama (yoga) seems to be beneficial for the pulmonary functions. Further studies are needed to confirm the possible mechanism(s) responsible for such an effect.

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