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Original Research Article

Effect of Nadi Shodhan Pranayama on Pulmonary Functions

Sandeep Garg [1], Sukhdev Chandla [2]

[1]PG Student, [2]Professor,
Department of Physiology, Pt. B.D. Sharma PGIMS, Rohtak-124001, India.

Corresponding Author: Sandeep Garg

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ABSTRACT

Background & objectives: Breathing is the most vital function for maintenance of life. Pranayama is an art of controlling the life force of breath. It produces many systemic psycho-physical effects in the body, besides its specific effects on the respiratory functions. It refreshes the air throughout the lungs, in contrast with shallow breathing that refreshes the air only at the base of the lungs. Pranayama helps to bring the conscious awareness in breathing to reshape breathing habits and patterns. Thus the present study was conducted to elucidate the effect of nadi-shodhan pranayama on various pulmonary functions.
Methods: The study included thirty medical students both male and female of age group 17-21 years. Students practiced nadi-shodhan pranayama twenty five minutes daily for three months. Pulmonary Function Test (PFT) is measured before and after pranayama practice. Parameters included in the study were Vital Capacity (VC), Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV).
Results: There occurs a significant increase (p value <.01) in all the parameters included in the study following practice of nadi-shodhan pranayama for three months.
Interpretation & Conclusion: Nadi-shodhan pranayama plays a significant role in improving the various ventilatory functions of lungs in pranayama practicing subjects. Thus helps in improving the quality of life.

Key Words: MVV, PEFR, Pranayama, VC.

INTRODUCTION

Yoga is ancient heritage of India that has given man the answers to his spiritual and holistic search for perfect health and well-being. The term "yoga" and the English word "yoke" are derived from Sanskrit root "yuj" which means union. It is an ideal way of living, providing rhythm to the body, melody to the mind, harmony to the soul and thereby symphony to life. It is an ancient Indian science which teaches man how to live in unity within himself and with those around him. [1,2]

Patanjali has described eight-limbs of yoga (ashtang yog). Role of different limbs of yoga are:

The first two limbs of ashtang yoga are "Yam" and "Niyam" which are universal morality and personal discipline for the development of our moral, spiritual and social aspects. Third and fourth limbs are "Asan" and "Pranayam" which help in our physical development and improvement of physiological functions and breath control. Fifth and sixth limbs are "Pratyahar" and "Dharna" for controlling our senses and making our mind one-pointed, calm and alert. The last two limbs

are "Dhyan" and "Samadhi" which cause inner peace, ecstasy, higher level of consciousness and the ultimate union of our individual consciousness with the Universal Consciousness, resulting in God realization. [3]

Pranayama, the fourth limb of ashtang yoga, is a controlled and conscious breathing exercise which involves mental concentration. The word Pranayama is derived from two words i.e. "Prana" meaning vital force or life and "Ayama" meaning to control the vital force. Hence pranayama means control of the vital force by concentration and regulated breathing. Yogis can decrease the RR upto 2 to 3 cycles/minutes with regular practice of pranayama. [4,5] With a decrease in RR, the metabolic rate of the body also reduces.

Previously done study by Manaspure, Shankarappa, Tanwar etc. included a combination of asanas and pranayama for a shorter duration. [6-8] Very few studies are available in literature that studied the effect of specific pranayama. So we planned to study the effect of nadi shodhan pranayama, practiced for 12 weeks, on pulmonary functions.

MATERIALS AND METHODS

The present study was conducted in the department of Physiology at Pt. B.D. Sharma PGIMS, Rohtak on medical and para-medical students. Thirty students both male and female of 17 to 21 years of age were enrolled in the study. Subjects were randomly enrolled who were interested in practicing pranayama.

Inclusion criteria

1. Healthy medical and paramedical students of either sex between 17 and 21 years of age.
2. Students who have not practiced pranayama before enrollment.
3. Students who were committed to practice pranayama as taught by the instructor regularly.

Exclusion criteria

1. History of smoking and alcohol intake
2. Subjects on long term medications or suffering from any chronic disease including neuromuscular or skeletal disorder.
3. Subjects who do not practice pranayama regularly during the study.

Each subject performed nadi-shodhan pranayama as instructed by a certified yoga teacher and detailed below.

The subject sat in sukhasana with eyes closed, neck and head straight. Wrists were kept on the knees on each side with palms facing upwards, elbows slightly bent and kept close to the chest. Middle and index finger of the right hand was placed on the brow of head, thumb was used to close the right nostril and little finger was used to close the left nostril alternately. Elbow of the right hand was kept close to the chest. To start with subjects inhaled slowly through the left nostril to a count of six while the right nostril was closed with thumb. After inhalation, the left nostril was closed with ring and little finger, breath was held for a count of three, subject then exhaled slowly through the right nostril again for a count of six. After completely exhaling, subjects inhaled again slowly through the right nostril for a count of six while right nostril was closed with thumb. Breath was held for a count of three and then left nostril was opened and exhalation was done to a count of six. Inhaling from the left nostril, exhaling from the right and then again inhaling from the right and exhaling from the left nostril completed one cycle. Ten such cycles comprised one set. Each subject performed three such sets with an interval of four minutes. Completing three sets took approximately 25 minutes. [9]

The pranayamic breathing was practiced early in the morning after a warm up for ten minutes by jumping and jogging on the spot. Subjects practiced pranayama with empty stomach or if required only a glass of water was allowed 30 minutes before starting pranayama. Subjects were required to wear light & comfortable clothing.

Pulmonary Function Tests: The following parameters were recorded on RMS MEDSPIROR Platform WIN 98 version-1.0 supplied by RMS Chandigarh:

1) Vital Capacity in liters.
2) Peak Expiratory Flow Rate in liters/min.
3) Maximum Ventilatory Volume in liters/min.

Procedure for VC and PEFR: The subject was asked to apply the mouthpiece and close the lips above it so that no air escapes. A nose clip was applied on the nose to close both the nostrils and then subject was instructed to breathe in and out normally through the mouth. After a few tidal breaths the subject was asked to inhale deeply and then exhale as fast and as completely as possible into the mouthpiece. The subject was asked to repeat it three times and the best attempt was selected for analysis.

Procedure for MVV: The subject was asked to apply the mouthpiece and close the lips above it so that no air escapes. A nose clip was applied on the nose to close both the nostrils. The subject was then instructed to inhale and exhale as quickly and as deeply as possible into the mouthpiece for a period of 15 seconds. The subject was advised to stop the maneuver if he/she feels uncomfortable during the procedure.

All the tests were done at 7:00 am on empty stomach, in the department of physiology. Three sets of recordings were done, one before the start of study, second after six week and third after twelve weeks of pranayamic practice.

Statistical analysis of data

For interpretation of the results, repeated measure ANOVA was used for analysing the data. Significance of results was predicted based on p value. p value > 0.05 was taken as non-significant, p value < 0.05 was taken as significant and p value <0.01 was taken as highly significant.

RESULT

The present study was conducted in the department of Physiology at Pt. B.D. Sharma PGIMS, Rohtak on medical and para-medical students. The study was carried out on 30 students of 17-21 years of age of either sex. Their PFT was recorded at basal, 6 weeks and 12 weeks. The observations and results of our study are presented in graphical and tabular forms in the following section:

Table 1: Effect of Nadi Shodhan Pranayama on Pefr (L/Min.)

PEFR	N	Mean	S.D.
BASAL	30	450.740	± 76.556
6 WEEK	30	456.240	± 77.061
12 WEEK	30	463.140	± 77.716

p value <.05, repeated measure ANOVA

Table 1 shows the effect of slow breathing pranayama on PEFR with time. There was an increase in mean PEFR from basal 450.740 ± 76.556 l/min. to 456.240 ± 77.061 l/min. at 6 weeks and 463.140 ± 77.716 l/min. at 12 weeks. Increase in PEFR was found to be statistically significant with p value <.05.

Table 2: Effect of Nadi Shodhan Pranayama on Mvv (L/Min.)

MVV	N	Mean	S.D.
BASAL	30	122.033	± 33.533
6 WEEK	30	125.933	± 34.107
12 WEEK	30	131.533	± 33.427

p value <.05, repeated measure ANOVA

Table 2 shows the effect of slow breathing pranayama on MVV in relation with time. There was an increase in mean MVV from basal 122.033 ± 33.533 l/min. to 125.933 ± 34.107 l/min. at 6 weeks and 131.533 ± 33.427 l/min. at 12 weeks. Data observed after practicing 12 week of pranayama was found to be statistically significant with p value <.05.

Table 3: Effect of Nadi Shodhan Pranayama on Vc (Liters)

VC	N	Mean	S.D.
BASAL	30	3.791	± 0.559
6 WEEK	30	3.863	± 0.550
12 WEEK	30	3.999	± 0.554

p value <.05, repeated measure ANOVA

Table 3 shows the effect of 12 weeks of nadi shodhan pranayama on VC of subjects. There was an increase in mean VC from basal 3.791 ± 0.559 l to 3.863 ± 0.550 l at 6 weeks and 3.999 ± 0.554 l at 12 weeks. The result observed from the table were found to be statistically significant with p value <.05.

DISCUSSION

In the modern day scenario of cut throat competition, the prevalence of time bound project is soaring high. Every single person particularly medical and paramedical student is striving hard to stay in the world of competition and it is taking its toll in the form of negative effects like anxiety, stress, mental tension and depression. Growing population and indiscriminate use of resources has led to polluted environment which further increases the negative effects. [7] Polluted environment affects the ventilatory functions of lungs over the time. Pranayama by its beneficial cardio-respiratory effect helps in decreasing most of the negative effects.

Pranayama, the fourth limb of yoga, in conjugation with other limbs of yoga plays a significant role in mental health issues like stress management, non-psychotic mood, generalized mood disorder and in case of depression. It is a type of physiological stimuli that leads to adaption of a positive behavior on regular practice. It helps in relaxing and calming the mind. [6] It acts as a main adjuvant in musculo-skeletal disorder like in osteoarthritis, joint pain, rheumatoid arthritis, acute and chronic pain. Also it causes tuning and strengthening of body. [10,11]

In addition to other limbs of yoga along with medical therapy pranayama plays a significant role in management of pulmonary, cardiac and other disease. In various diseases like Bronchial Asthma, COPD, DM, CAD, HT, Heart Failure, Bronchitis etc. pranayama not only controls the sign and symptoms of disease but also retards the progression of the disease. Thus it helps in improving the quality of life of the affected person.

In our study we have recruited 30 medical and paramedical students. Subjects practiced slow breathing pranayama i.e. nadi-shodhan pranayama. Their PFT was measured at the beginning, 6 weeks and 12 weeks after pranayama practice.

PFT Parameters included in the study: VC, MVV and PEFR.

Peak Expiratory Flow Rate

Peak expiratory flow rate is the maximum amount of expiratory flow rate that occurs after full inspiration. It depends upon effort of the individual with which a person can expire. [12] Increased PEFR signifies opening of smaller airways which are normally quiescent during normal breath. [13]

In our study we observed a significant increase in PEFR from basal to 12 weeks (Table 1) and it may be due to increase utilisation of physiological dead space. Subbalakshmi et al and other researchers observed a similar effect of significant increase in PEFR following practice of nadi-shodhan pranayama. [13-15]

Maximum Voluntary Ventilation

Maximum voluntary ventilation is the maximum amount of air that can be inhaled and exhaled with maximum effort in duration of 10-15 second. It depends upon respiratory muscle strength. [16,17] In our study we found a linear relationship between MVV and pranayama practice (Table 2). Similar to other studies conducted by Mooventhan and other researchers, we observed a significant increase in MVV after pranayama practice.

Vital Capacity

It is the maximum volume of air that can be expired when the patient exhales forcefully after a maximal inspiration. In our study we observed a significant increase in VC over the time (Table 3). Abraham and other researchers also depicted a significant increase in VC after performing slow breathing pranayama.

CONCLUSION

Effect of nadi-shodhan pranayama on PFT was studied over the time and concluded that: VC was found to be significantly raised after practicing nadi-shodhan pranayama. Increase in VC signifies complete emptying and fullness of air.

MVV was found to be increased significantly from basal to 12 weeks of pranayama practice.

PEFR was increased significantly from basal to 12 weeks. Thus demonstrating increase in respiratory muscle strength after practicing nadi shodhan pranayama.

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