

EFFECT OF YOGA PRACTICE ON PULMONARY FUNCTION TESTS AMONG ADOLESCENTS OF HILLY CITY IN NORTHERN INDIA

Gharu Yuvraj¹, Sanjay Dhiman², Puja Negi³, Lavinder⁴, Asha Negi⁵, Amit Sachdeva⁶

¹Associate Professor, Department of Physiology, Indira Gandhi Medical College, Shimla.

²Senior Resident, Department of Physiology, Indira Gandhi Medical College, Shimla.

³Senior Resident, Department of Physiology, Indira Gandhi Medical College, Shimla.

⁴Junior Resident, Department of Physiology, Indira Gandhi Medical College, Shimla.

⁵Junior Resident, Department of Physiology, Indira Gandhi Medical College, Shimla.

⁶Senior Resident, Department of Community Medicine, Indira Gandhi Medical College, Shimla.

ABSTRACT

BACKGROUND

Yoga is an ancient Indian Philosophy. Recent interest in Yoga is due to its beneficial effects on the various systems of the body and the way by which yoga exerts these effects. Yogic exercises when practiced regularly have shown to improve health and wellbeing. The present study was planned to find effects of 8 weeks Yoga practice on pulmonary functions in adolescents.

MATERIALS AND METHODS

The present study was an quasi experimental study which was conducted in Sarswati Vidya Mandir School, Vikasnagar, Shimla in coordination with department of physiology on 60 male students between the age of 14-17 years. They had to perform the yogic practices daily from 6am to 7am for about one hour. The observations were recorded by MEDSPIROR, in the form of vital capacity (VC), forced vital capacity (FVC), forced expiratory volume (FEV-1), FEV1/VC, FEV1/FVC, Forced Expiratory Flow (FEF) 25-75%, FEF 75-85% and Peak expiratory flow rate (PEFR) on day-1, after 4 weeks and 8 weeks of the yoga practice.

RESULTS

The study revealed that the Pulmonary Functions Tests (PFT) parameters like PEFR, FEF 75-85% were significantly increased at the end of 4 weeks of training but the PFT like VC, FVC, and FEV1/FVC were significantly increased at the end of eight weeks of training of yoga among school going adolescents of Shimla city.

CONCLUSION

From this study, we conclude that the yogic exercises are beneficial for the better maintenance of body functions, particularly pulmonary functions like VC, FVC, FEV1, FEV1/VC, FEV1/FVC, PEFR, FEF 25-75%, FEF 75-85%. So, yoga practice for 8 weeks can be advocated to improve respiratory efficiency in adolescents.

KEYWORDS

Vital Capacity, Peak Expiratory Flow Rate, Forced Vital Capacity, Forced Expiratory Volume.

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BACKGROUND

Yoga is a Sanskrit word which means "the unity of body and mind". It is a combination of breathing exercises, physical postures, and meditation, and has been practiced in eastern traditional medicine for over thousands of years.¹ Yoga has also been shown to be beneficial in the management of stress, anxiety and depression, aiding in the maintenance of mental health and improvement in overall respiratory performance.² It increases longevity and has therapeutic and rehabilitative effects.³

Yoga practice mainly consists of Asana (posture- a particular position of the body which contributes to steadiness of body and mind), Pranayama (to control the breathing in a superior and extra-ordinary way to get maximum benefits.) and meditation. It produces consistent physiological changes and has sound scientific basis.⁴ Yogic Asanas and Pranayama have been shown to reduce the resting respiratory rate. Furthermore, yoga increase timed vital capacity, and maximal voluntary ventilation, breath holding time, maximal inspiratory pressure and maximal expiratory pressure.⁵ Pranayama is an important component of Yoga training. Pranayama improves the air way reactivity in the asthmatic individuals. It was noted that high frequency breathing exercise resulted in more than tenfold increase in expired minute ventilation.⁶ A number of studies have been done to assess the effect of yogic practice on pulmonary functions.³⁻⁶ This improvement in vital capacity could be attributed to increase in development and strengthening of respiratory musculature in regular yoga practitioners.⁷

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Corresponding Author:

Dr. Sanjay Dhiman,
Senior Resident,
Department of Physiology,
Indira Gandhi Medical College, Shimla.
E-mail: drsanjudhiman@gmail.com
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Pulmonary function tests permits an accurate and reproducible assessment of the functional state of respiratory system.⁸ Practicing Yoga, in addition to its contribution in the improvement of pulmonary ventilation and gas exchange, helps in the prevention, cure and rehabilitation of many respiratory illnesses by improving ventilatory function.^{9,10} Pulmonary function is a long term predictor for overall survival rates and could be used as tool in general health assessment.¹¹

The present study has been done exclusively on young healthy males to add more data in the field of yoga and pulmonary functions. This study has been designed to assess the effect of Pranayamas (anulom-vilom, bhramari, bhastrika, kapalbhati), Asanas (Surya Namaskar, shavasana, mandukasana, halasana, dhanurasana, and pavanmuktasana), Aumkar citation and prayer on the specific pulmonary function parameters (VC, FVC, FEV1, FEV1/VC, FEV1/FVC, PEFr, FEF 25-75%, FEF 75-85%) and it determines that a practice of yoga for duration of 8 weeks has a favourable influence as it causes an improvement in the lung functions.

Objectives

To find out the change in lung functions tests of healthy adolescent boys after yoga training for 4 weeks and subsequently for 8 weeks

MATERIALS AND METHODS

Study Setting

It was an interventional observational study. The study was conducted in Sarswati Vidya Mandir School, Vikas Nagar Shimla in co-ordination with Department of Physiology.

Sample Size Calculation

Considering the mean difference in Vital capacity 15% before and after the intervention, standard deviation 0.5, variance 0.25, confidence interval 95%, power 80% and non-response rate 10%, total sample size come out to be 60.

Study Group

Male Students between 14 to 17 years of age were included in the study. Data on physical characteristics such as age, height was obtained. The students were explained about the importance and procedure of the study. An informed and written consent was obtained from all the students. All the data was collected at a fixed time of the day between 6 am to 7 am to minimize any diurnal variation. The students were asked not to change their lifestyle during the study and were instructed not to perform any other physical exercises if they were not doing the same regularly.

Inclusion Criteria

Young healthy males who were aged between 14-17 years.

Exclusion Criteria

1. The subjects with a history of allergic disorders or respiratory disorders.
2. Smoking.

3. Systemic disease like diabetes, hypertension and collagen disorders.
4. Treatment with beta-agonists or the Xanthene group of drugs.
5. Chest deformities like kyphosis and scoliosis.

All the students received same yoga training under the guidance of well-trained yoga instructor for a period of 8 weeks for 1hour daily, 6 days a week between 6:00am to 7:00am. The yoga practice schedule consisted of Pranayama and Asanas, which was concluded by prayer as: Mild warm up exercise, Surya Namaskar, Pranayamas (anulom-vilom, bhramari, bhastrika, kapalbhati), Asanas (shavasana, mandukasana, halasana, dhanurasana, and pavanmuktasana), Aumkar citation and prayer. At the end of 8 weeks of above mentioned Yogic practice, once again all the data of 60 subjects were assessed and recorded as done before the start of Yoga practice.

Pulmonary Function Tests (PFT)

The pulmonary functions were tested by using the instrument, 'Medspiror' (manufactured by Medicare Systems Pvt. Ltd., Chandigarh), a self-calibrating computerized spirometer that fulfils the criteria for standardized lung function tests which was available in the Department of Physiology.

Procedure

The students were familiarized with the set up and detailed instructions and demonstrations were given. The students were made to breathe out forcefully, following deep inspiration, into the mouthpiece which was attached to the spirometer. The expiration was maintained for a minimum period of 3-4 seconds. All the readings were taken with the students in the standing position.⁷ All the tests were carried out at the same time of the day, between 8.30 am to 9.30 am, to avoid the physiological and possible variations.¹² The tests were done in a quiet room to avoid the emotional and psychological stresses. Three such readings were taken then highest reading of these was taken as final one. The first phase of the recording of the pulmonary parameters was done at the beginning of their course, second phase of the recording was done after 4 weeks and third phase of the recording was done after 8 weeks of the regular yoga practice. The parameters of PFT included in the study were – vital capacity (VC), Forced vital capacity (FVC), Forced expiratory volume in 1st second (FEV1), FEV1/VC, FEV1/FVC, peak expiratory flow rate (PEFR), FEF 25%-75%, FEF (75%-85%).

Statistical Analysis

The data were analysed using Epi info v 7 software. The results of PFT were expressed as mean \pm S.D. Paired 't' test was applied and P values <0.05 & <0.01 were considered significant & highly significant respectively.

RESULTS

This study was conducted with the purpose of finding out the outcomes of Yoga practice on pulmonary functions in school going adolescents in Shimla city.

Table 1 depicts the demographic characteristics of study population. The age of the participants ranged from 14 to 17 years, the mean age of the students in the present study was 15.32 ± .84 years. The mean height (cm) was 167. 78 ± 9.20 at the start of study.

Variables	Mean	Standard Deviation
Age Group (yrs.)	15.327	.840
Height (ems)	167.78	9.206

Table 1. Demographic Characteristics of Study Students

Parameters	Day-1		After 4 wks.		After 8 wks.		P-value 0 day-4 wks.	P-value 0 wks.-8 wks.
	Mean	Sd	Mean	SD	Mean	SD		
VC	2.948	.527	2.954	.528	3.254	.479	.95	.002*
FVC	2.853	.591	2.672	.497	3.118	.349	.08	.005*
FEV1	2.4198	.598	2.267	.487	2.550	.527	.091	.098
FEV1/FVC	86.018	15.505	85.054	29.839	94.600	6.764	.832	.000*
PEFR	266.854	92.0596	329.8909	97.3389	311.939	141.368	0.000	.011*
FEF25-75%	3.2264	1.0541	10.9049	50.4300	4.3429	4.4184	0.265	0.54
FEF 75=85%	2.098	.7190	2.6856	.82152	2.3798	0.82493	0.000	0.001*

Table 2. Effect of Duration of Yoga on PFT along with Comparison at Different Follow up

Table 2 Shows that the VC, FVC, FEV-I, FEV1/FVC, FEV1/VC, FEF 25-75%, FEF 75-85% and PEFR of all the students on day-1, weeks-4 and weeks-8. The p value has been calculated at weeks-4 and weeks-8 in comparison to values on day-I. It is evident that the PFT parameters PEFR, FEF 75-85% were significantly increased at the end of 4 weeks of training but the PFT like VC, FVC, and FEV1/FVC were significantly increased at the end of eight weeks of training of yoga among school going adolescents of Shimla city. Thus, the training interventions could contribute to improve the pulmonary functions among healthy adolescents.

DISCUSSION

Patanjali, first exponent of yoga, described Pranayama as the gradual unforced cessation breathing and Asanas as different physical postures that makes muscles more strong and flexible.^{13,14} On analysing the results of present study on day-1, after 4 weeks and 8 weeks of regular yoga practice, it was found that there is highly significant improvement in all the pulmonary function parameters. In present study, VC, FVC, PEFR, FEV1/FVC, FEF 75-85% were significantly higher at weeks-8 from day-I (P<0.05).

Findings of significant VC, FVC of present study are consistent with other studies, Makwana et al reported significant increase in FVC following 10 weeks of yoga training.¹⁵ The improvement in vital capacity is due increased development of respiratory musculature incidental to regular practice of yogic exercise. Joshi et al reported significant increase in FVC and PEFR following 6 weeks of pranayam practice.⁵

Findings of significant increase in PEFR in present study are in consistent with other studies like Upadhyay et al & P S Raju et al showed the significant increase in PEFR. Increase in PEFR among our volunteers may be due to rise in thoracic pulmonary compliances and bronchodilatation.

Stimulation of pulmonary stretch receptors by inflation of the lung reflexly relaxes smooth muscles of larynx and tracheobronchial tree; this modulates the airways calibre and reduces airway resistance.^{15,16}

Pranayama like Kapalharti included in present yoga training schedule involves powerful strokes of exhalation, which trains the subject to make full use of diaphragm and abdominal muscles. Slow, deep and full inhalation and exhalation as in Anulom-vilom and Bhastrika pranayama also improves respiratory muscle strength.

These all above effects can be explained in further details on the following basis

I. Yoga postures (asanas) involve isometric contraction which is known to increase skeletal muscle strength. Yoga training improves the strength of expiratory as well as inspiratory muscles.¹² Yoga strengthens the respiratory musculature due to which chest and lungs inflate and deflate to fullest possible extent and muscles are made to work to maximal extent.⁵

II. Pranayama is characterized by slow and deep inhalation and prolonged exhalation. The stress is on more prolonged expiration and efficient use of abdominal and diaphragmatic muscles. This act trains the respiratory apparatus to get emptied and filled more completely and efficiently.¹⁴ Although a significant increase in all the pulmonary function parameters after the yoga practice in the present study is in accordance with the findings of other studies on effects of yoga practice in healthy individuals, the present study has some differences. The present study involved regular combined practice of Pranayama, Asana, Aumkar citation and prayer for 8 weeks, whereas many other studies reported the effects of individual pranayama, asana or meditation practice for different duration.¹⁷

CONCLUSION

Thus, the result and discussion as presented above revealed that yogic exercises are beneficial for the better maintenance of body functions, particularly pulmonary functions like VC, FVC, FEV1, FEV1/VC, FEV1/FVC, PEFR, FEF 25-75%, FEF 75-85% . It determines that a practice of yoga for duration of 8 weeks has a favourable influence in normal healthy adolescents as it causes an improvement in the lung functions. The results of this study justify the incorporation of yoga as part of our lifestyle and as a part of course in the medical field in promoting health.

Limitations

Research on particular set of Yogic exercises like only selected asana or pranayama is required and also further research with large sample size and for varied age groups and gender is required for applying these results to population in general.

REFERENCES

- [1] Barnes PM, Powell-Griner E, McFann K, et al. Complementary and alternative medicine use among adults: United States, 2002. *Adv Data* 2004;27(343):1-19.
- [2] Mandal B. Attitude towards yoga among secondary school students. *International Journal of Current Advanced Research* 2018;7(2):9769-9772.
- [3] Khanam AA, Sachdeva V, Guleria R, et al. Study of pulmonary and autonomic functions of asthma patients after yoga training. *Indian J Physiol Pharmacol* 1996;40(4):318-324.
- [4] Gopal KS, Bhatnagar OP, Subramanian N, et al. Effect of yogasanas and pranayamas on blood pressure, pulse rate and some respiratory function. *Indian J Physiol Pharmacol* 1973;17(3):273-276.
- [5] 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(2):105-108.
- [6] Frostell C, Pande JN, Hedenstierna G. Effects of high-frequency breathing on pulmonary ventilation and gas exchange. *J Appl Physiol Respir Environ Exerc Physiol* 1983;55(6):1854-1861.
- [7] Udupa KN, Singh RH. The scientific basis of yoga. *JAMA* 1972;220(10):1365.
- [8] Nayar HS, Mathur RM, Kumar RS. Effects of yogic exercises on human physical efficiency. *Indian J Med Res* 1975;63(10):1369-1376.
- [9] Miles WR. Oxygen consumption during three yoga-breathing patterns. *J Appl Physiol* 1964;19:75-82.
- [10] Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. *Indian J Physiol Pharmacol* 2001;45(4):493-496.
- [11] Udupa KN, Singh RH, Settiwar RM. Studies on the effect of some yogic breathing exercises (Pranayams) in normal persons. *Indian J Med Res* 1975;63(8):1062-1065.
- [12] Mandanmohan, Jatiya L, Udupa K, et al. Effect of yoga training on handgrip, respiratory pressures and pulmonary function. *Indian J Physiol Pharmacol* 2003;47(4):387-392.
- [13] Bhaduri S. *Yoga-sutra of patanjali*. New Delhi: D.K Printworld (P) Ltd 2006.
- [14] Makwana K, Khirwadkar B, Gupta HC. Effect of short-term yoga practice on ventilator function tests. *Indian J Physiol Pharmacol* 1988;32(3):202-208.
- [15] Upadhyay DK, Malhotra V, Sarkar D, et al. Effect of alternate nostril breathing exercise on cardiorespiratory functions. *Nepal Med Coll J* 2008;10(1):25-27.
- [16] Raju PS. Effect of aerobic exercise and yogasanas on peak expiratory flow rate among obese men. *International Journal of Current Advanced Research* 2014;3(1):1-3.
- [17] Bhole MV. Treatment of bronchial asthma. *Yoga Mimamsa* 1967;9:33-41.