

Effect of Yoga (Pranayama and Suryanamaskar) on Cardio Pulmonary functions among Adults.

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Abstract

Background: Yoga has been an ancient practice in India which promises many benefits both physical and mental. Present study was to assess the effect of long term practice of yoga on cardiorespiratory functions.

Method: The study was conducted on 64 subjects of age 20-65 years. Study group consisted of 32 yoga practitioners, practicing yoga daily for a minimum period of one year. Control group consisted of 32 subjects who never practiced yoga or any other exercises. Data on physical characteristics such as age, height, weight and Body Mass Index were obtained. Cardio respiratory parameters were assessed among both the groups.

Results: The mean Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure and Mean arterial pressure, Respiratory rate was significantly lower among yoga group compared to non yoga group. The mean breath holding time, forced vital capacity, forced expiratory volume in one second, peak expiratory flow rate and maximum volume ventilation are higher among yoga group

Conclusion: Regular practice of yoga improves the cardiopulmonary functions in both genders among healthy individuals hence we conclude that yoga practice can be incorporated in our lifestyle and hence prevents cardio respiratory disease in future.

Keywords: Yoga, Cardiopulmonary functions, Spirometer.

Introduction

Yoga is said to be psycho-somatic-spiritual discipline for achieving coalition and consonance between our body and mind. The term Yoga has its verbal root as 'Yuj' in Sanskrit which means 'Joining' ¹. The origin of yoga dates back to the Indus Valley Civilization (3300-1900 BC) as well as the Eastern states of India. There is also the prediction in our indispensable history of an early form of yoga known as Nirodhayoga (yoga of cessation) at the time of Mahabharata ². Yoga is an ancient Indian philosophical and religious tradition discipline designed to bring balance and health to the

physical, mental, emotional and spiritual dimensions of the individual. The benefits of yoga are innumerable and at the same time indispensable for a harmonial life ³.

Among all the benefits a few of them include increase in agility and strength of the body, enhancement of memory and the cognitive functioning of the brain, increase in efficiency of respiration and cardiac activity, prevention of degenerative disease and the increase in parasympathetic dominance ⁴. Breath is one of the mystery and the deeper mystery of our consciousness. One of few mechanisms contributing to a state of calm alertness includes increased parasympathetic drive. By voluntarily controlling breathing patterns, it is possible to influence autonomic nervous system functions, including heart rate variability and cardiac vagal tone, chemoreflex sensitivity. The act of concentration while performing pranayama removes the attention from worldly worries and de-stress him. This decreases adrenaline release which in turn decreases sympathetic activity, decreases heart rate, respiratory rate and blood pressure ⁵.

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Pranayama improves overall performance of the body. The regular practice of pranayama increases chest wall expansion and almost all lung functions. The beneficial effect of different pranayama is well reported and has sound scientific basis ⁶. Pranayama makes efficient use of abdominal and diaphragmatic muscles and improves the respiratory apparatus ⁷. 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.⁸

Much of information is available only with short term practice of yoga and their effects on cardiorespiratory functions. Hence our present study is to assess the effect of long term practice of yoga on cardiorespiratory parameters.

Material and Method

Type of the study: This is a cross sectional comparative study for duration of 2 months, conducted at Madikeri, Karnataka.

Study population: comprises of 64 healthy subjects of both sex in the age group of 20 to 65 years. The subjects were divided in to two groups. Study group consisting of 32 healthy subjects, selected randomly from a group of regular yoga practitioners practicing yoga daily for a minimum period of one year. Control group consisting of 32 healthy subjects who never practiced yoga or any other exercises.

Sample size: This sample size was found enough to estimate the cardiorespiratory parameters with 10% allowable error and 80% power.

Inclusion criteria:

Study group consists of yoga practitioners, practicing yoga daily for a minimum period of one year, in the age group of 20 to 65 years.

Control group consists of subjects who never practiced yoga or any other exercises in the age group of 20 to 65 years.

Exclusion criteria: The subjects with history of major respiratory, cardiac illness or neurological disorders or with history of major surgery in the recent past, smoking, alcohol consumption, obesity and pregnant females were excluded from our study.

Study Design: The study was performed after obtaining ethical clearance from institutional ethical

committee and after receiving informed and written consent from all the participants.

All the data were collected at a fixed time of the day between 6am to 8am to minimize any diurnal variation.

Data on physical characteristics such as age, height, weight and Body Mass Index were obtained. Parameters such as Heart rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Respiratory Rate (RR), Breath holding time (BHT), Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), peak expiratory flow rate (PEFR) and Maximum ventilatory Volume (MVV) were assessed among both the groups.

Heart rate (beats/min) was measured with help of ECG in lead II. Blood Pressure (SBP and DBP mm of Hg) was recorded in supine position in the right upper limb by using mercury sphygmomanometer after rest for 5 minutes. Three readings were taken at an interval of 15 minutes each and average of the three values calculated. Respiratory rate (breaths/min) was taken clinically by inspection. Subject was asked to lie in supine position on examination table in well ventilated and well lighted examination room. Clothing from the chest and abdomen was removed. Frequency of breathing was counted by observing abdominal wall movement for a full one minute from foot end position. Three such reading taken at the interval of 5 minutes and average is taken as a final reading.

Breath holding time was measured in seconds from the time of holding breath after quit expiration till the breaking point of the held breath by using stop watch in comfortable sitting position in which subjects were asked to hold breath by closing both nostril voluntarily by pinching nose between his/her thumb and index finger and closed mouth.

Forced vital capacity (FVC), Forced Expiratory Volume in one second (FEV1), Maximum Ventilatory Volume (MVV) and peak expiratory flow rate (PEFR) were recorded using computerised spirometer-RMS Medispiror Helios 702. All the subjects were made acquainted with spirometer before actual recording.

For recording of FVC, FVC test was done on medispiror. The procedure was explained to subject before carrying the test. They were asked to practice the procedure. After sufficient exposure to practice the subjects were asked to begin relaxed tidal breathing

through the mouth piece fixed over the transducer and then to take a deep breath in and to blow out as hard and fast as possible and continue blowing until no more air can be exhaled, then to take another deep breath back in, with mouth piece still in the mouth until lungs are full. It was ensured that a tight seal was maintained between lips and mouth piece of spirometer, nose clip was applied to close the nostrils. Three readings were taken and then highest reading of these was taken as final one.

For recording MVV the subjects were asked to breathe deeply and quickly for 15 seconds through mouth piece of spirometer. Nose clip was applied to prevent air leak through nostrils. Three readings were taken and best was considered as final one.

Statistical method: Mean and standard deviation of all parameters in the two groups under study were calculated. An Independent-Samples 't' Test procedure was applied to compare the means of parameters between study and control groups. Statistical analysis was carried out through the SPSS for Windows (version 16.0). P value of <0.05 was considered as statistically significant.

Results

The present study included 64 subjects (32 yoga practitioners and 32 non yoga practitioners) in the age group of 20-65 years. The age and anthropometric parameters of subjects are depicted in Table 1 as mean \pm standard deviation (SD). The Mean \pm S. D values of age and height showed no significant difference between two groups. The Mean \pm S. D. values of weight and Body Mass Index were significantly lower among yoga group compared to non yoga group.

Table 1: Comparison of age and physical parameters among yoga and non yoga practitioners.

Parameters	Yoga practitioners (Mean \pm S. D)	Non-yoga practitioners (Mean \pm S. D)	P-value
Age (in years)	48.33 \pm 14.15	46.23 \pm 10.10	0.733
Height (in cm)	161.77 \pm 6.10	164.27 \pm 8.07	0.181
Weight (in Kg)	55.13 \pm 6.25	75.00 \pm 8.57	0.001*
BMI (kg/m ²)	21.00 \pm 1.27	27.79 \pm 2.25	0.001*

The mean heart rate, Systolic Blood Pressure, Diastolic Blood Pressure and Mean arterial pressure, Respiratory rate was significantly lower among yoga group compared to non yoga group. The mean breath holding time, forced vital capacity, forced expiratory

volume in one second, peak expiratory flow rate and maximum volume ventilation are higher among yoga group compared to non yoga group as shown in Table 2.

Table 2: Comparison of cardiopulmonary parameters among yoga and non yoga practitioners.

Parameters	Yoga practitioners (Mean \pm S. D)	Non-yoga practitioners (Mean \pm S. D)	P-value
Heart rate	70.53 \pm 2.90	75.67 \pm 3.71	0.001*
SBP	113.27 \pm 7.72	124.07 \pm 5.81	0.001*
DBP	72.73 \pm 3.50	80.27 \pm 4.66	0.001*
PP	40.00 \pm 6.98	43.33 \pm 4.61	0.026
MAP	86.24 \pm 4.50	94.87 \pm 4.45	0.001*
Respiratory Rate (per min)	12.50 \pm 20	16.70 \pm 1.71	0.001*
Breath holding time (sec)	46 \pm 50	33 \pm 60	0.001*
FVC (L)	2.89 \pm 0.56	2.15 \pm 0.64	0.001*
FEV1 (L)	3.64 \pm 0.50	2.82 \pm 0.45	0.001*
PEFR (L/S)	6.5 \pm 1	4.4 \pm 1	0.001*
MVV (L/min)	109 \pm 22	94.18 \pm 24	0.001*

Discussion

The purpose of this research work was to study the effect of yoga on cardio-respiratory functions. The study was conducted on 64 subjects of age 20-65 years. Data on physical characteristics such as age, height, weight and Body Mass Index were obtained. Parameters such as Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, Respiratory Rate, Breath Holding Time, Forced Vital Capacity, Forced Expiratory Volume in one second, peak expiratory flow rate and Maximum Ventilatory Volume were assessed among both the groups.

In our study heart rate, systolic blood pressure and diastolic blood pressure were significantly lower among yoga practitioners when compared to non yoga practitioners. Lower values of heart rate and blood pressure among yoga practitioners indicates shift in the balancing components of autonomic nervous system towards the parasympathetic activity. This modulation of autonomic nervous system's activity might have been brought about through the conditioning effect of yoga on autonomic functions and mediated through the limbic system and higher areas of central nervous system.

Yoga by modifying the state of anxiety reduces stress-induced sympathetic over activity thereby

decreasing arterial tone and peripheral resistance and resulting in decreased diastolic blood pressure and heart rate^{9, 10}. The results of our study are consistent with Indla Devasena et al, who have observed reduction in heart rate and blood pressure after 6 months of yoga practice¹⁰. In our study the respiratory rate was significantly lower among yoga practitioners when compared to non yoga practitioners. Earlier study also has showed the similar result^{2, 11, 12}. In our study the lower respiratory rate among yoga practitioners is probably due to pranayama. Respiration during pranayama practice i.e. conscious process of respiration which is very much regulated one, is under the control of pneumotaxic respiratory centre. Pneumotaxic centre will control the apneustic centre which has its role in normal quiet breathing. So this regulated pattern of breathing during pranayama may be adopted by apneustic centre in normal quiet breathing leading to decreased rate of respiration. In addition the relaxation technique and meditation produce state of restful alertness. It decreases the anxiety state and help to reduce respiratory rate¹².

In our study the breath holding time was significantly higher among yoga practitioners when compared to non yoga practitioners. The result of our study is consistent with Reena et al, who have observed improvement in breath holding time on regular practice of yoga for 12 weeks¹³. This may be due to acclimatization of the chemoreceptors of lungs to hypercapnea and hypoxia or decreased responsiveness of respiratory centre or increased development of respiratory musculature leading to increased muscle endurance and delayed fatigue thus allowing breath holding for longer time among yoga practitioners⁷. The present study has shown significant higher values of forced vital capacity, forced expiratory volume in one second, peak expiratory flow rate and maximum ventilatory volume among yoga practitioners when compared to non yoga practitioners. Higher values of the above respiratory parameters among yoga practitioners can be explained on following basis,

Regular yoga practice increases the strength of respiratory musculature. Regular efficient usage of respiratory muscle causes their bulk to increase, strengthen the elastic & collagen fibres and increase the extensibility of chest wall and lungs thereby allowing the lungs to inflate and deflate to their fullest. Pranayama cleanses the secretions from respiratory passages and alveoli, decreasing the resistance to the air flow, making room for more air, consequence of which there is full and free utility of alveoli¹⁴. Lung inflation near to total

lung capacity in pranayama acts as a major physiological stimulus for the secretion of pulmonary surfactant and prostaglandins. Pulmonary surfactant increases the lung compliance and prostaglandins reduce the bronchiolar smooth muscle tonicity thereby allowing more air to enter into lungs which leads to increase of lung volumes and capacities¹⁵. During pranayama lungs inflate to the fullest resulting in stimulation of stretch receptors which reflexively relaxes smooth muscles of larynx and Tracheo-bronchial tree, thereby improving the lung volumes and capacities. Pranayama with its calming effects on mind, reduction of emotional stress and shift in the balancing components of autonomic nervous system towards the parasympathetic activity results in withdrawal of the bronchoconstrictor effect thereby relaxing smooth muscles of bronchi, thereby we can appreciate hike in the values of pulmonary function parameters¹⁶.

Conclusion

The following conclusions were drawn from our study on effect of yoga on cardiorespiratory functions. Yoga improves cardiovascular functions as observed from lower heart rate and blood pressure among yoga practitioners. This may be due to an overall parasympathetic dominance over sympathetic system with an improvement in cardiovascular endurance. Yoga also improves ventilatory function of lungs as shown by increase in forced vital capacity, forced expiratory volume in one second, peak expiratory flow rate and maximum ventilatory volume and increase tolerance to carbon dioxide as shown by higher breath holding time and decrease rate of respiration.

Regular practice of yoga improves the cardiopulmonary functions in both genders among healthy individuals hence we conclude that yoga practice can be incorporated in our lifestyle and hence prevents cardio respiratory disease in future.

Conflict of Interest: NIL

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Ethical Clearance: The study was approved by Institutional ethical committee.

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