

RESEARCH ARTICLE

The effect of yoga on cardiorespiratory and physical efficiency of the healthy subjects

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ABSTRACT

Background: Yoga as an exercise regime improves the physical and mental well-being in humans. Regular practice of yoga has positive impact on vital parameters of an individual. However, data pertaining to the effect of yoga on cardiorespiratory parameters in South Gujarat region is least available. **Aims and Objectives:** This study was undertaken to find out the effects of yoga on cardiorespiratory parameters in healthy subjects in South Gujarat region. **Materials and Methods:** This study was conducted on age-matched healthy individuals ($n = 80$) with the age group of 25–60 years. They were divided into control group ($n = 40$) and yoga group ($n = 40$). Yoga intervention was given to yoga group for 10 weeks continuously. Weight, chest girth, chest expansion, pulse rate, blood pressure, RR, tidal volume, breath holding time, vital capacity, expiratory pressure, Population Foundation of India (PFI), and work done were measured in both the groups before and after the yogic intervention. Data were compared using Chi-square test. $P < 0.05$ was considered for the statistical significance. **Results:** Significant ($P < 0.05$) improvement was noted in cardiorespiratory parameters, PFI and work done than their respective baseline values. Further, changes in weight, chest girth, and chest expansion were observed to be non-significant compared to their baseline values. **Conclusion:** This study shows that yogic practices promote and improve respiratory and cardiovascular function and enhance physical fitness.

KEY WORDS: Yoga; Blood Pressure; Pulse Rate; Tidal Volume; Breath Holding Time; Physical Fitness Index

INTRODUCTION

Yoga comes from the Sanskrit word “Yug” which means union, specifically the union of mind, body, and spirit. Originating in Tibet and India over 3000 years ago, yoga is one of the world’s oldest branches of spiritual inquiry and physical exploration. Yoga is described as a path for transcending the ordinary mind

(who you think you are) to merge with your “Higher self.” Yogic postures are specifically devised to endow the vital organs to function without giving fatigue to the muscles.

In recent years, a lot of research studies have shown that yoga can be useful not only in prevention, control, and rehabilitation of many diseases^[1,2] but also in acute cases of asthma.^[3] Yoga techniques reduce anxiety and depression,^[4] keeping the body supple, fit, and strong. It also gives a feeling of well-being. Yoga helps by increasing oxygen supply to the brain, improving memory, and increasing ability to focus attention for long periods.

This work is being undertaken to find out “The effect of yoga on cardiorespiratory and physical efficiency of the subjects.”

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In recent years, the benefits of yoga are being more and more realized and used in prevention, control, and rehabilitation of many diseases, and in physical training of players and athletes in many parts of the world. Yoga study is becoming more and more popular among people and scientists all over the world. Many generations of very hard working, sincere, and devoted yogis have divulged the knowledge and techniques of yogic practices to the scientific world today. It is necessary that medical science, in particular, should pay due attention to the investigations of yoga.

It is evident now that stress and strain are definite factors in the etiology of several chronic diseases. Yoga therapy could form the basis of prevention and permanent cure of these psychosomatic problems. Yoga is a system of exercises by means, of which the person develops resistance toward stress and strain. Regular practice of yoga is one of the best forms of relaxation.

MATERIALS AND METHODS

This study was conducted on 80 healthy subjects with the age group of 25–60 years, of which 40 subjects were given yoga intervention by performing regular yoga asanas at Aeroyog, Dreamland Arcade - 2nd Floor - 204, Tithal Road, Valsad, Gujarat, under the guidance of a yoga instructor continuously for 10 weeks, and rest 40 subjects were selected as control group.

This study was approved by the institutional ethics committee of GMERS Medical College, Valsad. An informed written consent was taken from all the subjects.

All the subjects were examined twice, first immediately before they started yoga practice and then after 10 weeks

of yoga practice. Height, weight, and chest measurement were taken for both groups. Cardiac parameters such as pulse rate (PR), blood pressure (BP) (systolic and diastolic BP), and fitness index were calculated using Harvard step test. Respiratory parameters such as tidal volume (TV), vital capacity (VC), respiratory rate, breath holding time (BHT), and expiratory pressure were recorded in both the groups.

All the candidates, except control cases, performed yoga asanas daily in the morning hours from 6:00 am to 7:30 am at the yoga centers, under the supervision of qualified yoga instructors, for a period of 10 weeks.

Yoga exercises included Surya Namaskar for 8 min, Sharir Sanchalan for 15 min, and asanas (Padmasana, Sarvangasana, Vajrasana, Halasana, Chakrasana, Dhanurasana, Bhujangasana, Ardha Paschimottanasana, and Matsyasana) for 40 min followed by Pranayam for 25 min and Prayer for 2 min.

RESULTS

The findings of the present study are presented in Tables 1-5.

DISCUSSION

In Table 1, we observed that after 10 weeks of yogic exercise, there was non-significant change in the mean value of body weight ($P = 0.813$), chest girth ($P = 0.8172$), and chest expansion ($P = 0.7918$). Similarly, the control group also did not show any significant change in these parameters. Another study by Nayar *et al.*^[5] also found that there is non-significant change after 6 months of yoga. While Makwana and associates^[6] observed significant fall in weight, but

Table 1: Comparative study of physical examination between control and yoga group

Examination	Control group			Yoga group		
	Mean with SD effective			Mean with SD effective		
	I	II	P-value	I	II	P-value
Weight (Kg)	63.600±8.182	64.053±8.679	0.8840	65.320±9.886	64.713±9.902	0.8131 (insignificant)
Chest girth (cm)	85.073±3.049	85.113±3.062	0.9716	87.170±8.009	86.683±8.232	0.8172 (insignificant)
Chest expansion (cm)	3.367±1.488	3.400±1.409	0.9502	3.570±1.324	3.657±1.205	0.7918 (insignificant)

SD: Standard deviation

Table 2: Comparative study of cardiac parameters

Examination	Control group			Yoga group		
	Mean with SD effective			Mean with SD effective		
	I	II	P-value	I	II	P-value
PR (min)	78.533±8.391	78.867±7.140	0.9075	80.067±7.292	70.633±5.209	<0.001 (significant)
BP systolic (mmHg)	128.933±8.102	128.400±6.685	0.8455	129.400±10.842	116.733±6.977	<0.001 (significant)
BP diastolic (mmHg)	81.733±4.301	81.333±5.014	>0.05	82.600±6.371	76.200±5.182	<0.001 (significant)

SD: Standard deviation, BP: Blood pressure, PR: Pulse rate

Table 3: Comparative study of respiratory parameters

Examination	Control group			Yoga group		
	Mean with SD effective			Mean with SD effective		
	I	II	P-value	I	II	P-value
Respiratory rate (min)	16.867±2.924	17.000±2.726	0.8981	17.267±2.363	13.900±1.470	<0.001 (significant)
TV (ml)	418.333±78.755	420.000±74.522	0.9529	437.500±91.385	459.333±83.982	0.3392 (insignificant)

SD: Standard deviation, TV: Tidal volume

Table 4: Comparative study of respiratory efficiency parameters

Examination	Control group			Yoga group		
	Mean with SD effective			Mean with SD effective		
	I	II	P-value	I	II	P-value
BHT (s)	41.733±5.625	41.200±5.441	0.7937	44.467±12.199	61.267±14.029	<0.001 (significant)
VC (ml)	2416.667±348.039	2390.000±343.927	0.8343	2580.000±477.800	2936.667±442.258	<0.05 (significant)
Expiratory pressure (mmHg)	82.400±15.733	81.733±14.079	0.9035	73.667±13.275	81.400±14.794	<0.05 (significant)

SD: Standard deviation, BHT: Breath holding time, VC: Vital capacity

Table 5: Comparative study on cardiac and physical efficiency parameters

Examination	Control group			Yoga group		
	Mean with SD effective			Mean with SD effective		
	I	II	P-value	I	II	P-value
Harvard step test (%)	77.800±11.156	76.933±10.512	0.8282	75.600±9.717	82.167±9.717	<0.05 (significant)
Work done by cycle ergometer (kg-m ²)	509.267±179.559	542.667±206.906	0.6404	520.000±188.990	766.033±251.365	<0.001 (significant)

only in overweight subjects ($P < 0.005$) after 2 months of yoga practice, chest girth and chest expansion did not show significant improvement. Udapa and Singh^[7] in his study showed that Shirshasana, Bhujangasana, Shalabhasana, and Mayurasana lead to reduction in weight and significant increase in chest girth and chest expansion in his study after 6 months of yoga practice.

In Table 2, yoga group showed significant decrease in PR ($P < 0.001$), systolic BP ($P < 0.001$), and diastolic BP ($P < 0.001$). In the control group, the change was insignificant ($P < 0.907$). The study conducted by Khanam *et al.*^[8] also observed significant fall in resting PR and BP in nine asthmatics following yoga ($P < 0.05$). Our readings also match with the study of Bowman and Murray,^[9] Naveen and Telles,^[10] Makwana *et al.*,^[6] Mohan and Vanane,^[11] Nayar *et al.* and,^[5] etc., change in PR is mediated through the conditioning effects of yoga practices on autonomic nervous system and through limbic system.^[12]

Table 3 shows respiratory rate in the yoga group fell from a mean value of 17.26 ± 2.3 to 13.9 ± 1.4 ($P < 0.001$) while the control group did not show significant changes. Our observations matched with similar studies.^[6,7,13,14] While in one study,^[5] they did not find any changes in respiratory rate. A possibility is that yoga practitioners have more TV than the

non-yogic persons and thereby fulfill the total O₂ demand of body even by low rate of respiration.

TV did not show significant changes in both the groups ($P > 0.05$). Similarly, Sachdeva *et al.*^[15] and Makwana and Khirwadkar^[6] also recorded insignificant changes in TV of yoga practitioners while Gopal *et al.*^[16] recorded a significant increase in TV after 6 months of yoga practice.

Table 4 shows that BHT, VC, and expiratory pressure in the yoga group were found to have increased significantly. Similar observations were recorded in other studies.^[5-7,13,16-19]

The regular practice of yogic exercises increases the development of respiratory musculature which improves the vital capacity of the subjects.^[19,5] In some yogic exercises, short powerful strokes of exhalation in quick succession train the subject to make full use of the diaphragm and abdominal muscles in breathing. It also helps in the removal of secretion from bronchial tree, clearing up the respiratory passage and the alveoli, making room for more air. Pranayam, on the other hand, is characterized by slow and deep inhalation and exhalation. The stress is on prolonged expiration and an efficient use of abdominal and diaphragmatic muscles. This act trains the respiratory apparatus to get emptied and filled more completely and efficiently. Some types of yogic

breathing create negative pressure in abdominal and thoracic cavity,^[20] raising the diaphragm at a higher level than its normal excursion. Due to removal of undue tension from the skeletal muscles in yogic exercises, the thorax relaxes better than before.^[17]

In Table 5, fitness index as assessed by Harvard step test showed improvement in the yoga group ($P < 0.05$). Our observation matched with similar studies.^[6,15]

The work done was calculated by bicycle ergometry. In the yoga group, it increased from a mean value of 520.00 ± 188.9 to 766.03 ± 251.3 ($P < 0.001$),^[7] while the control group, it did not show any significant improvement.

CONCLUSION

This study concludes that yogic exercises have a great value in improving cardiorespiratory efficiency, general health, and physical fitness. Its role in prevention, control, and rehabilitation of many diseases is also beyond any doubts. Yoga should be popularized among general public as a health-promoting measure. However, still, there is much scope of further study to evaluate specific *asanas* for improving specific parameters.

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