To Evaluate Effects of Long-Term Yoga on Cardiovascular System

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Abstract

Background: Yoga practices are known to improve the performance & working capacity of a person by slowing down the aging process.

Aim:

The present study was conducted to ascertain the effect of long-term Yoga on the cardio pulmonary system.

Settings and Design:

The parameters studied were pulse rate, systolic blood pressure, diastolic blood pressure, rate pressure product, respiratory rate, and peak expiratory flow rate.

Methods and Material:

50 subjects above 45 yrs. of age (mean age 50.02 ± 5.8) practicing Yoga for 5 years. Another 50 subjects of the same age group studied as control were not performing Yoga or any type of Physical Exercise.

Results:

From the present study, it is revealed that there is a statistically significant reduction in pulse rate, systolic blood pressure, diastolic blood pressure & rate pressure product. There was a significant increase in PEFR & decrease in respiratory rate.

Conclusions:

Long-term Yoga keeps cardiopulmonary parameters within normal limits by slowing the aging of the cardiovascular & pulmonary systems.

Keywords: Yoga – Pulse rate (PR) –Respiratory rate (RR)
Blood Pressure (BP) – Rate pressure product (RPP)
Peak expiratory flow rate (PEFR)

Introduction:

Yoga is an ancient system of Indian Philosophy Yoga Sadhana leads to harmony and perfection of body and mind. Yoga performed for a longer duration shows a slowing effect on the aging process of the body and increases longevity of the human being (1,2,3,4,5). Aging is inevitable and the cardiovascular & pulmonary system which holds key positions in the body, is not escape from it. Yoga exercises involve physical, mental spiritual task comprehensively.

As age advances the efficiency of the cardiopulmonary system reduces (6, 7). Yoga maintains this efficiency of cardiopulmonary regulatory mechanisms by maintaining a balance between the sympathetic & parasympathetic systems (8,9,10). Thus maintaining homeostasis.

The present study was undertaken to ascertain the effect of Yoga in long-term on slowing down the biological aging of the cardiovascular system & pulmonary system.

The parameters studied were pulse rate, systolic blood pressure, diastolic blood pressure & rate pressure product, respiratory rate & peak expiratory flow rate. In our study we observed that Yoga practice performed for long duration helps in reducing morbidity & mortality due to cardiovascular & pulmonary diseases by maintaining Pulse rate, BP, RPP, RR & PEFR within normal range, in spite of an increase in chronological age.

Material and Methods:

The present study was case-control study. The study groups included 50 subjects above 45 years of age (Mean 50.02 ± 5.8) performing Yoga since 5 years.
Another 50 subjects of the same age group were studied as the control group who were not performing yoga or another type of exercise.

The study was conducted in the centre of Yoga. All subjects were nonsmokers, non-alcoholics & were not suffering from any major Cardiopulmonary disease. All subjects of the study group were performing yoga, asanas, pranayam, and kriyas along with meditation since 5 years.

All subjects were examined around 7-8 am under similar conditions of rest, fast & environment, at above mention centre.

The physical characteristics as age, sex, height, weight, and body mass index of both groups were recorded. The parameters recorded were pulse rate, systolic & diastolic blood pressure, rate pressure product respiratory rate, and PEFR.

The rate pressure the product which is an index of myocardial oxygen consumption was calculated as product of heart rate & systolic blood pressure divided by 100.

$$RPP = \frac{HR \times SBP}{100}$$

The observations were subjected to statistical analysis.

Results:

The parameters subjected to students t-test after obtaining mean values. Table number one & two show the mean values of different physical characteristics & parameters respectively. Along with its comparison with the control group. P value less than 0.05 is considered significant.
(Table No. 1)

The mean value of age, height, weight, and BMI (Body Mass Index) in the study group was not showing a significant difference from the control group, though they had been performing yoga for 5 years.
(Table No. 2)
The mean value of pulse rate was lower in the study group than the control group (statistically significant $P<0.001$)
The mean values for systolic blood. Pressure and diastolic blood pressure were significantly less ($P<0.001$ & $P<0.001$) respectively, when compared with the control group.
The mean values of the Rate pressure product were statistically less ($P<0.01$) in the study group as compared control group.
(Bar Chart/Graph)
Similar changes were observed with pulmonary parameters. There was a significant decrease in respiratory rate with a significant increase in peak expiratory flow rate.

Discussion:

Environmental conditions and a variety of stresses, and anxiety, influence the cardiopulmonary response through the effect of higher cerebral cortical centres. The cerebral cortex controls the vasomotor centre through hypothalamus.

Cortical impulses in stress can cause a rise in the blood pressure & pulse rate due to a rise in sympathetic activity. In the subjects performing yoga blood pressure is maintained within normal limits. This indicates that stressful factors can be made ineffective from their harmful effects by achieving control of mind by yoga. The above observation has been supported by studies conducted by other (1,2,3,4).

Rise in blood pressure is also a result of the aging process, which is slowed down in persons practicing yoga. The Respiratory Rate (RR) is under the control of the autonomic nervous system (involuntary) along with cortical control (voluntary). The respiratory parameter (RR) showed a significant decrease which was maintained as long as yoga practice was continued. Yoga exercises especially different types of pranayamas help to maintain a slight higher parasympathetic tone indicated by a decrease in respiratory rate. Less respiratory rate also indicates maintenance of respiratory efficiency. These observations are supported by similar studies (5,6,7 and 8,9,10,11). The Peak Expiratory Flow Rate (PEFR) showed a significant rise in the study group.

The present study was undertaken to ascertain the importance of long-term yoga practice on cardiorespiratory functions and its role in delaying the aging process. Internal environmental stability is achieved by a perfect balance between the sympathetic and parasympathetic activity. Thus maintaining homeostasis.

Hess and Brigger in 1943 produced a response similar to the increased activity of the sympathetic nervous system by stimulating the particular area of the Hypothalamus. Similarly by simulating particular areas of the hypothalamus decreased activity of the sympathetic system and increased parasympathetic activity were observed. Prof. B. K. Anand Baldev Singh, Chinna (Indian Physiologist from All India Institute of Medical Science) studied different physiological parameters in persons performing yoga and their observations were complementary to the study performed by Hess. Madhuri Tolahunase and Rima Dada observed that Yoga and Meditation based lifestyle intervention reduced the rate of cellular aging (3). Marshall Hagins, McCaffrey R and Murugesan R also observed effective control of Blood

Pressure and other cardiorespiratory parameters maintaining the efficiency of the myocardium (12,13,14). The role of yoga and meditation in the management of stress has also been observed (15,16).

Yoga exercise involves physical, mental spiritual task comprehensively. These yoga exercises performed for longer duration changes the cerebral cortical influence on the hypothalamus which in turn regulates the vasomotor center, by decreasing the sympathetic tone and increasing parasympathetic tone. The ultimate result is a decrease in systolic as well as diastolic blood pressure, and reduced pulse rate.

In our study the mean values of Pulse rate, systolic blood pressure, diastolic blood pressure and rate pressure product were significantly less as compared to the control group, there was a similar response to pulmonary parameters such as a decrease in respiratory rate and an increase in peak respiratory flow rate.

The various studies performed by others on the effect of yoga on cardiovascular system obtained similar results (17,18). Jotsna R Bharshankar & others of Government Medical Collage Nagpur observed similar results when studied the effect of yoga on Cardiovascular system in 2001.

Kaviraj Udupa also observed similar changes in blood pressure pulse rate in 2003. Thus our observations have been supported by studies conducted by others (17,18,19)

The rate pressure product is an indicator of the consumption of oxygen by myocardium yoga practices especially Pranayam maintains increased parasympathetic tone & reduces catabolic activity thus reducing the requirement of O_2 by the myocardium. A study conducted by Bijalani RL in 2003 observed similar results.

Yoga exercises especially Pranayam improve pulmonary ventilatory capacity by increasing chest wall expansion. Pranayam exercise increases strength of contraction as well as relaxation of respiratory muscles which increases muscle strength & endurance (18,19,20,21). There is also a decrease in airway resistance due to better relaxation of respiratory muscles. This results in pulmonary efficiency (22,23,24). Short-term Yoga improves ventilatory functions and decrease blood pressure (25,26).

Conclusions:

From our study, it is ascertained that yoga stabilities autonomic equilibrium by decreasing sympathetic activity & maintains parasympathetic dominance through controlling cortical and hypothalamic activities. In turn this keeps the efficiency of cardiovascular system & pulmonary system in spite of increasing age.

Yoga can be considered as an intervention in aging persons to reduce the mortality & morbidity from cardiopulmonary diseases.

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Table No. 1
Showing physical characteristics of the study & control group

Physical characteristics	Study group, Mean Values With SD	Control group Mean With SD	P value
1. Age (yrs)	50.02 ± 5.8	48.1± 6.2	p>0.05
2. Height (cm)	160.1±5.741	161.4±5.2	p>0.05
3. Weight (Kg)	61.01±6.81	56.31±7.6	p>0.05
4. BMI	23.71±4.1	2.3.2±3.1l	p>0.05

SD – Standard deviation

Table No.2
Showing comparison between mean values of different cardiopulmonary parameters in the study & control group.

Parameters	Study Gr. Mean ±SD	Control Group Mean ±SD	P value
1. Pulse rate/mt	70.5 ±4.4	76.5±6.4	P<0.001
2. Systole Blood Pressure	130.5±5.4	138.4±8.6	P<0.01
3. Diastolic Blood Pressure	83.8±5.5	89±6.4	P<0.001
4. Rate Pressure Product	69.54±3.6	73.26±4.1	P<0.01
5. Respiratory Rate	16.3±3.4	13.3±4.2	P<0.001
6. Peak Expiratory Flow Rate Liters/mt	294±5.2	435±6.4	P<0.01

Comparison Between Study And Control Group For Different Parameters