

YOGA IMPROVES CARDIOVASCULAR PARAMETERSPramod P. Kadu¹, Akshataa Atul Deshkar²¹Assistant Professor, Department of Physiology, Punjabrao Deshmukh Memorial Medical College, Amravati, MS.²Demonstrator, Department of Physiology, Chhattisgarh Institute of Medical Sciences, Bilaspur, Chhattisgarh.**ABSTRACT****ABSTRACT**

Yoga in ancient technique practices by sage for a desirable and healthy life. Yogic exercise and Pranayam may modulate cardiovascular function. To assess the cardiovascular parameter in control and study group. We selected 90 healthy volunteers between age group 35 – 50 years and divided into two groups. i) Study group – 45 ii) Control group – 45.

Control group was not doing any type of exercise or yoga during 1 yr of period whereas yoga group did yogic exercise for 1 yr under supervision of yoga expert. In both the group heart rate SBP and DBP evaluate at 0, 6 and 12 month period. In control group heart rate, SBP, and DBP showed no significant change at 0, 6, and 12 month reading, whereas study group (yoga) 81.96±5.65 showed significant decreased heart rate From 81.96 ±5.65 to 75.60 ± 3.44 at 6 month and 73.75 ± 11.36 at 12 month (p<0.001) SBP decreased from 128 ± 7.66 to 120.97 ± 4.21 at 6 month and 120.48± 3.86 at 12 months (p<0.001). DBP showed significant decreased from 88.44 ± 5.25 to 80.53 ± 3.44 at 6 months and 80.53 ± 2.53 at 12months (p<0.001). Yogic exercise and Pranayam done regularly at long term improve cardiovascular efficiency.

KEYWORDS

Yogic Exercises, Blood pressure, Heart Rate.

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INTRODUCTION: It is here that yoga appears to make a vital contribution to the modern medical system. The ultimate aim of medical sciences is attainment of optimum, physical and mental health for individual. A medical science tries to achieve optimum, physical and mental well-being of the individual through preventive and curative means. Yoga practices mainly stress on promotive aspects although some yogic methods are prescribed for curative purpose.¹ Yoga is a methodized effect towards self- perfection. A wide variety of common diseases such as coronary heart diseases, hypertension and diabetes mellitus are now being attributed to a faulty life style. Yoga is probably the best life style, non-pharmacological intervention for prevention and treatment of several diseases.²

Yoga produces consistent physiological changes. Extensive studies on yoga claim that it increases longevity. It has therapeutic and rehabilitative effect.³ Aging is process that takes place over the entire life span. In man, old age is commonly associated with disease. However, aging cannot be regarded as synonymous with disease. Aging can be studied in terms of changes that take place in some function, trait or characteristic with passage of time. Aging is inevitable and no system is spared of its changes. Still cardiovascular system holds key position in the interpretation of age changes; throughout the body, since

an adequate blood supply is essential for any organ system. Peak physiological function generally occurs prior to age 30 and thereafter undergoes an age related decline of 0.75 to 1% per year. Cardio respiratory measure (O₂ consumption) decreases 5% to 15% per decade after the age 25 years. Greatest rate of decline is after the age of 40. This decline is largely mediated by age related decrease in cardiac output, heart rate and arteriovenous differences.⁴

A reduction in compliance of large size cardiothoracic (central) arteries is an independent risk factor of development of cardiovascular disease with advancing age. Regular aerobic endurance exercise attenuates age related reduction in central arterial compliance, restores levels in previously sedentary healthy middle aged and older men.⁵ Physical activity is perhaps the most obvious of variable which might reduce overall life morbidity in aged.⁶ Yogasana and Pranayama has beneficial effect on different system of body thereby increasing longevity, bringing equipose between psychic and somatic aspect of bodily function, helping in clearing certain diseases and thus prolonging life.⁷ Extensive studies are available on yogic asnas and pranayam all over the world. But comparatively very few research has been made on middle aged men as well as relatively lesser work has been found on yoga in this region with respect to cardiovascular system.

MATERIAL AND METHODS: The present study was conducted in the Department of Physiology, Jawaharlal Nehru Medical College, Sawangi (M), Wardha on 90 male volunteers of middle aged group. A routine health examination was performed before the study was started. All the subjects were healthy and free from any health problems.

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Corresponding Author:

Dr. Akshataa Atul Deshkar,

Demonstrator, Department of Physiology, Government Chhattisgarh Institute of Medical Sciences, Bilaspur.

E-mail: drakshataadeshkar@gmail.com

pramod.kadu23@yahoo.com

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The subjects were briefed about the study protocol and consent was obtained from them for the above study. The clearance (permission) of Institutional Ethical Committee of JNMC was obtained.

Selection of Subject: Study group was selected from yoga centre (Anekant Swadhay Mandir, Ramnagar Wardha) and from other yoga Centre in Wardha city who were enrolled for yogic exercise for the first time under the supervision of yoga experts. Study group consisted of forty five volunteers of middle aged (35-50 years). Control group also consisted of forty five subjects who were not practicing yoga or any other type of physical exercise and were selected from non-teaching staff of Jawaharlal Nehru Medical College and also from the general population of same age group (i.e. 35 to 50 years) from Wardha.

Inclusion Criteria of Study Group:

- Men in age group of 35-50 years.
- Not doing any exercise and yoga practice previously.
- Enrolled for yogic exercise under the supervision of yoga experts for the first time.
- Written consent obtained for participation in the study.

Inclusion Criteria for Control Group:

- Men in age group 35-50 years.
- Not doing any exercise or yoga practice.
- Consent to participate in the study was obtained.

Exclusion Criteria for Both Groups:

- Previous yoga practitioner (Those who practiced yoga).
- Smokers.
- With H/O chronic respiratory diseases or cardiovascular diseases.

Parameters: All subjects were assessed (Both study group and control group) for the following parameters.

- Heart rate in STD lead II in ECG (BPL).
- Blood pressure measured with Sphygmomanometer (Diamond India makes of ISI mark).

METHOD: All the subjects were called to the Department of Physiology at 10 a.m. Routine medical examination was done. Detailed history was obtained. All the subjects were found healthy and not suffering from any illness. Name, age, biodata of each subjects was recorded and physical characteristics were determined such as weight and height. BMI was then calculated. Control group consisted of subjects who did not perform any physical exercise or yoga practice. Study group was trained by yogic expert (in yoga centre) in different yoga exercises and pranayam. In yoga centre yoga classes were held early in the morning in two batches. All the subjects performed yoga for one hour daily for 12 months. The yogic exercise included.

i. Pranayam:

- 1) Anuloma- Viloma Pranayam.
- 2) Kapalbhathi.

ii. Asanas:

- 1) Tadasan.
- 2) Pawanmuktasana.
- 3) Bhujangasana.
- 4) Vajrasana.
- 5) Shalabhasan.
- 6) Makrasan.
- 7) Shavasan.

Physical Characteristics:

- Age was taken to nearest year
- Height was measured by measuring tape to nearest cm with subject standing barefooted.
- Weight was taken on standard weighing machine to the nearest of kg (in light cloth and without footwear), BMI was calculated by the formula.

$$\text{BMI} = \frac{\text{Weight in kilogram}}{\text{Height in meter}^2}$$

Methods of Investigation: Cardiovascular system was assessed by measuring heart rate and blood pressure in resting condition, after a period of 10 minutes rest.

I. Blood Pressure: Subject was asked to lie down in supine position on the examination table. He was asked to take the rest for 10 minutes. Then resting blood pressure was measured by sphygmomanometer in right arm by palpatory method. Then blood pressure was taken by auscultatory method (with stethoscope). First tapping of the sound (First phase of Korotkov's sound) was taken as systolic blood pressure and end of the muffling sound was taken as diastolic blood pressure. Three such readings were taken after the time interval of 10 minutes rest and average was taken as a final reading.

II. Heart Rate: Subject was asked to lie down in supine position on examination table and then after 10 minutes of rest, electrocardiogram was taken in lead II on BPL made electrocardiograph. Long strip in lead II taken. Heart rate was calculated from different distance of R-R wave as;

$$\text{Heart Rate} = \frac{1500}{\text{Distance between to R-R wave in mm}}$$

Mean of two R-R wave taken as a final reading.

STATISTICAL ANALYSIS: Appropriate statistical analysis was done using one way ANOVA.

OBSERVATIONS: In present study cardiovascular parameter such as heart rate, blood pressure were studied in 90 total subjects. Ninety subjects divided into two groups. Control group consisted 45 healthy subjects who were non-exercising and non-yogic person and study group consisted

45 healthy yoga practitioner. Both groups were free from any illness and from the same region. All subjects were ranged from 35-50 years of age. Age and physical characteristics such as height, weight were noted. BMI was calculated.

Parameters	Initial Reading (0 month)	Second Reading (6 month)	Third Reading (12 month)	F-value	p-value
Age (Years)	42.97±4.34	43.42±4.35	43.97±4.34	0.59	0.55 NS,p>0.05
Height (cm)	165.08±4.52	165.08±4.52	165.08±4.52	NA	
Weight (kg)	63.40±6.20	63.73±5.70	63.97±5.56	0.11	0.89 NS,p>0.05
BMI (kg/m ²)	23.26±2.22	23.32±2.05	23.48±1.96	0.13	0.87 NS,p>0.05
SBP (mmHg)	130.44±8.93	132.22±8.98	132.93±7.65	1.01	0.36 NS,p>0.05
DBP (mmHg)	86.93±5.14	87.33±5.92	88.17±4.52	0.66	0.51 NS,p>0.05
Mean Pressure (mmHg)	101.09±7.02	102.29±6.56	103.32±5.60	1.35	0.26 NS,p>0.05
Heart Rate (per min)	78.77±5.11	79.08±4.22	80.33±3.60	1.61	0.20 NS,p>0.05

Table 1: Comparison of various parameters at various times interval in control group

*NS-Not significant.

Parameters	Initial Reading (0 month)	Second Reading (6 month)	Third Reading (12 month)	F-value	p-value
Age (Years)	43.73±4.74	44.20 ±4.78	44.73±4.74	0.49	0.60 NS, p>0.05
Height (cm)	165.60±5.16	165.60±5.16	165.66±5.16	NA	
Weight (kg)	65.84±9.95	65.24±9.19	65.08±9.51	0.078	0.92 NS, p>0.05
BMI (kg/m ²)	23.95±3.00	23.73±2.72	23.71±2.90	0.091	0.91 NS, p>0.05
SBP (mmHg)	128.00±7.66	120.97±4.21	120.48±3.86	26.08	0.000 HS, p<0.001
DBP (mmHg)	84.44±5.25	80.53±3.44	80.53±2.53	14.98	0.000 HS, p<0.001
Mean Pressure (mmHg)	98.97±5.71	94.01±3.45	93.83±2.67	22.18	0.000 HS, p<0.001
Heart Rate (per min)	81.96±5.65	75.60±3.44	73.75±11.36	14.47	0.000 HS, p<0.001

Table 2: Comparison of various parameters at various time interval in study group

* i) NS-Not significant; ii) S-Significant; iii) HS-Highly significant.

DISCUSSION: Ninety normal healthy male subjects with age group 35-50 years were selected for the study and were divided into two groups. Control group consisted of 45 subjects which were non-exercising and non-yogic. Study group consisted of 45 subjects who were asked to perform yogic practices under supervision of yoga expert for one year and comparative study between both groups regarding changes in cardiovascular changes was carried out at 0, 6 and 12 months interval. The present study revealed many important and significant results.

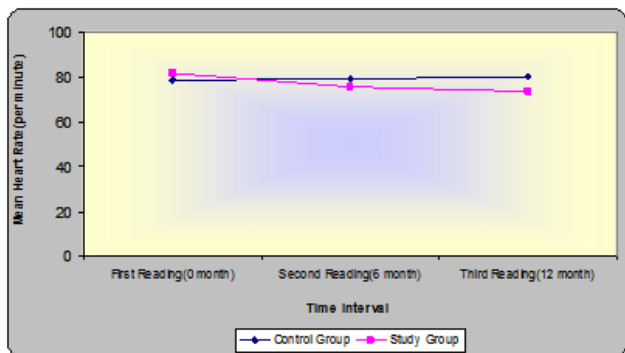
Follow up chart showing mean value and standard deviation(table no 1-2 in control and study group respectively) revealed that gradual changes take place in cardiovascular Age and physical characteristics such as height, weight and BMI in both the group was statistically not significant which shows both were comparable group. Thus it was a comparative case control study. The following parameters are discussed.

Cardiovascular Parameters:

A. Heart Rate: In the present study mean value of heart rate decreased from 81.96±5.65 to 75.60±3.44 at 6 months and 73.75±11.36 at 12 months of yogic practice in study group(table no.2) with F-value 14.47(p<0.001). The result is highly significant. Whereas in the control group (table no.1) it increases from 78.77 ±5.11 to 79.08±4.22 at 6 months and 80.33±3.60 at 12 months with F-value 1.61(p>0.05, not-significant).Similar finding were observed in other studies like Joseph S.,⁸ Khanam A.A,⁹ Udupa K.N,¹⁰ Srivastava R.D,¹¹ Selvamurthy W.¹² The decreased heart rate/pulse rate was significant except in study of Gopal KS.⁷ This exception is because the control group was of athletes in which the parasympathetic tone is high.

Our study shows significant decline in heart rate which might be due to pranayama (yoga) which is an art of controlled breathing, but at the same time it also tries to keep the attention of mind on the act of breathing, leading

to concentration. Due to this, attention is removed from worries and distress the subject. This stress free state of mind evokes relaxed response². Yoga brings about behavioral changes, cortical influence along with the influence of limbic system on hypothalamus. The result is increased parasympathetic tone and reduced sympathetic tone. The heart rate decreases mainly because of increased parasympathetic tone.^{7,8,9}



Graph 1: Comparison of heart rate (per min) at various time Interval (0, 6, 12 months) in both the groups

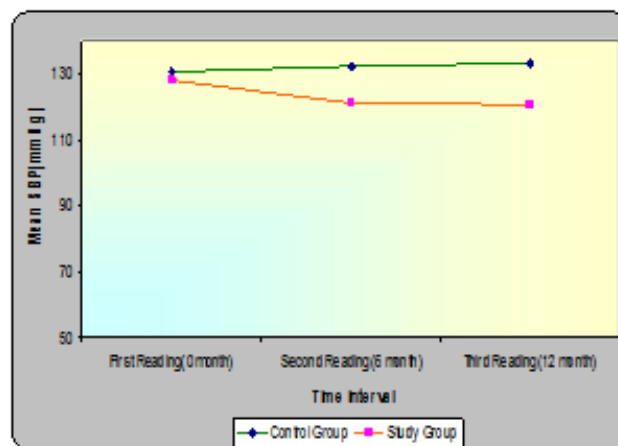
B. Blood Pressure:

I. Systolic Blood Pressure: In present study mean value of systolic BP decreases from 128±7.66 to 120.97±4.21 at 6 months and to 120.48±3.86 at 12 month in study group after yogic practices with F-value 26.08 and p<0.001 which is highly significant(table no.2). Whereas in control group there is slight increase from 130.44±8.93 to 132.22±8.98 at 6 months and 132.93±7.65 at 12 months with F-value 1.01 (p>0.05) which is not significant (table no.1).

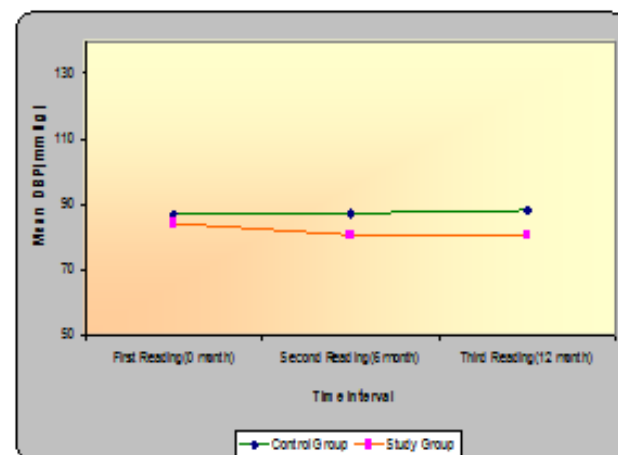
Our study is also supported by other workers Joseph S.⁸ Srivastava.R.D,¹¹ Selvamurthy W¹², Subbalakshmi,¹³ Bernardi L,¹⁴ Jain Nidhi,¹⁵

In present study after one year practice of yoga, study group showed significant decrease while in the control group slight rise was seen though statistically insignificant.

The cause of decrease in blood pressure probably that yoga brings about behavioral changes which influence the limbic cortex and the limbic system influence the hypothalamus. There are descending tracts to vasomotor area from cerebral cortex (Particularly the limbic cortex) that relay in hypothalamus. The connection from hypothalamus and vasomotor area are reciprocal, the efferent from brain stem closing the loop. The Inflation of the lung causes vasodilatation and decrease the blood pressure. This response is mediated via vagal afferents from lungs that inhibit vasomotor discharge.¹⁶



Graph 2: Comparison of systolic blood pressure (mmHg) at various time interval (0, 6, 12 months) in both the groups



Graph 3: Comparison of diastolic blood pressure (mmHg) at various time interval (0, 6, 12 months) in both the groups

II. Diastolic Blood Pressure: In the present study mean value of diastolic blood pressure decreased from 84.44±5.25 to 80.53±3.44 at 6 months and 83.53±2.53 at 12 months with F-value 14.98 (p<0.001) which is highly significant in study group (table no. 2). Whereas in control group mean value of diastolic blood pressure slightly increased from 86.93±5.14 to 87.33±5.92 at 6 months and 88.17±4.52 at 12 months with F-value 0.66(p>0.05) which is statistically not significant (table no.1). Similar findings were observed in other studies Joseph S,⁸ Udupa,¹⁰ Bernardi L,¹⁴ Murugesan R,¹⁷ Selvamurthy W.¹² In this study after one year of yogic practices study group shows significant decrease in diastolic blood pressure. Similar studies on hypertensive subjects who practices yoga showed reduced systolic and diastolic blood pressure.^{18,19,20} As seen in yogic practitioner this decrease in diastolic blood pressure is due to decreased sympathetic tone which reduce the peripheral resistance, thereby decreasing diastolic blood pressure.

CONCLUSIONS:

1. There was a significant decrease in heart rate with study group $p < 0.001$ whereas slightly increase was seen in heart rate ($p > 0.05$) though statistically not significant in control group.
2. The systolic and diastolic blood pressure showed a fall in yoga practitioner (Study group) while insignificant slight increase was seen in control group at 12 months follow-up.

Thus the present study reveal that yogic exercise and pranayam done regularly and for long term, improves cardiovascular efficiency.

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