EFFECT OF SPECIFIC "YOGASANAS" ON CARDIOVASCULAR AUTONOMIC FUNCTION TEST

Sahoo J K*, Vatve M*, Sahoo K D**, Patil V V*

Abstract

Evaluation of cardiovascular autonomic functions before and after four yogasanas viz. "Vajrasana" with "Yogamudra", "Paschimmotanasana", "Dwipad sahajhasta Bhujangasana", "Padmasana Yogasana" was carried out. Seventy healthy adults (30 males and 40 females) in the age group of 16-20 years were studied. They were trained for 15 days by a certified yoga teacher. Autonomic function tests were carried out before and after 2 and 4 months of yoga practice. Resting heart rate (HR), Blood Pressure (BP), heart rate and blood pressure response to standing, deep breathing and valsalva maneuver and pressure response to cold pressor test were studied. A statisticaly significant decrease in resting heart rate, systolic blood pressure after 2 and 4 months of yoga training in both males and females was found. There was also statistical significant increase in heart response to deep breathing (E:I ratio) from 1.4 (mean) to 1.56 in males and 1.4 to 1.49 in females. Valsalva ratio also increased from 1.09 to 1.17 in males and 1.09 to 1.21 in females after 4 months training. Our results indicate that the effects of these asanas is to increase vagal modulation of R:R intervals and reduce sympathovagal balance. However, the study is limited by the facts that it is not controlled.

***Key words**: Yogasanas, Heart Rate, Blood Pressure*

Introduction

"Yoga" is practiced in India and all over world for over thousands of years. Increased awareness of health and natural remedies, yogic techniques (including "asanas" and "pranayamas") are gaining importance and receiving world wide acceptance. "Yoga" produce physiological changes which has a sound scientific basis. Today man is subjected to far greater stress, strain and depression than before. It is well known that as a result of stress, various systems in the body are affected, giving rise to various psychosomatic disorders. The remedial medicines used for these disorders are temporary. Therefore non-pharmacological approach is beneficial. "Yogic" postures are now, one of the non-pharmacological therapies against stress and strain. "Yoga" practice has been shown to be effective in improving mood and decreasing stress and depression[1].

* Dept of Physiology, RMC, Loni

** College of Physiotherapy, Loni

Address for correspondence:

Dr J K Sahoo, Department of Physiology, Rural Medical College, PIMS, Loni, District-Ahmednagar, Maharashtra-413736,India

E-mail: physiology@yahoo.co.in

Interaction of sympathetic and parasympathetic nervous system is important in cardiovascular regulation.[2] The sympathetic system controls energy expenditure in stressful conditions whereas parasympathetic system conserves energy through relaxation at rest. In the resting state the cardiovascular system is influenced by both the divisions of the Autonomic Nervous System. The control of cardiovascular system via Autonomic Nervous System(ANS) varies from one individual to another and is also affected by many diseases. Regular exercise affects the cardiovascular status of the person and the ANS is the mediator of this response. It has been proved that regular physical exercise causes a decrease in sympathetic tone and an increase in parasympathetic tone. [3,4,5]

Cardiovascular autonomic functions are quantified by changes in the heart rate and blood pressure in response to some of the physiological stimuli.

Aim

To study the effects of specific "yogasan" practice on

cardiovascular autonomic function tests in healthy volunteers.

Materials and methods

The present study was conducted in 70 healthy volunteers (30 males and 40 females) in the age group of 16-20 yrs at Rural Medical College, Loni. The study protocol was explained to the subjects and written consent obtained. Approval by ethical committee of Pravara Institute of Medical Sciences was obtained. All the volunteers were clinically examined to rule out any systemic diseases. They were trained under the guidance of a certified "yoga" teacher. They carried out "yogasanas" for 4 months, under supervision, in a prescribed manner. All 70 volunteers carried out "asanas" for 50-60 minutes everyday. Each "asana" was performed for around 10-15 minutes. Numerous sets of "asanas" and "pranayamas" are practiced, but only 4 yogasanas were chosen for this study:

1. "Vajrasana" with "Yogamudra"
2. "Paschimmotanasana"
3. "Dwipad Bhujangasana"
4. "Padmasana" with "Yogamudra"

The volunteers practised the above asanas early in the morning in a quiet, well ventillated room or in open air space sitting in a comfortable posture. Initially all the "asanas" were carried out for short durations and then gradually increased over a period of the time. The techniques used for the "asanas" is described below:

"Vajrasana Yogamudra" (Fig 1)

Fig 1: "Vajrasana Yogmudra"

Techique:

- Kneel with your knees together
- Position the feet so that the big toes touch each other,inhale and take both the hands back and keep the palms facing outside interlocking the thumbs, keeping both hands straight.
- While exhaling bend the waist and touch the fore head on the floor, continue smooth breathing.
- Bring the buttocks downward on to the heels, keep the backbone straight for better results.

"Padmasana Yogamudra" (Fig 2)

Technique:

- Sit with both feet straight, bend right knee and place the outer border on the groin.Similarly bend left knee and place it on right groin.
- Try and lift heels further upon groin and move both knees as close as possible.

Fig 2: "Padmasan Yogmudra"

- Take the hands back with palms facing outside, interlocking the thumbs and keep both hands straight.
- While exhaling bend at the waist and rest the fore head on the floor. Continue smooth breathing.

"Paschimottanasana"(Fig 3)

Technique:

- Sit with legs straight and back erect.

- Exhale and lean forward and extending the arms from shoulders to hold the toes.
- Exhale, bend forward more by widening the elbows outwards.
- Bend and extend the trunk further forward and downward from hip towards legs placing forehead

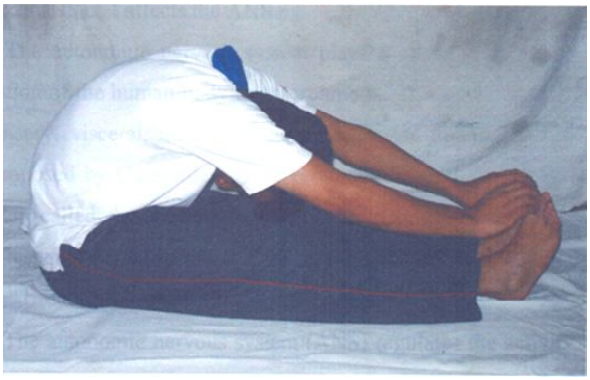

Fig 3: "Paschimmotanasana"

on knees.
- Hold toes or outer border of feet in middle of sole.
- Maintain the pose and breath normally.

"Dwipad Bhujangasana" (Fig 4)

Technique:
- Lower the body to the ground.
- Stretch both the legs backward, keep 12 inches distance between the elbows and keep the palms on cheek.
- Relax all the muscles,continue normal breathing and look at the distance.

The Cardiovascular Autonomic function tests were performed by the subjects before "yogasana" practice and then repeated after 2 months and 4 months of regular "yogasana" practice. The Cardiovascular Autonomic function tests included sympathetic function tests like pulse rate by palpatory method, arterial blood pressure by auscultatory method, orthostatic hypotension, cold pressor test. Parasympathetic tests included heart rate response, expiratory : inspiratory ratio and Valsalva ratio. The Autonomic function tests were restricted only to the above because of non-availability of computerized analyzer device. They

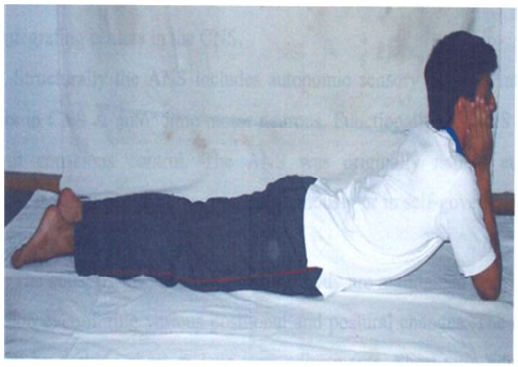

Fig 4: "Dwipad Bhujangasana"

are simple, reliable and non-invasive.

All the data of the above tests were recorded and statistical analysis carried out.

Results

A total of 70 volunteers including 30 males and 40 females were included in the study. The statistical analysis for sympathetic and parasympathetic tests were carried out seperately for male group and female group using student 't' test. After analysing both the groups, the autonomic function tests for sympathetic activity in males was compared before "yogasana" and after 2 months of "yogasana" practice and then between 2 and 4 months of "yogasana" practice. It was observed that the pulse rate, blood pressure and cold pressor test were statistically more significantly altered ($P < 0.001$) whereas the orthostatic variation in blood pressure was only slightly altered (Table I). The autonomic function tests for parasympathetic activity were also compared (Table II) for male volunteers before and after 2 months of "yogasana" practice and again compared between 2 months and 4 months of "yogasana" practice. It was analysed that alterations in the heart rate and valsalva ratio were statistically highly significant ($P<0.001$), but the expiratory: inspiratory ratio was only marginally significant ($P< 0.05$).

The autonomic functions for sympathetic activity in females showed that the pulse rate, blood pressure and cold pressor test were also statistically more significant ($P< 0.001$), but the orthostatic variation of blood pressure was only marginally significant

Table I: Sympathetic parameters (male): Statistical analysis

	Before yoga	After 2 month yoga	'P' values	After 2 month yoga	After 4 month yoga	'P' values
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Pulse rate **(per min)**	78.19±8.510	6.570±6.609	P<0.001	6.570±6.609	74.59±4.620	P<0.001
Supine						
***SBP(mmHg)**	117.44±8.549	115.69±7.588	P<0.001	115.69±7.588	113.13±6.445	P<0.001
****DBP(mmHg)**	70.13±7.129	69.44±6.122	P<0.05	69.44±6.122	67.69±5.682	P<0.05
Standing						
SBP(mmHg)	116.56±7.132	113.5±6.324	P<0.001	113.5±6.324	110.56±6.578	P<0.001
DBP(mmHg)	68.7±4.354	67.34±6.567	P<0.001	67.34±6.567	64.68±4.598	P<0.05
Orthostatic hypotension						
SBP(mmHg)	2.50±1.437	3.00±1.016	P<0.05	3.00±1.016	1.69±1.03	P<0.05
DBP(mmHg)	-5.75±1.951	-5.13±1.519	P<0.05	-5.13±1.519	-6.56±2.109	P<0.05
Cold pressor test						
SBP(mmHg)	126.69±7.596	124.69±6.43	P<0.001	124.69±6.43	122.13±5.375	P<0.001
DBP(mmHg)	80.13±7.093	78.56±6.43	P<0.001	78.56±6.43	77.06±5.541	P<0.001

* SBP = Systolic blood pressure; ** DBP = Diastolic blood pressure

Table II: Parasympathetic parameters (male): Statistical analysis

Group	Before yoga	After 2 months yoga	'P' values	After 2 months yoga	After 4 months yoga	'P' values
	Mean ±S.D	Mean ±S.D		Mean ±S.D	Mean ±S.D	
***HRR**	23.905±11.35	20.361±10.89	P<0.001	20.361±10.89	18.223±9.591	P<0.001
****E:I Ratio**	1.291±0.249	1.449±0.202	P<0.05	1.449±0.202	1.562±0.323	P<0.001
Valsalva ratio	1.067±0.061	1.095±0.051	P<0.05	1.095±0.051	1.175±0.094	P<0.001

* HRR = Heart rate response; ** Expiratory Inspiratory ratio

(Table III). The parasympathetic activity in female volunters were compared which showed that the heart rate response, expiratory : inspiratory ratio and valsalva ratio were statistically highly significant (P< 0.001) . Thus the statistical analysis revealed that not only were there significant changes in the sympathetic activity in male and female volunteers after regular practice of "yogasanas" but there were significant changes in parasympathetic activity as well.

Discussion

In our study the cardiovascular autonomic function tests were carried out before and after 2 months and 4 months of regular practice of "yogasanas". The volunteers after "yoga" practice showed autonomic equillibrium between sympathetic and parasympathetic nervous system.

The autonomic nervous system plays a major role in bringing about adaptation of human body to

Table III: Sympathetic parameters (female): Statistical analysis

	Before yoga	After 2 months yoga	'P' values	After 2 months yoga	After 4 months yoga	'P' values
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Pulse rate (per min)	77.18±7.310	75.68±5.645	P<0.01	75.68±5.645	74.15±4.87	P<0.001
Supine						
SBP(mmHg)	112.40±6.961	111±6.093	P<0.001	111±6.093	109.8±5.562	P<0.001
DBP(mmHg)	73.70±5.576	72.60±5.476	P<0.001	72.60±5.476	71.75±5.168	P<0.05
Standing						
SBP(mmHg)	110.5±6.34	109.6±6.98	P<0.001	109.6±6.98	107.9±5.532	P<0.001
DBP(mmHg)	71.4±6.761	70.5±4.782	P<0.001	70.5±4.782	69.3±6.98	P<0.05
Orthostatic hypotension						
SBP(mmHg)	2.45±0.846	2.15±0.533	P<0.05	2.15±0.533	1.35±0.949	P<0.001
DBP(mmHg)	4.10±1.63	3.60±1.374	P<0.05	3.60±1.374	4.10±1.499	P<0.05
Cold pressor test						
SBP(mmHg)	121.85±6.331	120.5±5.65	P<0.001	120.5±5.65	119.15±5.061	P<0.001
DBP(mmHg)	83.65±5.618	82.1±5.43	P<0.001	82.1±5.43	80.9±5.32	P<0.05

Table IV:Parasympathetic parameters (female): Statistical analysis

Group	Before yoga	After 2 month yoga	'P' values	After 2 month yoga	After 4 month yoga	'P' values
	Mean ±S.D	Mean ±S.D		Mean ±S.D	Mean ±S.D	
HRR	25.729±9.941	22.99±9.141	P<0.05	22.99±9.141	21.687±7.639	P<0.05
E:I ratio	1.40±0.20	1.405±0.193	P<0.05	1.405±0.193	1.491±0.227	P<0.001
Valsalva ratio	1.086±0.07	1.109±0.049	P<0.05	1.109±0.049	1.209±0.08	P<0.001

environmental changes, thereby modulating the sensory, visceral, motor and neuro-endocrine functions.[6] It regulates the activity of smooth muscles, cardiac muscles and certain glands. It can be described as a specific motor output portion of the peripheral nervous system. Autonomic nervous system is one of the most important mediators of this response and these changes may be responsible for the present observation in cold pressor test. [6] A large number of studies have been carried out to observe physiological effects of prolonged physical training. Bagchi B.K. and Wenger M.A, found changes in autonomic nervous system during 'yoga'. They observed that vagal tone increases and sympathetic tone decreases after "yoga" practice.[7] K.Joshi studied effect of "savasana." He observed that there was decrease in pulse rate and blood pressure.[8] Gharote M.L, studied effects of "yoga" in high school boys and concluded that there was increase in parasympathetic tone after "yoga". [9] Tulpule T.H et. al, concluded that "asana" practice in patients of myocardial infraction helps in early ambulation and reduced complications.[10]

In our study, the regular practice of "yogasanas" over a period of 4 months showed significant increase in parasympathetic activities. These effects are possibly due to increased vagal tone and increased sympathetic discharge. The parasympathetic tone had a gradual build up in "yoga" volunteers. This is vital for energy

conservation in order to built up an optimum reserve which can be used during times of stress. [11] The parasympathetic tone was expressed in terms of decrease in the heart rate, and decrease in systolic and diastolic blood pressure after "yogasana" practice. The practice of "asanas" relaxes the muscles and joints which influences the haemodynamic mechanism, thereby improving blood circulation to vital organs. This may also activate the neuro-endocrine axis which is important in facing physical and mental stress.[11]

In the present study we observed that there was significant difference in pulse rates, orthostatic blood pressures and cold pressor tests after practising "yogasanas" which indicates decrease in sympathetic activity. There was significant response to heart rate, expiratory : inspiratory ratio and valsalva ratio after "yogasanas" reflecting increase in parasympathetic activities which is mainly due to increase in vagal tone. Young individuals are invariably exposed to professional, social and environmental stress. These stressess create conflict in the mind, leading to distress. We conclude by saying that the practice of "yogasnas" and "pranayams would benefit the young population as it would prepare them in overcoming stress by modulating and optimizing sympathetic activities in stressfull situations thereby immediately restoring equillibrium, thereby avoiding intervention of inhibitory parasympathetic system.With "yogasanas" there is a gradual build up of inhibitory tone or parasympathetic tone with reduction in the heart rate and decrease in the systolic and diastolic blood pressures.

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