RESEARCH ARTICLE

THE COMBINED EFFECT OF SURYANAMASKAR, PRANAYAMA & MEDITATION ON HYPER-REACTORS TO COLD PRESSOR TEST IN YOUNG HEALTHY INDIVIDUALS

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ABSTRACT
Background: To survive in this competitive world, one has to go through a lot of stresses & strains which, in due course of time, reflected in altered physiology of body. One such change is the cardiovascular response to cold stress. Yoga has been reported to be beneficial as a de-stressing technique.
Aims & Objective: To investigate whether regular practice of Yoga which includes Suryanamaskar, Pranayama & Meditation for 3 months could reduce the cardio-vascular hyper-reactivity induced by cold stress.
Materials and Methods: In the present study, 53 young healthy medical students underwent cold pressor test. 20 turned out to be hyper reactors to this test. These hyper reactors performed Yoga (Suryanamaskar, Pranayama & Meditation) for 3 months and Cold Pressor Test was again performed at the end of this period and cardiovascular hyper-reactivity (parameters are Blood pressure, Pulse rate, and Respiratory rate) before and after yoga compared.
Results: Our results showed that 14 out of original 20 hyper reactors (70 %, P<0.001) were converted to hypo reactors.
Conclusion: Regular practice of Yoga reduces cardiovascular hyper-reactivity to cold pressor test. If we can spread its benefits and importance to the society we can reduce the risks of many diseases especially those related to stress.
Key Words: Yoga; Suryanamaskar; Pranayama & Meditation; Cold Pressor Test; Hyper Reactors

Introduction

Today's highly technological and competitive life style is poising a great stress on the society, resulting in the imbalance of physical & psychological changing leading to psycho-somatic disorders. Stress is a common condition, a response to a physical threat or psychological distress that generates a host of chemical and hormonal reactions in the body.[1] Stress is described as a state of anxiety, strain, nervousness, tension, constant worry or pressure. It is an accepted fact that psychosocial factors operate through mental processes, consciously or unconsciously, to produce hypertension and other cardiovascular disorders.[2] Cardiovascular disease has become a major cause of mortality in developing nations in the age group of 30- 69 years. The cardiovascular mortality due to hypertension is seen more in developing nations.[3,4]

Suryanamaskar literally translates as "sun salutations. Regular practice produces statistically significant reduction in pulse rate, which is attributed to increased vagal tone and decreased sympathetic activity.[5,6] Decreased sympathetic activity in turn reduces catecholamine secretion and also leads to vasodilatation leading to improvement in peripheral circulation. It is also observed that regular yogic practices reduce basal metabolic rate and resting oxygen consumption. All these may be responsible for reduction in resting pulse rate. These factors also decrease work load on heart leading to decrease in cardiac output and hence systolic blood pressure. Yogic practices alter the hypothalamic discharges leading to decrease in sympathetic tone and peripheral resistance and hence the diastolic blood pressure. Regular yogic practices strengthen the respiratory muscles; increase the excursions of diaphragm and lungs as well as thoracic compliance. Yoga practices also decrease airway resistance. All these factors contribute to improvement in the various lung function tests after regular practice of suryanamaskar.[7,9] Yogic practices also improve respiratory muscle endurance.[10]

Through practicing various body postures (asana), breathing techniques (pranayama), and meditation, it is believed that one can obtain a sound physical body as well as a calm and peaceful mind.[11] Regular practice of a variety of yoga techniques have been shown to lower heart rate and blood pressure in various populations.[12-14] In recent years, it has become more apparent that people need techniques to help them cope with the everyday stressors of modern life, with stress related hypertension and cardiovascular diseases.

Scientific research has shown that non pharmacological methods like yogic asanas, pranayama, and meditation

should be encouraged to control the modifiable risk factors by increasing parasympathetic activity and decreasing sympathetic activity and provides significant improvements in cardiovascular parameters and respiratory functions and physical fitness which improve one's tolerance to stressors.[15,16] In 1932 Hines & Brown devised a method to test the reactivity of the body to cold stress. They observed the effect of pain caused cold stress in the form of rise in blood pressure and on this basis subjects could be classified as hypo-reactors or hyper-reactors. The hyper-reactors to cold stress are likely to develop cardiac disorders later on in any phase of life. These hyper-reactive subjects should be properly dealt with to lower the incidence of such disorders.[17]

The present study has been undertaken with the aim of de-stressing the hyper-reactors by the application of Suryanamaskar, Pranayama (Anuloma-viloma & Kapalbhati) and Meditation because hyper-reactors are likely to develop hypertension in future life. This may be a humble attempt towards restoring the peace and normalcy of life. "In a tension-filled society, yoga, pranayama and meditation alone will bring solace from all problems and hence they are the essence of life".[18]

Materials and Methods

Study group comprised 53 healthy subjects of 18-24 years. They were subjected to cold pressor test introduced by Hines & Brown**.** The study protocol was explained to the subjects and written consent was obtained. Approval by ethical committee of S.S. Medical College, Rewa, M. P., was also obtained. All the volunteers were clinically examined to rule out any systemic diseases.

- **Inclusion Criteria:** Healthy, nonsmoker, with no cardio respiratory disorders. Subjects not doing any type of physical exercise.
- **Exclusion Criteria:** Subjects who were taking other physical activity like gym, athletics etc.

Subjects who were smokers, alcoholic, with respiratory disorders, jaundice, diabetes or any other disease related with cardiorespiratory system. All the 20 hyper-reactive volunteers were first trained under the guidance of a certified "yoga" teacher for 15 days. They then carried out "Suryanamaskar**,** Pranayama and Meditation" 30 minutes; ones a day for three months, the schedule consisted of,

- The asana: Suryanamaskar (12 Steps) – 10 minutes
- The Pranayamas: Anulom–vilom (Inhale : Exhale – 1:2) – 5 minutes & Kapalbhati (30 Breaths/min.) – 5 minutes
- Meditation: 10 minutes.

The volunteers practiced these exercises in the morning, in a quiet, well ventilated room or in open air space sitting in a comfortable posture. After giving a rest for 10 minutes BP was measured in supine posture by sphygmomanometer. Two reading were taken 5 minutes apart and the mean of two was taken as the basal blood pressure.

All volunteers were subjected for cold pressor test, of Hines & Brown 1932. A thick walled thermacol box measuring 38 cm × 26 cm × 18 cm, closed from all sides, was used. A hole was made in the centre of the top of the box to allow entry to one hand of the subject. Another small hole was made at the corner of the top of the box for laboratory thermometer. Before starting the experiment the thermacol box was filled with cold water and the laboratory thermometer was placed in such a way that its mercury bulb was immersed in the cold water. Temperature inside the box was maintained in the range of 3-4^{0}C. The hand was immersed in cold water up to the wrist for one minute (cold stress).

Response showing by elevated blood pressure was categorized as—

- **Hyper-reactors:** Those subjects in whom the systolic blood pressure raised more than 20 mm Hg and/or diastolic blood pressure raised more than 15 mm Hg.
- **Hypo-reactors:** Those subjects in whom the systolic blood pressure didn't exceed 20 mm Hg and /or diastolic blood pressure more than 15 mm Hg.

The statistical analysis was carried out using paired 't' test by using SPSS-16 software.

Results

Our results showed that "Yoga" causes significant reduction in the cardiovascular hyper-reactivity. A total of 53 volunteers were included in the study. Out of which 20 were hyper-reactor to cold pressor test. These hyper-reactors practiced yoga regularly for three months and after this period the 14 volunteers became hypo-reactors, whereas no change in the hyper-reactivity was observed in six volunteers. It was observed that the basal blood pressure, rise in BP due to cold stress (Table 1 & Table 2), pulse rate, respiratory rate were statistically and significantly altered. (Table 3)

Blood Pressure: The mean basal systolic blood pressure decreased from 116.20 ± 6.45 mmHg to 113.1 ± 5.29 mmHg ($P<0.002$) after 3 months of Suryanamaskar, pranayama and meditation. The mean basal diastolic Blood

pressure was found in the study to change from 74.5 ± 4.85 mmHg to 72.4 ± 3.92 mmHg (P<0.011). Average rise in systolic blood pressure, due to cold pressor test, initially was 20.7 ± 4.2 mmHg, and this rise reduced to 12.8 ± 4.17 mmHg (P<0.000). While the rise in diastolic blood pressure initially was 15.5 ± 4.04 mmHg and this reduced to 08.9 ± 2.46 mm Hg (P <0.000).

Pulse Rate and Respiratory Rate: Pulse rate decreased from mean value of 79.45 ± 5.11 to 75.4 ± 4.0 (P <0.000) and respiratory rate decreased from mean value 19 ± 1.97 per minute to 17.15 ± 1.56 per minute, which is statistically significant (P <0.000).

Table-1: Basal Blood Pressure (Before intervention) and effect of Cold Stress on Basal Blood Pressure with their Mean Value & Standard Deviation

Subjects	Blood Pressure	Basal Blood Pressure		Rise in BP due to Cold Stress	
		Mean	SD	Mean	SD
All Hyper-reactors (20)	Systolic	116.2	6.45	20.7	4.21
	Diastolic	74.50	4.85	12.8	4.17
Systolic Hyper-reactors (11)	Systolic	116.36	5.57	21.09	1.04
	Diastolic	75.27	5.53	9.45	2.20
Diastolic Hyper-reactors (4)	Systolic	113.5	4.72	14	3.65
	Diastolic	72.00	4.00	16.5	1.00
Both Systolic & Diastolic Hyper-reactors (5)	Systolic	118	9.59	25.2	1.09
	Diastolic	74.8	3.89	17.2	1.09

Table-2: Changes in blood pressure in mm Hg during cold pressor test in hyper-reactors before and after 3 months Yoga

Parameters		Before Yoga		After 3 months of yoga		Difference Mean Value	P Value
Blood Pressure (mm Hg)		Mean	SD	Mean	SD		
Basal B. P.	Systolic	116.2	6.45	113.1	5.29	3.1	<0.002
	Diastolic	74.5	4.85	72.4	3.92	2.1	<0.011
B.P. after Hand dip in 4^0 C water for 1 min.	Systolic	136.4	8.91	128.6	6.80	7.8	<0.007
	Diastolic	87.3	4.99	81.5	4.53	5.8	<0.000
Rise in Blood Pressure	Systolic	20.7	4.21	15.5	4.04	5.2	<0.000
	Diastolic	12.8	4.17	8.9	2.46	3.9	<0.000

Table-3: Comparison of Pulse Rate & Respiratory Rate in the hyper-reactor subjects before and after 3 months of Yoga

Parameters	Before Yoga		After 3 months of Yoga		Difference Mean Value	P Value
	Mean	SD	Mean	SD		
Pulse Rate (per Minute)	79.45	5.11	75.4	4	4.05	<0.000
Respiratory Rate (per minute)	19	1.97	17.15	1.56	1.85	<0.000

Discussion

The hypothalamus mediates person's response to stress. It activates the sympathetic nervous system to release epinephrine and nor- epinephrine, leading to intense vasoconstriction and increased systemic vascular resistance. Then blood pressure and cardiac workload are increased.[19] While under stress hypothalamus also stimulates posterior pituitary gland resulting in the secretion of ADH hormone. This hormone promotes water retention, leading to increased stroke volume. ADH also acts as a peripheral vasoconstrictor thereby resulting in increased-blood-pressure.[20] In addition, stress usually causes an increase in the level of aldosterone that maintains sodium and water retention along with potassium excretion leading to increased blood volume and increased blood pressure.[21]

Stresses, according to health experts, will produce change in set point of hypothalamopituitary axis activity leading to stimulation of autonomic nervous system resulting in immediate effects on heart rate, blood pressure, respiratory rate. Sympathetic over activity for longer time is known to be associated with hypertension and increase in cardiovascular morbidity and mortality.[22,23] Stress can sometime lead to severe health problems such as hypertension, cardiac failure, diabetes, strokes, mental problems as distrust, rejection, anger, depression, insomnia and in extreme cases, can cause even death.[24]

Yoga practices are time–honoured stress management/ health promotion techniques whose health benefits are being validated by modern medical science. Independent research has shown that yoga significantly reduces the levels of stress, relieve anxiety, depression, increase anti – oxidant production, enhance the sense of well – being and peace of mind.[25]

Conclusion

We thus can conclude that regular practice of Yoga reduces cardiovascular hyper-reactivity to cold pressor test. Yoga is a valuable gift provided to us by our great ancient Indian sages. If we can spread its benefits and importance to the society, can reduce the risks of many diseases & stress related disorders and thus we can have a society which is fit physically, mentally and spiritually.

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