

## Effect of Pranava Yoga on Acute Stress Induced Changes in Cardiovascular Parameters in Healthy Young Adults

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### Abstract

Stress is major problem faced by most of the people in the present environment. This phenomenon is more pronounced in young adults. Stress adversely affects the learning capacity of the student and stress induced headache is most commonly seen as immediate adverse effect of stress. Persistent stress also harms almost all the systems of the body including cardiovascular system predisposing the individual at higher risk for development of hypertension and other cardiovascular diseases. Pranava Yoga is one of the most popular techniques of yoga which involves Aum chanting. Pranava yoga is very simple yogic exercise and might be beneficial in relieving stress. One hundred asymptomatic healthy male medical students, aged 17-25 years, participated voluntarily. Acute stress was produced experimentally by using cold water of 8°C as per protocol of cold pressor test which is autonomic function test and produces marked stimulation sympathetic nervous system. Subjects were exposed to acute stress by standard procedure of CPT. Cardiovascular parameters were recorded using Impedance Cardiovasograph (Nivomon) and automatic digital sphygmomanometer. All the parameters were recorded before CPT, immediately after CPT and finally 5 minutes after CPT. All the above steps were repeated with a modification that subjects performed Pranava Yoga during cold pressor test and continued performing Pranava Yoga for next 5 minutes. All the parameters were recorded before CPT, immediately after CPT and 5 minutes after CPT. Statistical analysis was done by One-Way ANOVA and Tukey post Hoc tests using the window SPSS Statistics 17.0 version. Results showed that there was significant increase in all cardiovascular parameters immediately after exposure to cold stress for two minutes while all the cardiovascular parameters returned back to normal baseline after 5 minutes. In second stage subjects were performing Pranava Yoga during CPT and in recovery phase after CPT. All cardiovascular parameters increased significantly immediately after CPT nullifying the effect of Pranava Yoga but all the cardiovascular parameters recorded 5 minutes after CPT was significantly lower in comparison to parameters recorded before CPT nullifying the effect of cold stress. These results suggest that Pranava Yoga might not prevent appearance of stress induced adverse changes in the cardiovascular system and other parts of body but Pranava Yoga not only abolishes the stress induced changes but also produces marked relaxation even more than basal state before exposure to stress.

**Keywords:** Pranava Yoga; Acute Stress; Impedance Cardiovasograph.

### Introduction

Stress is a common phenomenon and major problem in the present scenario as people find unfavorable or adverse conditions or stressors in their

life which generate stress. Ability to cope up with stressor is declining in people as with advancement of technology; they are more self centered and more confined to television, computers and mobiles etc. In student life, they are having a tendency to remain in a

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well protected environment given by their parents and this feature is more commonly seen in people of high socioeconomic status. Young students specially are less involved in sharing their problem with their friends and parents and also do not try to get solution of a problem by combined efforts. This might be one of the reasons of their less ability to cope up with the problems and generation of stress with subsequent behavior changes including depression, anxiety and related disorders. Prolonged stress or repeated stress also makes the people more prone for generation of hypertension and other cardiovascular diseases [1,2].

Stress leads to release of stress mediators in brain which act via receptor on specific neurons and lead to unique downstream effects. Nature and intensity of the stressor and the response of the person varies. It has been demonstrated in many researches that responses to experimentally induced same stress are varied widely from person to person. However all types of stressors stimulate sympathetic nervous system. Problems are inevitable in our life but facing them properly, avoidance of generation of stress or quickly get relieved from stress is more important to remain healthy [3].

Various yoga techniques have been advocated and have been proved as stress reducer in many research studies. Yoga and meditation are practiced from Vedic period in ancient India. Yogic exercises have been proved to be very effective in relaxing the mind and body and advocated as adjuvant therapy in patients of hypertension, migraine and cardiovascular disease [4,5]. Pranava yoga is a very simple exercise among various yogic exercises. Pranava yoga (Aum yoga) is simple chanting of word Aum and focus the mind on the sound and vibrations produced during Aum Chanting. Many researchers have shown that yogic exercises shift the sympatho-vagal balance towards vagal side by decreasing the sympathetic activity and increasing the vagal activity [6-8]. Cold stress test or cold pressor test (CPT) is an autonomic function test and produces acute stress [9]. Cold stimuli cause intense stimulation of sympathetic nervous system with release of nor- epinephrine and epinephrine. Immersion in cold water activates afferent pain and temperature neurons which results in stimulation of sympathetic efferent neurons. Cold pressor test represents a wide spread neurogenic stimulation of multiple components of cardiovascular system [10]. Change in cardiac output and peripheral resistance is very good indicator of change in autonomic status. As they tend to increase with sympathetic stimulation and tend to decrease with increase in parasympathetic activity [11].

Cardiac output and peripheral resistance can be measured non-invasively by using Impedance Cardiovasograph (Nivomon, L&T Medical's). It is a Non Invasive vasography monitoring system. It measures the Cardiac Output (CO) and Blood Flow Index (BFI) of the patient non-invasively. It computes various other cardiovascular parameters [12,13].

As stress produces harmful effects on cardiovascular system and yoga may be helpful in reducing stress therefore this study aims to explore the effect of Pranava Yoga on acute stress induced changes in cardiovascular parameters in healthy young adults.

### Material and Methods

The present study was conducted in Saraswathi Institute of Medical Sciences, Hapur. One hundred asymptomatic healthy male medical students, aged 17-25 years, participated voluntarily in this study. Experiment procedures were in accordance with the ethical committee on human experimentation. Study was carried out at ambient temperature with minimal external or internal sound disturbances in the room. Subjects reported to laboratory 2 hours after light lunch. They were explained in detail about the experimental procedure. After getting informed consent from all subjects, procedure was conducted in 2 steps. In first step, subjects were asked to lie down supine and to take rest for 10 minutes. Blood pressure and heart rate were recorded by using automatic digital sphygmomanometer. Subjects were connected to impedance Cardiovasograph (Nivomon) via color coded 8 leads of NICO patient cable. Leads were connected at their respective locations as given below:

1. Red leads (I1 and I1') -Behind the ears (Top pair)
2. Yellow leads (V1 and V1') -Roof of the neck (Second pair)
3. Violet leads (V2 and V2') -Level of xiphisternum (Third pair)
4. Green leads (I2 and I2') End of ribcage or >5 cm from third pair (Bottom pair)

Cardiac output, peripheral resistance and other parameters were recorded using Impedance Cardiovasograph (Nivomon).

Subjects dip their left hand in water of 8°C for two minutes. Above mentioned parameters were recorded again immediately and at 5 minutes after removal of hand from cold water.

In next step, subjects took rest of 10 minutes again in supine position. All the above steps were repeated

with a modification that subjects performed Pranava Yoga during cold pressor test and continued performing Pranava Yoga for next 5 minute. All the parameters were recorded before CPT, immediately after CPT and 5 minutes after CPT.

All data were collected and statistical analysis was done by One-Way ANOVA and Tukey post Hoc tests using the window SPSS Statistics 17.0 version.

**Result**

Table 2 shows comparison of parameters before and after CPT. There was significant increase in all cardiovascular parameters immediately after exposure to cold stress for two minutes. Increase in heart rate (HR), Systemic Peripheral Resistance (SPR),

Systemic Vascular Resistance Index (SVRI) and Diastolic blood pressure (DBP), were highly significant (p<0.01). while increase in Stroke volume (SV), Stroke volume Index (SVI), Cardiac Output (CO), Cardiac Index (CI), Systolic blood pressure (SBP), were less significant (p<0.05). However, all the cardiovascular parameters returned back to normal after 5 minutes and there was no significant difference in parameters before CPT and 5 minutes after CPT.

Table 3 shows the comparison of parameters before and after cold pressor test with subjects performing Pranava Yoga during CPT and in recovery phase after CPT. All cardiovascular parameters increased significantly immediately after CPT even subject was performing Pranava yoga. Increase in HR, SPR, SVRI and DBP were highly significant (p<0.01); while increase in SV, SVI, CO, CI and SBP were less significant (p<0.05).

**Table 1:** Baseline characteristics of all subjects

S. N.		
1	Age (in years)	21.2±4.2
2	Height (cms)	168.5±5.1
3	Weight (Kg)	61.5±4.3
4	BSA (m <sup>2</sup> )	1.67±0.15

Data are expressed as Mean±SD

**Table 2:** Comparison of cardiovascular parameters before & after CPT

S. N.		Before CPT	Immediately after CPT	5 minutes after CPT
1	SBP (Systolic blood pressure; mm Hg)	115.82±2.5	137.2±5.2*	115.2±2.5#
2	DBP (Diastolic blood pressure ;mm Hg)	72.92±2.2	87.32±2.5**	73.12±3.6#
3	HR (Heart rate; per minute)	70.80±1.13	82.4±2.9**	71.18±0.23#
4	CO (Cardiac Output; L/min)	5.21±0.28	6.44±0.17*	5.22±0.28#
5	SV (Stroke volume ;ml/ beat)	72.04±0.6	76.21±1.5*	72.84±0.16#
6	SVR (Systemic Peripheral Resistance ;dyne.sec/cm <sup>5</sup> )	1355.1±9.4	1399±15.4**	1357.2±5.24#
7	CI (Cardiac Index ) (L/min/m <sup>2</sup> )	3.01±0.06	3.66±0.66*	3.02±0.07#
8	SVI (Stroke volume Index ;ml/ beat/m <sup>2</sup> )	43.81±0.02	45.46±0.13*	44.02±0.12#
9	SVRI (Systemic Vascular Resistance Index; dyne.sec/cm <sup>5</sup> /m <sup>2</sup> )	767.5±12.5	793.5±12.1**	769.2±12.5#

Data presented are Mean±SD. \*p<0.05, \*\*p<0.01, #p>0.05 (non-significant)

\*comparison between before CPT and Immediately after CPT, #comparison between before CPT and 5 minutes after CPT

**Table 3:** Comparison of cardiovascular parameters before and after Cold Pressor Test while subjects performing Pranava Yoga during and after CPT

S. N.		Before CPT	Immediately after CPT (with Pranava Yoga)	5 minutes after CPT (With Pranava Yoga)
1	SBP (Systolic blood pressure; mm Hg)	115.02±3.4	136.8±6.2*	105.6±2.1^^
2	DBP (Diastolic blood pressure ;mm Hg)	73.26±2.8	86.8±1.4**	64.12±1.3^
3	HR (Heart rate; per minute)	71.02±1.20	80.3±3.6**	65.2±0.14^^
4	CO (Cardiac Output; L/min)	5.26±0.20	6.18±0.06*	4.72±0.06^^
5	SV (Stroke volume ;ml/ beat)	71.84±0.8	74.22±1.4*	69.22±0.14^^
6	SVR (Systemic Peripheral Resistance ;dyne.sec/cm <sup>5</sup> )	1357.1±8.6	1388±18.4**	1324.2±5.34^
7	CI (Cardiac Index ) (L/min/m <sup>2</sup> )	2.92±0.18	3.72±0.16*	2.61±0.04^^
8	SVI (Stroke volume Index ;ml/ beat/m <sup>2</sup> )	44.12±0.02	44.16±0.24*	40.53±0.03^^
9	SVRI (Systemic Vascular Resistance Index; dyne.sec/cm <sup>5</sup> /m <sup>2</sup> )	765.5±12.44	796.98±14.8**	751.2±2.6^

Data presented are Mean±SD. \*p<0.05, \*\*p<0.01, ^p<0.05, ^^p<0.01, \*comparison between before CPT and Immediately after CPT (with Pranava Yoga), ^comparison between before CPT and 5minutes after CPT (with Pranava Yoga)

During next 5 minute subjects were performing Pranava Yoga and all the cardiovascular parameters recorded 5 minutes after CPT were significantly lower in comparison to parameters recorded before CPT. Decrease in HR, SV, SVI, CO, CI and SBP were highly significant ( $p < 0.01$ ) while decrease in SPR, SVRI and DBP were less significant ( $p < 0.05$ ).

### Discussion

Acute stress as well as prolonged stress increases sympathetic activity of autonomic nervous system. Prolonged sympathetic hyperactivity has been found to be associated with generation of hypertension. Cold stress produces intense stimulation of sympathetic nervous system with almost complete withdrawal of parasympathetic activity<sup>9</sup>. Increased sympathetic discharge produces arteriolar constriction which leads to increased systemic peripheral resistance, systemic vascular resistance Index and diastolic blood pressure. In addition, increased activity of sympathetic nerves increases heart rate, stroke volume, cardiac output and systolic blood pressure. Release of nor-epinephrine from postganglionic sympathetic neurons and epinephrine from adrenal medulla are responsible for these changes. By the action of cold stress, parasympathetic activity is abolished and heart rate increases to unopposed increased sympathetic activity. Stroke volume is also increased significantly due to increased myocardial contractility. Increased heart rate and increased stroke volume significantly increase the cardiac output. Regular yoga exercises improve quality of life, reduces morbidity and mortality. It gives sense of subjective well being in normal people as well as in patients suffering from diseases [13]. It can be used as powerful tool to combat stress. Aum chanting is very easy exercise and can be done any time in any posture [8]. Results in the present study show that intense sympathetic stimulation produced by acute stress of cold pressor test is washed out by Pranava Yoga. These finding suggest that Pranava Yoga practice leads to decrease in sympathetic activity and increases parasympathetic activity. This is thing which is required to combat stress in day to day life. So Pranava yoga is beneficial as quick stress reliever technique. As it reduces stress and quickly vanish adverse effects of stress, regular

practicing of Pranava Yoga is very beneficial for normal person and patients suffering from hypertension and other cardiovascular diseases.

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