

Comparison of Effects of Acute Stress on Cardiovascular Parameters in Sedentary Workers and Athletes

Sharad Jain

Abstract

Stress is common and inevitable in present scenario. Ability to combat stress varies from person to person. The present study was conducted to compare the effects of acute stress on cardiovascular parameters in sedentary workers and athletes. One hundred asymptomatic healthy males, aged 17-25 years, participated voluntarily. Subjects were divided into 2 groups of 50 each comprising of sedentary workers (Group A) and athletes (Group B). Cold pressor test (CPT) was used to induce acute stress. In CPT, cold water of 8°C was used to induce experimental stress. In both the groups, blood pressure and heart rate were recorded in basal condition and post CPT-immediate, 1 minute and 5 minutes after removal of cold stimulus. 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 cardiovascular parameters viz. blood pressure and heart rate in both the groups but these increments were more significant in sedentary workers in comparison to athletes. Recovery from the effects of cold stress was faster in group B (athletes). The results suggest that regular athletic activities and aerobic exercise reduces the effects of stress and also helps in faster recovery from the ill effects of stress.

Keywords: Acute Stress; Athletic Activity; Sedentary Life Style; Cold Pressor Test.

Introduction

Today human life is full of stress and everybody has to face stress in daily life. Stress is unavoidable and usually stressor develops unexpectedly all of sudden. Ability to cope up stress varies from person to person. Few people cope up stress very easily and few people face multiple problems in combating stress and suffer from ill effects of stress like apprehension, anxiety, insomnia, depression, hypertension etc. Lifestyles have been changed in people belonging to middle & high economic status where sedentary life style is very common [1]. Lack of exercise, lack of outdoor activities, more adherences to computer, mobiles and TV games is responsible to make the person lazy and sedentary. Sedentary life style has proven to be associated with increased risk of development of hypertension, obesity and other cardiovascular diseases [2].

Cold stress test is autonomic function test used for the assessment of autonomic functions especially sympathetic activity. Cold water of 8°C is used to

induce experimental stress which leads to wide spread neurogenic stimulation of sympathetic nervous system via afferent pain and temperature receptors and leads to increase in blood pressure and heart rate [3,4]. Cold pressor test was first described by Leblank in fisherman [5]. Cold stress produces intense stimulation of sympathetic nervous system and almost complete withdrawal of parasympathetic activity [6].

Regular exercise and athletic activities have proven to increase resting vagal tone. Resting bradycardia in trained athletes has been reported and now well established fact [7-9]. Regular exercise has been reported to produce pharmacological benefits and effective like a drug [10]. Many adaptations develop in the body in response to regular exercise which might be helpful to combat environmental stresses, and trauma/sickness [11]. As exercise may possibly increase the capacity of a person to combat stress. Therefore, the present study was conducted to compare the effects of acute stress on cardiovascular parameters in sedentary workers and athletes.

Author's Affiliations: Professor, Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur (U.P.).

Corresponding Author: Sharad Jain, Professor, Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur Road, Anwarpur - 245304 Uttar Pradesh.

E-mail: drsharadjain@yahoo.co.in

Received on: February 08, 2017 **Accepted on:** February 23, 2017

Materials and Methods

The present study was conducted in the Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India. One hundred asymptomatic healthy males, aged 17-25 years, participated voluntarily. Subjects were divided into 2 groups of 50 each comprising of sedentary workers (Group A) and athletes (Group B).

Inclusion Criteria

Subjects involved in athletic activities for more than 6 months were included. Subjects with sedentary life style with negligible exercise were included as control.

Exclusion Criteria

1. Smoking
2. Alcohol
3. Any acute or chronic illness
4. History of cardiovascular or pulmonary disease
5. Hypertension/prehypertension

Experiment procedures were in accordance with the Ethics Committee on human experimentation. The present study was carried out at ambient temperature with minimal external or internal sound disturbances in the room. Subjects reported to the laboratory 4 hours after breakfast. Cold water of 8°C was used to induce experimental stress in Cold pressor test (CPT). In both the groups, blood pressure and heart rate were recorded in right arm in basal condition. Then subject

was asked to dip left hand in cold water of 8°C for 2 minutes. Blood pressure and heart rate were recorded immediately after removal of hand from cold water, after 1 minute and after 5 minutes. Statistical analysis was done by one-way ANOVA and Tukey post-hoc tests using the (window) SPSS Statistics 17.0 version.

Result

Table 1 shows that, in group A (sedentary workers), systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were significantly higher immediately after CPT ($p < 0.01$) and after 1 minute in post CPT ($p < 0.05$). There was no significant difference in parameters recorded in basal condition and 5 minutes after CPT ($p > 0.05$).

Table 2 shows that, in group B (athletes) systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were significantly higher immediately after CPT ($p < 0.05$). There was no significant difference in parameters recorded in basal condition and 1 minute and 5 minutes after CPT ($p > 0.05$).

Table 3 shows that SBP and DBP were significantly higher in group A than group B immediately after CPT and 1 minute after CPT ($p < 0.05$) however there was no significant difference in SBP and DBP in both groups in basal and in 5 minutes after CPT ($p > 0.05$).

Heart rate was significantly lower in group B (athletes) ($p < 0.05$) in comparison to group A in basal and post CPT periods viz. immediate, after 1 minute & 5 minutes.

Table 1: Effects of acute stress on cardiovascular parameters in Group A (sedentary workers)

Parameters	Basal	Post CPT- immediate	Post CPT- After 1 minute	Post CPT- After 5 minutes
Systolic blood pressure (SBP) mmHg	122.6±5.2	160.5±8.4*	140.6±7.3#	121.9±4.2^
Diastolic blood pressure (DBP) mmHg	78.3±4.3	90.3±8.3*	82.2±6.3#	79.3±5.2^
Heart Rate (HR) per minute	74.7±5.2	94.1±8.2*	86.6±7.3#	74.2±4.8^

Data represented as Mean±SD. * $p < 0.01$, # $p < 0.05$, ^ $p > 0.05$

*Comparison between basal and post CPT- immediate.

Comparison between basal and post CPT -after 1minute.

^ Comparison between basal and post CPT -after 5 minutes.

Table 2: Effects of acute stress on cardiovascular parameters in Group B (athletes)

Parameters	Basal	Post CPT- Immediate	Post CPT- After 1 Minute	Post CPT- After 5 Minutes
Systolic blood pressure (SBP) mmHg	121.3±7.2	143.3±11.8*	124.2±8.2#	120.3±8.3^
Diastolic blood pressure (DBP) mmHg	74.4±6.3	82.6±9.1*	76.2±6.8#	74.5±5.4^
Heart Rate (HR) per minute	61.2±5.6	86.3±10.3*	64.2±6.1#	61.6±5.2^

Data represented as Mean±SD. * $p < 0.05$, # $p > 0.05$, ^ $p > 0.05$

*Comparison between basal and post CPT immediate.

#Comparison between basal and post CPT -after 1minute.

^ Comparison between basal and post CPT -after 5 minutes.

Table 3: Comparison of effects of acute stress on cardiovascular parameters in sedentary workers and athletes

Parameters	Group A (sedentary workers)			Group B (athletes)		
	SBP	DBP	HR	SBP	DBP	HR
Basal	122.6±5.2	78.3±4.3	74.7±5.2	121.3±7.2	74.4±6.3	61.2±5.6 [^]
Post CPT- immediate	160.5±8.4	90.3±8.3	94.1±8.2	143.3±11.8 [*]	82.6±9.1 [#]	86.3±10.3 [^]
Post CPT- After 1 minute	140.6±7.3	82.2±6.3	86.6±7.3	124.2±8.2 [*]	76.2±6.8 [#]	64.2±6.1 [^]
Post CPT- After 5 minutes	121.9±4.2	79.3±5.2	74.2±4.8	120.3±8.3	74.5±5.4	61.6±5.2 [^]

Data represented as Mean±SD. *p<0.05, #p<0.05, ^p<0.05

*Comparison of SBP in group A and group B.

#Comparison of DBP in group A and group B.

^Comparison of HR in group A and group B.

Discussion

The present study shows significant difference in heart rate in basal condition in group A (sedentary workers) and group B (athletes) which indicates higher resting vagal tone in athletes. However no significant difference was observed in SBP and DBP in two groups, indicating that higher vagal tone in athletes is not sufficient enough to produce significant reduction in resting blood pressure. On exposure to cold stress, SBP, DBP and heart rate significantly increased in both groups, however this increase was more significant in group A (sedentary) in comparison to group B (athletes). In recovery phase, 1 minute after CPT, all parameters were significantly higher in group A (sedentary) (p<0.05) and insignificantly higher in group B (athletes) (p>0.05) indicating faster recovery in group B. However all cardiovascular parameters returned to basal value in 5 minutes after CPT. With these observations, it can be concluded that regular aerobic exercise and athletic activities increase the resting vagal tone and also increases the ability to cope up the stress in better way and leads to faster recovery from the ill effects of the stress.

References

1. Mc Ewen BS. Physiology and neurobiology of stress and adaptation: Central role of the brain. *Physiol Rev.* 2007; 87(3):873-904.
2. De Kloet ER, Joëls M, Holsboer F. Stress and the brain: From adaptation to disease. *Nat Rev Neurosci.* 2005; 6(6):463-75.

3. Wirch JL, Wolfe LA, Weissgerber TL, Davies GAL. Cold pressor test protocol to evaluate cardiac autonomic function. *Appl Physiol Nutr Metab* 2006; 31:235-43.
4. Hines EA, Brown GE. The cold pressor test for measuring the reactivity of the blood pressure. *Am Heart J* 1936; 11:1-9.
5. Leblanc J, Cote J, Dulac S. Effects of age, sex and physical fitness on response to local cooling. *J Appl Physiol* 1978; 44:813-17.
6. Keatinge WR, Mcllory MB, Goldfien A. Cardiovascular responses to ice cold showers. *J Appl Physiol* 1964; 19:1145-1150.
7. Ganong WF. The heart as a pump. In: Ganong WF, ed. *Review of Medical Physiology* 23rd ed. India. Appleton & Lange, 2010.p.507-520.
8. Peter R, Sood S, Dhawan A. Spectral parameters of HRV in yoga practitioners, athletes and sedentary males. *Indian J Physiol Pharmacol* 2015; 59(4): 380-387.
9. Gomar SF, Lippi G. Physical activity - an important pre analytical variable. *Biochem Med* 2014; 24(1):68-79.
10. Vina J, Sanchis-Gomar F, Martinez-Bello V, Gomez-Cabrera MC. Exercise acts as a drug; the pharmacological benefits of exercise. *Br J Pharmacol.* 2012; 167:1-12.
11. Sawka MN, Convertino VA, Eichner ER, Schnieder SM, Young AJ. Blood volume: importance and adaptations to exercise training, environmental stresses, and trauma/sickness. *Med Sci Sports Exerc.* 2000; 32:332-348.