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Original Research Article

Associations between Serum Lipid Levels and Cardiovascular Risk in Men Exposed to Heat

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ABSTRACT

Objective:- To examine the association between exposure to stressful stimuli (heat) and cardiovascular risk in thermal power station workers with blood levels of serum cholesterol and triglycerides. ***Material and methods :-*** Two Hundred male workers were selected out of whom 100 were workers exposed to heat emitted by boiler in boiler section for 8 hrs daily and 6 days in a week and the control group consists of office workers and staff who were not exposed to extreme heat. Depending on age, they were divided into four groups. (Group I (21-30yrs), Group II (31-40yrs), Group III (41-50yrs) and Group IV (41 onwards). Estimation of serum total cholesterol and triglyceride was carried out by enzymatic method between cases and controls to see whether exposure to heat (stress) is associated with increase in lipid profile. ***Results :-*** It was observed that age adjusted average serum cholesterol and triglyceride level was highly significant (P< 0.005) in workers exposed to heat as compared to controls. ***Conclusion :-*** Above results suggests that greater is the risk of hypertension and coronary heart disease (CHD) in these workers exposed to heat as compared to controls.

Key words:- *Heat stress, Serum total Cholesterol, triglycerides*

INTRODUCTION

Stress is the reaction of the body to stimuli that disturb its normal physiological equilibrium or homeostasis. In our daily lives, some stress prepares us to meet certain challenges. The productive stress is called Eustress while the other harmful stress is called Distress**.** [1] Stressors can be Physical or mental. Examples of physical stressors include exertion, extreme cold, extreme heat, extreme noise; surgery etc. Mental

stress is one of the numerous factors which have been linked with hypertension and atherosclerosis. Exam:-Examination stress, unemployment etc**.** [2] The various physiological changes seen in response to stress are due to increased hypothalamo-pituitary action, activation of pituitary-adrenal system and secretion of various hormones e.g. cathecholamines, endorphins and encephalins etc. [3] Heat stress remains a very important issue even in developed and technologically advanced countries of the world. In industry, such stress may be caused by high ambient temperatures, high humidity, low air movements or high radiant energy sources. Heat is one of the most widespread forms of environmental stressor in the industrialized areas. [4] The biochemical parameters which have attracted the most sustained and widespread attention in relation to etiology, prevention and treatment of atherosclerosis are serum total cholesterol and triglycerides. Increase levels of serum total cholesterol and triglycerides are now recognized as major risk factors for CHD**.** [5] Effect of different stresses on lipid profile has been studied widely, but occupational exposure to heat stress is least studied part of the subject.

MATERIAL AND METHODS

The present study was conducted at Thermal power station, Parli-Vaijnath, Maharashtra (India). Estimation of lipid profile were carried out in 200 healthy male individuals in between age group of 21-58yrs out of which 100 were workers of thermal power station and remaining 100 were office workers and other staff with same age and socioeconomic status. The workers were exposed to heat emitted by boiler in "Boiler section" for 8 hrs daily and 6 days a week and temperature to which they are exposed is in between 40^0 C to 45^0 C. The control group consists of office workers and staff who were not exposed to extreme heat. Depending on age the cases and controls were divided into four groups. (I, II, III & IV)

In the present study, each subject was made familiar with the procedure to alleviate any fear or apphrension and before starting the procedure, they were asked to relax for five minutes. Screening of each volunteer was done with the help of proforma. After Screening, following volunteers were excluded from the study.

- Those having major cardiovascular illness or Diabetes mellitus in the past or present.
- Those with the H/O consumption of tobacco, alcohol, smoking.

Collection of samples:-

The collection of samples is done in cases after the overnight fasting from anti cubital vein with all aseptic precautions. The blood is collected in plain bulb for the estimation of serum lipids and lipoproteins. Blood was allowed to clot at room temperature for half an hour and then centrifuged at 3000rpm for the estimation of lipid profile. After separation of serum, estimation of total cholesterol was carried out by modified Roeschlau's method [6] and triglyceride by Trinder method. [7]

Statistical analysis

For statistical analyses, we have applied t-test to compare workers of thermal power station exposed to heat with controls.

RESULTS

Table-1: Comparison of Serum total cholesterol between cases and control belonging to different age group.

Groups	21-30yrs (Group-I)		31-40yrs (Group-II)		41-50yrs (Group-III)		51-58yrs (Group-IV)	
	Control	Cases	Control	Cases	Control	Cases	Control	Cases
No.	17	16	33	34	37	38	13	12
Mean	135.16	152.85	151.18	169.74	168.79	185.19	190.51	214.13
±SD	10.74	9.57	28.66	23.05	25.97	23.05	15.99	19.56
t- test	P < 0.001		P < 0.001		P < 0.001		P < 0.005	
Significant	H.S.		H.S.		H.S.		H.S.	

Table No. 1 showed highly significant increase in Serum total cholesterol in workers exposed to heat in all four age groups as compared to controls.

Table-2: Comparison of Triglycerides between cases and control belonging to different age group.

Groups	21-30yrs (Group-I)		31-40yrs (Group-II)		41-50yrs (Group-III)		51-58yrs (Group-IV)	
	Control	Cases	Control	Cases	Control	Cases	Control	Cases
No.	17	16	33	34	37	38	13	12
Mean	64.14	84.62	71.86	90.17	96.98	116.57	108.72	145.06
±SD	16.62	21.11	22.36	32.2	28.43	31.6	11.15	33.45
t- test	P < 0.005		P < 0.005		P < 0.005		P < 0.001	
Significant	H.S.		H.S.		H.S.		H.S.	

In table no.2 Serum Triglyceride showed highly significant increase in all four age groups.

DISCUSSION

Our study shows highly significant increase in serum total cholesterol level when compared with age-matched controls of all the four age groups. A similar statistical significant increase in serum total cholesterol was reported by Mathew F [8] and Ingrid Mattiason et al. [9] The mechanism by which stress raises serum total cholesterol is uncertain. But, it may be due to the fact that, during stressful periods, there is increase in the blood levels of lipolytic hormones like cortisol, epinephrine, nor- epinephrine and growth hormone. They mobilize lipid stores of adipose tissue and liver to meet the extra caloric requirement of tissue. [10] On the other hand, cholesterol

may also increase as an adaptive mechanism to maintain the adrenal cholesterol as adrenal cholesterol gets depleted during stress as a result of enhanced secretion of adrenal steroids. [11]

The effect of stress on serum triglyeride has been subjected to some controversy. The stress associated with flickering light [11] and noise [12] resulted in a significant decrease in triglyceride. In the present study, triglyceride showed a highly significant increase which correlates with the studies reported by Recher H [13] and Tsopanakis C. [14] These conflicting results in triglyceride values presumably due to the failure to distinguish acute from chronic stress and due to the varied type of stressful situations tested. Though, the exact mechanism responsible for the elevation of triglyceride is not known, it is probably due to increase sympathetic activity during stress. [10, 15]

However, Stoney et al [16] in their study on women found diminished ability to clear intravenous fat emulsion during stress and suggested that this may be one of the mechanisms for stress induced elevation of serum triglycerides.

CONCLUSION

We have observed a highly significant increase in serum levels of total cholesterol and triglyceride in workers exposed to heat as compared to control group. This suggests that the risk of hypertension, CHD in these workers is greater.

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