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BIOCHEMICAL ALTERATIONS DURING SWIMMING INDUCED STRESS

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ABSTRACT:

Stress can be defined as any stimulus that creates an imbalance in the internal environment. Hypothalamus has sensors that detect changes produced in the body. Stress can cause diseases by altering immune system, cardiovascular System neurotransmitter and neuroendocrine functions. Present study is designed to evaluate the effect of stress on few biochemical parameters during swimming induced stress. Significant changes have been observed especially in lipid profile. Corticosterone was also evaluated as reliable stress marker.

Introduction

Stress is the non-specific response of the body to any demand placed upon it. Stress can also be defined as any stimulus that creates an imbalance in the internal environment. The stimuli that produce the syndrome are called 'stressors'. Stress is a half-way station on the way to anxiety. From the hypothalamus ACTH is secreted which triggers the glucocorticoids mainly cortisol and corticosterone. The somatotropic of the pituitary stimulates defensive mechanisms. Catecholamines are also liberated to activate mechanism for adaptation. Alarm reaction represents a general call to arm the body's defences activated by autonomic nervous system and adrenal medulla. The resistance reaction characterized by hormone regulation, and exhaustion in which there is loss of potassium follows. Hence stress can lead to gastritis, peptic ulcer, hypertension, asthma, anxiety and depression (Tortora and Anagnostakos, 1990). In chronic stress situation, final corticosterone level on occasions have been reported to correlate with the extent of gastric pathology (Weiss *et al*, 1975).

Stress may effect tumor development depending upon the availability of coping responses. Stress is believed to be the main predisposing and precipitating factor in

depression (Anisman and Zacharco, 1982, Brelau and Davis, 1986). The catecholamines secreted during stress are involved in the peripheral control of ACTH secretion (Mercy *et al.*, 1984). Corticosterone and prolactin elevation occurs in response to the stress stimuli (Brown and Martin, 1974), while growth hormone is decreased (Kokka *et al*, 1972). The increased GABA release during stress may serve to limit the variety of stress induced changes mediated by corticotrophin releasing factor (Koob and Bloom, 1985). Stress can lead to many problems of ill health leading to any serious pathology. Present study is designed to observe the effects of stress on some biochemical parameters, such as triglycerides, albumin, cholesterol, glucose level, proteins and corticosterone level as an indicator of stress.

Material and Methods

Analytical grade chemicals, and male rats weighing 180-220 grams were used. The rats were forced to swim into water, and after 20 minutes of producing stress rats were removed, toweled, and sacrificed by decapitation (Porsolt *et al*, 1978). The effects were seen on:

1. Albumin concentration
2. Protein concentration
3. Cholesterol concentration
4. Lipid concentration
5. Triglyceride concentration
6. Corticosterone level
7. Glucose concentration

1. Albumin Estimation

Serum albumin has been determined by the colorimetric method using Kit Proti-2 of the Weiner lab.

2. Protein Estimation

Protein is also estimated by colorimetric method using Proti-2 Kit of Weiner lab.

3. Cholesterol Estimation

The serum cholesterol was determined by using 3312 Cholesterol Merkotest, based on Leibermann-Burchard reaction.

4. Lipid Estimation

Lipid is estimated photometrically using phosphoric acid/vanillin reagent.

5. Triglyceride Estimation

These are estimated in the lab by the enzymatic colorimetric test.

6. Corticosterone Estimation

Corticosterone level were determined by flourimetric method given by Mattingly *et al.* (1964).

7. Glucose Estimation

Glucose was estimated by O'toulidine method.

Results

Effect of 20 min. stress = a
Effect of 20min. stress on 2 consecutive days = b

Level of significance:

P 0.05 < (*)
0.02 < (*)
0.02 < *
0.01 < **
0.005 < ***

Effect of a and bon albumin:

Both type of stress did not produce any significant effect on albumin.

Effects of a and b on total protein concentration:

No significant effect was produced on protein concentration.

Effects of a and bon cholesterol level:

Both types of stresses increased cholesterol level ($P < 0.005$).

Effects of a and b on lipid concentration:

Significant increase on lipid concentration was noted ($P < 0.005$).

Effects of a and b on triglyceride concentration:

Both type of stress have significantly increased the triglyceride concentration ($P< 0.005$).

Effects of a and bon corticosterone level:

Corticosterone level is significantly increased by both types of stress ($P<0.005$).

Effects of a and b on glucose concentration:

Glucose level is highly increased in both types of stress which is statistically significant ($P< 0.005$).

Discussion

Stress is a daily occurrence, and the ability to adopt, or to cope stressor is a fundamental necessity of human life. Attempts have been made to correlate effects of stress in animals with the effects of stress produced in men.

Blood lipid as a whole participate as a key intermediate in atherogenesis. In present study increased level of cholesterol has been reported. The increase in lipids and cholesterol along with increased triglycerides can lead to myocardial ischemia leading to arrhythmias.

The plasma membrane consists of phospholipids, sterol, glycolipids and glycoproteins. Stress effects the composition of plasma membrane constituents. Increased cholesterol and total lipids impose stress periods trading to angina pectoris, coronary heart disease and atherosclerosis and also increase other factors causing atheromatous lesion (Arnott, 1954).

There are good evidences that requirement for some vitamins are increased during stress (Goodman and Gilman, 1980) and increased metabolic activity demands administration of high potency B-complex and ascorbic acid. Ascorbic acid is requ[i]red for the synthesis of steroids of adrenal cortex and there is increased requirement of vitamin in stress due to increased synthesis of stress hormones. Ubiquonine is a form of vitamin K and is found to be elevated in stress, and it is also formed during synthesis of squalene (a precursor of cholesterol), hence same biosynthetic route is involved for the synthesis of cholesterol, and for vitamin K (Harper, 1991).

In present study no significant change has been reported on protein and albumin concentration, whereas triglycerides are increased in the present study.

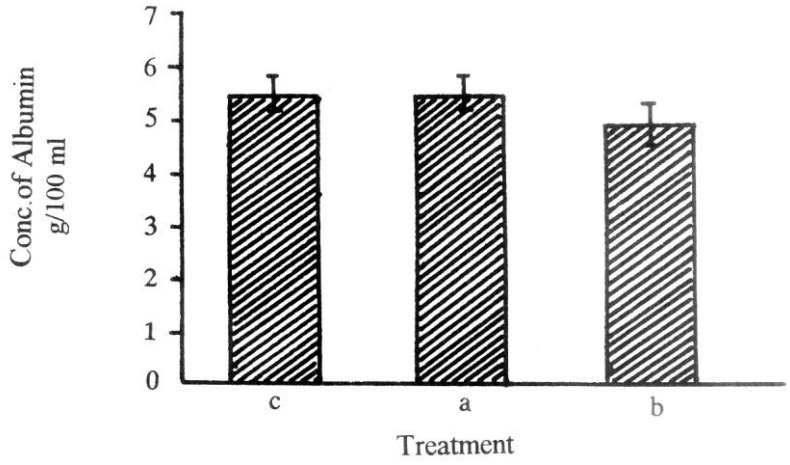

Fig. 1: Effect of stress on serum albumin. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

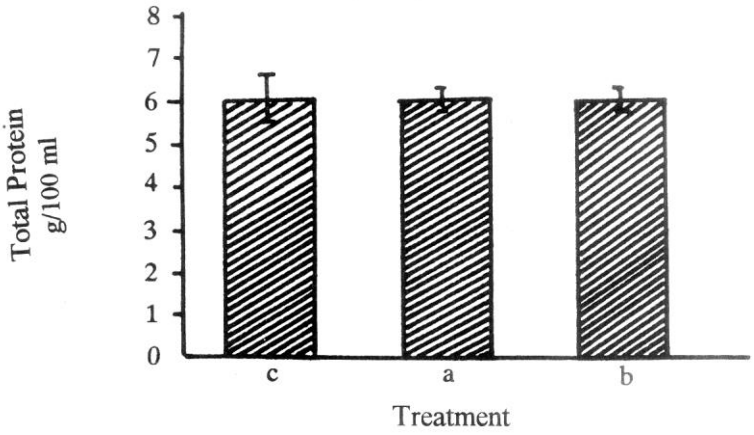

Fig. 2. Effect of stress on total protein. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

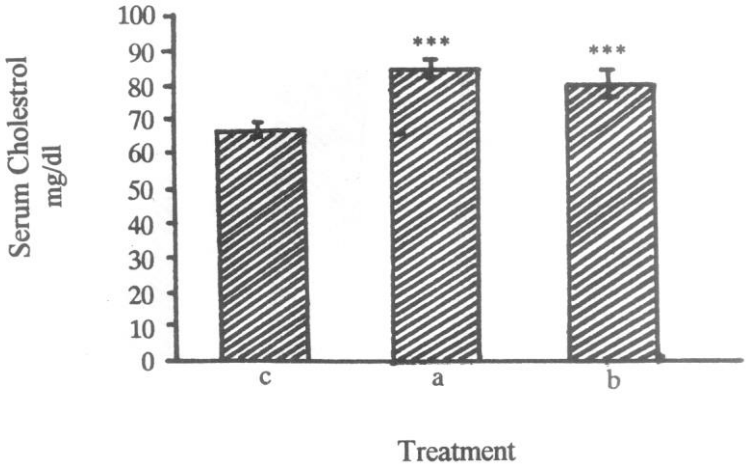

Fig. 3: Effect of stress on serum cholesterol. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

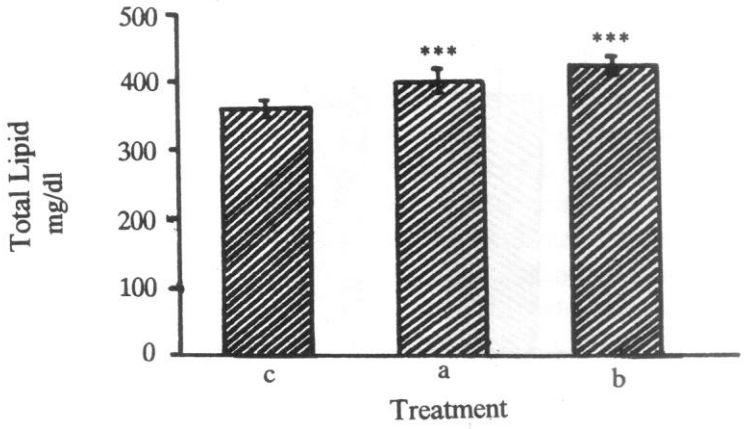

Fig. 4: Effect of stress on lipid. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

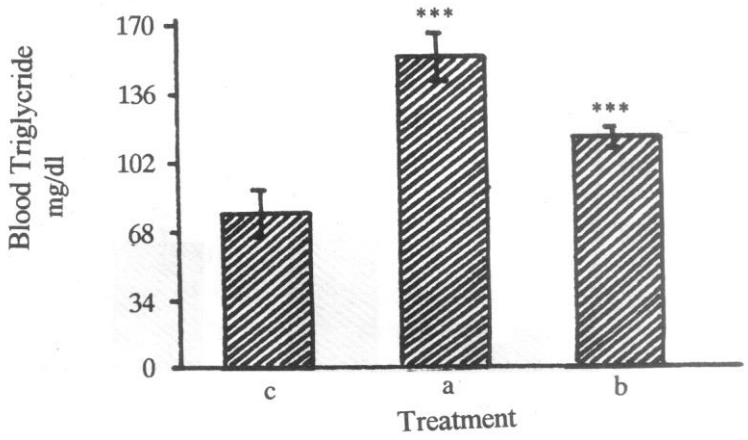

Fig. 5: Effect of stress on triglycride. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

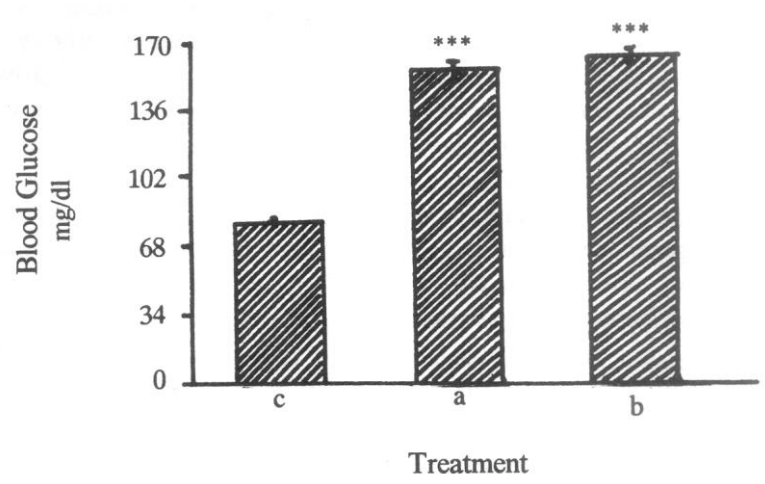

Fig. 6: Effect of stress on blood glucose level. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

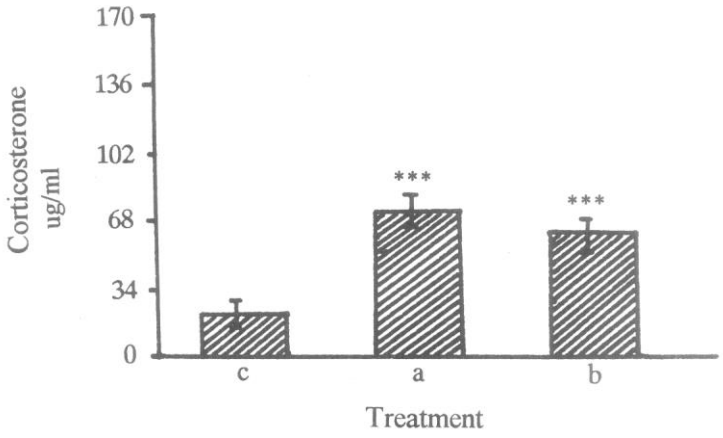

Fig. 7: Effect of serum corticosterone level. Vertical bars represent ± SEM. Statistical evaluation was done using student t-test.

As reported by Amirgova (Amirgova, 1979) that corticosterone level increases in acute stress, which is in accordance with our findings. Corticosterone and prolactin elevation occurs in response to stress stimuli (Brown and Martin, 1974 and Murison 1983) suggested that corticosterone can be considered as an index of stress only in acute situations. Catecholamines are released in response to stress (Goodman and Gilman, 1980). These twin hormones mediated stimulation of protein kinase via adrenaline may have a strong effect on various biochemical reactions such as stimulation of phosphorylase by specific protein kinase. Stimulation of kinase leads to in-creased blood sugar level while increments in lipid concentration, cholesterol, and triglyceride may also be related to activation of specific protein kinases by catecholamines released in acute stress.

The review of the literature has also revealed that heart diseases are common all over the world, especially those who are exposed to mental stress, whose symptoms if are left unchecked can lead to hypertension, depressive moods etc. The individual can be protected to intense stress response by the religious belief and different supports can counterbalance these responses and then an individual can cope with stress more effectively.

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