THE BODY'S HORMONAL RESPONSE UNDER THE INFLUENCE OF AUDITORY STRESS

Razvan Chirica

Physiology Discipline, Ovidius University, Faculty of Medicine, Constanta, Romania

Gheorghe Ionel Comsa

ORL Discipline, Ovidius University, Faculty of Medicine, Constanta, Romania

Abstract

Sound causes to the body not only beneficial effects, relaxing by his action, but also harmful effects, by changes, at both, cellular and hormonal level. The effect of repeated exposure to a noise source, on the enzymatic activity of cortisone is found in the present study. The study was conducted on laboratory animals (Wistar rats, albino line) through their exposure for 7 days at a noise source with an intensity of 38 ± 2 db.

Keywords: Sound, cortisone, noise, Wistar rats, albino line

Introduction

Stress is a normal people reaction to, too many, and various noise sources. Most striking neuro-endocrine immune interactions are occurring in the state of stress. Stress is defined as a dynamic condition during which normal homeostasis (steady state internal environment) is disturbed or threatened. State of imbalance is induced by stress factors, physical or psychological. Stressors, physical or mental triggers, are a complex adaptive response, called stress or alarm response designed to counteract the effects of the stressor. The intensity adaptive response is dependent on age, gender, hormonal status and genetic factors.

A too high or too low reactivity to stress may cause or contribute indirectly to the pathological manifestations. Response to stressors is mediated by factor (hormone) release of corticotropin (CRH), a hypothalamic-pituitary-adrenal axis and the sympathetic nervous system.

The most important physiological effects of cortisone are increased blood glucose (by stimulating gluconeogenesis) and anti-inflammatory and immunosuppressive action [Wallach, 2001] [Ciudin & Marinescu, 1996]

Stress increases cortisone secretion [Teodorescu,1989] [Wallach, 2001] [Synevo Lab., 2010] [labcorp.com, 2010] which is the most important glucocorticosteroid and it is essential for maintaining many body functions.

Materials and Methods

Experimental animals used in our model were albino rats of Wistar line, males aged 14 weeks and weighing 200-220 g, because of the similarity to humans, in physiologically terms. The animals were cared in compliance with the rules of hygiene, food and accommodation required by Community legislation. [Ciudin & Marinescu, 1996]

The experimental model consists of five groups, whose characteristics are:

- Control group (M) - animals in this group were not exposed to noise, serving as a reference for the experimental groups.
- Experimental group (E1) - animals in this group were exposed only once to noise (38 ± 2 dB) for one hour, three minutes exposure, 3 minute break
- Experimental group (E2) - animals in this group were exposed only once to noise (38 ± 2 dB) for 2 hours, 3 minutes exposure, 3 minute break
- Experimental group (E_{1-7}) - animals in this group were exposed to a cycle of exposure to noise (38 ± 2 db) which lasted seven days, for an hour, 3 minutes exposure, 3 minute break.
- Experimental group (E_{2-7}) - animals in this group were exposed to a cycle of exposure to noise (38 ± 2 db) which lasted 7 days, 2 hours, 3 minutes exposure, 3 minute break.

After noise exposure, blood samples were taken.

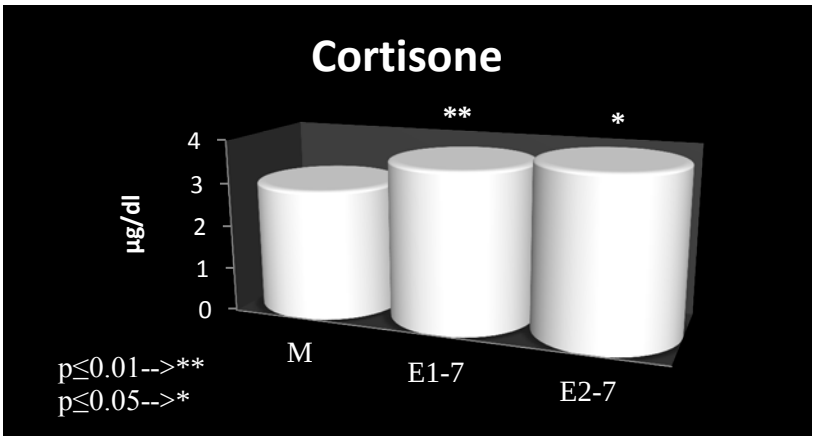
It was monitored the activity of the following parameters: serum cortisone and glucose

Determination of serum glucose levels was performed using a spectrophotometer CECIL CE 2012, 2000 Series, which is 1 cm cuvette, in accordance with the requirements of the International Federation of Clinical Chemistry and Laboratory Medicine, and serum cortisone determination was performed according to the protocol analyzer Immulite 100

Data were statistically analyzed using the usual methods, and calculating test "t" Student [Senedecor & Cochran, 1980] was to determine the significance of difference between the averages that was compared. The difference was considered significant for the threshold of significance (p) of less than 0.05.

Results and Discussions

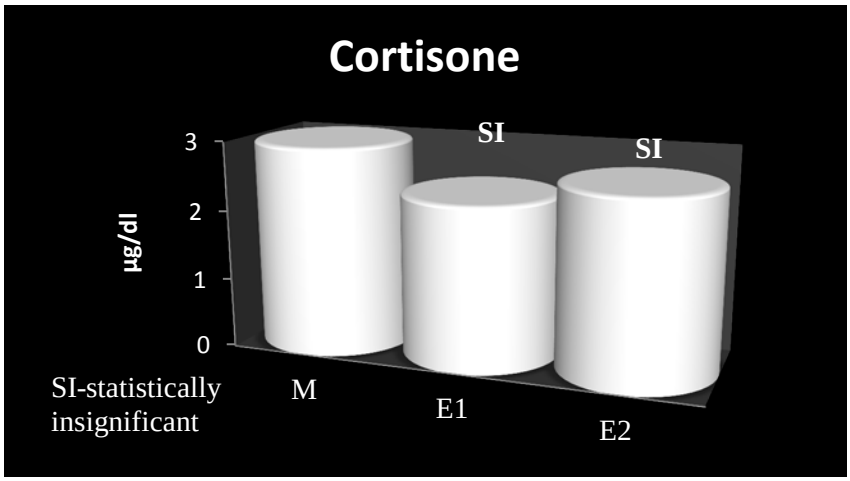
Hypothalamic-pituitary-adrenal axis (HHS) is a dynamically system adapted to respond to ever-changing conditions of the environmental interrelations body. HHS axis activity is regulated by a negative feedback mechanism, even by glucocorticoids. Effects of exposure to sound stress hormone level is seen by affecting, port hypothalamic-pituitary axis, which by prolonged stimulation, produce negative effects on the body.



Graphic no. 1 Statistical variation of serum cortisone values, after 1 hour of noise exposure per day for 7 days compared with values obtained after 2 hours of exposure to noise per day for 7 days

Such an effect is shown by modifying serum cortisone secretion in subjects who were undergoing stimulation, to a long sound stress. This is highlighted in the graphic no. 1. This graph represents the change in serum cortisone, to the action of an acoustic stimulus, acted for an hour, during 7 days ($p \leq 0.01$).

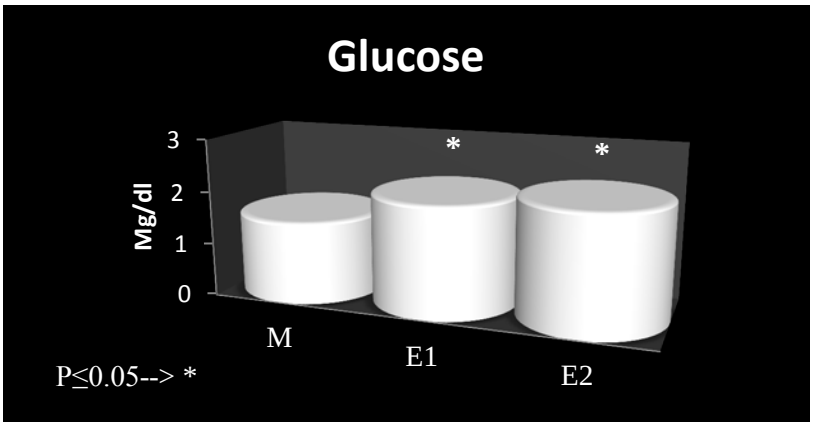
Exposure to the noise stress, activated for 2 hours, over 7 days, is producing the same thing, a change in serum cortisone levels. ($p \leq 0.05$)



Graphic no. 2 Statistical variation of serum cortisone values after a single exposure to noise for an hour, compared with values obtained after a single exposure to noise for 2 hours

Graphic no.2, reveals the results of serum cortisone after a single exposure to auditory stimuli, for a lot of subjects, for an hour, and for the second batch for 2 hours. By this, we tried to emphasize the changes in the acute phase serum cortisone, by the stress sound action.

The results are statistically insignificant because in the acute phase changes are produced by simpato-adrenergic stimulating updates (changes that are characteristic of acute stress) and adrenal system involvement, evidenced by increased serum cortisone values (graphic. 1) is characteristic of the chronic phase of stimulation. [Gitanjali & Dhamotharan, 2003]

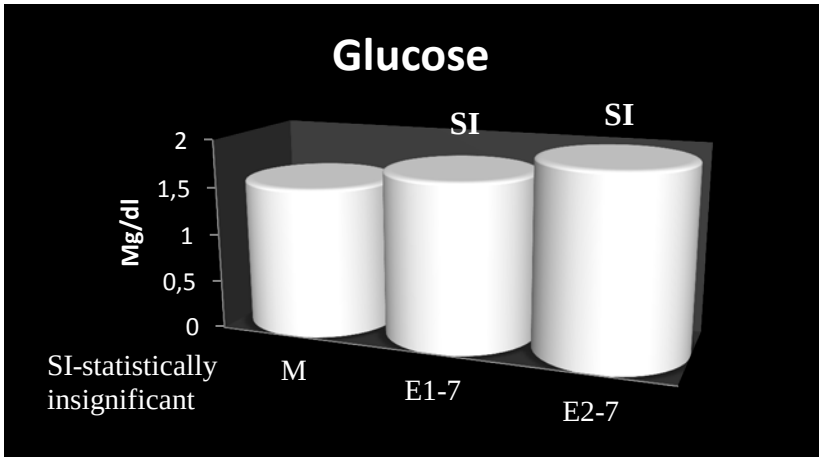


Graphic no. 3 Statistical variation of blood glucose after a single exposure to noise for an hour, compared with values obtained after a single exposure to noise for 2 hours

The link between stress and the occurrence of changes in serum levels of glucoses can be observed in all three stages, the result of the body's response to stress.

Alarm status- appears at first contact with the agent stressor and is accompanied by increased discharge of adrenaline- this stage is associated with decreased insulin levels and increased transformation present in muscle glycogen, into glucose, which is why blood glucose level will rise to give muscles more energy, which is statistically accounted ($p \leq 0.05$) in graphic no. 3. Tremors occur, accompanied by nervousness, tension and anxiety, and increased peripheral temperature (sign seen in subjects tested).

Stage of resistance- occurs in repeated contact with the stress agent that release the cortisone- among other effects, it causes transformation of proteins and fatty acids in the liver causing carbohydrates increase the amount of blood sugar (hyperglycemia), thereby overburdening pancreas functions. As a result, the pancreas will make a "rebound" higher secretion of insulin, which will lead to normalization of blood glucose values, statistically insignificant (graphic no. 4).



Graphic no. 4 Statistical variation of blood glucose after an hour daily noise exposure for 7 days, compared with values obtained after 2 hours of exposure to noise per day for 7 days

Also the pituitary gland generates HGH (human growth hormone) that promotes the transformation of fats (lipids) in carbohydrates causing hyperglycemia even if the subject has not consumed food. [terapieholistica.ro, 2012]

Conclusions

1. Acoustic stress is an important factor of developing diseases in different cellular and anatomical levels
2. Chronic stimulation of the auditory stimulus can cause both changes at the cellular and behavioral changes in vegetative state, with the substrate modification of serum cortisone secretion
3. Cortisone is a hormone considered vital because it hijacks the use of muscles glucose to the brain
4. In terms of overexposure to noise may be an increase in blood glucose due to maintaining high levels of cortisone, which can eventually lead to diabetes mellitus

References:

Ion Teodorescu Exarcu. Fiziopatologia corticosuprarenalei. In Fiziologia si fiziopatologia sistemului endocrin. Editura Medicala, Romania, Ed. 1989, 699-727.

Jacques Wallach. Afectiuni endocrine. Interpretarea testelor de diagnostic. Editura Stiintelor Medicale, Romania, Ed. 7, 2001, 866-868.

Jacques Wallach. Afectiuni endocrine. Interpretarea testelor de diagnostic. Editura Stiintelor Medicale, Romania, ed. 7, 2001, 835-837.

Laborator Synevo. Referintele specifice tehnologiei de lucru utilizate 2010. Ref Type: Catalog.

Laboratory Corporation of America. Directory of Services and Interpretive Guide. Cortisol. www.labcorp.com 2010. Ref Type: Internet Communication.

Ciudin Elena, Marinescu D. Animale de laborator, vol. I, *Ed. All, Bucureşti.* 1996, 99 - 136.

Senedecor G.W, Cochran WG. Statistical methods.7th ed. *Ames, Iowa, Iowa State University Press.* 1980, 334-364

Gitanjali B, Dhamotharan R.: *Effect of occupational noise on the nocturn*al *sleep architecture of healthy subjects*, Indian J Physiol Pharmacol. 2003 Oct;47(4):415-22, Erratum in: Indian J Physiol Pharmacol. 2004 Apr;48(2):136.

http://www.terapieholistica.ro/index.php?pagina=0_436_437_458&section=proiect&lang=ro