

# OCCUPATIONAL NOISE NON-TRAUMATIC EFFECTS

NICULINA ȘCHIOPU<sup>1</sup>, D. I. BARDAC<sup>2</sup>

<sup>1,2</sup>„Lucian Blaga” University of Sibiu

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**Abstract:** Noise is an undesirable stimulus which can determine traumatic effects (lesions to receptors) or non-traumatic. The non-traumatic effects occur at physiological level (cardio-vascular changes, respiratory disorders, dysfunctions of the neurohormonally regulated system) and at behavioural level (feeling of annoyance, changes in the general conduct, disturbances in communication and performance).

**Cuvinte cheie:** zgomot, stres, efecte nontraumatice ale zgomotului, hipertensiune arterială, tulburări de somn

**Rezumat:** Zgomotul este un stimul sonor indezirabil care poate să determine efecte traumatice (leziuni ale receptorilor) sau nontraumatice. Efectele nontraumatice se manifestă la nivel fiziologic (modificări cardio-vasculare, tulburări respiratorii, disfuncționalități ale sistemului reglat neurohormonal) și la nivel comportamental (senzația de neplăcere, modificări ale comportamentului general, perturbări ale comunicării și performanței).

Noise exposure can cause effects manifested as a response in the form of stress. If the exposure is temporary, the body takes a few minutes to return to normal or to the previous condition of noise exposure. If the exposure is always present or repeated, definitive deterioration may occur in the neuro-sensorial, circulatory, endocrine, digestive systems.

The purpose of this study is to present the current knowledge about the non-traumatic effects of noise on the employees exposed to noise. In recent literature, a stimulus sound has been defined as a noise not only by physical characteristics, but also by its effects on the individual. All authors subjectively emphasize the disagreeable character of noise, with particular emphasis on the interface between noise and the detection of other stimuli (1), disruption of work (2) or the physiological and psychological health of the individual.(3)

Smith and Broadbent (4) define the non-auditory effects of noise as being “all effects on health and wellbeing caused by the exposure to noise with the exception of the effects of the auditory analyzer and the masking effects of the auditory information”.

Audible noise is an undesirable stimulus which can have traumatic effects (lesions to receptors) or non-traumatic effects. The non-traumatic effects occur at physiological level (cardio-vascular changes, respiratory disorders, dysfunctions of the neurohormonally regulated system) and at behavioural level (feeling of annoyance, changes in the general conduct and disturbances in communication or performance).

The physiological effects of noise are observed at motor level (tonic muscular contractions), vegetative level (transitional increase or decrease in heart rate, peripheral vasoconstriction, the increase in the diastolic blood pressure, respiratory movements decrease etc.), biochemical level (increase in the catecholamine and cortisol secretion etc.) and at electroencephalographic level (Async EEG).(5,6,7) These effects may be of short duration or persistent depending on the intensity and duration of the exposure.(8) Regarding the

mechanisms of action, noise, like all sensory attributes, brings about two categories of effects on the central nervous structures which control behaviour. First category has a specific character and corresponds to noise perception and physiological responses that determine the significance of the noise. The specific effect results from the processing of the audible stimuli in action potentials by the auditory receptors in the ear, their transmission by the sensory neurons up to the auditory cortex, their decoding and linking with different functional structures that participate in decoding the information.

The second category of the non-specific effects is manifested by the diffuse brain and vegetative activation. This results from stimulating the ascendant activation system, through the collaterals of the auditory neurons. Acoustic nerve messages touch in a secondary manner other nervous centres, causing more or less specific reactions, more or less prominent functions at biological level, other than those related to hearing.

Therefore, in response to a sound stimulus, the body reacts in a non-specific way, similar to an aggression case, either mental or physical. If this stimulus is repeated and is intense, it leads to multi-determined responses of the body, which on long term, may cause a state of fatigue and exhaustion. This intense fatigue is a sign of stress.

Exhaustion is the stage in which the body is no longer able to respond in a adapted way to stimuli or to the exterior aggression and, as a result, the body's defence mechanisms become ineffective. The reaction to stress is a mechanism of adaptation. This reaction is accompanied by the secretion of stress hormones including adrenaline, noradrenalin and cortisol, as well as changes in heart rate and blood pressure. Normally, these variables return to their initial values when the person adapts to the noise, or when the exposure to noise ceases.(9) These physiological changes are generally considered biomarkers of stress (10,11) and represent a generalized reaction to all the sources of non-specific stress, such as noise. The individual reactions of the persons exposed to stress depend on

<sup>1</sup>Corresponding author: Schiopu Nicolina, Int. Polux, Nr. 6, Bl. G 13, Sc. B, Ap. 28, Ploiești, România, E-mail: schiopu\_nina@yahoo.com, Tel: +40723 576193

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the perception and the physical health of those persons, largely depending on the genetic factors, development, experience, behaviour and lifestyle.(9,12)

It was assumed that the persons exposed to noise have increased levels of stress hormones, and blood pressure may be increased immediately. Where these higher levels of the stress hormones are prolonged and excessive, the persons exposed to noise may have compromised operational integrity of several organs and tissues.(13) Prolonged release of cortisol has been associated with increased blood pressure, depression, immunosuppression, increased resistance to insulin, obesity, excessive stimulation of the amygdale, the centre of fear at the cerebral level.(9,13,14,15) Increased levels of cortisol can also affect the hippocampus neurons.(9)

Chronic stress may result in adverse effects on health if the reaction occurred in difficult situations causes social isolation, damage or excessive consumption of alcohol, cigarettes, food, or drugs.(9)

### 1. Cardio-vascular changes:

- increased heart rate which causes vasoconstriction (decrease of the size of the small arteries);

- blood pressure increase;

### 2. Digestive disorders:

- decreased secretion of the salivary gland and of the intestinal transit;

- changes in the secretion and composition of the gastric juice may cause gastric or duodenal ulcers;

### 3. Hormonal changes:

- hyper secretion of cortisol, catecholamine, thyroxine;

- developed hypoglycaemia;

### 4. Respiratory changes:

- increased rhythm and amplitude breaths as a result of an unexpected noise (effect of surprise);

### 5. Effects on vision:

- decrease in dopamine secretion causes a decrease in contrasts;

### 6. Sleep disturbances:

- increasing the falling asleep time;

- nightly awakenings are extended;

- premature wake up which is not followed by sleepiness;

- changes in sleep stages: increasing periods of doze to the detriment of the deep sleep;

### 7. Effects on thermoregulation:

- increased sweating;

- decreased skin temperature and heat production;

### 8. Effects on the immune system:

- decreases the ability of defence of the organism;

### 9. Effects on the ability of work:

- reduces the intellectual concentration;

- decreased accuracy and efficiency of movements;

- distraction;

- increased energy expenditure required to make a physical effort;

- difficulty in perceiving the verbal information (orders, demands);

- voice and cerebral overload;

### 10. Effects at behavioural level:

- aggressiveness and changes in behaviour;

- drop in intellectual performance, memory and in learning capacity;

- anxiety, stress, emotional instability, increased use of psychotropic drugs and sleeping pills.

The non-traumatic effects of noise occur at physiological and behavioural levels. According to the epidemiological studies, cardio-vascular changes, arterial

hypertension are most frequently in the workers exposed to noise. These changes have a tendency to become more frequent with age and seniority in a noise-exposed occupation. Therefore, these ones depend on the predictable or not character of the noise, type of activity exerted and other stress factors.

Occupational noise exposure has adverse effects on the quality and duration of sleep, reducing the number of sleep cycles, therefore interfering with the sleep functions, causing chronic fatigue. The noise may represent a factor of stress at the workplace. The annoyance caused by noise can be associated with increasing labour dissatisfaction, irritability, anxiety or sometimes aggressiveness. In conclusion, excessive noise can be detrimental to a person's health.

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