RESEARCH REGARDING THE GENERAL EFFECTS OF THE NOISES IN A WEAVING MILL ON THE HUMAN ORGANISM

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Keywords: *experimental research, industrial noise*

Abstract: *The present study was performed on SC Cisnădie Silk SA, a company designated to operate in special conditions of employment in accordance with Government Decision 261/2001, meaning that the process cannot be changed and no technical measures can be taken in order to reduce noise with the current technology. The solution would be a complete replacement of equipment. The field of activity for this unit is to produce fabrics. The clinical and statistical study material for assessing occupational exposure to noise consisted of two groups of workers. In conclusion, we can say that there is an increase of pulse, SBP and DBP at the end of the work shift, both in subject with hypoacusis as well as for those with no hearing deficits, who had normal values for SBP, DBP and pulse when entering the work shift. We have demonstrated the negative influence of exposure to industrial noise over the values of arterial blood pressure and pulse, both for subjects who had normal blood pressure and pulse as well as for those with increased values for the followed parameters.*

Cuvinte cheie: *cercetare experimentală, zgomot industrial*

Rezumat: *Studiul întreprins s-a efectuat la societatea S.C. Mătasea S.A. Cisnădie, societate încadrată în condiţii deosebite de muncă în conformitate cu HG 261/2001, adică procesul tehnologic nu poate fi schimbat şi nu pot fi luate măsuri tehnice pentru reducerea nivelului de zgomot la actuala tehnologie doar prin înlocuirea completă a utilajelor. Domeniul de activitate a acestei unităţi este producerea de ţesături. Materialul de studiu clinico-statistic pentru evaluarea expunerii ocupaţionale la zgomot, a fost constituit din două loturi de lucrători. Se observă o creştere a valorilor TAS, TAD şi AV la ieşirea din tură, atât la subiecţii cu hipoacuzie cât şi la cei fără afecţiuni legate de auz, care au avut valorile TAS, TAD şi AV normale la intrarea în tură. Se demonstrează astfel influenţa negativă a zgomotului industrial asupra tensiunii arteriale, atât la subiecţii normotensivi cât şi la cei hipertensivi, precum şi influenţa negativă a zgomotului industrial aupra AV.*

THE AIM OF THE STUDY

It was assumed that exposure to intense industrial noise (over 87dB) can cause, along with occupational diseases (hearing loss and deafness) profession related diseases (high blood pressure and cardiac arrhythmias). Occupational noise can also cause short-term general effects and can influence the health status of workers on a long-term basis.

Knowing the effects of intense occupational noise exposure would provide occupational medicine specialist doctors, ENT, and those with degrees in industrial medicine, the necessary levers to take preventive measures, adopt the appropriate medical technique and organizational according to each particular situation.

We started from the premise that an in-depth analysis of the effects of noise on the human organism in the case of workers servicing mills, was necessary in order to obtain data on the health of workers as well as a new insight on technical and organizational measures possible in order to reduce the incidence of medical and professional diseases related to occupation.

Keeping in mind this aspect, we consider a multilateral approach to be appropriate when studying this problem, through research focused on both the working conditions and human body. In order to consider this appropriate multilateral approach to this problem through research focused on both the working conditions and human body. Following the way noise produces effects on the health of workers in mills, we intend to draw some conclusions on improving the management of noise in mills, technical, organizational and medical improvements.

We also consider that it is necessary to assess each company or unit health risk for occupational illness and injury, otherwise a mandatory requirement under the laws in force in health and safety according to Law 319/2006 (LD 25), and developing, according to the results obtained, a health program adapted to the working conditions that can be found in mills.

Improving working conditions by organizational and technical measures to lower medical and occupational diseases (deafness, occupational deafness) and other associated diseases that might occur due to exposure to noise above the exposure limit 87 dB (A). [84]

MATERIAL AND WORK METHOD

The present study was performed on SC Cisnădie Silk SA, a company designated to operate in special conditions of employment in accordance with Government Decision 261/2001, meaning that the process cannot be changed and no technical measures can be taken in order to reduce noise with the current technology. The solution would be a complete replacement of equipment. The field of activity for this unit is to produce fabrics.

The clinical and statistical study material for assessing occupational exposure to noise consisted of two groups of

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workers.

I. A study lot consisting of 110 subjects, women, exposed to noise, employees of the silk-weaving section of SA Cisnădie SC women.

As a particular aspect the workers included in the study were all employed for at least ten years in these conditions, being exposed to high levels of noise, above the accepted limit of 87dB, produced by looms. The level of noise exposure was between 90.8 dB and 100.8 dB.

II. The second group, the control group, also consists of 110 subjects, women, administrative and technical staff belonging to SC silk SA Cisnădie. These subjects are not exposed to industrial noise and work in the morning shift.

The members of the control group are between 27 and 57 years old, with a working experience of over 10 years in the field.

The two lots are homogenous in terms of age and seniority.

Control group age range is 27 years and 57 years seniority over 10 years. Lots contained in the study are homogeneous in terms of age and seniority. Regarding the physical and neuropsychological demands of the two groups, besides noise exposure, there are no significant differences, both groups being subjected to similar conditions.

Working method

Symptom questionnaire

The query is not standardized and was put together from a set of written questions which were set in a logical order. The questions were related to name, age, seniority at the work place, number of years of working in the field of weaving, living in the proximity of a noise source (noise present during the time in which the dominant noise is absent); the subjective perception of the effects of noise at the workplace: you have a sensation of clogged ears, experience tinnitus (ringing in the ears), intermittent tinnitus when passing from a healthy environment to a quiet ambiance; do you have the sensation that you cannot hear normally, that you have to turn up the radio volume, TV volume (to the family's discontent), that you cannot hear the clock ticking anymore, or that you cannot follow a conversation? What kind of symptoms do you perceive at the workplace, and outside of it? Fatigue, headaches, migraines, dizziness, syncope, irritability, depression, deterioration and loss of attention, a deterioration of perception, loss of movement precision, difficulties in maintaining balance, tachycardia, heart palpitations, chest pains, hyperventilation, anomalies related to visual perception, the attenuation of color perception (difficulties in perceiving colored lights – red) and shapes, modifications in accommodation and eyeball movement, diminished appetite, a decrease in labor productivity, muscle pain, epilepsy seizures and hysterical manifestations, insomnia.

Method used to determine professional noise (method principle, technique, devices)

Noise intensity was measured with a Quest 2800 digital sound meter with noise integrator, in accordance with the standards employed by the European Union). The principle of the method is to turn the sound captured by the microphone into electrical signals and showing them on the display, directly in decibels, in the weighing circuit. (A)

Methodology for performing liminal tonal audiometry (after audio relaxation)

Typically, early detection of hearing loss and diagnosis of occupational deafness is determined by using tonal liminal audiometers. Audiometric testing was performed with the corresponding quality standard required by European Union rules. We met the basic requirements for conducting a proper tone for audiometric liminary diagnosis.

The examination begins with an average frequency of 1024 Hz and then pass on to low and high frequencies. The sounds emitted can be of continuous or discontinuous nature. The threshold is tested by the ascending technique, with discontinuous tones.

When interpreting the results of audiometric we took into account:

- What is the frequency where a hearing deficit is present (eg 500, 1000, 2000 or 4000 Hz).
- Intensity of auditory deficit that is expressed in dB hearing loss.
- Two types of conducting behavior (CA and CO).
- Age of the subject (in order to apply presbycusis correction)
- The definition of occupational hearing loss and deafness.

Psychological evaluation using the Reactivity and Emotional Dynamic Questionnaire (RED)

The Reactivity and Emotional Dynamic Questionnaire (RED) consists of 75 questions and is divided into 5 scales as follows: Lie (relevance of the questionnaire), Nervous energy, Emotional Mobility, Force of inhibition and Emotional dynamics.

Measuring arterial pressure values (SBP, DBP) and pulse at the beginning and ending of the work shift, for both the study lot and the control lot

We measured systolic and diastolic blood pressure for all the employees included in the study at the beginning and at the end of the work shift, for both the study lot and the control lot, using the manual sphygmomanometer.

Statistical processing:

For statistical processing we used v.10 of SPSS.

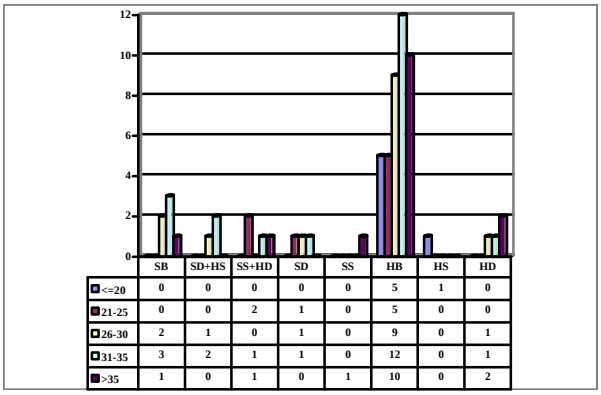
Analysis of the health status of workers from the factory taken into study by the prevalence of chronic diseases and morbidity with temporary work incapacity

Prevalence of chronic diseases in 2009

Study lot

From the total cases recorded in 2009 the first peaks of morbidy in the company are: deficits related to hearing (33.61%), cardio-vascular diseases (27.73%), neurological disorders (10.08%), diseases spine (6.72%), and ophthalmological affections (2.42%). (Fig. 1)

Figure no. 1. Case repartition for hypoacusis and deafness for workers exposed to industrial noise considering the unilateral or bilateral affection of the audio analyzer and considering the number of years spent in this working environment



	SB	SD+HS	SS+HD	SD	SS	HB	HS	HD
<=20	0	0	0	0	0	5	1	0
21-25	0	0	2	1	0	5	0	0
26-30	2	1	0	1	0	9	0	1
31-35	3	2	1	1	0	12	0	1
>35	1	0	1	0	1	10	0	2

The situation revealed by this study is due to the specific work conditions: intense noise, physical effort, psychological stress, long standing hours, lighting, etc.

Control lot

For the control lot the etiology of ITM disease was mostly acute, recurrent respiratory affections, ENT and gynecological pathology.

Morbidity with temporary work incapacity

The number of cases is higher in the study lot, (67.27%), compared to the control lot (32,72%), which shows a higher number of sick leave granted to the original group studied, and a longer duration for the illness.

The analysis of the of the disease diagnosis we have concluded that the ITM cases in the study lot are mostly chronic diseases which require longer recovery: hearing deficits, cardiovascular diseases, ophthalmological affections, neurological pathology. The etiology of ITM cases present in the control lot was mostly acute recurrent respiratory afflictions, ENT and gynecological affections. The difference between the frequency index of the study lot and that of the control lot is significant for both lots.

RESULTS

Professional exposure to noise can cause general long term and short term effects, influencing the health status of the workers exposed to such conditions.

It was assumed that exposure to intense industrial noise (over 87dB) can cause, along with occupational diseases (hearing loss and deafness) profession related diseases (high blood pressure and cardiac arrhythmias). Occupational noise can also cause short-term general effects and can influence the health status of workers on a long-term basis.

Knowing the effects of intense occupational noise exposure would provide occupational medicine specialist doctors, ENT, and those with degrees in industrial medicine, the necessary levers to take preventive measures, adopt the appropriate medical technique and organizational according to each particular situation.

We started from the premise that an in-depth analysis of the effects of noise on the human organism in the case of workers servicing mills, was necessary in order to obtain data on the health of workers as well as a new insight on technical and organizational measures possible in order to reduce the incidence of medical and professional diseases related to occupation.

Keeping in mind this aspect, we consider a multilateral approach to be appropriate when studying this problem, through research focused on both the working conditions and human body. In order to consider this appropriate multilateral approach to this problem through research focused on both the working conditions and human body.

Thus, the research from this chapter was focused on:

- The exposure parameter, characterized by the determinations of the values of the industrial noise at the studied workplace, representing an important marker for the correlation with biological effect parameters and with those showing the impact on individual health. This helps to establish whether or not the workplace is healthy and to establish a group with high exposure risk and high risk of developing various symptoms and diseases related to the exposure to industrial noise.
- The medical evaluation was based on an examination protocol which included clinical examination (monitoring the pulse and blood pressure), functional examinations (the audiogram) and psychological evaluation.
- Conducting a symptom questionnaire which allowed us to investigate and analyze the subjective perception of some aspects concerning the workplace.
- Objectification of the data regarding age, length of exposure and some workplace characteristics from the statistical records of the institution

The selection criteria for the two lots were the age factor and the number of years spent at the workplace; for the experimental lot exposure to industrial noise (workers from a weaving department), whereas the control lot was not exposed to industrial noise.

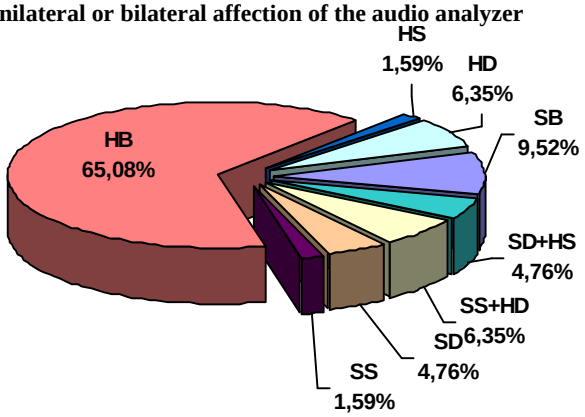
Among the studied parameters were the manifestation of hearing loss and deafness related to exposure to industrial noise, changes in pulse and arterial blood pressure values connected to exposure to industrial noise and going in and out of the work shift, as well as some psychological manifestations.

Particularly important results were obtained regarding the onset of hearing loss and deafness connected to professional exposure to industrial noise. Audiometric data shows that the association between occupational exposure and the lowering of the acoustic threshold is statistically significant, revealing statistical correlations between exposure to industrial noise and the manifestation of hearing loss and deafness.

We observed that hearing loss and deafness appear exclusively in the experimental lot, exposed to industrial noise.

Statistical processing of the data showed a significant reduction of auditive sensibility at a tonal frequency of 4000 Hz, whilst at frequencies of 500, 1000 and 2000 Hz the people had a normal response. This proves hearing loss is connected to noise exposure.

Figure no. 2. Case repartition for hypoacusis and deafness for workers exposed to industrial noise considering the unilateral or bilateral affection of the audio analyzer

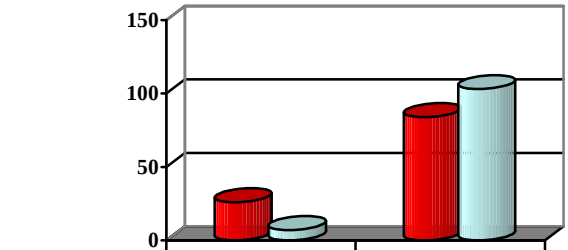


SB - bilateral deafness; SS - left deafness; SD - bilateral deafness; HB - bilateral hypoacusis; HS - left hypoacusis; HD - right hypoacusis

Analyzing the data from the symptoms questionnaire has shown that the onset of insomnias is connected to the exposure to intense industrial noise, and by studying the statistical correlation between the manifestations of insomnias and hearing deficits we have found that insomnias are more common with patients suffering from hypoacusis than those suffering from deafness. (Fig. 3)

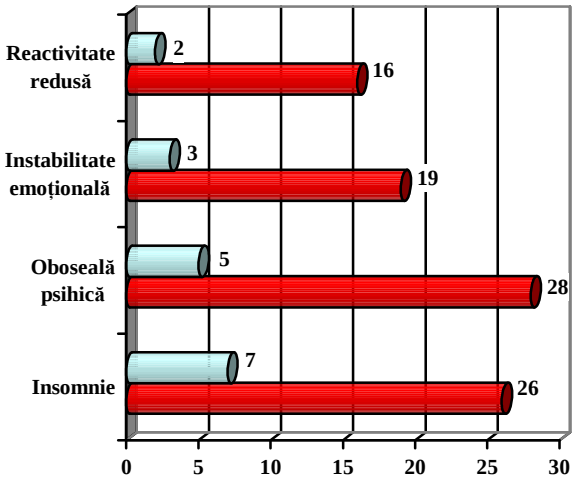
From the psychological examination we can conclude that working in conditions of exposure to industrial noise can cause: emotional instability, psychological fatigue, reduced reactivity, due to the number of subjects from the experimental lot who present these manifestations compared to those from the control group. Most cases of psychological fatigue are among those suffering from hypoacusia, whereas emotional instability is mostly associated with patients suffering from deafness, whereas reduced reactivity is exclusively associated with the subjects suffering from professional related deafness. All the patients with modifications of the psychological test have a history of noise exposure of at least 22 years. (Fig. 4)

Figure no. 3. Repartition of insomnia for the two lots



	DA	NU
Experimental	26	84
Martor	7	103

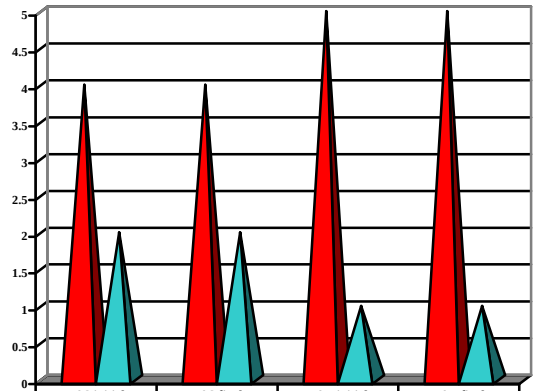
Figure no. 4. Lot repartition of the affections taken into study



The results of the medical examinations (pulse and arterial blood pressure examinations) have shown a series of modifications which statistically reveal a series of significant modifications between the staff exposed to industrial noise and the ones who were not exposed. These modifications are directly linked to the working conditions, being determined by these conditions. The subjects exposed to industrial noise present increased values for pulse and arterial blood pressure, both for those who entered the shift with higher values than normal and for a part of those who had normal blood pressure and pulse when entering the shift. It has also been shown that as workers have more years spent in this working environment they have higher SBP and DBP when entering the shift, as well as an increase of the number of subjects with increased values when coming out of the work shift. This is mostly due to exposure to industrial noise, as well as age related changes in the values of arterial blood pressure.

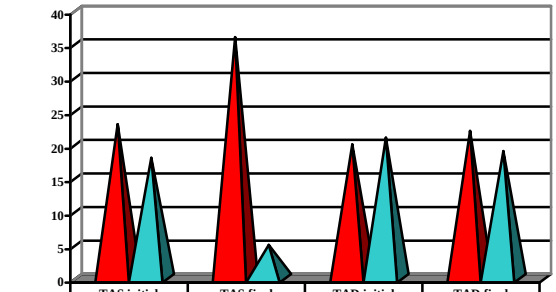
It has also been shown that patients with bilateral deafness do not show any modifications of the followed parameters (both coming in and going out of the shift), whereas patients with bilateral hypoacusis present the most modifications (arterial blood pressure and pulse) when entering and coming out of the shift. (Fig.5 and 6)

Figure no. 5. Blood pressure variances for those suffering from bilateral deafness



	TAS initial	TAS final	TAD initial	TAD final
Crescut	4	4	5	5
Normal	2	2	1	1

Figure no. 6. Blood pressure variances for those suffering from bilateral hypoacusis



	TAS initial	TAS final	TAD initial	TAD final
Crescut	23	36	20	22
Normal	18	5	21	19

CONCLUSIONS

In conclusion, we can say that there is an increase of pulse, SBP and DBP at the end of the work shift, both in subject with hypoacusis as well as for those with no hearing deficits, who had normal values for SBP, DBP and pulse when entering the work shift.

We have demonstrated the negative influence of exposure to industrial noise over the values of arterial blood pressure and pulse, both for subjects who had normal blood pressure and pulse as well as for those with increased values for the followed parameters.

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