Analysis of the Correlation Between Hearing Impairment and Glycemia Disorders

Elma Ibrahimpasic¹, Miralem Music¹, Mida Tiro¹, Almir Fajkic²
Institute for Occupational Medicine of Canton Sarajevo, BiH ¹
Institute of Pathology and Physiology, Faculty Of Medicine, University of Sarajevo, BiH ²

3. SAMPLE AND METHODOLOGY
Respondents
We tested 235 workers and on the basis of inclusion and exclusion criteria’s sample is made out of 81 workers in exposed group. As a control group we take 50 workers who were not exposed to noise - administration staff. For all patients audiogram was done and determined is the level of glucose in the blood.

Methods
Testing is made in audiology cabinet with use of machine “AMPLAID 171” at the Institute of Occupational Medicine, in the morning after a night of rest in order to exclude hearing fatigue due to noise at work. Analysis of the glucose level in the blood is made also using first morning sample before eating, with hexokinase–glucose-6-phosphate dehydrogenase method on the appliance “DIMENSION POND PLUS “ During clinical examination we obtained data on body weight and height, and on the basis of these data body mass index (BMI) is calculated.

4. RESULTS
Results are grouped in tables and graphically displayed. Statistical data processing was performed using the method of correlation.

Baseline sample involved 131 respondents. Exposed group is consisted of 81 respondents and the control group of 50 respondents. Gender representation is almost identical in both groups. The average age of workers in the exposed group was 37.47, std. deviation 8.5251. The average age of workers in control group was 35.30, std. deviation 7.5815.

SUMMARY
Objective: Aim of this project is to establish blood glucose level of workers who are by occupationally exposed to noise, to establish correlations between degree of damage of sense of hearing and blood glucose level of exposed workers and correlations between duration of exposure and levels of disturbances of glucose. Patients: Examination included 235 workers. After applying strict criteria for inclusion or exclusion, 81 workers (male and female) have been selected. In control group there were 50 clerks (male and female) who were not exposed to industrial noise. Methods: Audiometric examination was performed using apparatus AAMPLAID 171. Examination of level of glucose was performed using apparatus DIMENSION POND PLUS by method glucoso-6-phosphat dehydrogenase (hexokinase). Body height and mass was determined by anthropometric measurement and BMI was calculated using standard formula.
Results: This examination analyses effect of industrial noise on hearing and effects on level of blood glucose. The results were determined by correlation method and show that workers exposed to industrial noise for years, have higher damage of hearing sense and higher level of blood glucose than those workers who were not exposed to the noise.
Key words: noise, hearing loss, hyperglycemia

1. INTRODUCTION
Noise is a subjective term determined by the physical characteristics of sound and physiological properties of the human ear and body. Noise is unwanted sound, or unpleasant sound that interferes with human work and leisure, and in the extreme case, pose damage to health. It affects the organs and body systems such as cardiovascular, endocrine and hormone, leading to metabolic and endocrine disorders, with impairment to human health, it cause the reduction of working capacity (1). Noise, as stress factor affects the pituitary-adrenal axis in this way that increases ACTH and cortizole secretion. Interpretation of blood glucose level is generally unreliable in case of obese (>20% above the ideal weight) and with exposure to stress (3). Age and noise exposure were tested and analyzed, and testing has found that people under 60 years of age who are exposed to noise and have increased blood sugar level also in large percentage have also hearing impairment, which is, usually, of higher level (4).

2. GOAL
Determine the correlation between the extent of hearing impairment and glycemia. Determine the correlation between the duration of exposure to noise and the extent of hearing impairment. Determine the correlation between BMI and levels of blood glucose.

Key words: noise, hearing loss, hyperglycemia

3. SAMPLE AND METHODOLOGY
Respondents
We tested 235 workers and on the basis of inclusion and exclusion criteria’s sample is made out of 81 workers in exposed group. As a control group we take 50 workers who were not exposed to noise - administration staff. For all patients audiogram was done and determined is the level of glucose in the blood.

Methods
Testing is made in audiology cabinet with use of machine “AMPLAID 171” at the Institute of Occupational Medicine, in the morning after a night of rest in order to exclude hearing fatigue due to noise at work. Analysis of the glucose level in the blood is made also using first morning sample before eating, with hexokinase–glucose-6-phosphate dehydrogenase method on the appliance “DIMENSION POND PLUS “ During clinical examination we obtained data on body weight and height, and on the basis of these data body mass index (BMI) is calculated.

4. RESULTS
Results are grouped in tables and graphically displayed. Statistical data processing was performed using the method of correlation.

Baseline sample involved 131 respondents. Exposed group is consisted of 81 respondents and the control group of 50 respondents. Gender representation is almost identical in both groups. The average age of workers in the exposed group was 37.47, std. deviation 8.5251. The average age of workers in control group was 35.30, std. deviation 7.5815.
The average work age in the exposed group was 11.89 years, std. deviation 8.5251. The average work age of workers in the control group was 9.92 years, with std. deviation of 7.2783.

Correlation of hearing impairment and increased glucose levels among workers exposed to noise was 0.282 (small positive correlation). Correlation of hearing impairment and increased glucose in the control group was negative in -0.312 (moderate correlation).

From a total of 131 tested workers, the majority of them (66 or 50.38%) have increased BMI values (25.1-30.0). This trend has been recorded in the exposed group of workers (49.38) and also in the control group of workers (52.00%). In the exposed group average BMI was 26.72, std. deviation of 3.3572. In the control group the average value of BMI is 36.85, std. deviation 3.4333.

In the group of workers who are professionally exposed to noise we found a total of 11 workers with increased BGL values. The largest number of these workers (5) has BMI in value of 18.6-25. This trend was maintained in the control group, but in much smaller extent (only 2 workers have a higher BGL values). Among workers exposed to noise, there is no significant correlation between the BMI, and the BGL. Correlation is – 0.147 (small correlation), p>0.05.

5. DISCUSSION

Reactions of humans to noise can be physiological and psychological, and are not the same for each individual. They do not depend only on the individual features but also on the duration of exposure, intensity, frequency, duration and complexity of sound. Hearing impairments are usually caused by occupation, and are result of continuous exposure above the tolerable level (5). The results of this survey indicate that the effect of noise is the possible factor that leads to the hyperglycemia, while other factors as age, total work experience and increased BMI according to this study did not influence the level of blood glucose. The results of previous surveys have shown that there is correlation between the period in life with increased blood glucose and loss of hearing, and that the hearing impairment is largest in medium frequencies range (7). Also, an elevated blood sugar level may be risk a factor for the emergence of sensory neural damage to hearing because of micro vascular complications (8), a situation is further deteriorated with extended exposure to noise with increase in hearing impairment mostly for middle and high frequencies. Statistical analysis showed that the hearing of people exposed to noise with high blood glucose levels is worse than among people who have normal values of blood glucose (9). Numerous studies have shown that elevated glucose levels associated with stress leads to acute myocardial infarction (10), so noise as stressor, as well as hearing impairment caused by exposure to professional noise (constant exposure to high levels of noise induce hearing impairment which is irreversible) (11). They are the possible causes of permanent disability so the exposed workers are also became social and economic problem for themselves, the company, as well as for the whole community (public health problem). From all mentioned stems that for every worker who is exposed to noise there should be thoroughly examinations of working conditions, exposure duration, the level of noise at the
workplace, and that they must have regular monitoring of heating and levels of blood glucose.

6. CONCLUSIONS
Exposure of workers to noise as part of occupation leads to hearing impairment. These defects are most frequent at age from 36 to 55, or in the most productive age. Percentage and degree of hearing impairment by noise grows with the duration of exposure. We have found that the absolute value of blood glucose among exposed workers increases with age and exposure to the maximum after 4 to 10 years of exposure to occupational noise.

In both groups of workers BMI values were increased; we found that BMI values did not affect blood glucose levels (negative correlation).

REFERENCES

Corresponding author: Elma Ibrahimpašić, MD, MSc. Institute for Occupational Medicine of Canton Sarajevo. Tel.: +387 33 204 556. Mobile: +387 61 206 046. E-mail: elmaibrahimpasic@gmail.com