ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at: www.mjotu.com

Tahir Abid Mohammed[1]

(1) Department of community medicine, College of Medicine, University of Tikrit. salah aldeen health directorate. Iraq

Prevalence of Hypertension among workers exposed to occupational noise in Baiji power plants with Hearing Impairment

ABSTRACT

Background: Noise induced hearing loss, a permanent bilateral hearing impairment due to long term exposure to high levels of noise, represents one of the most common occupational hazards. This cross sectional study was undertaken to evaluate the auditory effects of noise and to further examine the hypothesis that a link between noise exposure and hypertension exists.

Objectives: The objectives of the present study were to study the (i)prevalence of hypertension and hearing impairment in electric power plants workers, (ii) association between hypertension and hearing impairment, (iii) association between hypertension and hearing impairment, with duration of exposure, and (iv) correlation between levels of sound and noise induced health problems viz. hypertension and hearing impairment in a cross sectional study involving Workers working in Baiji electric power plants.

Methods: This was a cross-sectional study. The study sample (population) consisted of 240 healthy male employees from Baiji electric power plants with a history of past and present exposure to noise. The study was conducted during the period from the 15 December of 2012`to the 15 February of 2013. There are four sections in the power plants. Turbine, Boiler, central control room and fuel . All workers who worked in the power stations for 5-7 years or more were included in the study.Data was gathered from the results of available portable audiometric test and the blood pressure was measured in supine position by using mercury sphygmomanometer.

Hearing impairment was defined as average hearing threshold for frequencies 0.5kHz, 1kHz ,2kHz and 3kHz equal or more than 25 dB(A) in both ears. Workers are classified according to expoeure time in to two groups. The workers are working in turbine and boiler formed continuously exposed group(CEG).While the workers are working in central control room and fuel formed intermittently exposed group(IEG).

Results:The prevalence of hearing impairment in this study was 17.08% among all the exposed workers .The prevalence of hearing impairment was significantly more in(CEG 14.58%)as compared to (IEG 2.5%).The Prevalence of hypertension among continuous exposure group to noise was(12.5%) significantly higher than the intermittent exposed group to noise (2.08%) .There was a positive association between duration of exposure and prevalence of Hypertension .Both hearing impairment and hypertension showed in the current study increasing frequency in relation to the duration of exposure(employment). The results of the present study indicate that hypertension and hearing impairment are commoner in workers continuously exposed more than that in workers intermittent exposed group to high level of occupational noise. The prevalence of hearing impairment and hypertension distributed according to the age of workers, we found that the 12.95% of bilateral neurosensory in age below 40 years, while 30.04% of cases in age above 40 years. While the prevalence of hypertension, we found 10.47% of cases in age below 40 years and 30.6% in age above 40 years .

Conclusions: These findings provide corroborative evidence to further substantiate the notion that exposure to noise is associated with hearing impairment .They also support the proposition that long term occupational exposure to noise appears to be a risk factor for arterial hypertension.

DOI: http://dx.doi.org/10.25130/mjotu.27.2021.06

***Keywords*:**

Noise induced hearing loss; Occupational exposure; Hypertension

ARTICLE INFO

Article history:

Received	07 Feb	2021
Accepted	13 Apr	2021
Available online	01 Dec	2021

*Corresponding author E mail : nis78reen@tu.edu.iq

Introduction:

Noise is unwanted sound. The sound is propagated in the form of wave .Workers are exposed to noise in power plants ,textile glass, manufacture of boiler pressures ,ship building, engineering, industries ,Iron steel factories[1,2,3] Each of which can be described in term of frequency or number of cycle per second measured in hertz. Intensity as expressed in decibel, the human ear ranging in frequency from 20Hz—20000 Hz.

The intensity of very faint sound is around Zero dB and jet normally, engine can produce sound of 130dB,which is painful to the ear the sound we normal hear are complex sound formed from many waves of varying frequencies, intensities, ordinary speech is heard at frequencies at 500Hz—2000Hz.the most important effect of exposure to noise is noise induced hearing loss (NIHL)[4,5]The hearing impairment is a temporary as exposure to noise about more than (85dB)continuous more than 8h/day or >40h/week and duration of exposure 5-15year to the develop the must hazardousis high intensity, high frequency, continuous noise susceptibility has definite effect to develop hearing problem.[6]

Many epidemiological and clinical studies have demonstrated on association between prolonged occupational exposure to noise and elevated blood pressure or increase the prevalence of hypertension in different sectors as hypertension affect 25% of adult population in the Mediterranean region. Seventy-five percent of hypertension patient are unaware of hypertension. Fifty percent of hypertension who know their condition are not treatment to controlled despite of their knowledge of their hypertension.[20,21]

Hypertension is sustained high blood pressure(>hypertension 140/90mmHg)blood pressure itself is pressure exerted by blood on the wall of the blood vessels each time the heart beat about 60-70 beat at rest, it pump

blood into the arteries. So million Americans have elevated in Blood pressure(DBP,SBP).The hypertension as non auditory result of noise exposure.[22-25]

Aim of the study:

To identify and evaluate the hearing status of the workers in the Baiji electric power plants and role out percentage of hypertension among those with long term exposure to occupational noise.

Objectives of the study:

1-Measurement of hypertension (H.T) cases among workers in Baiji electric power plants (gases and thermal).

2- Identify the correlation between sound level of noise and noise induced health problems.

3-To verify hearing impairment and hypertension according to duration of exposure in period of employment.

4-Identify hearing impairment and hypertension(H.T) according to the age of employment .

Occupational disease can be defined as a disease occurs or induces or aggravates by work place like noise, probably is the most common occupational environmental hazard and the most common cause of hearing loss. Noise induced hearing loss an irreversible hearing impairment resulting from long term exposure to level of noise beyond 85dB,NIDHL a permanent bilateral sensory neural deaf , temporary or permanent shift in the hearing threshold, present clinically by in sensitivity to sound frequencies.[26,27]which occupational exposure can be shown to be major causal or contributory factor.[28,29]hearing loss effect at a large percentage of population according national center of health statistic 37millon adults in USA have trouble hearing . This is making its public issue third in line after heart disease and arthritis.[13 ,14]about 2 to 3 of every 1000 children in US are born deaf or hard of hearing. Nine out of every 10 children who born deaf, they are born to parents who can hear.[14,29]

Approximately9% of people in US have hearing loss that resultin communication problem. [14,30]Large

community studies in UK and USA haverelated that between 25% of the work force in US (asmanyas 30 million) isregularly exposure to potentionally damaging noise level between 90db-100db and proximately 50% of the industrial work environment in US. In united kingdom(UK),it has been estimated that between 1-4% of the population are exposed harmful or potentially harmful noise level. Twelve percent of adult suffer from sensory neural hearing impairment.[31,32,33]|Of which, approximately 33% is age related(presbycusis) and 5% is accounted for noise this would imply that around 0.6% of adult population has noise related sensory neural hearing impairment[34]

Primary Hypertension—essential hypertension also commonly known as essential hypertension , primary high BP is adisorder which is associated with elevatedBP whose cause are not readily identifiable, its prevalence tend to raise with age in the most population in recently however, reports of younger age group. Developing essential hypertension have been on the raise this is case especially in UK where there exceptional bring drinking due to fact that the case unknown, this type of hypertension also known idiopathic H.T.[22,25]

In many countries done studies in the noise induced hearing loss (NIHL) because it is one of the most prevalent occupational health problem .InGeremany about 12-15% of occupational hazards,[45] others studies power station in the Sarawak[46] ,Iron and steel industry Nagpur in the India[47,48] and local petro chemical industry in Iran.[20]All these studies showing long time or continues exposure to occupational noise. Which is lead to increased the prevalence of hearing impairmentand hypertension. The prevalence of hearing impairment which is(55.9% ,25.51%,38.5%) respectively.

Subject and methods

Administration and ethical consideration.

To carry out this study an official

permission was obtained from Baiji electric power plants. The context of work declared to the subject to obtain their acceptances and cooperation during the study.

Design of the study and timing:

The current work is an observational cross –sectional study among convenient sample. It was carried out during the period from 15th December 2012 to the 15th February2013 .only four days per week were list for achieving the interview.

The study group:

The study was conducted among workers attending of the Baijielectric power plant (gas, thermal station) working in work place with source of noise (Turbine, Boiler) the total workers in the study samplewas 240 workers exposed to occupational noise.

Results

The total of subjects included in this work 240 workers are working in Baiji electric power plants (gas, thermal station).During the period from 15th December 2012 to the 15thFebruary 2013.The study includes all workers who working in place exposed to noise like turbine, boiler .This work had studied the epidemiology of hearing impairment and hypertension among thosewith long term occupational exposure to noise in Baiji power plant. All worker is male ,age is between two group .The first is below 40 yearsthere are 193 which represent(80.4%) of the total study group, while the second group more than 40years old which represent(19.6%) from total study. a shown in Figure.1

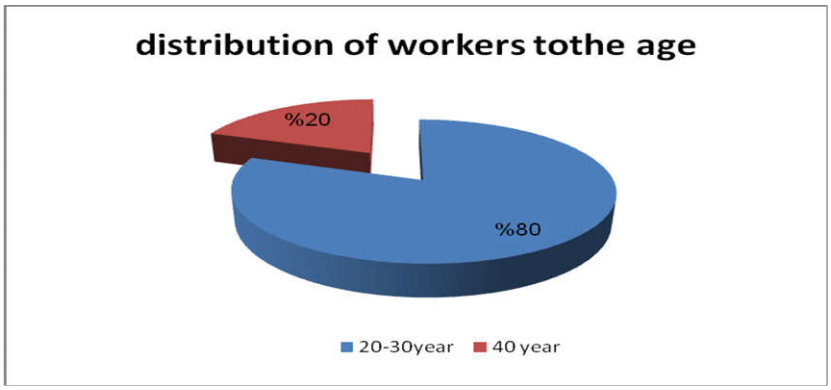

Figure.1.Distribution of workers according to the age. (percentage)

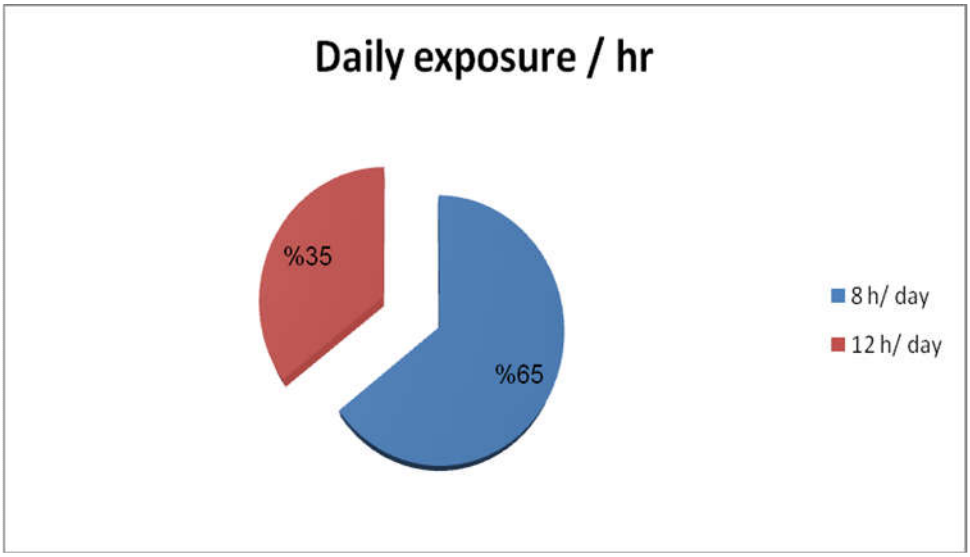

Figure 2.Distirbution of workers according to daily exposure per hour.(percentage).

It was found that the workers who exposed to 8h/day were 155 worker represent about [64.58%] out of total study. On the other hand those who exposed to 12h/day were 85worker represent about [35.4%].

Table 1: Distribution of hypertension case according to the duration of exposure years.

Duration of exposure	No. of worker with hypert ension	%	N0.of workers without hypertension	%	Total	%
5 -9year	21	12.2	151	87.8	172	100
10 -15year	9	15.8	48	84.2	57	100
> 15year	5	45.5	6	54.5	11	100
Total	35		205		240	100

Chi-square test(X^2=9.261, df=2 , P –value < 0.01)

Regarding to the period of employment or duration of exposure on development and aggravating hypertension, we identified that case of hypertension for worker. Whose their duration of exposure, between 5 -9year was 21 case[12.2%], while the period between 10 -15year was 9case[15.8%] and 5case [45.5%] of hypertension in the period more than > 15 year association between hypertension and duration of

exposure is statistically significant(X= 9.261, df= 2, P< 0.01)

Table 2 Distribution of hypertension cases according to the work place.

Section and sound level	Workers with Hypertension	%	Workers without hypertension	%	total	%
Turbine+Boiler	30	16.7	150	83.3	180	100
CCR +Fuel	5	8.3	55	91.7	60	100
Total	35		205		240	100

(X^2 = 2.491, Df= 1, p-value more than 0.05)

The relation of hypertension with sound level in the work place,Shown the percent of hypertension cases in turbine, boiler(16.7) higher than CCR and fuel(8.3%) because high sound level in these two place. The correlation between level sound and hypertensionwas found to be statistically unsignificantin(X^2 =2.491,Df=3,p-value 0.05> p> 0.50)

Table 3: The relation between hearing impairment and hypertension .

Hearing impairment	No. of workers with hypertension	%	No. of workers with out hypertension	%	Total
Present	35	85.4	6	3.02	41
absent	6	14.6	193	96.98	199
Total	41	100	199	100	240

Chi-square test(X^2= 126.760, df=1, P-value < 0.0001)

Table 3. Shows association between hearing impairment and hypertension it was observed that workers with hearing impairment have significantly more hypertension than workers with normal hearing,represent 85.4% of hearing impairment cases is hypertensive while only 14.6% is non- hypertensive. This association was foundstatisticallyis highly significant. Chi-square test(X^2= 126.760, DF =1, P-value<0.0001). The prevalence of hypertension was positively association with hearing impairment and duration of exposure.

Discussion

Result from this cross –sectional

study indicates that there is a relationship between blood pressure and noise induced hearing disorder. Prolonged exposure to industrial noise firstly elevation of the systolic blood pressure and to some extent the diastolic blood pressure awell if noise exposure continues, with resulting in sever hearing loss ,the systolic blood pressure tends toreturn to normal,diastolic blood pressure seems to either rise or fall.The positive correlation of the age and blood pressureamong population has been confirmed in many studies(Andriukin,AA,1961; Aroma,A.1974).[44,80]Percentage of workers experiencing hearing impairment in both ears(bilateral neurosenseory) is (17.08%) in this study. Similar to the study done in Terengganu by(Inddrus, 2002)[12].The prevalence of hearing impairment among workers in power station in Terengganu was only (18.1%) therefore HCP conducted in this power station should be reviewed of it effectiveness and employees compliance. In that study the prevalence of hearing impairment is higher than my study.

In our study the noise level in Turbine and boiler(94.5, 95.4dB) respectively higher than in CCR and fuel(85,90dB) .which is leading to NIHL increase and prevalence of hearing impairment which is represented about 23.85% in turbine,12.85% in boiler while in the CCR which is represent about 10.5% , 8.3% in fuel. This first two section which is statistically significant . But the prevalence of hypertension in the turbine and boiler higher than in CCR and fuel .which is represent about 19.27% in turbine, 12.85% in boiler while in the CCR represent 8.16 % and 8.3% in fuel. This agrees with (Lutman ,M.E). [85] who is describes the risk of noise induced hearing loss at 80,85,90dB(A)and above with hypertension . and agrees with that study

According to distribution of occupationalhypertension cases according to the duration of exposure year. We found there is a significant

relation between duration of work [in year] and prevalence of occupational hypertension represent[29.9%] cases who work less than 15year and[45.45%] of cases who work more than 15year. Because the duration of exposure to noise is longer. This agrees with(penny PJ,Earl CE,2004;Uday W.Narlawar,2006)[18,48].who describes occupational noise effect onBlood pressure, exploring the relation of hypertension and noise exposure during work. Because the exposure to noise for long time.

Similar to our study, the prevalence of hypertension in exposed group 20% was significantly higher than that in the unexposed group 12.8%(Penny PJ)[18]it is lower percentage of hypertension than our study.

Regarding to the age of employment and effect on development of hypertension we found that [10.4%]of workers cases present in the age less than 40 year while [30.6%]of workerscases present in the age above 40year. Because the long duration of employment which is lead to increase duration of exposure to noise in work place. This agrees with (Zwerling,C,et al,1998;Fagari,1994)[15,86].who describes occupational exposure to noise, Blood pressure and occupational injuries among older workers auditory, visual and other impairments.

In our study the workers working in Baiji electric power plants were male more occupational noise than female because female working in administration, quality control, maintenance department. While the male working heavily like turbine and boiler . Disagrees with(O. manninen , S.Aro,) who describes noise induced hearing loss and blood pressure international archives of occup. Environmental health 1997 in both gender in Finland.[87]

According to the relation between hypertension and hearing impairment in the work place and expose to high level of noise. We found that[85.4%] workers cases of hearing impairment is hypertensive and only [14.6%]of cases is with out hypertension. We found to be statistically highly significant .

This agrees with (Penny,PJ, EarlCE, 2004;Talbot EO,1990) [18,27]which is described the occupational noise and effected on blood pressure.

Regarding to the relation between the sound level and hypertension, which is more common in turbine and Boiler due to high level of noise (19.27%, 12.85%) respectively compared to the CCR, fuel (8.16% ,8.3%).We found that statistically un significant. This agrees with (Lutman, M.E, 2000; Simon PV, 1990) [85,88] who describe the relationship of the exchange rate to noise –induced hearing loss with hypertension

Conclusions& Recommendations

1.We found that association between hearing impairment and hypertension. The prevalence of hypertension which is represent 85.4% of hearing impairment cases is hypertensive while only 14.6% of cases is non – hypertension .

2. According to duration of exposure continuously or intermittently to noise induced hearing loss. The prevalence of hypertension during a continuous exposed group to noise estimated(CEG 12.5%)significantly higher than the intermittent exposed group to noise at about(IEG 2.08%)

3. According to the effect of age on development hypertension cases. We found that 10.47 % of cases(H.T) in the age below 40year, while 30.06% of cases in the age above 40year.

Recommendations:

To the ministry of electrician.

1. Trying to provide a good condition in the work place.

2.Advice and teach the workers to use the protective measure mainly PPE.

3.Do programs for the workers about the risk factors of different occupationsand the best way to avoid them.

4.Provide the factories, industries, power station and other place at risk to developing occupation hearing disease in their employees by a doctors who are a specialist in occupational health.

5.Focusing on the already existing programs.

To ministry of higher education and scientific researches.

1. Focusing on already existing researches about occupational hearing disorder.

2. Encourage researchers to have full recent studies about occupational hearing loss.

3. Consider occupational hearing disorder as one of the important subject in occupational medicine.

References

1. Palmer, K.T., Griffin, M.J., Sydall, H.E., Davis, A., Panetta, B. & Coggon, D. *Occup Environ Med 2002;* 59(9): 634-63

2.Hong O. Hearing loss among operating engineers in American construction industry. *Into Arch Occup Environ Health* 2005;78:565-74.

4.Minja BM, Moshi NH, Riwa P. Noise induced hearing loss among industrial workers in Dares Salaam. East Afr Med J 2003;80:298-302.

6.Guerra MR, Lourenco PM, Bustamante-Teixeira MT, Alves MJ. Prevalence of noise-induced hearing loss in metallurgical company.Rev Saude Publican. occupational noise exposure of marble industry works 2005;39:238-44.

7.Ponomarenko, I I : The effect of constant high-frequency industrial noise on certain physiological functions in adolescents HygSaint1966; 31, 188-193.

8.Tarter SK, Robins TG. Chronic noise exposure.High frequency hearing loss and hypertensionamong automotive assembly workers. J Occupational Med1990; 32: 685–689

9. NIOSH (National Institute for Occupational Safety and Health). Alice Hamilton Lab. Columbia . Health Hazards Evaluation (HHE).(1986 to 1997)

10. Kryter GKD. Extra auditory effects of noise inhearing. Edited by D. Henderss, P Hamernik,Dosani DS and J Mills, New York Academic Pressure.1976; 535–540.

11. European Agency for Safety and Health at Work. Reproduction is authorized provided the source is acknowledged.Printed in Belgium , 2006.

12.IddrusOsman.KajianPrevalentHilangPendengaranAkibatKebisinganDikalanganPekerja-pekerja Di StesenJanaletrikPaka, Dungun, Terengganu.Postgrad. Dip. thesis. University Kebangsan Malaysia2002 .

13.National Institute on Deafness and Other Communication Disorders1994; Annual Report.

14.National center for health statistics-2006 and HLA-National.

15.Zwerling, C., Whitten, P.S., Davis, C.S. &Sprince, N.L. Occupational injuries among

older workers with visual, auditory, and other impairments. J Occup Environ Med 1998 ;40(8): 720-72.

17.NIOSH (National Institute for Occupational Safetyand Health). Occupational noise induced hearing loss meeting, Pooks Hill Marriott, Maryland, 1998;30.

18. Penny PJ, Earl CE. Occupational noise and effects on blood pressure : Exploring the relationship of hypertension and noise exposure in *workers A AOHN J 2004; 52: 476–480.*

21.TalbotEHelmkamo J, et al. Occupational noiseexposure. Noise induced hearing loss and theepidemiology of high blood pressure. Am J ofEpidemiology 1985; 21: 505–514.

22.Miller-crag M et al circadian variation of blood pressure. lancet 1978; 1:795-797.

26. Wang H, Jiang Z. et al. Study on the working noise in BYPC and the effects caused by working noise on the workers' vestibular and auditory function .*Lin Chuang Er Bi Yan HouKeZaZhi* 2001;15:176-8.

.27.TalbotEO,EindlaRC,et al. Noise induced hearing loss: a possible marker for high bloodpressure in older noise exposed population. JOccupational Med 1990; 32: 696–699.

28.Nedić O, Rodić-StrugarJ,et al . Noise as a stress factor for the onset of hearing disorders in workers using drilling equipment.*Med Pregl* 2001;54:267-7.

31. Clark WW, Bohne BA.Effect of noise on hearing. JAMA 1999;281:1658-9.

32. Suter AH, von Gierke HE. Noise and Public Policy. Ear Hear 1987;8:188- 91.

34.Dobie RA. Prevention of noiseinduced hearing loss. *Arch Otolaryngol*ogy *Head Neck Surg*1995;121:385-91.

38. National Institute for Occupational Safety and Health Revised Criteria for a recommended standard - Occupational noise exposure, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 1998;98-126.

39.WorldHealthOrganizationProtection Of The Human Environment Geneva,2004;(WHO environmental Burden of disease series No.9)

40. Ahmed HO, Dennis JH, Barden O,Ismail M, Ballal SG, Ashoor A, Jer wood D. Occupational noise exposure and hearing loss of workers in two plants in eastern Saudi Arabia .Ann occup\Hyg 2001; 45: 371 -80.

41. Michael KL, Byrne DC. Industrial noiseand conservation of hearing. In: HarrisRL, ed. Patty's industrial hygiene. 5thed. John Wiley & Sons, inc, New York ,USA 2000; pp. 757-8.

42. Hinchcliffe R. Sound, infrasound and ultrasound. In: Raffle PAB,Adam PH, Baxter PJ, Lee WR, eds.Hunter's diseases of occupation. 8thed. Edward Arnold, London,

UK 1994; pp. 271-94.

45.Mosskov, J I , Ettema, J H : Extra-auditory effects in short-term exposure to aircraft and traffic noiseInto Arch Occup Environ Health1970a; 40:165-173.

48.Uday w. Narlawar,BHoosh an G.surjuse and sushamas. Thakre.hypertension and hearing impairment in workers of Iron steel industry .Indian J physiology pharmacal 2006;50(1) 60-66.

80.Aromaa, A : The prevalence of hypertension in Finland Duodecimal1974; 90: 641-654 .

81.Jong-Dar, C. &Jui-Yuan, T. Hearing loss among workers at an oil refinery inTaiwan. *Arch Environ Health 2004;*58(1):55-58.

82. Chen JD, Tsai JY. Hearing Loss among Workers at an Oil Refinery in Taiwan .*Arch Environ Health* 2003;58:55-8 52

83.McFadden, S.L. & Henderson, D. Recent advances in understanding andpreventing noise-induced hearing loss.*CurrOpineOtolaryngology Head Neck Surge* 1999;*7(5):* 266-273.

84.ACOEM Evidence-based statement .Noise-induced hearing loss. *JOccupEnviron Med 2003;*45(6): 579-581.

85.Lutman, M.E. What is the risk of noiseinduced hearing loss at 80, 85,90 dB(A)and above? . *Occupational Medicine* 2000;50(4): 274-275.

86.Fogari R, Zoppi A. VanasiaA,Marasi G, Villa G. OccupationalNoise exposure and blood pressure .*J Hypertens*1994;12:475-9.

87.O.manninen and S. Aero. noise-induced hearing loss and Blood pressure international archives of occup. environmental health 1997; 42,252-256. .

88. Simon PV. Iron and steel health and safetyproblems and patterns. International Labour Office1992;3:73.