

The Influence of Industrial Noise on Lipid and Lipoprotein Levels in Workers of Erbil Textile Factory.



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Abstract

This study was conducted to evaluate the influence of occupational noise (sound stress) exposure on fasting serum lipid and lipoprotein levels [serum total cholesterol (TC), Triglycerides (TGs) and lipoproteins profile : Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL-C) and High Density Lipoprotein (HDL-C)] in Erbil textile factory workers. These workers are exposed to high ambient noise level which is generated by big machines used in the factory for more than six hours daily at a strength of 90 deci-Bel [dB] without using ear protectors. The data obtained indicate that under these conditions of chronic and high noise exposure levels there are a significant increase ($P < 0.05$) in the level of fasting serum (TC), a non significant increase in the levels of fasting serum (TGs, VLDL and LDL-C) and a significant decrease ($p < 0.05$) in the level of fasting serum (HDL-C).

Key words: sound stress, lipid and lipoprotein profile.

Introduction

Noise is a type of unwanted sound pollution that penetrates the environment. Noise pollution can be caused by many sources including vehicles, factories, concerts, air conditioners, engines, machine, aircraft, helicopters, alarms, public address systems, industrial development and construction work, walkman-type headphones and power garden tools. In general noise pollution refers to any noise irritating to one's ear which comes from an external source [1].

Noise is a disturbance to the human environment that is escalating at such a high rate that it will become a major threat to the quality of human lives [2].

Noise is ubiquitous in every day interaction, and no one on the earth can escape the sound of noise wanted or unwanted [3]. In Europe, about 450 million persons are exposed daily to equivalent noise levels of at least 55 dB, 113 million persons are exposed to equivalent noise levels of at least 65 dB and 9.7 million persons are exposed to equivalent noise levels of 75 dB or more [4]. In Erbil city nearly all the population are exposed to equivalent noise levels of 65 dB, range 40—90 dB. (Measured by the authors at different loci).

Health risks attributed to noise have increasingly attracted political attention in recent years, this is due to continuous

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Growth of noise encumbrance in the surroundings of daily life and progressive number of protests by noise plagued citizens or those representing their interests [5].

Noise can act as a non-specific stressor inducing stress reactions, anxiety disorders, insomnia, syndromes of immune disregulation, fatigue as well as hearing impairment [6]. A sound above 80 dB has been considered to produce ill effects on the health of animals and human beings, affecting functional ability, biochemical parameters, immunological system and histology. Some of stressor induced alterations have been attributed to an imbalance in autonomic system and involving hypothalamo-pituitary-adrenal axis activation, this is followed by changes in physiological function of the organism, including total peripheral resistance, cardiac output, and blood lipid metabolism [6-8].

Acute exposure to maximum sound pressure level above 90 dB has the potential to stimulate the sympathetic nervous system to increase catecholamines and cortisol secretions. However if the noise disturbed activities such as conversation, concentration, recreation, sleep, acute increase of catecholamines and cortisol secretions were observed even at an environmental noise level > 50 dB [6].

Chronic exposure to environmental and industrial noise may be a risk factor for cardiovascular disease (CVD) and the possible pathway that links noise exposure to CVD may be elevated serum lipid levels [5,7,9].

The aim of the present study is to examine the influence of sound noise on fasting serum lipid and lipoprotein levels of male workers who were working for a long periods in Erbil textile factory. To the best of our knowledge no attempt has been made previously to study this unexplored field in our region, therefore we designed the present study to fill this gap.

Subjects and Methods

1-Subjects

This study was conducted on 50 apparently healthy male workers which were divided into two groups:

Group I (Non-exposure or control group)

Consists of 20 male workers, their mean age was 39 years and the range was 21—55 years. These are also workers, working different administrative works in relatively silent environment.

Group II (Exposure group):

Consists of 30 male workers, their mean age was 39 years and the range was 18—56 years. These are workers of Erbil textile factory, and professionally subjected to noise intensity of 90 dB from Sunday to Friday (~35 hrs/week).

The details concerning both groups are elucidated in table (1)

Table(1) :Basic characteristics of the studied groups .

Group	Number	Employment Period(years)	BMI(Kg/m ²)		Age (Years)	
			Mean	Range	Mean	Range
I	20	3-19	27	18-33	39	21-55
II	30	3-20	28	20-34	39	18-56

2-Samples

Five mls. of peripheral blood was drawn from each worker in the morning after an overnight fasting using disposable syringes. The samples were quiting for 30 minutes for clotting, centrifuged for 10 minutes at 3000 r.p.m and the separated serum was used for measurement of fasting serum (TC, TGs, VLDL, LDL-Cand HDL-C) .

3-Methods

Ready made kits *Biomerieux Sa. (France)* supplied by World Health Organization (WHO) were employed for estimation of fasting serum TC, and HDL-C according to the method of *Trinder* [10] .Fasting serum TGs was determined by a method described by *Young and Destany*[11] ,while serum fasting LDL-C and VLDL) were calculated according to *Friedewald equation* [12]

$$VLDL = (TG/5)$$

$$LDL-C = T.Cholesterol - (HDL-C + (TG/5)).$$

4-Statistical analysis

Statistical analysis of the data obtained was carried out using unpaired T-test. P

IV values <0.05 were considered significant [13] .

Results

Group I (Non-exposure or Control group):

The mean fasting serum TC level was 202 mg/dl and the range was 139--245 mg/dl .The mean fasting serum TGs level was 139 mg/dl and the range was 34--158 mg/dl .The mean fasting serum levels of lipoproteins VLDL , LDL-C and HDL-C were 26 , 118 and 63 mg/dl respectively ,whereas their ranges were 6.8--33 ,77--142 , and 35--72 mg/dl respectively ,as shown in table (2) .

Group II (Exposure group):

The mean fasting serum TC level was 219 mg/dl and the range was 146--245 mg/dl. The mean fasting serum TGs level was 161mg/dl and the range was (59-188 mg/dl). The mean fasting serum levels of lipoproteins (VLDL, LDL-C and HDL-C) were (32, 133 and 45 mg/dl) respectively, whereas their ranges were (25 - 89, 23 -145 and 15 - 41 mg/dl) respectively as shown in table (2).

Table (2): Details of biochemical parameters of the studied groups

Parameters	Group II		Group I		Statistical Evaluation Pb
	Mean±S.E	Range	Mean±S.E	Range	
TG(mg/dl)	163±3.7	59-188	139±3.7	34-158	N.S
TC(mg/dl)	219±4.4	146-249	202±3.8	139-245	P<0.05
VLDL(mg/dl)	32±2.1	15-41	26±2.2	6.8-33	N.S
LDL-C(mg/dl)	133±3.3	23-145	118±3.5	77-142	N.S
HDL-C(mg/dl)	45±1.8	25-89	63±1.7	35-72	P<0.05
BMI(Kg/m ²)	28±2.2	20-34	27±2.3	18-33	N.S
Age (years)	39±2.1	21-55	39±1.8	18-56	N.S

Pb statistics obtained by student *t*—test. N.S. Non Significant differences .S.E. Standard Error

Discussion

As noted earlier (Table 2) the data obtained for the individuals of the unexposed group are similar to generally accepted means of fasting serum TC ,TGs ,VLDL , LDL-C and HDL-C in normal individuals on a full ordinary diet and not exposed during their works to chronic and high noise levels .

The mean±S.E value of fasting serum TC for the workers of the exposed group was 219 ±4.4 mg/dl. This value indicates a significant increase ($p<0.05$) in the level of fasting serum TC in Erbil textile factory workers. Whereas the mean±S.E value obtained for fasting serum HDL-C was 45±1.87mg/dl for workers of the exposed group indicates a significant decrease ($P<0.05$) .

On the other hand noise induces a non significant increase in the mean levels of fasting serum TGs, VLDL and LDL-C.

The noxious effects of sound stress have been the subject of numerous investigations *Zhasminova VG et al.* [14] studied serum lipids in workers of a mining enterprise who were affected by unfavorable occupational noise and found that the miners have greater mean levels of triglycerides and potentially atherogenic lipoprotein cholesterol .

The effect of stress caused by aircraft noise was studied on 14 female and 11 male volunteers ,who were of a age ranging from 21-42 years and of a mean age of 25 years by *Marth E. et al.* [15] and they found an increase in the serum levels of ACTH ,TC and free fatty acids .

Maschke C. and Hecht K. [5] ,*Assmann G.* [7] and *Gehlot et al.* [8] reported in their studies a significant increase in the levels of serum TC , TGs and lipoprotein profile in workers exposed to high noise levels .

Tappila E. et al. [16] conducted a study on 406 paper mill workers exposed to noise levels of 91—94 dB , 124 forest workers exposed to noise levels of 96—99 dB and 176 shipyard workers exposed to noise levels of 95—97 dB and reported also an increase in the level of serum cholesterol .

In another study done by Jovanovic Jovica and jovanovic Milan [17] on 150 workers professionally exposed to noise intensity of 70—110 dB and 150 workers working in relatively silent environment found that industrial noise caused an increase in the serum levels of TC ,TGs and LDL-C and a decrease in the level of HDL-C .

It is now well established that there is a relationship between high cholesterol and low HDL-C levels and increased risks of cardiovascular and circulatory diseases. Whereas enhanced total cholesterol encourages atherosclerosis .HDL-C is more likely to prevent the development of atherosclerosis. Total cholesterol should therefore always be considered together with HDL-C. In terms of the current state of knowledge, an increased level of TGs also has to be seen as an independent risk factor for heart diseases, especially in connection with low level HDL-C [5].

Iysing et al. [6] in a case—control study with 395 myocardial infarction(MI) patients 31-65 years and 2148 controls found a significant increase in the rate of (MI) with the loudness of work noise, and they reported that work noise appeared to be the second greatest external risk factor in (MI) after smoking .

Elise E.M.M van kempen et al. [4] in a meta—analysis study to investigate the relation between occupational noise exposure and blood pressure and / or ischemic heart disease found a statistically significant increase in systolic blood pressure (an increase of 0.51 mmHg / 5 dB for noise levels exceeding 85 dB).

In another quasi—experimental field study by Melamed Samuel and Bruhis,Shelly[18] to explore the effect of noise attenuation on urinary cortisol excretion,fatigue and irritability among 35 healthy industrial workers chronically exposed to high ambient noise levels (> 85 dB) without using ear protectors ,found an increase in urinary cortisol excretion at the end of work shift .

The alteration in the levels of lipids and lipoproteins found in the present paper could be due to sound stress--induced hypothalamo—pituitary axis and sympathetic system stimulation (7).

The stimulation of the hypothalamo—pituitary axis and sympathetic system causes an increase secretion of their corresponding hormones (glucocorticoids and catecholamines) . These hormones increase lipolysis, gluconeogenesis in liver and inhibition of insulin secretion [5]. The excess glucocorticoids and catecholamines increase also stored lipid mobilization that leading to the activation of the enzyme lipase in fat cells. Consequently there will be an increase in the release of fatty acids from these cells [19, 20].

The excess released fatty acids undergo metabolism and causing an increase of hepatic cholesterol contents which down regulates the activity of hepatic LDL-C receptor resulting in an increase in the levels of serum TC, LDL-C and TGs rich lipoproteins [21-23].

Conclusions and Recommendations

The most important conclusions and recommendations obtained from this paper can be summarized as follows:

1. The mean level of noise [sound stress] in Erbil city was 65 dB ,whereas that in the Erbil textile factory was 90 dB ,so Erbil textile factory workers are exposed to chronic high noise levels which may participate in hearing impairment, since they are working without ear protectors .
2. Such high sound stress levels cause a significant increase in the levels of fasting serum TC, a non significant increase in the levels of fasting serum TGs, VLDL, LDL-C and a significant decrease in the level of fasting serum HDL-C.
3. The significant increase in the level of serum TC and the significant decrease in the

level of serum HDL-C due to chronic occupational noise exposure of Erbil textile factory workers may participate in the pathogenesis of cardiovascular diseases.

4. In front of these results, environmental medicine is required to examine the health risks attributed to noise and particular attention should be paid to the association of noise with the so-called classical risks of cardiovascular disorders and hearing loss.

5. To minimize the stress and other effects of noise, we recommended the use of ear protectors which can reduce the noise level by 20—30 dB.

6. The Kurdistan Regional Government should put the (Noise Pollution Control Act) to control cities noise pollution in general, and mainly that of big factories.

7. People in general and workers of plants should be educated through radio, TV, news papers about the grave effects of noise pollution.

8. Further studies are necessary to examine the effects of noise on other biochemical, haematological and histopathology parameters.

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کارێگەری ژاوه ژاوه لەسەر رێژەی چهوری و لیبیپروتینەکان لەشەلی خوینی کریکارانی کارگەری رستن و چنن لەشاری هەوئێر .

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پوختە

نامانج ئەم لیکۆئینە دەیه بریتییە ئە کارێگەری ژاوه ژاوه ئە کارگەری ئەسەر رێژەی کۆلیسترونی گشتی ، گلیسرایدی سیانی و لیبیپروتینەکان لەشەلی خوینی کریکارانی کارگەری رستن و چنن لەشاری هەوئێر ئەم کریکارانە پۆژانە نزیکەی شەش کاتژمێر رووبەرۆوی واژە واژە دەبۆنەوه ئەکاتی کارکردندا . کە توندیەکی بە پلە ی نهوت دەسی بل بوو . واژە واژەکە (دەنگی بەرز) . ئە نجامی لیکۆئینەوه کە دەری خست کە ژاوه ژاوه ئەبیتە هوی بەرزکردنەوهی رێژەی کۆلیسترونی گشتی بە رێژەیهکی بەرچاوو وههروهه بەرزبۆنوهی رێژەی گلیسرایدی سیانی ، لیبیپروتینی چری زۆرکەم و لیبیپروتینی چریکەم بەلام ئە لایهکی تر بوه هوی نزم بۆنەوهی رێژەیهکی بەرچاوی لیبیپروتینی چری زۆر .

تأثير الضوضاء على مستوى الدهون والليبوبروتينات في مصل الدم لدى العاملين في معمل الغزل والنسيج في مدينة اربيل.

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الخلاصة

یهدف هذا البحث الى دراسة تأثير الضوضاء على مستوى الدهون والليبوبروتينات لدى عمال معمل الغزل والنسيج في مدينة اربيل يتعرض العاملون في المعمل المذكور الى الضوضاء ذى شدة (90 دسی بیل) لمدة (6) ساعات یومیا اظهرت النتائج بان ضوضاء تسبب زیادة احصائية ملموسة فی مستوى الكولسترول الكلی زیادة فی مستوى کلا من الكلیسراید ثلاثی ، لیبیپروتین ذو كثافة واطنة جدا و لیبیپروتین واطنة . و اظهرت النتائج ایضا بان هنالك علاقة عكسية بین زیادة شدة الضوضاء و مستوى لیبیپروتین ذو كثافة عالیة .