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Effect of Noise Pollution on the Health of Technicians at Dental Laboratories in Duhok City – Kurdistan Region of Iraq

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ABSTRACT

Noise pollution is one of the disturbing noise that may harm the activity of human life. Dental technicians are exposed to diverse noise levels while working in dental laboratories due to using different dental instruments. The purpose of this work is to evaluate the sound pressure levels and its effects on the systolic and diastolic blood pressure , heart pulse rate , blood oxygen concentration , and hearing threshold level for 20 technicians working in the governmental dental hospital and the most five popular laboratories in Duhok city, in Kurdistan region of Iraq. The mean sound pressure level values in all studied laboratories were ranged between 56.6 and 68.7 dB(A), whereasthe maximum sound level was ranged between 76.7 and 99 dB(A). The results of this study refers to existence of a significant relation correlated positively (P-value < 0.050) for each of HTL at some frequencies for both right and left ear, DBP and HPR while there was no a significant relation (P-value) for SBP and SpO_2 %.

Keywords

Noise, Dental, Laboratories, Technicians.

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Introduction

Provide We are all face to increasing levels of environmental noise, from traffic and aircraft, from industrial processes, in the workplace and due to urbanization. So noise pollution is one of the main problems, which may people are facing with it in different places and situation according to their job. Measuring noise is not entirely straightforward, because of the various characteristics of sounds of different frequencies, the logarithmic decibel scale used for measurement, and the human response to sound. So Noise is measured in units of sound pressure levels called decibels, (dBA).Sound level meter contains an electronic filter that selectively diminishes certain frequencies. the A scale filters low and high frequencies to fit a curve that represents the human auditory responds. Some noise is merely annoying, while in other cases it can be hazardous to hearing, cause stress or prevent us from enjoying our normal daily lives. For this reason noise pollution is now recognized as a serious and increasing environmental issue [1]. It is also the second most common cause of hearing loss[2]. The extent of damage depends primarily on the intensity of the noise and the durationof the exposure. Some studies show that exposure to noise level above 85 dBA for more than 8 hours causes hearing loss[3]. Another studies show that noise level of 40 dBA may cause interruption in activities which are need concentration [4]. Hearingloss can be a temporary damage that results from short-term exposures to noise, with normal hearing returning after a period of rest[1] or a permanent damage which isdue to long term exposure to 85-95 decibels, over a period of time[2]. Some workers exposure to noise, due to use different devices in their working places. So in order to make ourcommunity safe some groups try to solve people's difficulty in their working place for example in case of noise pollution OSHA groups (Occupational Safety & HealthAdministration) put some rules and standards for level of noise in different working places [1]. In addition, noise may cause non- auditory health effects such as hypertension, cardiovascular disease and behavioral effects [5]. Dental technicians are exposed to noise during their work. The most devices used in dental laboratories are producing sounds like: compressed air, stone cutter (grinder), denture polishing unite, stone mixer, and sandblaster. So if they are working where noise levels are more than 40 dBA, there is a higher potential for error. It is agree with EPA levels document "the highest noise level that permits to have relaxed and clear conversation throughout the room is 45 dBA". So when background noise exceeds 45-50 dBA people tend to raise their voices [6]. For this reason technician in their working place when need to talk always raise their voice to be able to hear. And totally this noise affects their hearing as our results will be shown later. Asmentioned before noise pollution affects both health and behavior. Noise-induced cardiovascular effects have been extensively studied in occupational settings as well as at community levels [7,8,3]. It has been concluded that long-term exposure to occupational and/or environmental noise (at sound levels of 60-85 dB (A)) can contribute to increased risk for Cardiovascular disease [9]. Hypertension is a very common health problem, which is associated with some factors such as family history of hypertension, obesity, low physical activity, too much salt in the diet, too much alcohol consumption, stress and smoking [10]. In order to prevent possible health related effects, workplace monitoring, eudiometry and blood pressure screenings are essential [8]. The objective of this research is to evaluate the effect of noise in noisier place for dental technicians in their working place on their health during their working time.

METHOD

Measurements of the sound pressure level carried out in governmental dental hospital beside five dental laboratories inDuhok city, in Kurdistan region of Iraq by using a sound level meter; type PeakTeak 8005. Manual inflation blood pressure monitor, (Model HEM-412) was used for blood pressure measurements. Blood oxygen concentration and the threshold of hearing at different frequencies of right and left ears were measured using the pulse oximeter type CMS50D and Beltone model 119 audiometer respectively. This work was carried out on twenty samples of laboratory technicians (4 females, 16 males) theirages were ranged between 23 to 60 years. The 6 dental laboratories are located in different sites in the city. Microsoft Excel program spreadsheet has used for data entry and analysis whereas Package for Social Sciences (SPSS) version 16 has used to find the association between noise level and dependent variables and to calculate the probability value (p-value) and the Pearson's correlation coefficient (R) for all samplers in all studied lab.

Results and Discussion

Sound pressure level SPL measurements were performed every minute in each dental laboratory during working hours. While the other factors: systolic and diastolic blood pressure (SBP, DBP), heart pulse rate (HPL), blood oxygen concentration (SpO_2 %) and hearing threshold level (HTL) were taken twice before and after working hours.

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Sound Pressure Level (SPL)

The sound pressure levels (SPL) in the all six laboratories are shown in Fig.1. The data carried out every second, during the working hours.

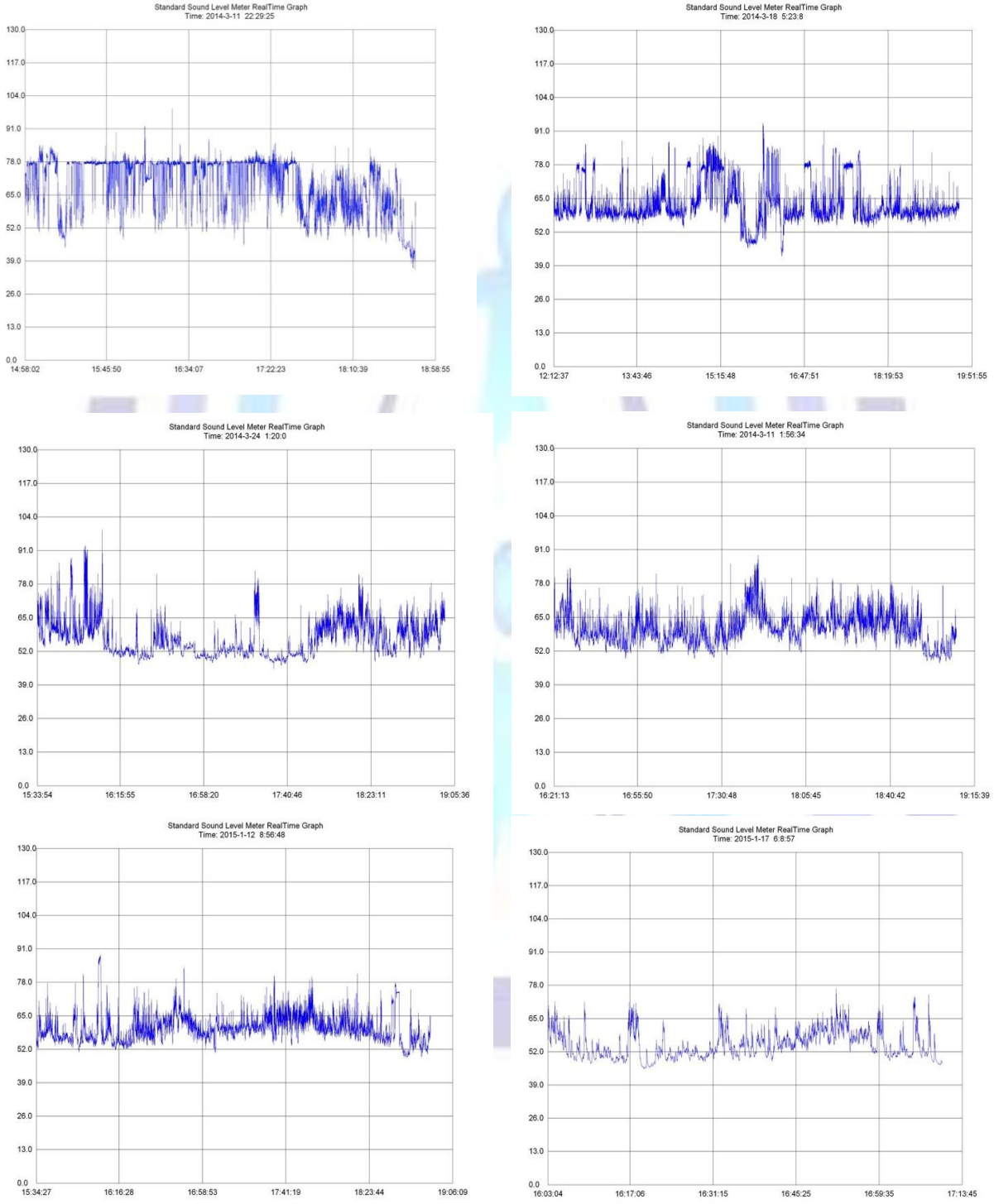

Fig1: SPL as a function of time in six different laboratories

The maximum (max), minimum (min), and average (mean) values of sound pressure level SPL in each studied laboratory were 99.0dBA, 35.70 dBA, 68.70dBA for lab.1 ,99.10 dBA 42.0 dBA, 62.54dBA for lab.2 , 98.90 dBA 45.20 dBA 56.66dBA for lab.3, 88.90 dBA, 47.40 dBA, 60.49 dBA for lab.4, 88.9 dBA, 48.90 dBA 60.01 dBA for lab.5, 76.7 dBA, 45.40 dBA and 54.6 dBA for lab.6 respectively.

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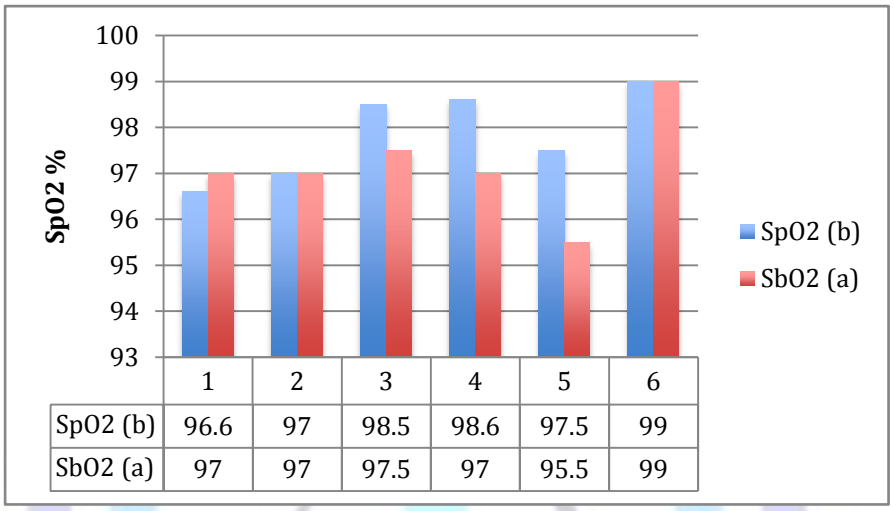
Blood Oxygen Concentration

The averages of blood oxygen concentration (SpO_2%) in the blood for the technicians (before and after working) in all labs are shown in Fig2.

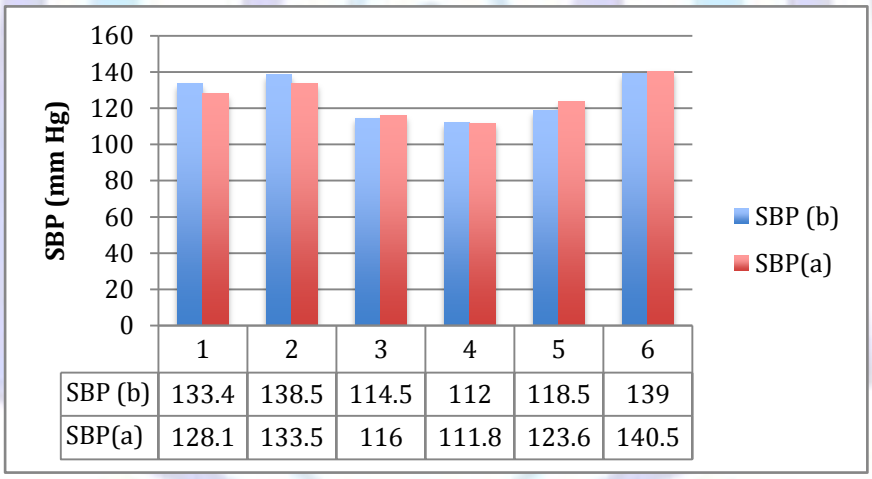


	1	2	3	4	5	6
SpO2 (b)	96.6	97	98.5	98.6	97.5	99
SbO2 (a)	97	97	97.5	97	95.5	99

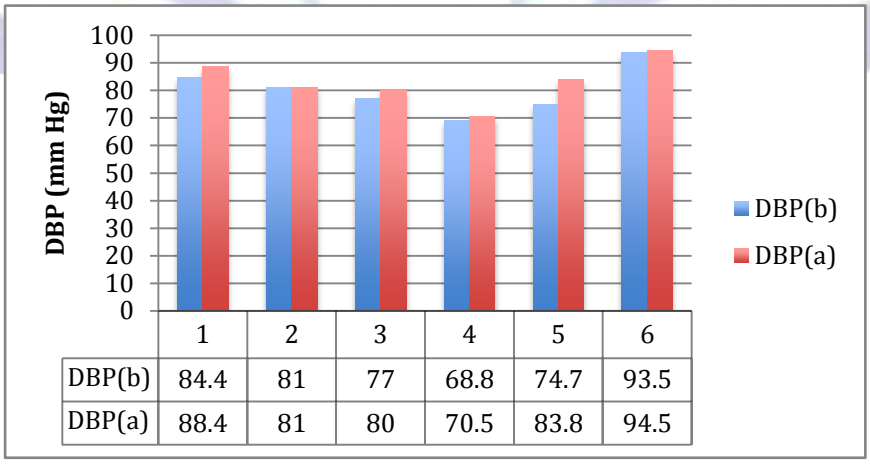
Fig2: the average of blood oxygen saturation (SpO_2) of the technician (before and after working) in the six lab.

Blood Pressure and Heart Pulse Rate

The results of the average of SBP and DBP for the workers in all studied labs before and after working hours as a function of time are shown in fig3. While The results of the average of HPR are shown in fig. 4.



	1	2	3	4	5	6
SBP (b)	133.4	138.5	114.5	112	118.5	139
SBP(a)	128.1	133.5	116	111.8	123.6	140.5



	1	2	3	4	5	6
DBP(b)	84.4	81	77	68.8	74.7	93.5
DBP(a)	88.4	81	80	70.5	83.8	94.5

Fig 3:the average of SBPand DBP of the 20 technicians in the six lab before and after working.

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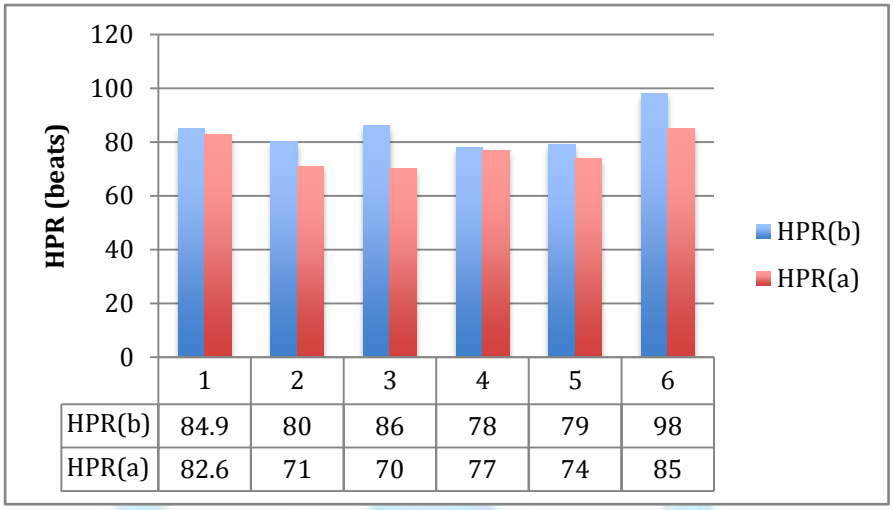
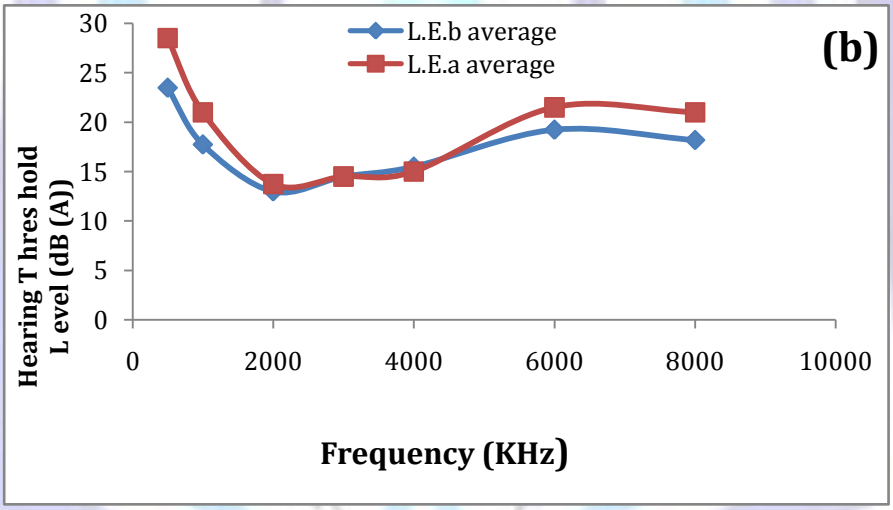


	1	2	3	4	5	6
HPR(b)	84.9	80	86	78	79	98
HPR(a)	82.6	71	70	77	74	85

Fig 4:the average of HPR of 20 technicians in the six labs before and after works

Hearing Threshold Levels

The average of hearing threshold levels at different frequencies for right and left ear of the technicians in the all studied sample are shown in figure 5.



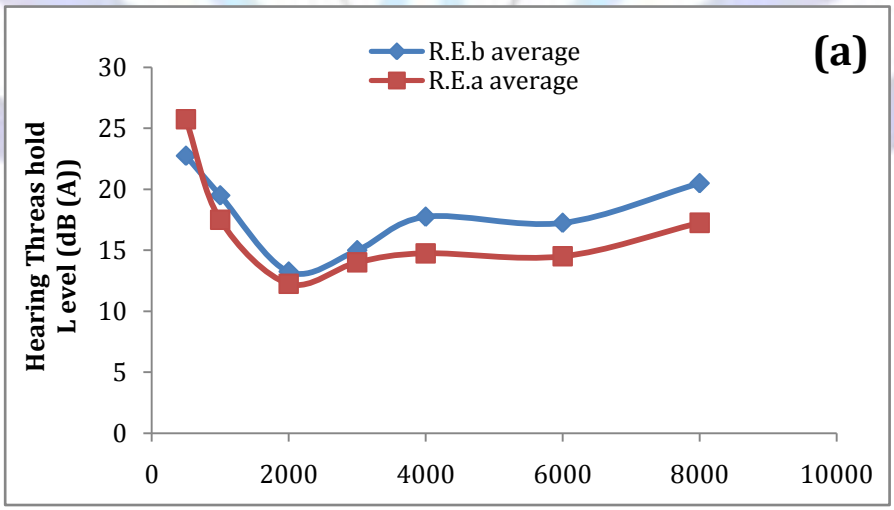


Fig5:the average of hearing threshold level for (a) the right ear before(R.E.b) and after (R.E.a) (b) the left ear before (L.E.b) and after (L.E.a) working in all six dental laboratories as a function of frequency.

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The minimum sound level that a human can hear when no other sounds are present is called threshold of hearing whereas hearing impairment (H. I.) is a wide term used for describing the loss of hearing in one or both ears. American National Standard Institute (ANSI (1969)) studies the hearing impairment phenomenon and classified it according to put degrees of hearing impairment as follows: 1. Normal: for ear that can hear between -10 dB(A) and 26 dB(A). 2. Mild: for ear that can't hear less than 27 dB(A) and it can hear between 27 dB(A) and 40 dB(A). 3. Moderate: for ear that can't hear less than 41 dB(A) and it can hear between 41 dB(A) and 55 dB(A). 4. Moderately severe: for ear that can't hear less than 56 dB(A) and it can hear between 56 dB(A) and 70 dB(A). 5. Severe: for ear that can't hear less than 71 dB(A) and it can hear between 71dB(A) and 90 dB(A). 6. Profound: for ear that can't hear less than 91 dB(A). The Percentage of degrees of hearing impairment in right and left ears before and after exposure to occupational noise in all studied samples have presented in table (1).

Table1. Percentage of degrees of hearing impairment at different Sound frequencies in all laboratories on the rightand the left ears before and after the work.

Degrees of H.I.*	Right ear (b) %	Right ear (a) %	Left ear (b) %	Left ear (a) %
1	100	100	100	85.71
2	0	0	0	14.28
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
Total	100	100	100	100

***H. I.: Hearing Impairment.**

The results appeared that the first degree of H. I. criteria [normal: -10 dB(A) to 26 dB(A)] were 100% for the right ear before and after the work while it was 85.71 % for the left ear after the work. The second degree of H. I. criteria [mild: 27 dB(A) to 40 dB(A)] for the right ear before and after the work were 0 % while for the left ear after the work it was 14.28%. These results indicate to existence of a slight weakness in hearing within the second degree of H. I for the left ear after working hours and it was 0 % for the rests of the degree of H. I (3,4,5 and 6).

Statistical Analysis

Table (2) shows mean values of SpO2%, SBP, DBP , HPR , p-values and Pearson correlation coefficients R for all technicians in all studied laboratories.

Table 2. Mean values of SpO_2%, SBP, DBP, HPR, p-values and Pearson correlation coefficients R for all technicians in all studied laboratories.

Dependent variables	Number of workers	Mean value of dependent variables		The difference between means	P value	R value
		Before	After			
SBP	20	108.545	120.525	11.98	0.828	0.052
DBP	20	81.6	83.925	2.325	0.009	0.567
HPR	20	82.475	77.95	4.525	0.001	0.676
SPO2	20	97.5	96.975	0.525	0.214	0.291

It is clear that there are a significant relation correlated positively (P-value < 0.050) for DBP and HPR and the values for R are 0.56 and 0.67 respectively. This result indicates that there is a moderate correlation for DBP and HPR while the p-values for SBP and SpO2 % shows that there was no a significant relation .

Table (3) shows p-values and Pearson correlation coefficients R of threshold levels for all technicians in all studied laboratories.

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Table3. p-values and Pearson correlation coefficients R of threshold levels for all workers in all studied hospitals.

Dependent variables	b	a	P-value (Sig.)	R.value
R 500 HZ (b) & R 500 HZ (a)	22.75	25.75	0.374	0.21
L 500 HZ (b) & L 500 HZ (a)	23.5	28.5	0.008	0.575
R 1000 HZ (b) & R 1000 HZ (a)	19.5	17.5	0.314	0.237
L 1000 HZ (b) & L 1000 HZ (a)	17.75	21	0.378	0.208
R 2000 HZ (b) & R 2000 HZ (a)	13.25	12.25	0.006	0.591
L 2000 HZ (b) & L 2000 HZ (a)	13	13.75	0.01	0.562
R 3000 HZ (b) & R 3000 HZ (a)	15	14	0.025	0.5
L 3000 HZ (b) & L 3000 HZ (a)	13.75	14.5	0.001	0.686
R 4000 HZ (b) & R 4000 HZ (a)	17.75	14.75	0.438	0.184
L 4000 HZ (b) & L 4000 HZ (a)	15.5	15	0.027	0.494
R 6000 HZ (b) & R 6000 HZ (a)	17.25	14.5	0.253	0.268
L 6000 HZ (b) & L 6000 HZ (a)	19.25	21.5	0.029	0.488
R 8000 HZ (b) & R 8000 HZ (a)	20.5	17.25	0.163	0.324
L 8000 HZ (b) & L 8000 HZ (a)	18.2	21	0.219	0.288

There are a significant relation correlated positively (P-value < 0.050) for HTL at some frequencies (L 500 Hz, R 2000 Hz, L2000 Hz, R 3000 Hz, L 3000 Hz, L 4000 Hz, L 6000 Hz). The average value of R at those frequencies is 0.55 which indicates to a moderate correlation for HTL before and after the work at some frequencies.

Conclusion

The results of this study indicate to the following: The average of noise level in all laboratories is 60.5 dBA, which is greater than the acceptable value for this kind of working place according to the international standard (45.0dB(A)) in daytime and (35.0dB(A)) in nighttime (American Academy of Pediatrics, 1997). There is a moderate positive correlation between noise and the average of the following factors: HTL at some frequencies for both right and left ear, DBP and HPR while there was no a significant relation for SBP and SpO_2 % for all the technicians. 14.28 % from the workers suffered from a mild hearing impairment on the left ear after working hours.

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