



## Study of consequents noise on hearing threshold in Wasit textile and knitting factory

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In this study, noise levels are measured in the Wasit Textile and Knitting Factory (measuring the equivalent sound pressure level). Using a sound level meter device at three sections of the factory: Textile, Knitting and Boilers. The average noise level in 12 points is about 92.98 dB, which is greater than the noise level allowed for continuous work for 8 hours a day. All of these 150 workers are brought in groups of 8 workers per week to the hearing unit at Al Karama Teaching Hospital. A hearing test is conducted to evaluate their hearing level and determine the extent of the effect of noise on the hearing threshold, after they are examined by an ear, nose and throat consultant using an otoscope device. 23 workers are excluded from the study because they are suffering from middle ear infection. Thus, the number of workers who underwent hearing testing reached 127 workers, and after conducting statistics on the data, it is found that 108 workers suffer from hearing loss in high frequencies (left ear) and 106 workers (right ear). The latest findings of this study are that noise-induced hearing loss can develop many years before the worker complains of hearing loss.

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**Keywords:** Hearing loss; Hearing threshold; Noise; Hearing examination.

### 1. INTRODUCTION

In an era where calm has become almost non-existent in the entire daily life of the individual, as a result of the technological transformation that societies are witnessing. This is evident through the manufacture of automated products, which the individual has come to rely on because of their advantages, such as saving effort, accuracy, and speed, in addition to strength. However, they are not devoid of various defects that threaten the safety of the individual. For example, we find a lot of work done with machines that make loud noises, without caring about the negative effects on the worker [1,19]. Although the success of any organization depends mainly on attention to several factors, including the “human

element.” Among the concerns with the human element is providing an appropriate environment. For work. Because environmental conditions may have positive factors and negative factors that affect the activity and performance of the worker during his work [20], and among these effects are occupational diseases and work accidents [21-31]. In industrial establishments in particular, we find that the environmental factors that most influence the worker’s activity, performance, and health are lighting, heat and noise that are not suitable for work. Given the importance of this Topic: “Physical Conditions” Among these conditions, “noise” is identified, which is considered the most widespread in industrial establishments and which causes what is called noise-induced hearing loss (NIHL) [2]. In factories in general and especially in the textile industry [9], the work of machines in the production sector produces undesirable noises [11], which when very intense can cause damage to workers' hearing [10]. Exposure to noise for a prolonged period of time can lead to hearing loss [7,12]. Noise can be defined as unwanted sounds resulting from the vibration of objects, which in one way or another affect public health [4]. "Noise" is a word derived from the Latin expression (NAUSES) [2]. The intensity of the noise to which the human ear is exposed is measured by a unit of measurement known as the decibel (dB), and is calculated by the difference between the logarithmic pressure between the sound pressure whose intensity is to be measured and the pressure of the lowest sound that the human ear can hear, which is (20) micro pascals [4]. Noise levels above 85 decibels for 8 continuous hours a day for a long period of time is considered sufficient to cause hearing loss and cochlear damage. Exposure to loud noise is one of the most serious problems causing persistent hearing loss [3]. Noise-induced hearing loss (NIHL) indicates that workers exposed to noise levels higher than 85 dB will suffer hearing loss, as studies shown [5,24]. NIHL is diagnosed by determining the duration of exposure to noise, examining the ear via otoscopy and performing an audiological test. Continuous exposure to intense noise leads to gradual hearing loss over a period ranging from 6 to 10 years [6,30]. The research aims to measure the noise levels emitted by textile machines and study their effects on the hearing threshold.

## 2. DEVICES AND SAMPLES

The data is collected from October 2023 to February 2024 through random sampling. Our study included 150 workers exposed to noise. Because NIHL takes about 5 years to develop, employees with fewer than five years of service are excluded. Noise levels (equivalent sound pressure level) are measured using a sound level meter device. The noise evaluation we made are at three sections of the factory: textile, knitting and boilers. Then, all of these 150 employments are brought in groups of 8 workers per week to the Hearing Unit at Al Karama Teaching Hospital for examination.

### 2.1 Interview

All workers are interviewed in person. The interview included filling out a pre-prepared questionnaire, which included a set of questions asked to the workers, including age, workplace, duration of exposure to noise, chronic diseases, and uses of personal noise protection devices (PPD). The workers' hearing level is assessed with a pure-tone test.

### 2.2 Hearing examination

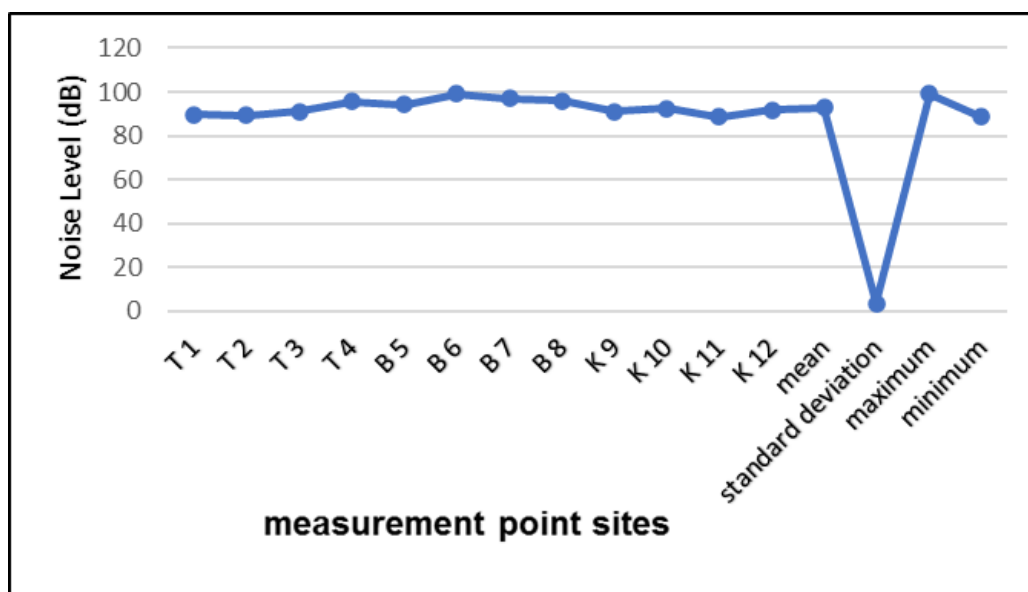
After otoscopy is performed to examine the workers' tympanic membrane, 23 workers are excepted from the examination. Therefore, the number of workers who are subjected to a hearing test is (n = 127 workers). Note that the test is conducted before the employment started avoid contamination of the hearing level numbers with the temporary shift threshold due to recent noise exposure. The test is performed using a pure tone tester (model TSM500-1752-GNDK). Hearing tests are performed by trained nursing staff who performed audiometric evaluations of the staff.

### 3. RESULTS

Evaluation of noise: Measurements are made at three sections of the factory: Textile (T), Knitting(K) and Boilers(B)., the mean is 92.98333333 dB (table1 and Figure1).

**Table 1** Measurements of noise level.

sections	measurement point sites	noise level (dB)
Textile	T 1	89.8
	T 2	89.4
	T 3	90.9
	T 4	95.6
Knitting	B 5	94.2
	B 6	99
	B 7	96.9
	B 8	96.1
Boiler	K 9	90.9
	K 10	92.4
	K 11	88.7
	K 12	91.9
	mean	92.98333333
	standard deviation	3.31794935
	maximum	99
	minimum	88.7



**Figure 1** Distribution of noise levels at 12 measured points.

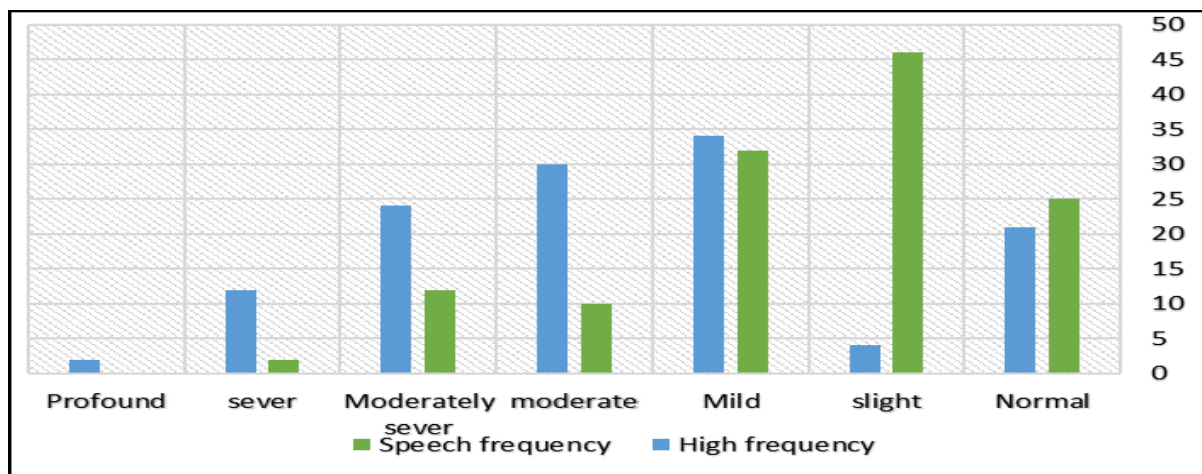
#### 3.1. Audiometric assessment

The pure tone testing: which done to (n=127) the employment shown as distributed in Table 2 ( fig.2) and Table 3 (fig.3) for the right ear and left ear respectively, there are 108 hearing loss shown left ear in

high frequency which reflect the real clinical apparent hearing loss worker (because all worker with right ear NIHL are bilaterally affected) and This value (n1=108) will be considered as a reference value in all calculations below to be compared with other values.

**Table 2** The testing assessment of the right ear.

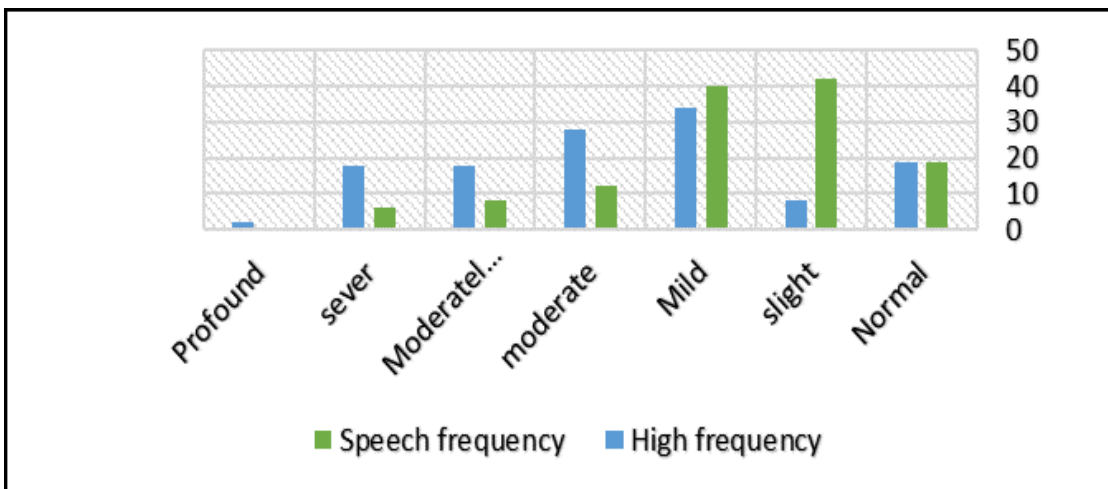
Testing assessment	Speech frequencies	High frequencies	Percentage%
normal	25	21	17 %
slight	46	4	3 %
mild	32	34	27 %
moderate	10	30	24 %
moderately sever	12	24	19 %
sever	2	12	9 %
Profound	0	2	2 %
Total hearing loss	102	106	-



**Figure 2** Right ear hearing loss at the average of hearing sensitivity at Speech and High frequencies.

**Table 3** The testing assessment of the left ear.

Testing assessment	Speech frequency	High frequency	Percentage%
ordinary	19	19	15 %
slight	42	8	6.3 %
mild	40	34	27 %
moderate	12	28	22 %
moderately sever	8	18	14 %
sever	6	18	14 %
Profound	0	2	2 %
Total hearing loss	108	108	-

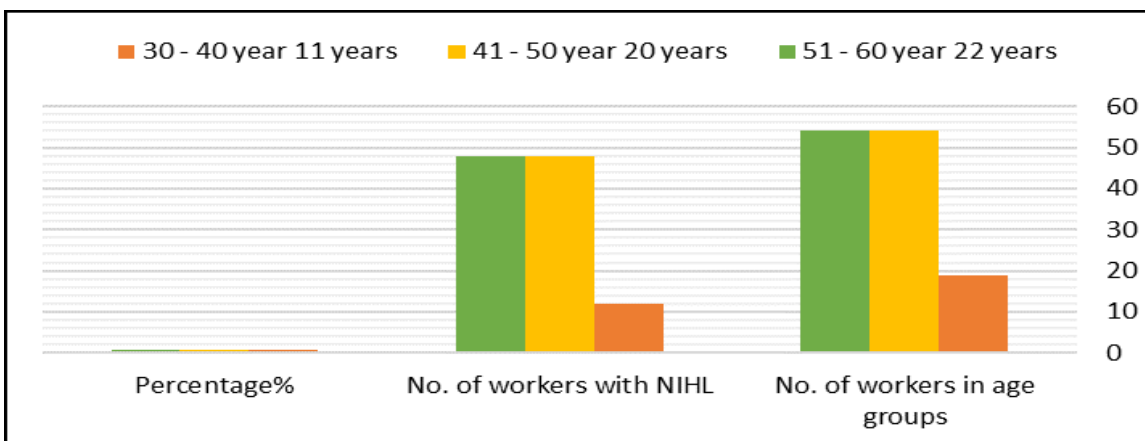


**Figure 3** Left ear hearing loss at the average of hearing sensitivity at Speech and High frequencies.

The distribution of NIHL in High frequencies (n1=108) by age groups are studied shown as in Table 4 and Fig.4 which explain shows the direct relationship between NIHL, age and period of noise exposure.

**Table 4** Distribution of the NIHL in high frequencies (n1=108).

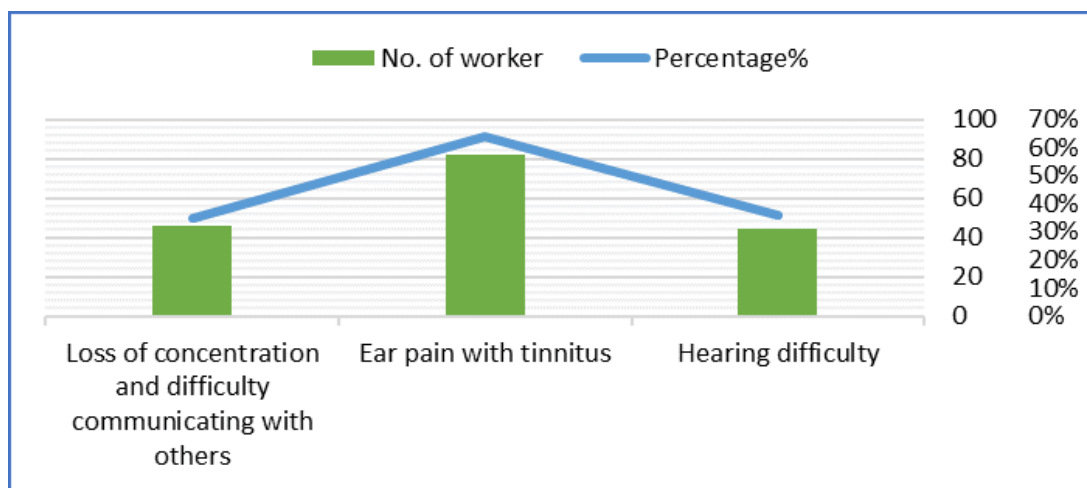
Age	Average period of noise exposure	Number of employees in age Categories	Number of employees with NIHL	Percentage%
30 - 40 year	11 years	19	12	63 %
41 - 50 year	20 years	54	48	89 %
51 - 60 year	22 years	54	48	89 %



**Figure 4** Distribution of the NIHL in High frequencies (n1=108).

**Table 5** Partition of employees according to their main protest.

Main protest	Number of workers	Percentage%
Difficulty hearing	44	35 %
Ear pain with tinnitus	82	64 %
Loss of concentration and difficulty communicating with others	46	36 %

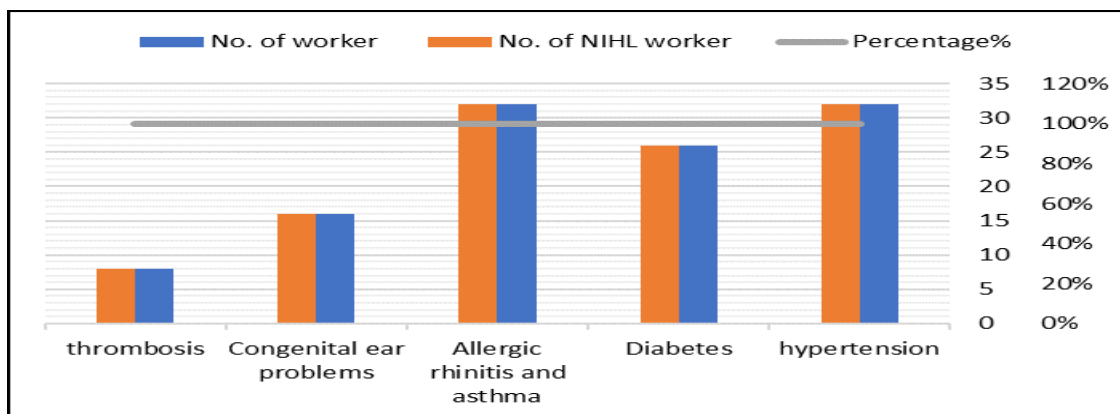


**Figure 5** Partition of workers depending on their main protest.

According to Table 5 and Fig.5, which shows the distribution of workers according to their main complaint, it is found that 44, 82, and 46 workers complained of difficulty hearing, ear pain, tinnitus, loss of concentration, and difficulty communicating with others, respectively. The results about the number of employments who use personal noise protection devices (PPD), which amounted to 7% for about 8 workers. The questionnaire sheet also included many questions that are asked to the workers, the most prominent of which is the presence of diseases that affect hearing, as shown in Table 6 and Fig.6.

**Table 6** Distribution of workers according to the presence of diseases affecting hearing.

Affecting illnesses	No. of worker	No. of NIHL worker	Percentage%
hypertension	32	32	100 %
Diabetes	26	26	100 %
Allergic rhinitis and asthma	32	32	100 %
Congenital ear problems	16	16	100 %
thrombosis	8	8	100 %



**Figure 6** Distribution of workers according to the presence of diseases affecting hearing.

Among the questions that are considered also the most important are those related to the worker’s workplace and the extent to which he is affected by noise, as shown in Table 7 and Fig.7, Fig.8 also Fig.9.

**Table 7** Distribution of workers according to some variables related to the workplace.

variable	No. of NIHL worker	Percentage%
Workplace space		
wide	78	61.4 %
middle	30	23.6 %
narrow	0	0 %
Working distance from noise		
Very close	66	51.9 %
middle	34	26.7 %
far	8	6.2 %
Duration of exposure to noise at work		
Less than 1 hour	6	4.7 %
From 1 - 3 hours	10	7.8 %
More than 3 hours	92	72.4 %

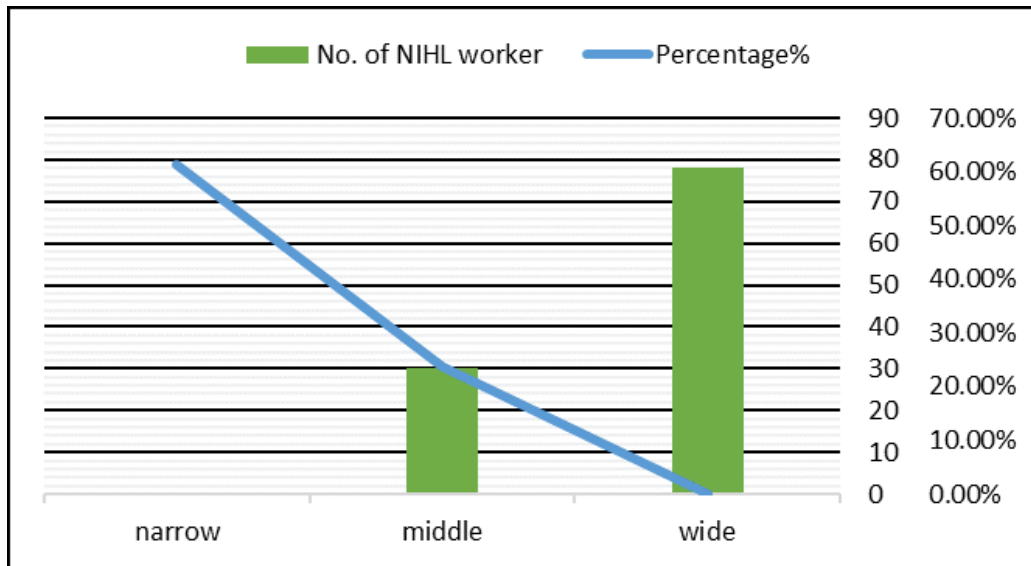


Figure 7 Distribution of No. of NIHL worker according to workplace characteristics.

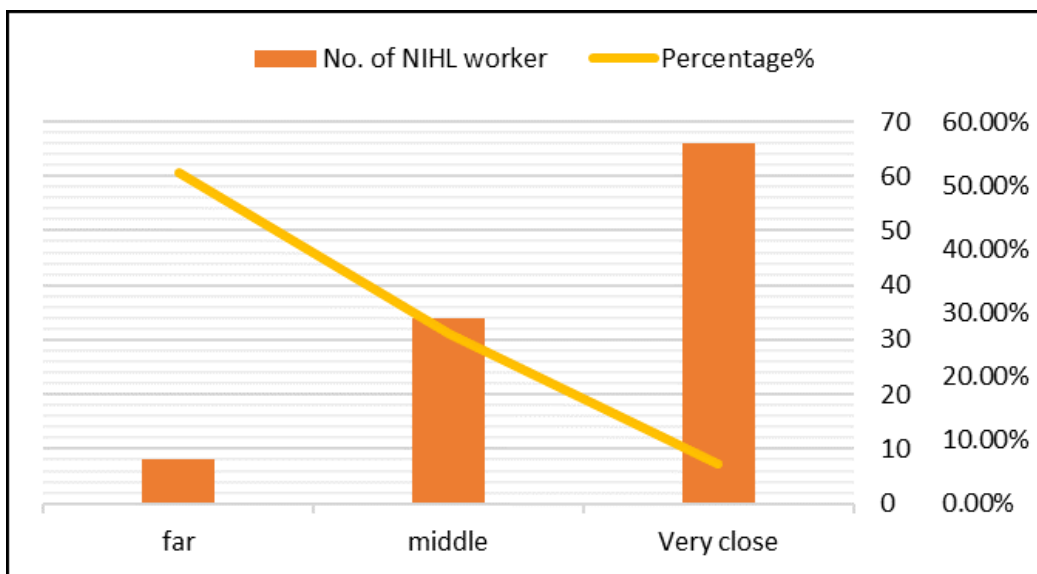
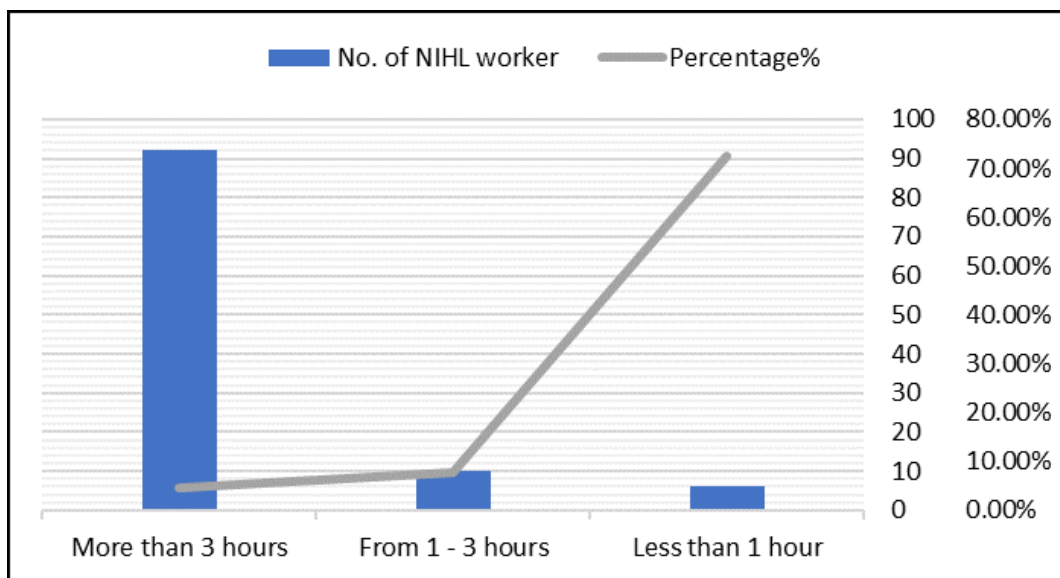


Figure 8 Distribution of No. of NIHL worker according to Working distance from noise.





**Figure 9** Distribution of No. of NIHL worker according to period of noise exposure at work.

### 3.2 Safe Sound Level

According to National Institute for Occupational Safety and Health (NIOSH) guidelines [3].

**Table 8** Duration of exposure to noise by NOISH.

Sound Levels (dB)	Permissible exposure
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes

It is found that workers in the knitting department are unsafe due high noise levels, which averaged more than 90 decibels, which is the established standard value. After conducting a hearing screening test for the workers, it is found that 108 workers (left ear) are suffering from hearing loss in high frequencies, while only 35% of workers complained of difficulty hearing, because hearing loss usually initially includes high frequencies, so we note that the worker suffers from Hearing loss and he does not complain about it. He only complained of ear pain and tinnitus, which is the highest percentage of 64%. According to the World Health Organization, the degree of hearing loss is classified as shown in Table 9 [8].

**Table 9** Degrees of hearing loss.

Hearing Loss (dB)	Degree of Hearing Loss
< 15	Normal
16-25	Slight
26-40	Mild
41-55	Moderate
56-70	Moderately severe
71-90	Severe
≥ 90	Profound

The largest percentage of hearing loss is in the mild/high frequency classification. Therefore, hearing loss is likely to be minimal at noise levels of less than 75 dB and even at noise levels of up to 80 dB for 8 hours per day. Through our study, it is found that there is a significant effect of the worker's age and the duration of his exposure to noise on the level of hearing, as the percentage of hearing loss is high, about 89% and 89% for the late age groups (41 - 50 years) and (51 - 60 years), respectively. However, the age factor accounts for a small amount of variation among workers in their tendency to lose hearing compared to exposure to a noisy environment. As for the duration of the employment work (the number of years of work, which is more than 10 years in our study), The level of hearing compared to the effect of age and the noisy environment. Among the effects that are also noted in the study, which have a major role in increasing hearing loss, are chronic diseases. In our study of 32, 26 and 32 workers with an associated chronic disease (hypertension, diabetes, allergic rhinitis and asthma), respectively, all had hearing loss, suggesting a strong relationship between chronic diseases and the chance of developing hearing loss. One of the things that is also noted in the study is that workers who survived hearing loss did not use any type of personal noise protection device (PPD), and only 8 workers (7%) used them.

#### 4. CONCLUSIONS

Noise evaluation in the knitting section was more than the permissible noise for 8 hours. Hearing Loss resulting from noise develops in workers without them complaining of hearing loss. their only complaint was tinnitus and discomfort in the ear.

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