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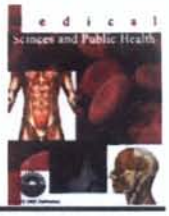

Occupational Exposure to Noise and Patterns of Hearing Threshold among Factory Workers in Ibadan Nigeria

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Abstract

This study examined occupational exposure to noise and patterns of hearing loss among industrial workers in Ibadan, Nigeria. The study adopted an ex-post facto research design; sampling 100 participants comprising of industrial workers and sawmillers, who were assessed by means of Pure Tone Audiometry, the sound level of the factories were measured with sound level meter. Frequency count, percentage, mean, standard deviation and pearson product moment correlation were employed to answer the four research questions raised. The sound assessment revealed that the sound level in the industrial plant is higher than that of the sawmill, and the notched pattern of hearing threshold predominated the hearing among the respondents on the left and right ears. There was positive significant relationship between age, work experience and bilateral hearing loss. Based on these findings, it was recommended that the altering of design and technology of mechanical equipments resulting in low noise emission should be put in place in factories, and that receptors of sound should be protected adequately from industrial noise.

Introduction

Exposure to noise has been observed to have deleterious impact on the health status of individuals working within the ravaging environment. Continuous exposure to this high and unwarranted sound remains as one major cause of hearing disorders all over the world. To this end, The World Health Organisation Programme for the Prevention of Deafness and Hearing Impairment in 1997 reported that exposure to excessive noise is the major avoidable cause of permanent hearing impairment worldwide, just as Noise-Induced Hearing Loss is the most prevalent irreversible industrial disease, and suggest compensatiable occupational hazard.[1,2] The impact of deleterious nature of noise on man has prompted the assertion that noise must be recognized as a major threat to human beings.[3] The word noise is derived from the Latin term 'nausea.'[4] It has been defined as an unwanted sound, a potential hazard to health and communication, dumped into the environment with regard to the adverse effect it may have on unwilling ears.[5-6]

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Sound which pleases the listener is music and that which causes pain and annoyance is noise. At times, what is music for some people can be noise for others.[7] Noise mainly could be industrial or non- industrial. Industrial noise sources include the noise from various industries and big machines working at a very high speed and high noise intensity,[4] while non-industrial noise could be sourced from home, aircraft, construction firms, road traffic, rail road, consumer products and building. Evidence has shown that noise is a risk factor in sleep disturbance, cardiovascular dysfunction, speech interference and mental health distortion, as it includes hearing impairment and balance disorder.[8] Exposure to loud, distracting and possibly hazardous noise is a common experience for everyone. Reports from studies indicated that for the 90th percentile of noise- exposed population, the risk of presumed Noise-Induced Hearing Loss (NIHL) increases exponentially for noise level beyond 85dB and over prolonged period.[9-10]

Hearing impairment may be gradual but it can eventually result in the destruction of the hair cells of the organ of the corti.[11-12] Apart from high noise causing acoustic trauma, it causes temporary or permanent shift in hearing threshold. Such impairment may result in profound or total deafness. NIHL can be caused by one time exposure to noise as well as repeated exposure to noise at various levels of loudness over an extended period. The usual conversation is conducted at or less than 60 dB. Exposure to daily average noise level that is above 80dB is unsafe because of damage to the hair cells. NIHL manifests irreversible subtle change in the sensory cells and other structures in the organ of corti inside the cochlea. Consequently, the hair cells and supporting cells will become disintegrated and ultimately the nerve fibres that enervate the hair cells will disappear and resulting in permanent threshold shift and hence, irreversible hearing loss at higher frequencies will be recorded.[13-14]

Occupational noise-induced hearing impairment is hardly a matter of public health concern in many developing countries such as Nigeria. There are few or poorly enforced noise-pollution control laws in many parts of the country. In the rapidly industrializing parts of the country, the occupational groups exposed to noise pollution are hardly aware of the health risks of the noise levels at their places of work.[12] It is impossible to assess the risk of noise-induced hearing loss without considering exposure duration. Even noise levels as high as 130-140dB (A) can be harmless if the duration is only a matter of a few seconds and there are no or few repetitions of such - gun-fire would be an example of this kind. Occasional exposure between a criterion noise level such as 90dB (A) and exposure duration has been called the time-intensity trade off. Occupational Safety Health Administration (OSHA) uses a 5dB exchange rate, which allows 8-hour exposure at levels of 90dB (A) per day.

In the United States alone, about nine million workers are exposed to Time Weighted Average (TWA) sound levels of 85 dB (A) and above,[15] while about 10 million have Noise- Induced Hearing Loss (NIHL) 225 dB.[16] In the European Union, 28% of workers surveyed reported that at least one fourth of the time, they were occupationally exposed to noise loud enough to the extent that they would have to raise their voice to hold a conversation corresponds to approximately 85 to 90 dBA.[17] High occupational noise exposure levels were reported in 17 studies conducted in 12 countries in South America, Africa and Asia. This high noise levels occurred in a wide range of work places, including manufacturing and mining industries. However in Nigeria, there is dearth of summary statistics on noise exposure for most industrializing and non- industrialized states.

Occupational exposure to noise usually results into Noise Induced Hearing Loss (NIHL), which is Sensori-neural Hearing Loss (SNHL) in nature. Sensori-neural hearing losses occur when sound

that gets to the inner ear is not transmitted to the brain or is transmitted in a distorted manner. Damage to the cochlea and the auditory nerve which is mostly due to continuous exposure to noise or viral diseases will bring about sensori-neural hearing loss. Both SNHL and NIHL do manifest irreversible subtle change in the sensory cells and other structures in the organ of corti in the cochlea. Consequently, the hair cells and supporting cells disappear resulting in permanent threshold shift and hence irreversible hearing loss at the higher frequencies will then occur.[18] Some individuals may be more susceptible to noise exposure than others, as certain population studies indicate that males and fair-skinned people are more susceptible to noise-induced hearing loss than females and dark – skinned people.[10] Patients with noise-induced hearing loss typically present with gradual bilateral, high frequency, sensori-neural hearing loss. Hearing loss resulting from excessive exposure to noise is bilateral in the sense that both ears are affected. Like most instances of sensori-neural hearing loss, there is no affective medical or surgical therapy for noise–induced hearing loss.[10] Noise- induced hearing loss may also be prominent among workers in the heavy industry and sawmills.[4] Like the home and the school, the place of work is also known as an important part of man's environment. The protection of the health and safety of the workforce from hazards related to work activities is imperative and underpins a healthy and vibrant economy of any country. Therefore, this research work is aimed at evaluating the impact of occupational noise on the auditory performance, general well being and productivity of those working in such environments.

Purpose of the Study

Determining whether there is hazardous level of noise exists at the working areas and prevalence of affected workers was the main objective of this study. Also the study sought to identify factors and personal characteristics which make industrial workers susceptible to hearing loss.

Specifically, the study intended to:

- determine whether the noise level in the factories under investigation exceed the damage risk criterion of 85-90 dB.
- investigate the pattern of hearing thresholds prevalent among the workers in some selected industries.
- investigate type of hearing loss prevalent among the workers in the selected industries.

Research Questions

1. Does the sound level in the factories exceed the damage risk value of 85-90dB?
2. Are there cases of occupational induced hearing loss among factory workers in Nigeria?
3. What are the common patterns of hearing loss among factory workers?
4. What is the relationship between age range, and years of experience of factory workers and patterns of threshold of hearing?

Research Design

This study adopted the ex-post facto research design. The study represented a probe to describe a given state of affairs that exists at any given time.

Population

The target population comprised factory workers in Ibadan metropolis, Oyo State Nigeria.

Sample and Sampling Technique

The sample for the study were 100 participants, selected using simple random sampling technique, while the organizations were purposively selected. Out of the 100 participants designated for the study, 40 were drawn from the production section of a manufacturing plant in Ibadan, while the remaining 60 were drawn from Bodija sawmill. The participants comprised both male and female gender. 37(37.0%) of the participants had their ears evaluated audiologically so as to determine their suitability for the job (see table 1), while majority 63(63.0%) were not privileged of audiological evaluation before they were employed (see table 1). 58(58.0%) of the participants spend 8 hours at work daily while 42(42.0%) spend 9 hours and above at work daily (see table 2). Also, 77(77.0%) of the participants expressed that their working environment was noisy, while 23(23.0%) expressed that their working environment was not noisy in any way (see table 2). In addition, 2(2.0%) of the participants worked for 2days per week, 1(1.0%) worked for 3days per week at work, 23(23.0%) worked for 4days per week at work, and majority 74(74.0%) worked for 5days per week at work. This result shows that the sampled industries worked for 5 days per week (see table 3). 26(26.0%) of the participants worked in an environment that is slightly noisy, 19(19.0%) reported noisy, while majority 38(38.0%) reported very noisy, and 17(17.0%) reported extremely noisy (see table 4). 45(45.0%) of the samples experience ringing in the ears after the day's work (tinnitus), while majority reported that they do not experience tinnitus after the day's work (see table 5). 14(14.0%) reported that since they started working, they had reported cases of hearing problem to the doctor, while majority 86(86.0%) reported that since they started working, they had not reported any case of hearing problem to the doctor (see table 5). Based on the above information, it can be concluded that the noise-level in these factories have significantly affected the auditory performance of the workers, most especially those who work 5 days per week.

Furthermore, 41(41.0%) of the participants reported that they follow conversation conveniently, particularly when engine is at work. 59(59.0%) claimed unawareness to the items, 28(28.0%) reported that they have problem in hearing normal speech (see table 6). 72(72.0%) reported that they do not have problem in hearing normal speech, 38(38.0%) reported that people always complain that they speak loud whenever they talk, 62(62.0%) reported that people do not complain whenever they speak loud (see table 6). 45(45.0%) reported that they have difficulty in locating the source of sound, 55(55.0%) reported that they do not have difficulty in locating the source of sound (see table 6). Therefore, it is evident that majority of the participants were unaware of the damaging effect of noise from the engine. 7(7.0%) reported that ear plug is the protective devices for workers in the factory (see table 7), 74(74.0%) reported ear muffs, 9(9.0%) reported head phones, and 10(10.0%) reported other devices (see table 7). 33(33.0%) of the participants reported that they use the device always, 20(20.0%) reported occasionally and majority 47(47.0%) of the respondents reported that they did not use it at all (see table 7). This implies that the factory workers are exposed to noise and are at risk of noise- induced hearing loss.

Instruments

The following instruments were used in data collection for this study:

i) Sound level meter
ii) Audiometer: Maico 53 model
iii) Research Scale: Occupational Noise Assessment Scale (ONAS)

- Sound Level Meter (SLM): - The sound level meter was used to measure the sound level in dBA in each of the two factories that was studied.
- Calibrated Audiometer: Maico 53 which is a two channel Audiometer for advanced pure-tone and speech tests. It consists of an audio oscillator, which generates pure tone of different frequencies ($125H_Z$ to $12KH_Z$), and each tone is amplified to a maximum of 110dBHL and minimum of 10dBHL.
- Occupational Noise Assessment Scale (ONAS): The ONAS consists of thirty items which were distributed to participants. The items were divided into two different sections of A and B. Section ''A'' consists of the bio-data of the respondents e.g. Date, Sex, age, work section and educational qualification while, Section ''B'' consists of probing questions on year of experience, duration of work per day and investigation into any abnormalities so far experienced by the workers on the job due to the nature of their places of work.

Procedure for Data Collection

A familiarization tour was initially made to the factories to observe the level of noise and the state of working environment. When permission to carry out the research work was given, the noise level of the production units of the factories was measured. The workers (samples of the study) were assessed audiometrically using the audiometer to measure their hearing level- particularly the patterns of hearing loss due to noise – exposure. Also, questionnaire was administered to the respondents to elicit response on their work experience, duration of work per day and to verify whether they are experiencing any symptoms of hearing loss, or any other health-related problems.

Method of Data Analysis

The data gathered through the research instruments was analyzed with the use of measures of central tendency such as mean, frequency counts and percentages, and Pearson product moment correlation. He results generated through the use of Pure-Tone Audiometry (PTA) test were reported in percentage based on the frequency of the patterns of hearing loss, after the threshold had been determined.

Results

Research Question1: Does the sound level in the factories exceed risk value of 85-90dB?

The sound assessment revealed that the sound level in the manufacturing plant is higher than that of the saw mill (see table 8). This may be due to the big machines and industrial equipment in use. The risk level in the two areas is very high, and this may have implications for onset of noise induced hearing loss among the workers. The findings of this study therefore agreed with earlier findings which stated that exposure to loud, distracting and possibly hazardous noise is a common experience for everyone.[9-10] Reports from these studies indicated that for the 90th percentile of noise-exposed population, the risk of presumed Noise-Induced Hearing Loss (NIHL) increases

exponentially for noise level beyond 85dB and over prolonged period. Also in line are studies that revealed that exposure to high noise levels greater than 80dB, could lead to hearing impairment.[5,11-12] Such exposure may result in profound or total deafness, if early intervention strategy is not taken

Research Question 2: Are there cases of Occupational Noise Induced Hearing Loss among the factory workers?

Data from table 9 shows that 77 (77%) workers out of the total sample of 100 workers had Occupational Induced Hearing Loss, while the remaining 23(23%) workers had normal hearing. This result showed that there are cases of occupational noise induced hearing loss among the factory workers. The findings also agreed with the study which examined 165 workers of a car assembling factory in Nigeria, and concluded that the hearing threshold of the 165 workers were significantly higher than non- exposed controls and correlated significantly with employment duration.[19] The study was in line with the reports that in the United States alone, about nine million workers are exposed to Time Weighted Average (TWA) sound levels of 85 dB, and that above 10 million have noise-induced hearing loss 225dB.[14] Also, the study was in consonant with the findings that in the European Union, 28% of workers surveyed reported that at least one fourth of the time, they are occupationally exposed to noise loud enough, to the extent that they would have to raise their voice to hold a conversation, corresponds to approximately 85 to 90 dBA.[20] The reports further showed that high occupational noise exposure levels were reported in 17 studies conducted in 12 countries in South America, Africa and Asia. This high noise levels occurred in a wide range of work places, including manufacturing and mining industries.[20]

Research Question 3: What is the common pattern of hearing loss among factory workers?

The results in table 10 and graph 1shows that 16(16.0%) of the participants had normal pattern of hearing threshold, 9(9.0%) had flat pattern of hearing threshold, 4(4.0%) had sloping pattern of hearing threshold, 3(3.0%) had rising pattern of hearing threshold, 7(7.0%) had trough pattern of hearing threshold, while only 1(1.0%) had peaked pattern of hearing threshold, majority of the participants 58(58.0%) had notched pattern of hearing threshold, 1(1.0%) had precipitous pattern of hearing threshold and 1(1.0%) had low pattern of hearing. The result showed that notched pattern of hearing threshold is predominant among the participants with evidence of hearing loss in the right ear which indicate that noise level within their workplace has contributing effect on their pattern of hearing threshold. Results in table 11 and graph 2 further reveal that 16(16.0%) of the participants had normal pattern of hearing threshold; 9(9.0%) had flat pattern of hearing threshold; 4(4.0%) had sloping pattern of hearing threshold; 3(3.0%) had rising pattern of hearing threshold; 5(5.0%) had trough pattern of hearing threshold; 2(2.0%) had peaked pattern of hearing threshold, majority of the participants 60(60.0%) had notched pattern of hearing threshold, and 1(1.0%) had low pattern of hearing threshold. The result showed that notched pattern of hearing threshold predominated the hearing among the respondents on the left ear which shows that noise had effect on their pattern of hearing. These findings therefore corroborated earlier studies that noise- induced hearing loss produces a sensorineural defect which evolves over the years.[21] The audiogrammes used showed a pattern which is usually bilateral and a typical 'notch' at the 4000Hz. Also, the findings acquiesced with earlier work that noise- induced hearing loss is generally observed to affect the person's hearing sensitivity in the higher frequencies especially at 4000Hz.[22] It is usually associated with a notch-shaped high frequency sensorineural loss that is worst at 4000Hz, although the notch often occurs at

3,000Hz or 6000Hz as well. The findings of this study confirmed the result which stated that Noise Induced Hearing Loss usually occurs initially at high frequencies (3, 4 or 6KHz), and then spreads to the low frequencies (0.5,1, or 2KHz).[23] The notched pattern of hearing loss was found prevalent among workers of the punching and cutting manufactories.[24] This further supported Oleru et al's study of 1990 on hearing thresholds in an auto assembly plant in a Nigerian factory which showed that hearing loss among sawmill and plant workers usually occurs at higher frequencies. Similarly, NIHL at frequency of 4000 Hz is more than that of 1000 and 2000 Hz.[19] Hearing loss in workplaces starts at 4000 Hz and is then directed towards higher and lower frequencies.[24]

Research Question 4: what is the relationship between, gender and years of experience of factory workers mostly affected by occupational noise induced hearing loss?

Table 12 shows the right and left ear of the participants based on age, with evidence of increasing level of hearing thresholds. Participants between the ages 20 -25 years reported lower hearing threshold values ($\overline{X}$ = 27.4, SD = 10.39) for right ear, and ($\overline{X}$ = 25.2, SD = 10.35) for left ear, compared to participants between 25 -30 who had higher hearing threshold values ($\overline{X}$ = 31.9, SD = 8.36) for right ear, ($\overline{X}$ = 29.15, SD = 7.5) for left ear. Also, participants between the ages of 30-35 reported lower hearing threshold values($\overline{X}$ = 35.19, SD = 10.25) for right ear, ($\overline{X}$ = 32.9, SD = 9.2) for left ear, compared to participants between the ages of 35 -40 had ($\overline{X}$ = 33.2, SD = 11.8) for right ear, ($\overline{X}$ = 33.3, SD = 10.94) and for participants between the ages of 40 and above had highest hearing threshold values($\overline{X}$ = 44.07, SD = 8.1) for right ear, ($\overline{X}$ = 41.2, SD = 8.8) for left ear.

Table 13 reveals the right and left ear of the participants based on work experience: participants with 0 -5 years work experience had low hearing patterns ($\overline{X}$ = 27.14, SD = 8.50) for right ear, and ($\overline{X}$ = 25.2, SD = 8.80) for left ear, compared to participants who had between 5-10 years experience with high hearing pattern ($\overline{X}$ = 32.4, SD = 10.2) for right ear, ($\overline{X}$ = 30.06, SD = 9.7) for left ear; while participants who had between 10-15 years work experience had high hearing threshold values ($\overline{X}$ = 36.10, SD = 11.64) for right ear, ($\overline{X}$ = 34.6, SD = 9.7) for left ear; compared to participants who had 15-20 years work experience reported having high hearing threshold values($\overline{X}$ = 40.5, SD = 9.26) for right ear, ($\overline{X}$ = 40.5, SD = 9.26). Participants who had between 20 and above work experience had high hearing threshold values ($\overline{X}$ = 46.6, SD = 5.7) for right ear, ($\overline{X}$ = 40.0, SD = 8.6).

From table 14, it is clear that there is positive significant relationship between Age of the participants, right hearing loss (r = 0.218; $p < 0.05$) and left hearing loss (r = 0.228; $p < 0.05$). This shows that with increase in age, the more hearing loss experienced by the workers, while table 15 shows that there is positive significant relationship between work experience of the participants, right hearing loss (r = 0.212; $p < 0.05$) and left hearing loss (r = 0.230; $p < 0.05$). This implies that the more years of working experience the more hearing loss. These findings therefore substantiated the findings that reported that the prevalence of hearing difficulties and tinnitus as the result of excessive exposure to loud noise were strongly related to age, severe difficulties in hearing being unusual under the age of 35 years.[25] The relationship between noise induced hearing loss, age and work history in the present study is in line with the results of another study.[26] There was a meaningful

relationship between mean daily work hours and noise induced hearing loss at frequencies of 2, 3, 4 and 8 kHz and correlation test confirmed the relationship between work history and NIHL. Also, increase in age results into more hearing loss experienced by the workers. There is positive significant relationship between Age of the respondents and right hearing loss and left hearing loss. There is positive significant relationship between working experience of the respondents and right hearing loss and left hearing loss. The more years of working experience results into more hearing loss.[26] According to the results of the present study, the rate of hearing threshold pattern and loss varied in workers of the factory sections. The study found that noise interferes with many aspects across the age groups. Generally the growing age group bears more effect of noise pollution.

Recommendations

Based on the results of this study, the following recommendations are made:

- There should be regular medical examinations of workers in all industries. The regular check-ups should include comprehensive evaluation, in order to detect cases of any hearing loss.
- Personal protective devices should be used to provide appropriate medical education of both workers and the management staff of said industries in order to prevent this kind of occupational disease.
- More effort should be put into hearing conservation programme activities in order to achieve a greater positive impact on employee awareness. And reduce the risk of occupational noise induced hearing loss.
- The design and technology of machines/equipments should be altered resulting in low noise emission, while noise barriers may help to control noise.
- Receptors of sound should be protected by a shield (e.g. buildings may be insulated against noise and also body and window planes may be made sound proof).
- Organisations may undertake various steps to modify or regulate the behaviour of users of machines and equipment, by educating the employers on the effect of occupational noise.
- There should be change in employers' attitude through government policies, non-governmental organizations, and civil measures (fines) in order to reduce or prevent noise pollution. Many conflicts over noise pollution could be handled by negotiation between the emitter and receiver.
- The National Assembly of Nigeria should pass a bill making it mandatory for all states and local government of the federation to enact a similar law to combat noise pollution aggressively in Nigeria.
- Regulatory agencies should be put in place to assist in the measurement, control and enforcement of the laws to achieve a desired goal.
- Gadgets like insulator and sound proofing to doors, walls, ceilings, using ear protection and planting vegetation and screen out noise pollution and zoning urban area to maintain a separation between residential area and zones of excessive noise.

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Table I: - Distribution of the Respondents showing Audiological Assessment before getting Employment.

Were your ears tested audiologically	Frequency	Percent
Yes	37	37.0
No	63	63.0
Total	100	100.0

Table II: Work Duration Characteristics

How many hours do you spend at work daily	Frequency	Percent
8 hours	58	58.0
9 hours and above	42	42.0
Total	100	100.0
Do you consider your working environment noisy	Frequency	Percent
Yes	77	77.0
No	23	23.0
Total	100	100.0

Table III: Distribution of Participants based on Work Duration

Work Duration (in days)	Frequency	Percent
2	2	2.0
3	1	1.0
4	23	23.0
5	74	74.0
Total	100	100.0

Table IV: Participants Perception of Noise Level in the Factory or Sawmills

Perception	Frequency	Percent
Slightly noisy	26	26.0
Noisy	19	19.0
Very noisy	38	38.0
Extremely noisy	17	17.0
Total	100	100.0

Table V: Participants Experience of Ringing in the Ear after the Day's Work

Experience	Frequency	Percent		
Yes	45	45.0		
No	55	55.0		
Total	100	100.0		
Since you started working, have you ever reported any case of hearing problem to the doctor	Frequency	14	86	100
	Percentage	14	86	100

Table VI: Distribution of the Perception of the Effect of Noise Level on Work Process.

Items	Response	Yes	No	Total
Can you follow conversation conveniently particularly when engine is working	Frequency	41	59	100
	Percentage	41	59	100
Do you have problem in hearing normal speech	Frequency	28	72	100
	Percentage	28	72	100
Do people complain that you speak too loudly when you speak	Frequency	38	62	100
	Percentage	38	62	100
Do you have difficulty in locating the source of sound	Frequency	45	55	100
	Percentage	45	55	100

Table VII: Types of noise prevention device and frequency of use

Types of noise prevention devices	Frequency	Percent
ear plug	7	7.0
ear muffs	74	74.0
Head phones	9	9.0
Others	10	10.0
Total	100	100.0
Frequency of use	Frequency	Percent
Always	33	33.0
Occasionally	20	20.0
not at all	47	47.0
Total	100	100.0

Table VIII: Distribution of sound level in the two production sites

Location	dB level
Sound level at saw mill	90
Sound level at coca-cola	115

Table IX: Hearing Variables of Respondents.

Hearing Status	Frequency	Percentage
Normal hearing	23	23.0
Hearing loss	77	77
Total	100	100.0

Table X: Distribution Showing the Pattern of Hearing Loss in the Right Ear

Pattern of hearing loss	Frequency	Percent
Normal	16	16.0
Flat	9	9.0
Sloping	4	4.0
Rising	3	3.0
Trough	7	7.0
Peaked	1	1.0
Notched	58	58.0
Precipitous	1	1.0
Low	1	1.0
Total	100	100.0

Table XI: Distribution Showing the Pattern of Hearing Threshold in the Left Ear

Pattern of hearing loss	Frequency	Percent
Normal	16	16.0
Flat	9	9.0
Sloping	4	4.0
Rising	3	3.0
Trough	5	5.0
Peaked	2	2.0
Notched	60	60.0
Low	1	1.0
Total	100	100.0

Table XII: Average Hearing Threshold In The Left Ear Based on Age

Age		Right ear	Left ear
20-25	Mean	27.4667	25.2000
	Std. Deviation	10.39139	10.35236
25-30	Mean	31.9615	29.1538
	Std. Deviation	8.36412	7.51900
30-35	Mean	35.1905	32.7143
	Std. Deviation	10.59537	9.20947
35 -40	Mean	33.2500	33.3750
	Std. Deviation	11.86610	10.94974
40 and above	Mean	44.0714	41.2143
	nStd. Deviation	8.16620	8.89407
Total	Mean	33.9700	32.0100
	Std. Deviation	10.92810	10.32061

Table XIII: The Average Hearing Threshold in the Right Ear Based on Work Experience

Work experience		Right ear	Left ear
0-5	Mean	27.1429	25.2857
	Std. Deviation	8.50210	8.80060
5-10	Mean	32.4667	30.0667
	Std. Deviation	10.21274	9.73606
10-15	Mean	36.1071	34.6071
	Std. Deviation	11.64709	9.70047
15-20	Mean	40.5000	40.5000
	Std. Deviation	9.26463	9.26463
20 and above	Mean	46.6667	40.0000
	Std. Deviation	5.77350	8.66025
Total	Mean	33.9700	32.0100
	Std. Deviation	10.92810	10.32061

Table XIV: Summary of Pearson product moment correlation showing significant Relationship among hearing loss of factory workers and their Age

Age	Mode	Right ear	Left ear
Age	Pearson Correlation	.218*	.228*
	Sig. (2-tailed)	.029	.022
	N	100	100
	Remark	Significant	Significant

Table XV: Summary of Pearson product moment correlation showing significant Relationship among hearing loss of factory workers and working experience

Work experience	Mode	Right ear	Left ear
Work experience	Pearson Correlation	.212*	.230*
	Sig. (2-tailed)	.034	.022
	N	100	100
	Remark	Significant	Significant

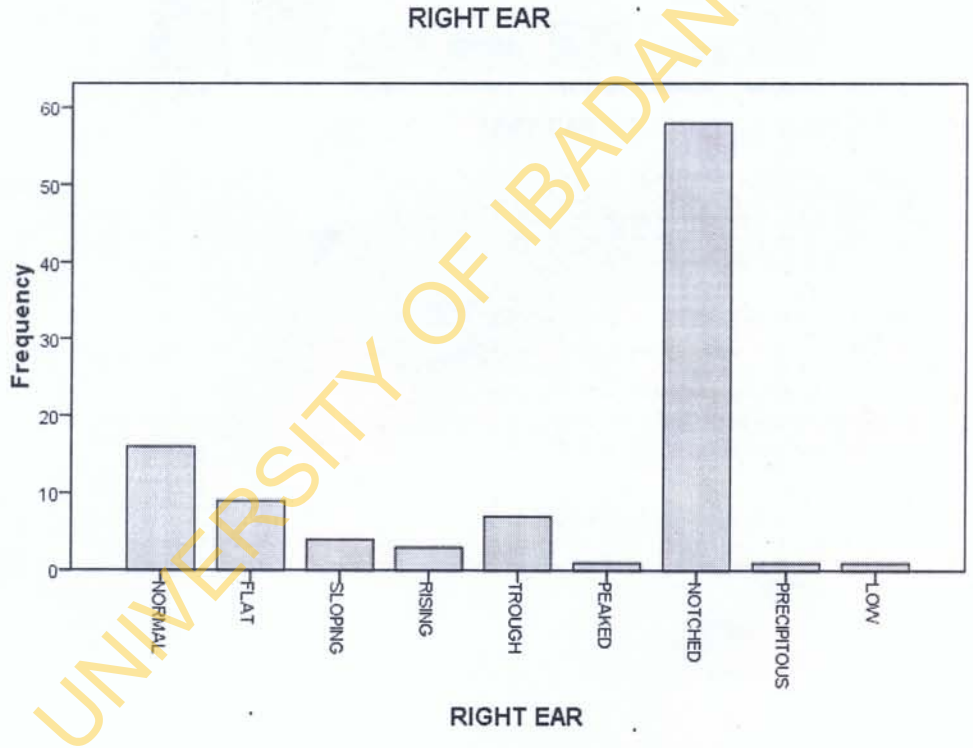

Figure 1. Right Ear

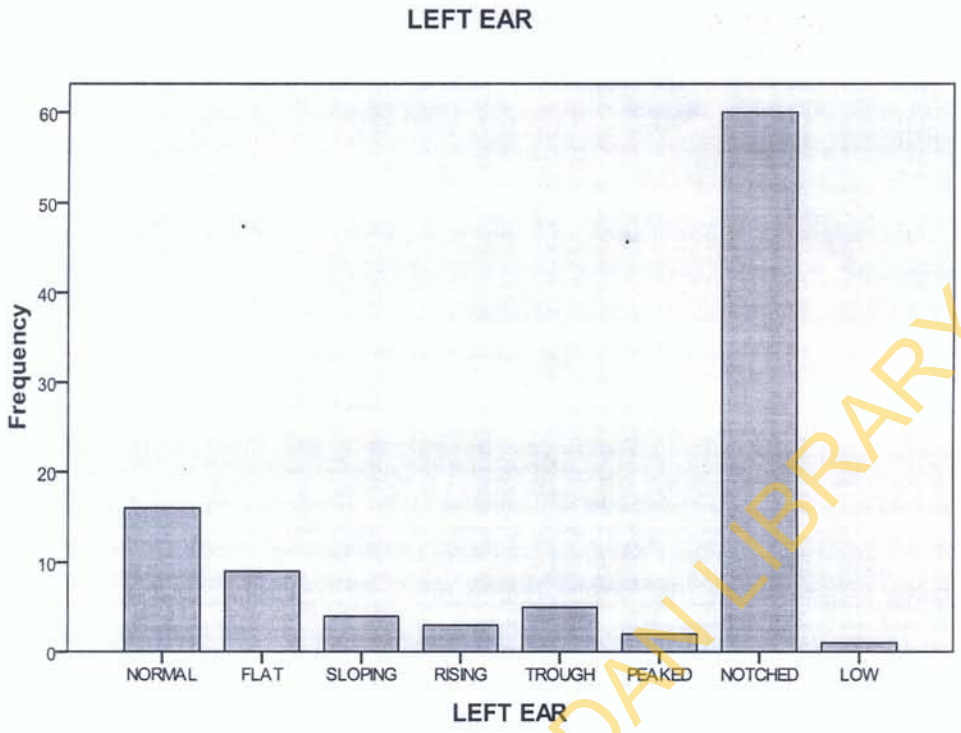

Figure 2. Left Ear