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Electrical Generators Noise Effect at The Hearing Threshold on Workers

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Abstract

Sound level meter was used to assess the noise levels produced by electric generators. The average noise level of 15 generators was measured, and it was found to be greater than the daily exposure limit of 101.5333 decibels. It was also investigated how this kind of noise affected workers' health, particularly in terms of hearing loss. The study involved 51 workers who underwent a pure tone average (PTA) test to assess their hearing level after otoscopic examination. After statistical analysis of the data, it was found that 42 workers had hearing loss in the high frequencies (left and right ear) and 30 and 38 workers had hearing loss in the speech frequencies in the right and left ear respectively. The study also covered the connection between aging and hearing loss.

Keywords: Hearing loss, electrical generators noise, hearing threshold.

1. Introduction

Environmental noise pollution is turning into a global concern. It is currently thought that one of the most significant public health issues is the recognition of noise as a major health danger [1]. Numerous sources including cars, industry, home appliances, and generators create noise. Noise and vibrations from generators are known to be detrimental to both the environment and human health. Generator-related noise and vibrations are becoming a global issue. Although power plants are designed to function as a backup and alternative energy source in the event of a power outage, they are presently the main source of energy for households and businesses due to the inconsistent power supply in the nation [2]. Due to inadequate electricity supplies, the utilization of power plants and the noise pollution they cause to the environment and public health has increased [3]. These generators produce

noise that is high, especially at night. Most houses and businesses employ relief to benefit the people who live or work there. These standards differ from nation to nation and are imposed as laws, guidelines, or recommendations based on industry burden, economic situations, and technological advancements.

Certain nations have laws specifically pertaining to noise pollution. For example, the Federal Noise Control Code of 1972, the New York Noise Control Code of 1972, and the Chicago Noise Control Regulations of 1971 in the United States of America, in Great Britain, the Control of Pollution Act, 1974, in Japan, Noise Control Laws of 1968, are the specific laws to control the growing problem of noise pollution [4].

When electric generators are running, they emit gaseous pollutants and make a lot of noise. They seriously endanger the health of users as well as members of the local community. This volume of noise has the potential to damage hearing. The human hearing range is between (20-20000) Hz. Above and under this range, a person cannot hear any sound. Both one-time and repeated exposure to noise over a lengthy period at different loudness levels can result in Noise Induced Hearing Loss (NIHL) [5].

The health impacts of using a generator might be either non-auditory or auditory (hearing). Due to the subtle effects of noise on hearing, many people may not become aware of their hearing impairment until it has gotten worse. Noise poses a major risk to one's health. Furthermore, in their need for financial stability, many people frequently put their health last and work long hours and quite close to generators [6]. One of the things that prevents transformation is a lack of knowledge [7]. It has been proposed that awareness of workplace dangers (such noise from electric generators) can predict workers' use of preventive measures [8]. The aim of the research is measuring the noise levels emitted by generators and study their impact on workers' hearing.

2. Methodology

2.1 Data Collection

Data were collected from October 2023 to April 2024 through random sampling of generator workers in Al-Jihad neighbourhood. This area was chosen for the study because it is an area that lacks government electrical equipment, which led to an increase in the number of generators, in addition to the fact that the generator sites were within residential neighbourhoods, which led to negative effects on the residents. Our study included 60 workers exposed to noise. Noise levels (sound pressure level equivalent) were measured using a sound level meter (figure1). The noise level of 15 generators was evaluated.

Then, 60 generator workers were brought in groups weekly to the hearing section to assess their hearing by audiometer device (figure 2).

Figure 1: Sound level meter device.

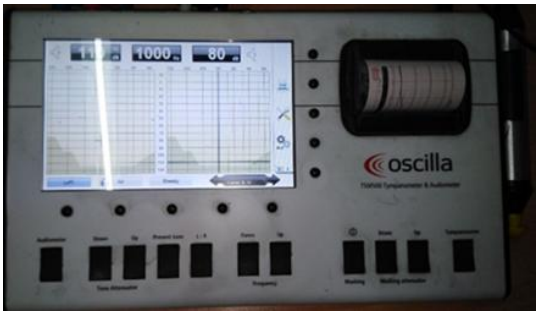

Figure 2: Audiometer device.

2.2 Hearing Test

A specialised examined the generator workers' tympanic membranes with an otoscopy test prior to the hearing examination. They excluded nine workers who had otitis media. Following an in-person interview, the employees filled out a pre-made questionnaire that asked them a few questions about their age, how long they had been exposed to noise, any chronic illnesses, a pure tone test was utilized to determine the workers' hearing threshold. To prevent recent noise exposure from contaminating the temporary threshold hearing level data, a test involving 51 workers was conducted prior to the worker commencing work

3. Results and Discussion

An assessment of noise was carried out on fifteen generators. 101.53333 dB was the average noise level (table 1) and (figure 3).

Table 1: Measurements of noise level.

Generators	Noise level (dB)
G 1	103
G 2	100
G 3	101
G 4	104
G 5	101
G 6	100
G 7	104
G 8	99
G 9	100
G 10	100
G 11	105
G 12	99
G13	100
G14	102
G15	105
Mean	101.5333333
Standard deviation	2.133630932
Maximum	105
Minimum	99

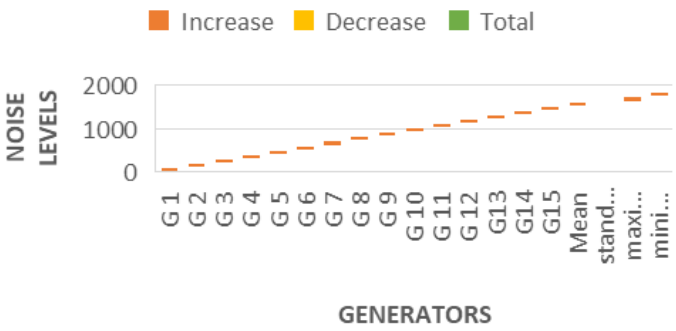

Figure 3: Distribution of noise levels of fifteen electrical generators.

3.1 Audiometric Assessment

All workers with R-ear NIHL were bilaterally affected. The results of the pure tone testing for generator workers (n=51) are shown in (tables 2), (figure 4), (table 3), and (figure 5) for the right and left ear, respectively. Forty-two workers had hearing loss in the L-ear / high frequency, which represents the real clinical apparent hearing loss worker. This value (n1 = 42) will be used as a reference value in all calculations below to be compared with other values.

Table 2: Testing assessment of right ear.

Testing assessment	No. of HL at Speech frequencies	No. of HL at High frequencies	Percentage %
Normal	13	9	18 %
Slight	15	8	16 %
Mild	9	26	51 %
Moderate	7	3	6 %
Moderately sever	6	3	6 %
Sever	1	2	4 %
Profound	0	0	0 %
Total hearing loss	38	42	

Table 3: Testing assessment of the left ear.

Testing assessment	No. of HL at Speech frequency	No. of HL at High frequency	Percentage %
Normal	21	9	18 %
Slight	10	15	29 %
Mild	8	11	22 %
Moderate	6	6	12 %
Moderately sever	4	5	10 %
Sever	2	3	6 %
Profound	0	2	4 %
Total hearing loss	30	42	

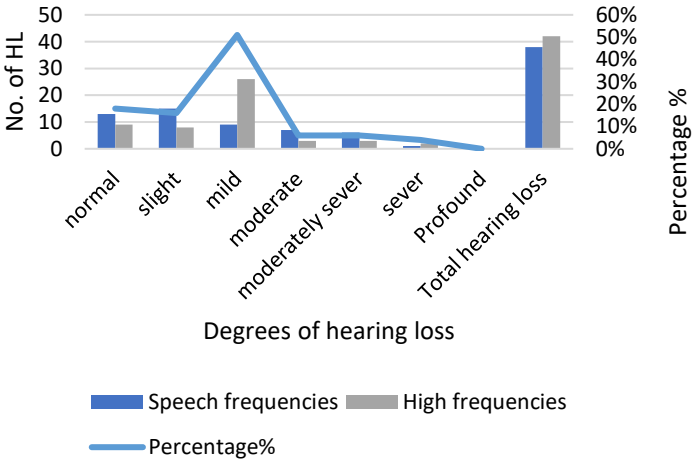

Figure 4: R-ear hearing loss at the average of hearing sensitivity at Speech and High frequencies.

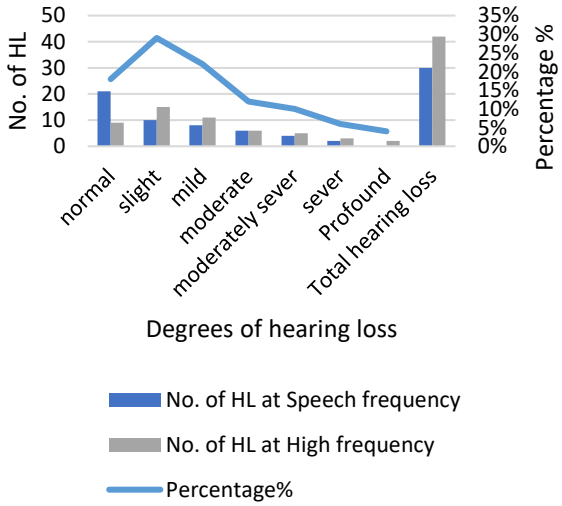

Figure 5: L-ear hearing loss at the average of hearing sensitivity at Speech and High frequencies.

The direct correlation between NIHL, age and is explained by the distribution of NIHL in high frequencies (n1=42) in (table 4) and (figure 6).

Table 4: Distribution of the NIHL in high frequencies (n1 = 42).

Age / Years	Average period of noise exposure / Years	Number of workers in age Categories	Number of workers with NIHL	Percentage %
20 – 30	8	12	11	92 %
31 – 40	9	19	16	84 %
41 – 50	14	11	10	91 %
51– 60	14	9	5	56 %

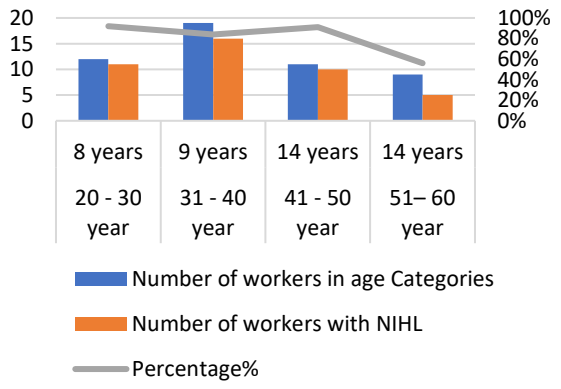

Figure 6: Distribution of the NIHL by age Categories.

Age range of the 51 workers included in this study was 20 to 60 years. 92 % of the workers were 20-30 years old, 84 % were 31-40 years old, 91 % 41-50 years old, and 56 % 51-60 years old, as shown in (table 4) and (figure 6).

Moreover, the results illustrate the distribution of NIHL in high frequencies (n1 = 42) for generator workers by age groups and provide an explanation for the direct correlation between NIHL and age. Age has a direct correlation with hearing and is thought to be a factor in hearing loss, as demonstrated in (table 4), which charts the association between age and the risk of hearing loss.

Age groups above 40 are found to be more sensitive to hearing loss. Consequently, samples older than 60 were not included because aging is thought to contribute to hearing loss. The duration of noise exposure greatly affects ear sensitivity because it weakens the cochlea's hair cells, which are responsible for hearing.

The likelihood of developing hearing loss increases with the length of time spent in loud environments. Since hearing loss takes five years to occur, the study included participants whose employment term (exposure period) exceeded five years. The existence of disorders that influence hearing was one of the most prominent items on the questionnaire sheet, as shown in (table 5), and (figure 7).

Table 5: Distribution of workers according to the presence of diseases affecting hearing.

Affecting illnesses	No. of worker	No. of NIHL worker	Percentage %
Hypertension	15	15	100 %
Diabetes	10	10	100 %
Allergic rhinitis and asthma	5	5	100 %
Congenital ear problems	0	0	0 %
thrombosis	4	4	100 %

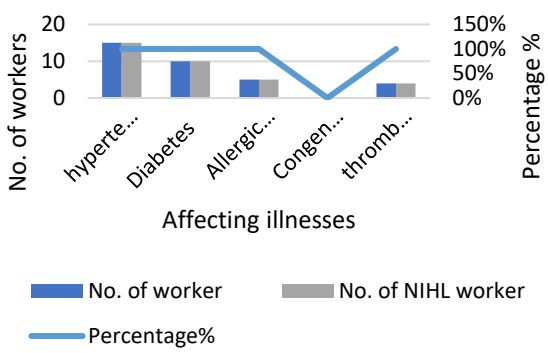

Figure 7: Distribution of workers according to the presence of diseases affecting hearing.

The results demonstrated that high noise levels which averaged higher over 90 dB, the imposed standard value make employment near generators dangerous. 42 workers were discovered to have high-frequency hearing loss after a hearing screening test was administered. most of these workers fell into the mild to high-frequency category.

The investigation revealed that age and length of noise exposure have a substantial effect on hearing level. The percentage of hearing loss rose with age, indicating a clear association between the two. On the other hand, compared to exposure to a noisy environment, age explains only a low number of the inter-individual variation in their tendency for hearing loss.

Chronic diseases are one of the consequences the study mentioned, and it has been shown to play a major role in increasing hearing loss. All workers in study had related chronic conditions (hypertension, diabetes, allergic rhinitis, asthma, and thrombosis) had hearing loss., indicating the presence of a strong relationship between chronic diseases and the chance of hearing loss.

4. Conclusion

Noise levels emitted by the generators measured exceeded the permissible noise level. Averaging 101.5 decibels, while the permissible exposure level is 85 decibels. Most of the generators in neighbourhoods of Jihad city are large, and old. Those machines had lack of maintenance and no contain silencers. However, that was the reason for the increase in noise emitted by them during operating hours. In addition, most generators are operating on diesel fuel. Thus, increasing their environmental impacts, with lack of provision of electrical energy, even for limited, regular hours, has increased the problem of noise pollution and the almost complete dependence on the operation of generators, especially during the summer.

5. References

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