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Research Article

Evaluation of Noise Emissions from Everyday Sound Sources in Bosso, Niger State, Nigeria

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Abstract

In the Nigerian population, hearing loss and noise harm are serious issues. Noise-induced hearing loss can have social repercussions for the afflicted individuals and their families as well as impaired people. This study used a sound level meter at various places in Bosso, Minna, Niger State, Nigeria, to measure the noise level of twenty-seven (27) distinct sources. The manufacturer's standard process was closely adhered to, and statistical analysis was performed on the outcomes. Among the outcomes are: 5.5 capacity engine generator (99.0±9.5-101.8±8.4 dBA), loud speaker (86.3±6.7-109.4±11.0 dBA), refrigerator (57.5±2.5-69.2±6.4 dBA), fan (63.7±4.6-87.7±7.6 dBA), pressure pot (84.9±6.7-89.5±6.5 dBA), 81.6±5.6-100.2±8.4 dBA), and television (49.6±2.4-91.4±7.6 dBA). The findings demonstrated that many of the sources beyond the standard limits. Signifies the presence of noise pollution in Bosso, Minna, and the necessity of noise control in this region. It is advised that the Nigerian government work to lessen the nation's noise pollution. This can be accomplished by raising awareness of the threat posed by noise pollution and implementing the appropriate regulations.

Keywords: Bosso, noise pollution, standard limits, hearing loss, noise control, regulations

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Introduction

Noise is defined as unwanted and/or harmful sound (Fink, 2024; Banks and Cohen Hubal, 2025). Noise is a disturbing sound, but when it exceeds international standards, it is considered pollution. A widespread environmental problem that has serious negative consequences on human health is noise pollution (Hassan, 2024). Similar to other forms of pollution, noise pollution has its own set of issues. Stress, high blood pressure, hearing loss, heart disease, sleep disturbances, and more are among the associated issues, according to Mercola (2015). A US study found that a 5dB reduction in noise has an impact on the prevalence of coronary heart disease and high blood pressure, lowering them to 1.8% and 1.4%, respectively. Additionally, the proposal predicted that reducing noise pollution would have an annual economic benefit of $3.9 billion (Mercola, 2015).

The surroundings of the noise pollution get noisier if the noise level at a place stays constant. As a result, finding a peaceful space becomes challenging and noise pollution spreads widely (Roy, 2015; Cai et al., 2025). Noise is not only an annoyance in peaceful circumstances, but it also makes it difficult to carry out local tasks. For instance, in educational settings, teachers and students feel uncomfortable (Ana et al., 2009; Fidencio et al., 2014). Patients will be negatively impacted while in a noisy hospital. Yuen (2014) states that prolonged exposure to noise levels between 85 and 90 dBA can alter hearing threshold sensitivity and result in hearing loss.

Over 5.2 million children and 10 million people in the US have irreversible noise-induced hearing damage, according to data released by the WHO. Over 250 million people worldwide are susceptible to hazardous noise levels throughout their daily activities. A person is considered to have hearing loss if they are unable to hear as well as someone with normal hearing, which is defined as hearing thresholds of 20 dB or higher in both ears. According to WHO (2021), hearing loss can be classified as mild, moderate, moderately severe, severe, or profound. One or both ears may be affected, making it difficult to hear loud noises or conversational speech. People with modest to severe hearing loss are referred to as hard-of-hearing. Hearing aids, cochlear implants, and other assistive technologies, as well as captioning, can help people who are hard of hearing communicate primarily through spoken language. The majority of deaf persons have substantial hearing loss, which means they can hear very little or nothing at all. Cochlear implants may be beneficial to them. Some of them communicate through sign language (WHO, 2025).

Environmental noise exposure ('noise pollution') is an important global public health concern, having implications for physical health, wellbeing, and mortality (Thompson et al., 2022). Due

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to residential and industrial activities, vehicle traffic, and population growth, noise has become an annoyance in Nigeria. This problem is related to a variety of perceived elements which are characterized as: i. Socio-economic and cultural factors; ii. Attitude or Behavioral factors; iii. the structure of Nigerian cities (Abel, 2015) and Ganiyu and Ogunsote (2010) divided noise sources into two categories: external (sound coming from outside the building) and internal (activities, office equipment, and building services). By passing laws that are vigorously enforced, the government has now taken decisive action to lessen the threat. Religious organizations, businesses, and social establishments that violate these regulations face applicable sanctions (liable upon conviction to the penalty stipulated in sections 36 or 37 of the Federal Environmental Protection Agency Act).

The Federal Environmental Protection Agency (FEPA) in Nigeria has set a standard noise level of 55 dB (FEPA, 1992), but the World Health Organization has set a limit of 60 dB (WHO, 1991).This study was conducted in Minna, Bosso area, Niger State, which is categorized as a comparatively medium-sized urban metropolis in Nigeria's northern region. In Bosso, environmental studies of buildings have been conducted, but none have examined broad sources of noise.

The study objective was to measure the noise level from twenty-seven (27) distinct sources.

Materials and Methods

The study area is located in Minna, Niger State, Nigeria, and is a part of Bosso Local Government. The main metropolitan area of Minna, the capital of Niger State, is Bosso and its surroundings. With a land mass area of roughly 1,592 km^2 with population of 208, 212, it is located between $9^o39'12''$ N; $6^o30'58''$ E. The study area is diagrammatically presented in Figure 1 (Oluibukun et al., 2015).

This place is an urban town that is expanding quickly. The noise levels were recorded at various sites in the study's surrounding area. The study employed 27 noise sources. The sound level meter (GB: 2266204, manufactured in China), which has a measurement range of 30dBA to 130dBA, an accuracy of ±1.5dB, a frequency range of 31.5Hz to 8kHz, and a power supply of 3*1.5V AAA battery, was used to conduct the study on a variety of noise sources. After turning on the meter, the LCD panel showed the current ambient noise level for one second. When the MIN button was hit, a value replaced the current environmental noise. This value was interpreted as the noise source's minimum sound level once it had steadied. The MAX reading underwent the same process. The noise sources were the direct source of the noise level measurements (dBA). Minitab 16 statistics software was used to statistically evaluate the

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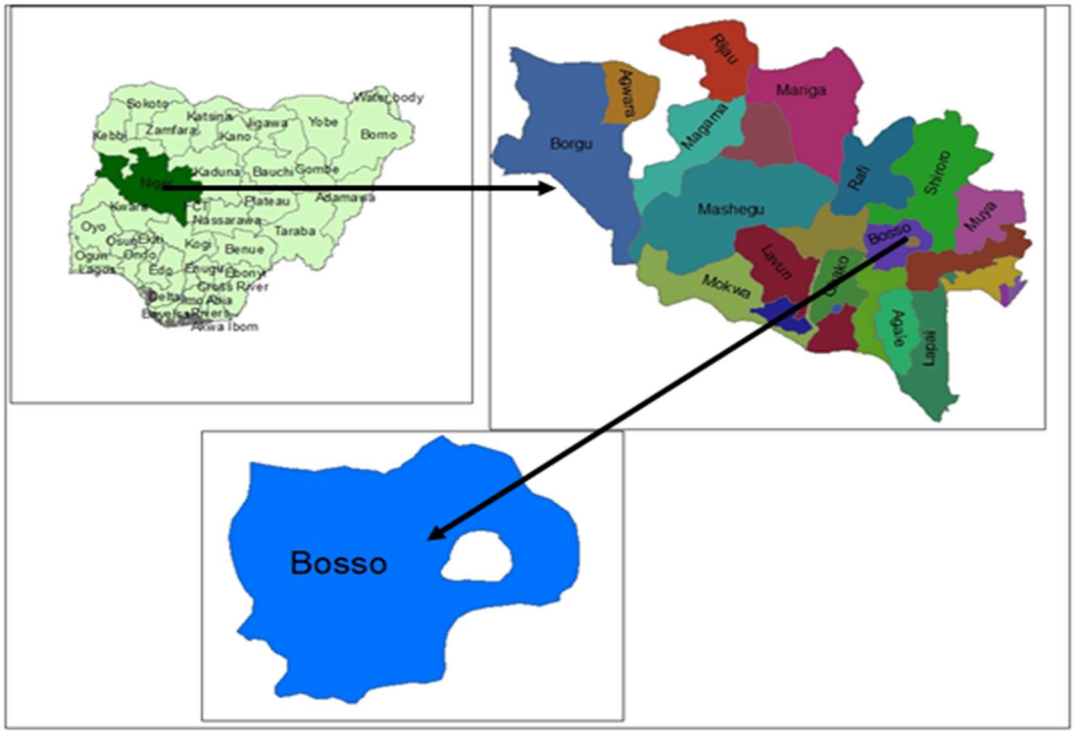
generated values (triplicates). Sound level meter (manufactured in China, GB: 2266204) (Abulude and others, 2018).



Source: Oluibukun et al. (2015)

Figure 1: The map of the location used in this study.

Result of the noise generated from Tambourine (54.0±3.1 dBA) is shown in Table 1. The maximum sound of the Tambourine is 77.5±5.8 dBA) as shown in Table 1. Is considered very dangerous according to the EPA's sensitivity zone in Table 2. A one-year-old baby's weeping and stone-grinding noises were measured at 54.6±5.5 dBA and 65.6±4.2 dBA, respectively. In their work, Dudek and Faress (2016) proposed that deliberate bias to newborn signals (noise) is caused by cognitive control processes. The outcome of the baby's cry was significantly different from the 99–120 dBA sound levels that Carney (2014) reported. There was undoubtedly more noise from the quarry.

Results from livestock include: Goats (59.2±4.4-78.5±7.8), pigs (66.9±2.4-77.9±6.6), and bulldogs (87.7±5.4-108.5±11.3 dBA) are shown in Table 1. The loudest noise level was produced by bulldogs barking. Broucek (2014) found that noise levels in pig farm fattening units varied from 69 to 78 dB. This was contrasted with the findings for the pig in this

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Table 1: The results of the noise levels from different sources in Bosso town

S/N	Noise Point	Minimum Sound (dBA)	Maximum Sound (dBA)
1	Television	49.6±2.4	91.4±7.6
2	Fan	63.7±4.6	87.7±7.6
3	Fridge	57.5±2.5	69.2±6.4
4	Speaker	86.3±6.7	109.4±11.0
5	Generator (5.5 Capacity engine)	99.0±9.5	101.8±8.4
6	Hand Bell	90.7±9.0	111.2±10.3
7	Tractor	83.5±8.8	99.6±8.9
8	Vulcanized engine	85.7±6.7	101.5±10.34
9	Welding machine	88.7±8.1	101.8±10.44
10	Cassava grating machine	105.3±9.0	121.0±11.2
11	Bulldog bark	87.7±5.4	108.5±11.3
12	Washing machine	64.3±3.8	77.3±6.3
13	Car horn	88.6±5.0	113.0±12.1
14	Baby cry	65.6±4.2	82.4±6.5
15	Pressure pot	84.9±6.7	89.5±6.5
16	Stone grinder	54.6±5.5	65.7±4.4
17	Mower (Handheld)	97.2±4.6	99.3±8.7
18	Sawmill	98.4±6.2	100.2±9.9
19	Block making machine	114.8±10.56	121.4±10.5
20	Phone ringing tone	81.6±5.6	100.2±8.4
21	Tambourine	54.0±3.1	77.5±5.8
22	Pig	66.9±2.4	77.9±6.6
23	Goat	59.2±4.4	78.5±7.8
24	Drum set	88.4±5.6	99.0±9.2
25	Carpentry work (roofing)	53.9±2.49	77.0±7.8
26	Automobile painting workshop	88.3±7.1	97.7±9.9
27	FUT gate	108±6.2	112±10.2

investigation. A sound level of 50dBA has been advised to prevent annoyance to animals or personnel (Clough (1999) as cited by Abulude et al., 2018). According to Broucek (2014), the sound levels fluctuated between 85-138 dB in pig fattening halls including vocalisations of the piglets as well as background noise. Technical equipment, daily tasks, mechanical ventilation, animal activity, and animal vocalizations can all be sources of noise in the animal house. According to the National Institute for Occupational Safety and Health (NIOSH, 2024), prolonged exposure to noise levels of at least 85 dBA can result in cochlear damage and

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permanent hearing loss. According to Abulude et al. (2018), a study conducted by Pfaff and Stacker (1976) revealed that noise levels in animal facilities were roughly 60 episodes/0.5 hours at ≥ 90dBA in the morning and > 60 episodes/0.5 hours at ≥100dBA in the evening. Animals' productivity and behavior are impacted by their sensitivity to noise. In addition to

its loudness (dBA) and frequency (Hz), the effects also depend on the species' and breeds' hearing tendencies, age, and physiological state at the time of exposure. Once more, the consequences also depend on the predictability of the acoustic stimulation and the kinds of sounds the animal has experienced during its existence.

The Block Making Machine had a value of 114.8±10.56-121.4±10.5 dBA, as shown in Table 1. These figures are significantly higher than the WHO's and several nations' recommended limits for acceptable noise exposure (Table 4). Noise pollution has an impact on people's quality of life everywhere. In the workplace, noise can also have detrimental effects. Because of what they do and what goes on around them, building construction workers are constantly exposed to noise. persons in the vicinity of a block-making company are not protected from noise hazards, but they are vulnerable to the risks of noise pollution if they sit or work next to persons who make noise on a regular basis. Ninety percent of construction workers have some degree of hearing loss, according to NIOSH studies conducted in the mid to late 1990s (Abulude et al., 2018). By the age of twenty-five, the average worker's hearing is comparable to that of an otherwise healthy fifty-year-old male who hasn't been exposed to noise. Approximately thirty million workers in the US are exposed to hazardous sound levels at work (NIOSH, 2024).

The cassava grating machine (105.3±9.0-121.0±11.2dBA), tractor (83.5±8.8-99.6±8.9dBA), and mower (handheld) all had results between 97.2±4.6 and 99.3dBA. These values can be classified as substantial disability, according to WHO (1991). Even a shouted voice will be incomprehensible to the individual (Table 5). Because different types of machinery were tested than those utilized here, the results of this study were lower than those of Depczynski et al. (2005) (131.4±11.2dBA). Additionally, the variations could be caused by considerable variability around the mean noise level since some machinery produces extremely high levels of noise, as well as fluctuation related to age, manufacturer, horsepower, condition, and power source. The majority of farm tools are often noisy. Before hearing damage occurs, it is advised to shorten the duration of exposure. If the tool is worn out and old, the hazards are higher.

Table 1 displays the noise levels of common household items. 5.5 capacity engine generator (99.0±9.5-101.8±8.4 dBA), loud speaker (86.3±6.7-109.4±11.0 dBA), refrigerator (57.5±2.5-69.2±6.4 dBA), fan (63.7±4.6-87.7±7.6 dBA), pressure pot (84.9±6.7-89.5±6.5 dBA), 81.6±5.6-

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100.2±8.4 dBA), and television (49.6±2.4-91.4±7.6 dBA). The loudness of these materials varies depending on the user. One person's favorite sound could not be to another's liking or desire. According to Table 2, these noise levels are classified as extremely harmful and highly dangerous. Our results were found to be significantly higher than the limits shown in Tables (4 and 5) when compared to USEPA (2015), WHO, and other nations' norms (Table 4). The average noise level was higher than the 50dBA WHO standard that is advised for residential areas. The noise values in the studied locations differed significantly from the WHO standard ($p<0.05$). The results obtained here were consistent with the values (97.60 dBA) for generators obtained by Menkiti and Agunwamba (2015). Similarly, this study's recorded sound levels for washing machines and refrigerators matched those of Agharifard (2017). According to Agharifard (2017), more than 40% of Europeans suffer from exposure to noise levels above 55 dBA. The author verified that the main household product sources of noise pollution are vacuum cleaners, extractor fans, and washing machines.

The main road and seven other roads across from it make up the FUT gate's typical findings (Table 1). The average values varied from 108±6.2 dBA to 112±10.2 dBA. Throughout the day, there are always a lot of moving cars. Sundays, holidays, and celebration days are the only times when noise levels are lower. Unnecessary horn use, vehicle wear and tear, heavy vehicular movements, and the fact that many homes, businesses, markets, garages, and motor parks are located along the roadsides are all contributing factors to the noise on roadways. The careless use of loudspeakers and musical instruments for commercials, religious events, and social gatherings, and pedestrian traffic are other causes of the high noise levels. These results supported those of Ganiyu and Ogunsote's (2010) investigation on the causes of environmental contamination in Akure. In a study carried out in Fulton County, Georgia, Seong et al. (2011) found that 32% of the population was exposed to noise levels exceeding 50dBA at night and over 48% of the population was exposed to noise levels exceeding the recommended limits (55dBA) during the day. In the US, Lee et al. (2014) carried out a study on traffic-related noise. Noise and urban traffic were found to be correlated. According to the techniques employed, New York City had the most cars and the loudest noise levels, followed by Los Angeles and Atlanta. According to a study done in Germany by Schlittmeier et al. (2015), people are less irritated by 50dBA traffic noise than by 70dBA traffic noise.

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Table 2: Noise sensitivity zones

S/N	dB(A)	Sensitivity
1	55-60	Risky
2	60-65	Moderate risky
3	65-70	Highly risky
4	70-75	Dangerous
5	75-80	Highly dangerous
6	>80	Extremely dangerous

Source: USEPA (2014)

Table 3: Limits for permissible noise exposure

S/N	Duration (hours)	Noise Limits (dBA)
1	8	90
2	6	92
3	4	95
4	3	97
5	2	100
6	1.5	102
7	1	105
8	30 minutes	110
9	15 minutes	115

Source: Li et al. (2016)

Table 4: Limits for permissible noise exposure limits by WHO and some countries

S/N	Selected noise level standards	Noise level Leq dBA	
		Day time	Night time
1	WHO recommended health criteria	55	45
2	Germany	45	35
3	Australia (recommended outdoor background noise	45	35
4	Japan	45	35
5	Korea	50	40
6	Philippines	50	40
7	Malaysia	65	60

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Table 5: The effects of sound on wellness of inhabitants within the surrounding

S/N	Grade	Explanation	Audiometric ISO value[b]	Performance
1	0	No impairment	≤ 25 dB (better ear)	No, or very slight hearing problems. Able to hear whispers
2	1	Slight impairment	26-40 dB (better ear)	Able to hear and repeat words spoken in normal voice at 1 m
3	2	Moderate impairment	41-60 dB (better ear)	Able to hear and repeat words using raised voice at 1 m
4	3	Severe impairment	61-80 dB (better ear)	Able to hear some words when shouted into better ear
5	4	Profound impairment including deafness	≥ 81 dB (better ear)	Unable to hear and understand even a shouted voice

[a] Source: WHO (1991), [b] International Organization for Standardization, average of 500, 1000, 2000, 4000 Hz

Conclusion

According to the study, there is noise pollution and it needs to be controlled because many of the sources' noise levels were higher than the standard limits set by the WHO, FEPA, OSHA, and nations like Germany, Australia, Japan, Korea, and the Philippines. It is advised that the Nigerian government work to lessen the nation's noise pollution. Raising awareness of the threat posed by noise pollution is one way to accomplish this. Even the elites act carelessly when it comes to noise, and the bulk of people lack literacy. Two Nigerian governments are currently attempting to compel citizens to conform to the criteria. In order to effectively reduce noise pollution in the nation, this should be extended to other states. Every action taken to lessen noise pollution should be closely adhered to.

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Contributions of the authors: Every author was involved in the problem's conception, experiment design, data collecting, and manuscript approval.

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