



ASSESSMENT OF SOUND LEVELS IN SOME MARKETS AND WORSHIP CENTRES IN OYO AND OGUN STATES OF NIGERIA

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ABSTRACT

Environmental noise pollution has become a major public health concern in rapidly urbanising cities of developing countries. This study assessed sound pressure levels in selected markets and worship centres in Oyo and Ogun States, Nigeria, and evaluated variations in noise levels using Analysis of Variance (ANOVA). Noise measurements were conducted in five major markets (Bodija, Ogunpa, Sango, Dugbe, and Sabo Markets) and three churches (Churches A, B, and C) using a calibrated sound level meter. Maximum and minimum sound levels were recorded at designated locations together with ambient temperature. The results showed that the mean of the maximum sound levels in the markets ranged from 93.54–110.34 dBA, while the mean values for the churches ranged from 87.80 – 107.68 dBA. The highest market noise level was observed at Dugbe Market (121.20 dBA), whereas the highest church noise level was recorded at Church C (115.30 dBA). One-way ANOVA revealed no statistically significant difference among the market noise levels ($F = 0.902$, $p = 0.482$) and among the church noise levels ($F = 2.784$, $p = 0.102$). The t-test shows that there is no significant difference between the sound levels in the church and the noise levels in the markets. Most measured values exceeded the, World Health Organization (WHO) recommended environmental noise limit of 53 dBA, indicating potential adverse health effects on traders, worshippers, and nearby residents. The study recommends stricter enforcement of environmental noise regulations and regular monitoring of community noise exposure.

Keywords: Analysis of variance (ANOVA), Churches, Markets, Noise pollution, Sound level

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INTRODUCTION

The disturbance of noise pollution is a daily experience due to the surrounding activities, such as the noise of moving vehicles, rowdiness in marketplaces, and other sources of noise that contribute to the sound level at a particular time. Many companies that operate with heavy-duty machines on a daily basis add to the noise level in the environment. The noise levels, which differ from location to location, are issues of concern in developing and developed countries; hence, the operations of noise regulatory bodies are well established and empowered by the government. The growing number of markets, churches, and large mechanical enterprises, along with the fast-paced development of communities, highlights the numerous possible risks associated with working in an environment that is noisy. Noise pollution is a new kind of pollution brought about by modern living [1].

One of the main environmental contaminants that is not compatible and environmentally friendly on a daily basis is noise pollution, which has both immediate and long-term impacts on humans and the environment. The constant loudness of modern

recreational and entertainment equipment, along with the noise level associated with transportation systems in crowded cities and towns, is also sources of pollution in the environment. Noise may also be referred to as a natural occurrence in life, and one of the best alert systems available to humans in their physical surroundings. Nonetheless, it persistently disrupts the tranquility and quiet of human existence [2]. Sound a vibration of regular frequency is produced when anything vibrates in the open, and pressure waves are released into the atmosphere [3]. Sound beyond the permissible limit for human hearing is not good for the ears. Excessive noise has a number of negative effects on health, including increased blood pressure, irritation, stress, sleep deprivation, hearing damage, decreased productivity, and difficulty concentrating [4].

Increased noise pollution has an impact on people, animals, plants, and even inanimate items like buildings and bridges. In developing nations like Nigeria, there has been a noticeable rise in noise levels in recent times due to prevailing challenges faced by citizens, with the corresponding increase in the number of churches springing up to combat the

challenges. This has resulted in churches being sited close to residential areas and the associated loud sound levels during vigils and different weekly services. It is now acknowledged that one irritant of the urban environment is noise, which is a type of air pollution [4]. Recently, in Kano State, the Emir of Rano banned church activities in residential buildings after receiving various petitions from residents living close to where churches are situated [5]. The most typical consequence of noise pollution, according to an investigation, is hearing loss if the length of exposure is not appropriately controlled [6]. Hearing loss due to chronic noise exposure is typically linked to the breakdown of the ear cells of the inner ear. Other powerful or explosive sounds, such as those experienced in some states in Nigeria characterised by insecurity, have the potential to rupture the eardrum or impair the middle and inner ear structures immediately. The impacts of noise pollution fall into two categories: auditory and non-auditory. Hearing problems are frequently referred to as auditory effects or physical impacts. Non-auditory effects include those that affect how well people perform at work, like decreased output and misinterpreting what is said, psychological effects like disorders, insomnia, agitation, and stress, and physiological effects like elevated blood pressure, irregular heartbeats, and ulcers [1].

The neurological system can be severely disrupted by noise pollution, which can have an impact on people's physical and psychological behaviour. Individuals vary in how sensitive they are to noise [6]. Hence, what one person hears as sound may be considered noise to another. Man's survival and ability to live a healthy life are mostly dependent on the supportive environment in which he lives, since environmental disruption can cause problems with one's health and widespread kind of noise pollution. According to Mucci *et al.* [7], trees can be planted along streets, roads, and highways to mitigate the health risks associated with residential noise.

Not every sound that vibrates can be heard; the audible frequency ranges from 20 Hz to 20 kHz [3]. Mucci *et al.*; Samara and Tsitsoni [7, 8] define community noise as household, residential, or ambient noise. Noise is generally defined as unwanted or disturbing sounds [9]. In churches, sound has existed for thousands of years. It is widely used in Christianity to make worship interesting and enthralling to the worshipers, hence the reasons why music and loudspeakers are used to generate sound up to a certain level inside the churches. However, many of the worship centres amplify the loudspeakers to volume levels that are not convenient for worshipers and the immediate environment. The European Union and the World Health Organization released a set of noise-related guidelines. The most well-known of these guidelines states that individuals should not be exposed to noise levels above 85 dBA (decibels a unit of sound intensity) for longer than eight hours per day,

and 70 dBA for kids. Mucci *et al.* [7] advised that for optimal teaching and learning environments, community noise levels in classrooms should not be more than 35 dBA and not more than 30 dBA in bedrooms during the night.

The combination of buyers and sellers in a market creates communities through their social, commercial, and economic interactions, which also pollute the surrounding air with noise. Environmental noise pollution is a major issue at these open-air markets because of the large number of vendors and purchasers ranging from hundreds to thousands of individuals [10]. Marketplaces with extremely high noise levels carry a significant risk to people's health. The general public may be affected by commercial noise due to prolonged exposure to excessive noise, which has raised concerns about human health in marketplaces, especially for those in the environment.

Ninety-one percent of people on earth reside in areas where air quality is higher than what is recommended by the World Health Organization [11]. One significant environmental issue is air pollution, which hurts people's quality of life by making health problems worse for those who already have them and, in rare instances, even killing them. Market operations and religious activities, like churches participating in so many activities on a weekly basis, are among the sources that have been linked to the deprivation of people's ability to experience peace and comfort. The sounds produced by the different kinds of market transactions and the movement of people involved raise the area's sound pressure level. The churches and markets are randomly selected based on acceptance by church leaders and the researcher's accessibility. There have been past studies on sound levels in churches and marketplaces, but none have compared the sound levels in both cases to note if there is any significant difference between the two. This is the gap the present study attempts to address with the goal of ascertaining if there is any significant difference between the two sound levels purely for health implications.

The study aims to measure sound levels in selected markets and churches, compare noise exposure across locations, evaluate compliance with international noise standards, and determine whether significant differences exist among measured sound levels between markets, churches, and market and church combinations using One-way Analysis of Variance (ANOVA) and t-test.

MATERIALS AND METHODS

Description of the study area

This study of assessment of sound levels was carried out in four selected major markets and three churches in Ibadan, Oyo State, and a market in Sagamu, Ogun State, Nigeria. The churches and markets were randomly selected based on the researcher's acceptance at the study locations and accessibility. The markets include Bodija market, Ogunpa market,

Sango market, and Dugbe market in Ibadan North-East Local Government Area of Oyo State, and Sabo market, Sagamu in Ogun State, South western Nigeria. Churches A, B, and C, as named for an anonymous purpose, are located in Ibadan, situated in the South east of Oyo State in south west Nigeria.

Ibadan is located near the line dividing the tropical forest zone from the derived Savanna, but it is entirely inside it. The city's elevation varies from 150 meters above sea level in the valley region to 275 meters above sea level on the main north-south ridge that runs through the middle of the city. The city is the largest in Nigeria with a total area of 3,080 square kilometres. Ibadan is located at a latitude of 7.377° N, and a longitude of 3.906° E. Sagamu is located in Ogun state along the Ibu River and Eruwuru Stream between Lagos and Ibadan. It lies between Latitude 6.832° N and Longitude 3.632° E. The weather in Ibadan is mostly consistent throughout the year, with a long-wet season and a tropical wet-and-dry climate. Though there is a little dip in precipitation in August, Ibadan experiences its wet season from March through October. There are two distinct wet seasons in Ibadan. As a result of this, the typical West African harmattan occurs during the dry season, which runs from November to February.

The average annual precipitation is roughly 1,230 mm spread over 123 days. June and September see the highest amounts of rainfall. The average daily temperature is 26.46°C with a mean minimum of 21.42°C and a relative humidity of 74.55%. In Sagamu, the dry season is partly cloudy, the wet season is cloudy, and the year-round heat is oppressive. The average annual temperature fluctuates between 71°F and 93°F ; it is rarely lower than 65°F or higher than 96°F . In Sagamu, large limestone deposits are present in the Sagamu region, and these deposits are utilised in the city's main industry, which is the manufacture of cement. The region's agricultural products include kola nuts and cocoa. The nation's largest hub for gathering kola nuts is Sagamu. In order to store the kola nuts, the kola nut industry supports a number of secondary industries, including the production of rope and baskets.

Method of data collection

This noise meter, Mestek, was used for in-situ data collection at the selected markets and churches. Stratified and random methods were used to collect

the data at the churches and markets, respectively. The device has a frequency range of 31.5Hz – 8KHz, a digital displacement of three digits, an accuracy of ± 1.5 dB, a resolution of 0.1 dB, a battery: 3 * 1.5V AAA $\times$ 3 battery, and a measuring range of 35 – 135 dBA. Its sampling rate is 125 ms to 1000 ms, working conditions are 0 - 40°C temperature, $\leq 80\%$ RH humidity, and storage conditions of -20°C to 60°C temperature. Figure 1 presents the noise meter.



Figure 1: Mestek (35-135) dB noise metre

The minimum and maximum noise levels and the temperature were recorded. Five (5) sets of readings were taken per location to make a total of 40 sets of readings with a 300-second interval. The noise level was measured at different locations at the markets and 50m apart in churches.

Statistical analysis of the results

Data analysis was performed using descriptive statistics and one-way Analysis of Variance (ANOVA). The null hypothesis was tested: H_0 : There is no significant difference among sound levels in the selected locations, and H_1 : At least one church differs significantly. Significance was evaluated at $p < 0.05$. An independent-samples t-test (Welch's t-test) was used to compare the sound levels measured in the markets and the churches selected for the study, since the measurements come from two different groups of locations.

RESULTS AND DISCUSSION

The results for the study are shown in Tables 1- 5 and Figures 2 – 3, respectively.

Table 1: Consolidated noise level measurements in selected markets in Oyo and Ogun States, Nigeria

Market	Location	Maximum Sound Level (dBA)	Minimum Sound Level (dBA)	Temperature (°C)
Bodija	Pepper seller's stand	113.20	45.20	30.40
Bodija	Cloth seller's stand	89.60	62.30	30.90
Bodija	Food stuff stand	85.20	68.70	32.90
Bodija	Meat seller's stand	113.40	67.10	34.00
Bodija	Car park	112.20	56.50	33.90
Mean		102.72	59.98	32.42
Ogunpa	Gadget stand	113.00	61.30	30.80
Ogunpa	Jewelry stand	120.00	65.60	30.70
Ogunpa	Pepper seller's stand	111.20	53.90	30.70
Ogunpa	Fashion bag store	93.50	72.60	30.30
Ogunpa	Footwear stand	114.00	66.90	30.40
Mean		110.34	63.86	30.78
Sango	Footwear stand	88.60	61.20	32.50
Sango	Provision stand	89.60	69.90	33.00
Sango	Park	117.00	44.40	32.30
Sango	Meat seller's stand	83.80	60.90	32.20
Sango	Cassava flour stand	88.70	55.80	31.90
Mean		93.54	58.24	32.38
Dugbe	Car park	121.20	63.20	28.40
Dugbe	Stationary stand	88.00	50.40	28.30
Dugbe	Book store stand	86.90	67.10	28.20
Dugbe	Zenith stand	117.10	47.40	27.80
Dugbe	Boutique	118.80	68.10	27.20
Mean		106.40	59.24	27.98
Sabo	Car park	113.90	54.10	28.00
Sabo	Groundnut seller's stand	85.70	67.50	27.50
Sabo	Meat seller's stand	121.50	48.60	28.40
Sabo	Grinding stand	86.40	71.70	28.30
Sabo	Salon	120.50	75.20	28.10
Mean		105.60	63.40	27.86

Source: Present study

As presented in Table 1, the measured maximum and minimum sound levels at Bodija market ranged from 85.2 – 113.4 dBA with the mean of 102.72 dBA and 45.2 – 68.7 dBA with the mean of 59.98 dBA, respectively. The measured temperature ranged from 30.4 – 34.0°C with a mean of 32.4°C. The mean values for the noise levels at Bodija market exceed both the Federal Ministry of Environment (FME) limit (90 dBA), and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit, which is 70 dBA. It is worth noting that the noise level at the car park is quite high, with a maximum value of 112.2 dBA. The park is characterised by the use of speakers by the road transport workers who announce the destinations for all the vehicles using the car park. There are times when the recorded version of

the announcement is played continuously, thereby contributing to the elevated sound level at the park. The minimum noise levels at the car park seem to be low, indicating that at some times, the noise level is within acceptable limits, but still, the high value of the maximum noise levels could impact hearing challenges for workers and passengers. This suggests that corrective actions are needed to reduce noise levels. Most studies suggest that consistent exposure to noise levels above 70 dBA can lead to health issues. High average level of 102.72 dBA indicates a significant concern.

Similarly, the measured maximum and minimum sound levels at Ogunpa market ranged from 93.5 – 120.0 dBA with a mean of 110.34 dBA and 53.9– 72.6 dBA with a mean of 63.86 dBA,

respectively. The measured temperature ranged from 30.3 – 30.8°C with a mean of 30.78°C. From Table 1, the minimum noise level at the fashion bag store exceeds the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA), but others are below both the Federal Ministry of Environment (FME) limit (90 dBA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA). The maximum noise level at Ogunpa market exceeds both the Federal Ministry of Environment (FME) limit (90 dBA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA). The maximum noise levels at all the selected markets for the study exceed both the Federal Ministry of Environment (FME) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) permissible limits, indicating a significant issue with noise pollution. The mean of the maximum noise level at Ogunpa (110.34 dBA) indicates a severe noise issue.

Again, the measured maximum and minimum sound levels at Sango market ranged from 83.8 – 117.0 dBA with a mean of 93.54 dBA and 44.4– 69.9 dBA with a mean of 58.34 dBA, respectively. The measured temperature ranged from 31.9 – 33.0 dBA with a mean of 32.38°C. In this market, the car park's maximum noise levels exceed the Federal Ministry of Environment (FME) limit (90 dBA), while other locations are below the Federal Ministry of Environment (FME) limit of 90 dBA, but all locations' maximum level exceeds the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA). The minimum noise level is below both the Federal Ministry of Environment (FME) limit (90 dBA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA). Studies showed that transportation activities and trading activities at the marketplaces are the main sources of high noise levels. Immediate

action is required to mitigate noise exposure especially in locations like the parks and provision stands. The government should enforce compliance laws and regulate the activities of industries in these areas.

Also, as presented in Table 1, the measured maximum and minimum sound levels at Dugbe market ranged from 86.9 – 121.2 dBA with the mean of 106.40 dBA and 47.4– 68.1 dBA with a mean of 59.24 dBA, respectively. The measured temperature ranged from 37.2 – 28.30 dBA with a mean of 27.98°C. The average maximum noise level (106.40 dBA) is significantly higher than both the Federal Ministry of Environment (FME) (90 dBA) and National Environmental Standards and Regulations Enforcement Agency (NESREA) (70 dBA) limits. This indicates a severe noise pollution issue across all locations. Prolonged exposure to noise levels above 70 dBA can be harmful, and levels above 90 dBA are particularly concerning. The minimum noise level (59.24 dBA) is lower than both the Federal Ministry of Environment (FME) (90 dBA) and National Environmental Standards and Regulations Enforcement Agency (NESREA) (70 dBA) limits, indicating an acceptable noise level at times.

Also, the measured maximum and minimum sound levels at Sabo market ranged from 85.7– 120.5 dBA with a mean of 105.40 dBA, and 48.6– 75.2 dBA with a mean of 64.40 dBA, respectively. The measured temperature ranged from 27.5 – 28.40°C with a mean of 27.86°C. Table 1 also, shows that at Sabo market, the minimum noise level at the grinding stand and salon exceeds the Fink [12] limit of 70 dBA but others are below both Saylar *et al.* [13] limit of 90 dBA and Fink [12] limit of 70 dBA. The maximum noise level exceeds both Saylar *et al.* [13] limit of 90 dBA and Fink [12] limit of 70 dBA, except for the groundnut seller and grinding stand, which are below Saylar *et al.* [13] limit of 90 dBA. The maximum noise levels at Sango and Sabo markets are greater than the study of Joshua *et al.* [15], with noise levels that ranged from 75.4–100 dBA.

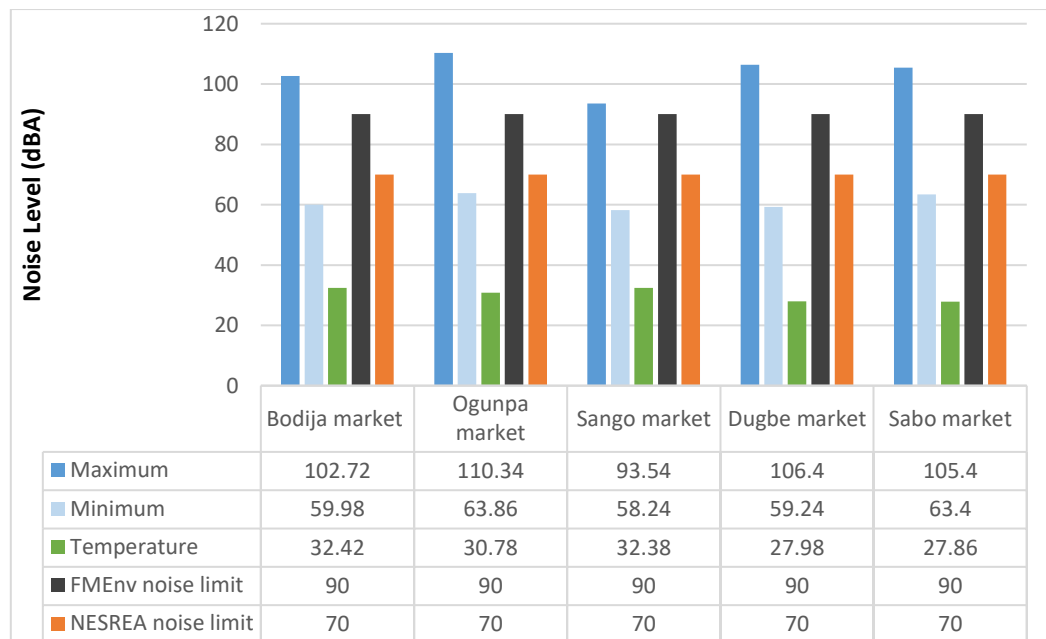


Figure 2: The mean of the noise level in the selected markets for the study

In Figure 2, the mean of the maximum sound level at Bodija market (102.71) dBA exceeded both the Federal Ministry of Environment (FME) limit (90 dBA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA). The same applies to the remaining four markets. The sound level at Sango market is slightly higher than the limit recommended by the Federal Ministry of Environment (FME). The average

maximum sound level at Sango Market (93.52 dBA) is among the five markets. The average minimum sound level for all markets is lower than the Federal Ministry of Environment (FME) limit (90 dBA) and the National Environmental Standards and Regulations Enforcement Agency (NESREA) limit (70 dBA), which makes the sound in the markets acceptable for some time.

Table 2: Consolidated noise level measurements in selected churches in Ibadan, Nigeria

Church	Distance (m)	Maximum Sound Level (dBA)	Minimum Sound Level (dBA)	Temperature (°C)
Church A 0	89.70		74.30	27.40
Church A 50	78.20		50.40	27.80
Church A 100	84.00		62.30	28.00
Church A 150	112.80		57.20	28.10
Church A 200	74.30		55.80	28.50
Mean	87.80		60.00	27.96
Church B 0	82.50		67.90	29.60
Church B 50	109.80		62.40	31.30
Church B 100	114.10		59.30	30.00
Church B 150	89.90		59.90	29.50
Church B 200	110.40		49.70	29.30
Mean	101.34		59.84	29.94
Church C 0	87.90		56.50	28.70
Church C 50	111.00		48.90	29.10
Church C 100	113.40		56.60	29.40
Church C 150	115.30		58.80	30.00
Church C 200	110.80		74.70	30.50
Mean	107.68		59.10	29.54

Source: Present study

In Table 2, the mean of the maximum sound level of 87.80 dBA in church A exceeds the permissible limit of 75 dBA for worship cents, indicating a potential issue with excessive noise levels at these locations. Even though some locations have minimum noise levels below the limit, the maximum levels are still of concern. Measures should be taken to reduce noise levels, particularly at church locations where the sound level significantly surpasses the safe limit. Maintaining acceptable noise levels is crucial for ensuring a comfortable and respectful environment in worship centres.

In Church B, the mean of the maximum sound level of 101.34 dBA significantly exceeds the permissible limit of 75 dBA for worship centres. This indicates a major concern regarding noise pollution at the locations. The minimum noise levels are below the limit at all church locations, but the maximum levels are consistently problematic. The risk of sound exposure increases with increasing duration of

exposure. Immediate actions are needed to mitigate these high noise levels to ensure compliance with environmental regulations and maintain a conducive environment.

For Church C, the mean of the maximum sound level of 107.68 dBA significantly exceeds the permissible limit of 75 dBA for worship centres, indicating a serious issue with noise pollution at all locations. The present study shows that the maximum sound levels in the selected churches are higher than the safe permissible limits. There should be increased advocacy and implementation of the noise regulation laws in worship centres and markets to reduce the risk of noise-induced hearing loss. Comparing the present study done by Ekott *et al.* [10], who reported a sound level in churches to range from 40.12–57.62 dBA with a mean of 46.39 dBA, it is well noted that the mean of the maximum sound level for the present study is greater than that reported in their study.

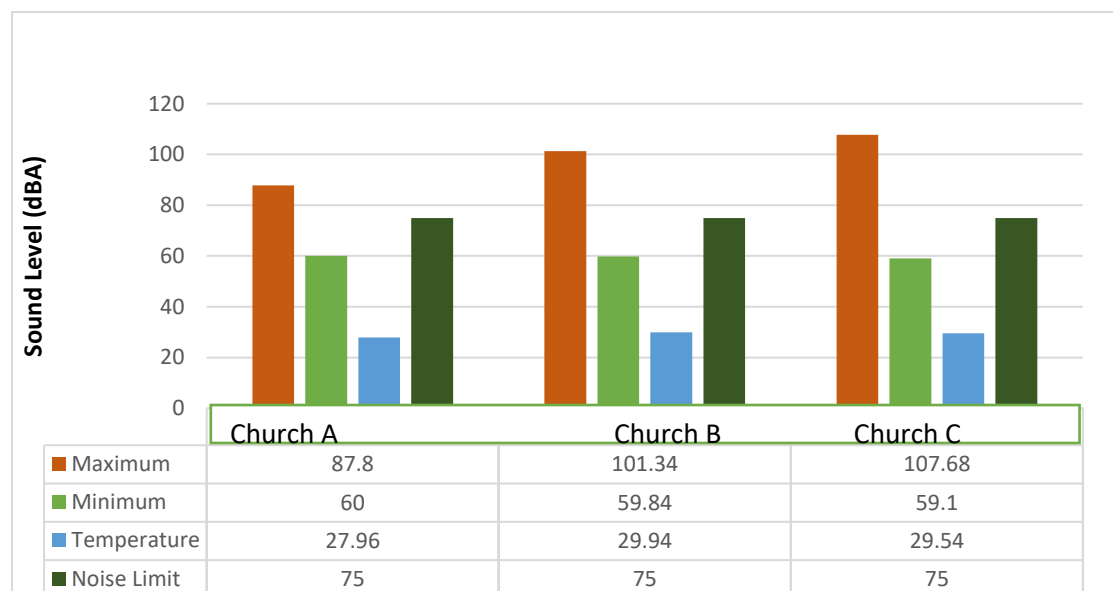


Figure 3: The mean of the sound level in the selected churches for the study

In Figure 3, the average maximum sound level for the churches exceeded the Nigerian National Environmental Noise Standard and Regulation Act noise limit, which indicates an unacceptable noise environment, while the average minimum sound levels were below the noise limit, making the sound acceptable at some times.

The present study concludes that the selected churches for the study generate sound levels that are not in line with the Nigerian National Environmental Noise Standard and Regulation Act, which was created in 2007 and implemented to determine essential health and safety, which stipulates that the maximum allowable noise level in places of worship should not exceed 75 dBA due to the exposure risk posed by the exceeded sound level recommended by the Act.

The findings of the study also suggest that high noise exposure is prevalent across all the markets studied and that noise pollution represents a common environmental concern in these commercial centres. The measured sound levels in both markets and churches substantially exceeded internationally accepted environmental noise limits. The guidelines by Brigitta *et al.* [14] recommends that continuous community noise exposure should generally remain below 70 dBA to prevent hearing impairment. The highest market noise levels were associated with vehicular movements, commercial generators, public announcements for the bus conductors, and trading activities, while elevated church sound levels were largely due to high-powered loudspeaker systems, loud musical instruments, and congregational participation. The absence of statistically significant

differences among locations suggests that excessive noise exposure is widespread across the investigated environments rather than being confined to a particular market or church.

Continuous exposure to noise above 85 dBA may increase the risk of noise-induced hearing loss,

hypertension, reduced concentration, and sleep disorders. The measured maximum values exceeding 120 dBA in some locations indicate potentially hazardous short-term exposures

Table 3: ANOVA Analysis results for sound level in the selected markets for the study

Source of Variation	SS	Df	MS	F	p-value
Between Groups	1019.84	2	509.92	2.78	0.102
Within Groups	2198.94	12	183.25		
Total	3218.78	14			

A one-way Analysis of Variance (ANOVA) was conducted to determine whether significant differences existed among the maximum sound levels measured in the three churches investigated. The analysis revealed that the variation between church mean sound levels was not statistically significant, $F(2,12) = 2.78$, $p = 0.102$, as presented in Table 3.

Since the p-value (0.102) is greater than the significance level of 0.05, the null hypothesis was accepted. This indicates that there was no statistically significant difference in the maximum sound levels

recorded among the three churches. Although Church C exhibited the highest mean sound level and Church A the lowest, these differences were not sufficiently large relative to the within-group variability to be considered statistically significant.

The ANOVA results suggest that elevated sound levels are common across the worship centres studied, implying that excessive sound exposure may be a widespread characteristic of church environments in the study area rather than being confined to a particular church.

Table 4: ANOVA Analysis results for sound level in the selected churches for the study

Source of Variation	Sum of Squares (SS)	Df	Mean Square (MS)	F-value	p-value
Between Groups	857.96	4	214.49	0.90	0.482
Within Groups	4753.73	20	237.69		
Total	5611.69	24			

A one-way Analysis of Variance (ANOVA) was performed to determine whether significant differences existed among the maximum sound levels measured in the five selected markets. The analysis showed that the differences among market mean sound levels were not statistically significant, $F(4,20) = 0.90$, $p = 0.482$, as presented in Table 4. Since the p-value (0.482) is greater than the significance level of 0.05, the null hypothesis was accepted. This indicates that there was no statistically significant

difference in the maximum sound levels recorded among Bodija, Ogunpa, Sango, Dugbe, and Sabo markets.

Although Ogunpa market recorded the highest mean sound level while Sango market recorded the lowest mean value, the observed differences were not sufficiently large relative to the variability within the markets to be considered statistically significant.

Table 5: The result of the t-test analysis for comparison of the sound level in selected churches and markets for the study

Parameter	(Markets) Mean of sound level / (dBA)	(Churches) Mean of sound level (dBA)	t-value	p-value	Decision
Maximum Sound Level	103.72 ± 14.76	98.94 ± 15.06	0.972	0.339	Not Significant
Minimum Sound Level	61.02 ± 9.44	59.65 ± 7.81	0.508	0.615	Not Significant

An independent samples t-test was conducted to compare the noise levels measured in selected markets and churches in Oyo and Ogun States. The mean of the maximum sound level recorded in the markets was 103.72 ± 14.76 dBA, while the churches recorded a mean maximum sound level of 98.94 ± 15.06 dBA. The difference was not statistically significant ($t = 0.972$, $p = 0.339$). Similarly, the mean of the minimum sound level in the markets was 61.02 ± 9.44 dBA compared with 59.65 ± 7.81 dBA in the churches. The difference was also not statistically significant ($t = 0.508$, $p = 0.615$).

The results indicate that although the markets exhibited slightly higher average noise levels than the churches, the observed differences were not statistically significant at the 95% confidence level ($p > 0.05$). Therefore, both environments can be considered to experience comparable levels of environmental noise exposure. Based on the t-test analysis, there is no significant difference ($p > 0.05$) between the sound levels measured in the markets and those measured in the churches. One would have expected that the mean of the noise levels at the selected markets would be significantly different from the mean of the sound levels in the churches; this suggests that worshippers in the churches need to reduce the volume of the sound system for the health benefits of the worshippers.

CONCLUSION

This study assessed environmental noise levels in selected markets and worship centres in Oyo and Ogun States, Nigeria. The findings revealed that: the mean market noise levels ranged from 93.54–110.34 dBA while the mean church noise levels ranged from 87.80–107.68 dBA. Most measured values exceeded the WHO recommended limits. The ANOVA analysis showed that there were no significant differences among markets ($p = 0.482$) and the churches ($p = 0.102$). Also, both markets and worship centres constitute important sources of environmental noise pollution. Regular environmental noise monitoring should be conducted, religious organisations should regulate loudspeaker output levels, and periodic hearing assessments should be provided for traders and workers exposed to prolonged noise.

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