



# Noise Level Evaluation at Major Markets in Calabar, Nigeria

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## Authors' contributions

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The aim of this study was to determine the prevailing noise levels at major markets in Calabar, Nigeria. Data was collected by measuring noise levels in three different markets using RS232 digital sound level meter with measuring range of 32- 80 dB for low range, 50 – 100 dB for medium range and 80-130dB for high range and the analysis was done using OriginPro software. The results obtained were compared with the World Health Organization regulatory standard and it showed that the average daily noise level value produced at Watt and Marian markets were 73.0 dB and 71.5 dB individually, which were beyond the safe limit recommended by the World Health Organization (WHO) for commercial areas while the daily average noise level produced at Goldie market was moderate and within the safe limit.

**Keywords:** *Traffic noise; noise pollution; noise level in Nigeria; noise level in Calabar markets; effects of noise.*

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## 1. INTRODUCTION

Noise is an undesirable and annoying sound which come in the form of environmental pollution and it is a source of stress. When noise is loud, it becomes harmful and creates negative impact within the environment [1,2,3,4]. Noise is dangerous to health and well-being on people within the community [5]. "According to the World Health Organization, noise is considered the third most hazardous environmental pollutant in big cities" [6].

Some effects of noise level on humans include; speech interference, annoyance, headache, stress and hearing loss. Generally, individuals and traders within the market are at high risk of excessive noise exposure.

In Nigeria and globally, there are regulations put in place by the governmental agencies to control the rate of noise pollution. Table 1 shows the World Health Organization (WHO) recommended standard of noise description for daytime and Table 2 represents the WHO guideline values which are arranged according to specific environment and health effects. It considers all identified adverse health effects for the specific environment.

Emmanuel et al. [4] reported "the assessment of noise levels in pubs within Calabar, Nigeria. The work lasted for three consecutive months. Results obtained were compared with the permissible noise level recommended by the National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigeria which showed that all the pubs under study were in excess of the permissible noise level recommended by NESREA".

Ugwoha et al. [7] evaluated "noise level at Trans-Amadi market in Obio/Akpor Local Government Area of Rivers State. The measurement lasted for three weeks at four different stations, starting from 9am to 7pm daily. A sound level meter was placed at a height of 1.2 m to get a weighted noise level at the selected locations with readings taken at 2 hours' intervals. Noise indices such as peak noise level, background noise level, equivalent noise level and noise pollution level were calculated, and values obtained were compared with regulatory standards. It was found that

the calculated noise indices were all above the recommended 65 dBA for commercial areas".

Anjorin et al. [8] assessed "noise levels from industrial machines at two selected industries namely: Denki Wire and Cable Nigeria Limited and Wanwood Nigeria Limited, both in Akure, Ondo State, Nigeria. A precision grade sound level meter was used for the study, which had facilities to determine the various pressure levels of sound at thirty minutes interval for a duration of five days. The research observed that noise limit values were exceeded for almost all the machines considered based on the regulation criteria and international standard. The study showed that noise control measures were not put in place".

Usikalu, (2016) reported "the growing level of noise pollution in Ota, Ogun State, Nigeria. Sound level meter was used to conducted measurements in five different areas in Ota and three locations inside Covenant University to serve as control. The study showed that the noise pollution levels measured exceeded the limits set by the World Health Organization (WHO), Federal Environment Protection Agency (FEPA). Reasons for noise increases was due to vehicular activities".

**Table 1. Noise quality description for daytime**

Sound (dB) A	Noise quantity description
55- 60	Good
60-65	Moderate
65-70	Highly risky
70-75	Dangerous
75-80	Highly dangerous
Greater than 80	Extremely dangerous

[6]

"The study ascertained the noise level at a wheat processing mill in Ilorin, Nigeria. A digital sound level meter type, HD600 manufactured by Extech Inc. in the United States of America (USA) was used to determine the noise level around various machines at different sections, including offices and factories at pre-determined distances. The result of the study revealed the average noise level produced by the machines to be 99.4 dBA which was beyond human standard of hearing. It was further recommended that room acoustics should be upgraded for workers to absorb sound transmitted to offices" [9].

**Table 2. Guideline values for community noise in specific environment**

<b>Specific environment</b>	<b>Critical health effect (S)</b>	<b>Average noise level</b>	<b>time base (hours)</b>	<b>Max. noise level (dB)</b>
Outdoor residential area	Serious annoyance	55	16	-
	Moderate annoyance	50	16	-
Indoor residential area	Speech intelligibility and	35	16	
Inside bedrooms	moderate annoyance, day and Evening			
	Sleep disturbance, night	30	8	45
Outside bedrooms	Sleep disturbance, window	45	8	45
	Open			
School class room and pre- schools, indoors	Speech intelligibility,	35	During class	-
	disturbance of information extraction, message			
	Communication			
Pre-school bedrooms, indoor	Sleep disturbance	30	Sleeping time	45
School playground, outdoor	Annoyance (external source)	55	During play	-
Hospital, ward rooms,indoors	Sleep disturbance, night	30	8	40
	Sleep disturbance, day and Evening	30	16	
Hospitals, treatment rooms, indoors	Interference with rest and Recovery	As low as possible		
Industrial, commercial, shopping and traffic areas,indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment should be less than 5 times in a day	100	4	110
Public addresses, indoor and outdoor	Hearing impairment	85	1	110
Music and other soundsthrough earphones and Headphones	Hearing impairment	85	1	110

[6]

Christopher et al. [5] assessed traffic noise pollution and a survey on residents' health at Alimosho local government Lagos, Nigeria. The result of volumetric analysis indicated that more commercial vehicles produced higher noise levels than private vehicles. Furthermore, the traffic noise level produced by vehicular activities was about 71.70 dB which was beyond the recommended outdoor standard of 55dB during daytime in a residential area and as such lead to effects such as; headache, annoyance, speech interference and lack of concentration to the residents living in the study area.

Sources of environmental noise and impact on market women was examined at six markets namely; Bodija, Ogunpa, Sango, Dugbe, Mokola and Ojoo, within Ibadan metropolis. Two hundred and fifty (250) market women participated in the study. Three (3) types of research questionnaires were raised and answered. Data collected were analyzed using frequency counts and percentages. The results of the findings identified that sources of noise in the markets were from; vehicles, people, religious centers/activities, machines, generators, public address system for product advertisement and incessant loud shouts/calls on intending buyers/customers towards calling for sales. Result also revealed that there is high level of noise generally in the selected markets, as Bodija, Dugbe and Sango markets ranked the high category of markets with higher noise level, compared to the low noise making category of markets; which are Ogunpa, Ojoo and Mokola markets. Bodija market had the highest noise level, while Mokola market has the lowest noise level. The study further revealed that exposure to noise in the markets affected the auditory performance of the market women while most of them had reduction in hearing perception and reduced productivity due to auditory fatigue and noise-related stress" [10].

Olumuyiwa, [11] examined the noise level in selected areas within Akure Metropolis, Nigeria with a view to generate noise maps using ArcGIS to identify high impact areas and support environmental management in the study area. Selected areas such as; Oja-oba Market (commercial Land use), Ijoka (Residential land use), and the Federal University of Technology, Akure (Futa as an Educational Land Use) were considered. The digital sound level meter of the type (IEC651) was used to measure noise level in the morning (8:00am-9:00am), afternoon (1:00pm-2:00pm) and evening (4:00pm-5:00pm) for a period of 7days in each of the selected areas. The compiled data were imported into the

ArcGIS Software for analysis and geo-referencing whereby transforming the data and presenting it on noise contour maps. The study revealed that Sunday bus stop had the high mean noise level with 64.3 dB(A) while Olowookere street had a low noise level of 38.1 dB(A) for the Residential areas. Ijomu recorded the highest noise level with 78.6 dB(A) and Erekesan market had noise level of 61.5 dB(A) for the commercial areas. Northgate had the high noise level which was of the order 76.3 dB(A) and low noise level within the Library and Institutional areas which was of the order 41.0 dB(A). 80% of the commercial areas were exposed to the highest risk of noise pollution. The residential area was exposed to 18.7% noise pollution which makes the area suitable for housing. The institutional land use recorded 36.6% for total area exposed to noise pollution.”.

“The prevailing noise level and its implication on individuals and traders were determined at major markets in Aba, Abia State Nigeria. Noise levels at outspread distances within the markets were measured using mini sound level meter (NEDA model) and questionnaires were administered. The results showed that noise levels values at open shade apartments were higher than those in the lock-up shops. The study further revealed that Ariaria International Market had maximum noise limit of 90.0dB and minimum value of 92.3dB respectively, and both were beyond the regulatory standard recommended by WHO. The research work suggested that proper regulation should be put in place by both state and local government environmental protection agencies to reduce noise pollution in the markets and improve the health of the market operators” [12].

Onuu, [13] considered measurement of road traffic noise and psychological survey of approximately 60 sites in 8 cities in South-Eastern Nigeria. Instantaneous and 24 hours noise measurements were taken at the noisiest points, near the frontage, of the houses. Maximum measured values were as high as 105 dB (A) while residents were exposed to instantaneous levels of road traffic noise of the order 110 dB (A)”.

Ganiyu [1] “research aim was to identify major sources of noise and its impact within already developed environments in Akure, capital of Ondo State. A survey method was adopted for the research. It was observed that average noise

level produced from vehicular traffic, pedestrian traffic and religious buildings, were the major sources of external noise, having very serious negative effects on the residents. Generating sets, telephone/mobile phones, radio and television sets were listed as major sources of internal noise with very serious negative effects on the residents of the study area. The result confirmed that noise level beyond 65dB could result in health effects such as; annoyance, mental and physical fatigue. The research work further recommended good design and building orientation, adequate set back distances, reduction in the opening sizes and reduction of noise from sources as some of the ways to minimize the problems of noise pollution in built environment.”.

Industrial noise was measured using a sound level meter and a subjective assessment of industrial workers response were taken using questionnaires in Akwa Ibom State, Nigeria. It was observed that workers were exposed to noise level of about 115 dBA after measurements were taken. It was clear that the industries were not acoustically secure for workers and the author further called on the government to make and enforce necessary laws to control industrial noise pollution [14,15].

## 2. MATERIALS AND METHODS

### 2.1 Materials

A RS232 digital sound level meter with measuring range of 32- 80 dB for low range, 50 – 100 dB for medium range and 80-130dB for high range was used.

## 2.2 Methods

Three major markets within Calabar local government area of Cross River State were considered for the study. The markets include; Goldie market (G), Marian market (M) and Watt market (W) specifically. The study lasted for 8 weeks. The experiment was done for 5 days in each week starting from Monday to Friday. The time for the studies was; 8-10 am in the morning, 12-2 pm in the afternoon and 4-7 pm in the evening. Measurements were taken at different locations around the market environment and codes were assigned to those locations as shown: G1, G2, G3, M1, M2, M3, M4 W1, W2, W3, W4, W5 for simplicity. The average value for all measurements made in the morning, afternoon and evening for each market was taken and the daily average values were obtain; G, M, W which is the total daily average for all the measurements as shown in Table 3.

## 3. RESULTS AND DISCUSSION

Table 3 compares the daily averaged sound level measured at each market location Goldie (G), Watt (W), and Marian (M) with the recommended standard by World Health Organization (WHO).

Fig. 1 is a pie chart, displaying the percentages of average noise levels at three major markets in Calabar. Watt market produced 35 % of noise level which was the highest percentage of noise when compared with other markets. The noise level was seconded by Marian market with 34.4%. Goldie market produced the least percentage which was 30.7%. The reason was because the major sources of noise within Watt

**Table 3. Daily averaged value of noise level**

S/N	MarketName	Location with code	Morning (7-10 Am) Average sound level(dB)	Afternoon(12-3 Pm) Average sound level (dB)	Evening (4-7 Pm) Averagesound level(dB)	Daily averaged values Sound level(dB)	Recommended standard by WHO (dB)
1	Goldie (G)	G1	64.0	64.7	70.0	64.6	65.0
		G2	61.3	57.2	68.9		
		G3	55.4	68.2	68.0		
		G	61.52	63.30	68.90		
2	Watt (W)	W1	84.7	77.9	69.5	73.0	65.0
		W2	77.3	74.7	67.8		
		W3	67.8	75.7	71.0		
		W4	67.2	69.6	60.8		
		W5	82.1	74.6	70.3		
		W	75.8	75.0	68.1		
3	Marian (M)	M1	81.4	76.3	70.8	71.5	65.0
		M2	68.4	71.8	65.4		
		M3	76.6	68.2	60.6		
		M4	81.1	69.2	63.0		
		M	76.9	72.8	64.9		

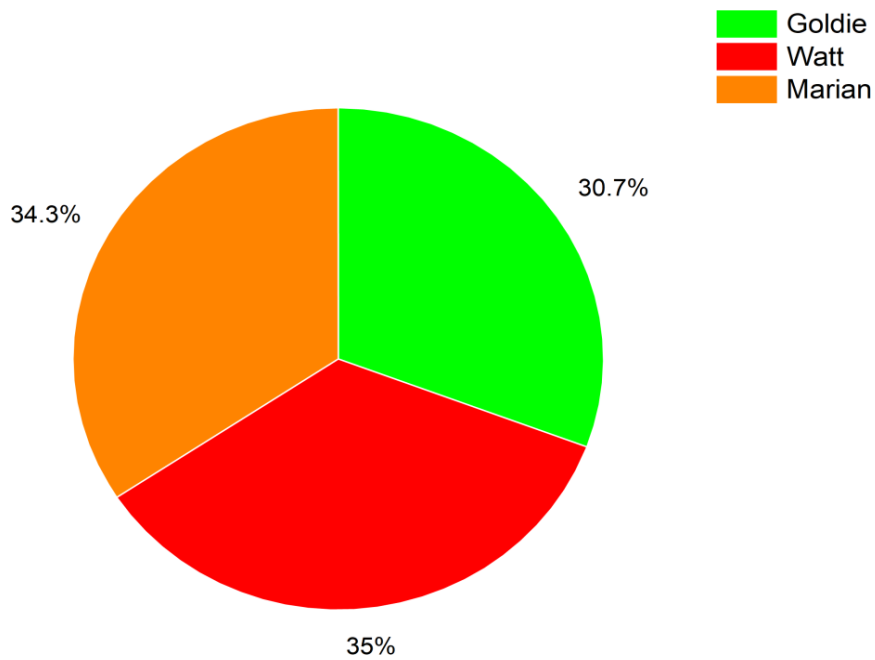


Fig. 1. A pie chart representing the three markets in consideration. (The Goldie, Marian and Watt market)

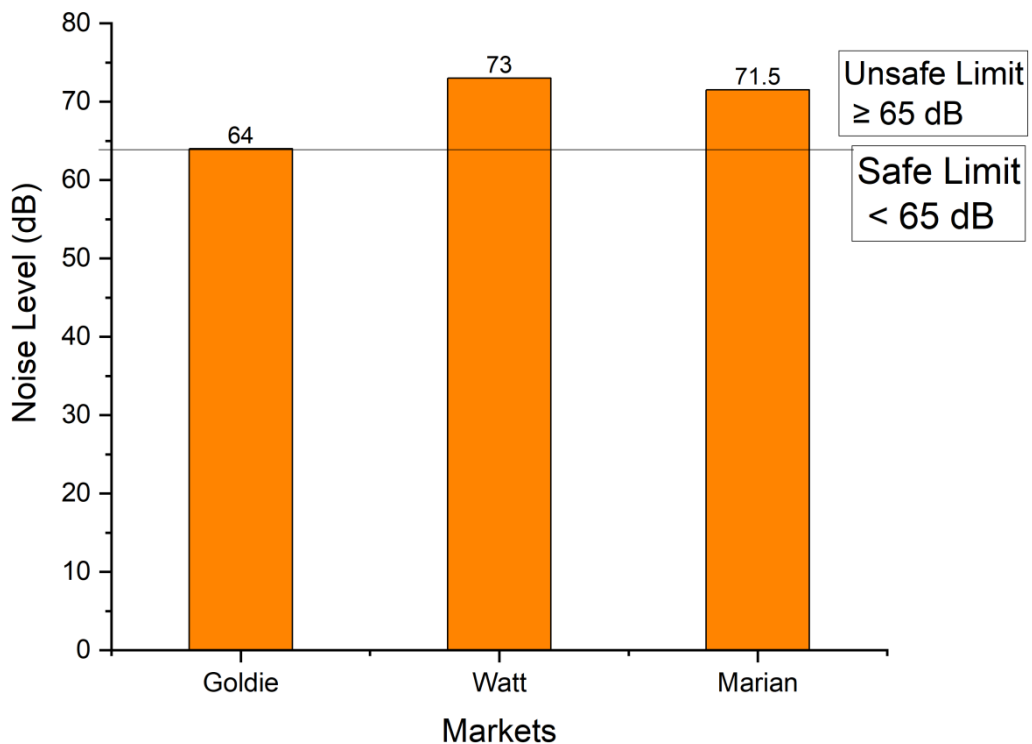


Fig. 2. Daily averages of noise levels measured for each market

market and Marian markets were due to more vehicular activities such as; buses, bikes, lorries, trucks. Other sources of noise were loud speakers from public address systems, playing of music, grinding machines, knife sharpening

machines, blowing of siren by government vehicles and the use of electrical generators to produce power. Sources of noise at Goldie market were mainly human speech and verbal conversation. They were less vehicular activities

because the market location was far from the road. In addition, they were no public address systems and no machineries for grinding.

Fig. 2 is a bar chart, representing average daily noise level for the three major markets in Calabar. The result displayed on the bar chart showed that noise level was highest in watt market with an average daily value of 73dB then followed by Marian Market with daily average of 71.5 dB. The lowest noise level was at Goldie market with an average of 64.0 dB. Watt and Marian markets produced noise levels beyond the safety limit of the World Health Organization (WHO) regulation which were dangerous to human health while average noise level produced at Goldie market was moderate and within the safe limit.

#### 4. CONCLUSION

The objective of this study was to estimate the noise level emission in Calabar markets, Nigeria and to find out whether the noise level produced are within the threshold limits as recommended by World Health Organization WHO. Results of the research showed that some markets (Watt and Marian) were above the level of comfort and safety while Goldie market was within a safe range.

#### 5. RECOMMENDATION

Firstly, we recommend that the marketers should make use of hearing protection, Secondly, the Nigerian government should ensure compliance with the activities of the WHO and other standards to control noise emission within and around the markets and our environment.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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