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Characterization of Noise Pollution in Market Environments Across Abuja Municipal Area Council, Federal Capital Territory, Abuja, Nigeria

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Abstract: The degree of environmental noise pollution and its potential effects in thirteen (13) of AMAC's primary marketplaces in the Federal Capital Territory of Nigeria, have been analyzed. Noise measurement has been done throughout the mornings, afternoons, and nights to determine noise pollution all over the major markets of AMAC, FCT. Thirteen markets (13) was selected based base on the phases and the level of development; ten are selected from phases 1 and 2, while phase three and four (3and 4) is represented by two (2) because the markets present in the district are either local or just coming up because of the level of development that is still coming up in these places. Other criteria are; markets along heavy and light traffic road, markets that have submerged and other gradually submerging into residential building and the busiest markets in AMAC. The analysis of the noise levels measurement was done for seven (7) days, three (3) times a day (mornings, afternoons and evenings), using Testo 816 Digital sound level meter with accuracy class of two to IEC 60651, precision integrated was employed in order to gather the noise data. The loudest mean levels, 122.1 dB(A), 119.2 dB(A), and 95.1 dB(A), were measured at Gosa Market (GM), Nyanya Market (NM), and Nyanya Market (AM), respectively, in the nights, afternoons, and mornings. This generated a serious health hazards for the merchants and some buyers who stay more than two hours in the market as this results far exceed the acceptable recommended standards of WHO/NESREA. The findings revealed that generators, grinding machines, mobile sellers, vehicular movement, siren from security vehicles, horn from moving vehicles, traffic jams etc. are the sources of noise in the markets. With the exception of Asokoro Modern Market, Garki International Market, and Wuye Ultra-Modern Market, most markets have high levels of noise pollution, which may have an adverse effect on the public's and traders' health. The results of the analysis of variance (ANOVA) test and one sample t-test indicated that there were no appreciable variations in sound levels among the various markets in the research region. Because noise can have physiological and psychological effects on people, governments and environmental managers should enforce laws and implement policies to educate the public about the importance of adopting energy-efficient building techniques like solar energy and other environmentally friendly options that will improve urban livability, such as noise-proofing (power) and retrofitting.

Keywords: *Noise, Pollution-Level, Market.*

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I. INTRODUCTION

Unwanted auditory phenomena are called noise. The word "noise," which comes from the Latin word "nausea," simply refers to an uncomfortable sound. When sound disrupts daily activities or lowers one's quality of life, it is considered undesirable. Harmful sounds that interfere with hearing and cause stress, impede focus, and reduce productivity are referred to as noise. Due to advancements in commercial, industrial, and social activities, this environmental contaminant is growing quickly. (Anomohanran, 2013).

According to Encyclopedia Britannica (2012), noise is any unwanted sound, whether it is inherently offensive or disrupts other noises being heard. Noise starts to unjustly interfere with and impose itself on people's comfort, health, and quality of life (Gorai and Pal, 2006). Noise pollution is the term used to describe unwanted and excessive sound that is harmful to living things. It is thought to be a problem

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caused by technology. Due to the world's largest cities' dense populations, transportation, traffic, and related commercial and industrial operations, noise pollution is currently becoming a bigger issue (Chauhan, 2008). One effect of industrialization and urbanization is noise pollution. It is one of the main issues affecting metropolitan regions' quality of life globally (Ozer *et al.*, 2009).

Given the greater sources of noise that are now found both indoors and outdoors, the noise issues of contemporary industrial cultures appear to be incomparable to those of the past. One of the biggest risks facing the planet today is acknowledged to be noise pollution. In 2005, the WHO declared that noise is a harmful substance that has an impact on both the environment and human health (Zanin *et al.*, 2006). According to Basner *et al.* (2015), exposure to noise has been connected to a number of non-auditory impacts, such as irritation, disturbed sleep, cardiovascular disorders, and a decline in children's cognitive function. The severity of noise pollution and its harmful effects on the environment are not given enough thought by Nigerians (Anomohanram, 2013).

In Nigeria, regulation of noise pollution was vested on the Federal Ministry of Environment and passed on to individual states. In the context of our study area Abuja, the mandate for the control of noise pollution rests with the Abuja Environmental Protection Board (AEPB). As the Federal Capital Territory's (FCT) environmental regulatory body, AEPB is tasked with upholding a healthy environment through appropriate regulatory measures. Its goals include establishing standards, gathering information on industrial dangers, and addressing policy issues related to air and other types of pollution.

Noise pollution in Abuja, Federal Capital Territory (FCT) is an increasing menace, activities like constant use of generating sets across the cities center, road usage, commercial and industrial activities and such are increasing noise pollution and it has become imperative to tackle this problem before it gets out of hand, some argue it already. Noise pollution has been viewed from various perspectives, while some argue that it should be governmental initiatives, others feel that the analysis should be done according to the financial strength of the individual (Adejobi, 2012).

Abuja Municipal Area Council (AMAC) FCT has periodic markets, such as the Kado Fish Market, Garki Model Market, Utako Ultra-Modern Market, Wuse Market, Nyanya Market, Gosa Market, etc., where vendors and buyers congregate for social, commercial, and economic exchanges. These gatherings cause noise pollution in the surrounding area. In addition to the fact that some of these markets in AMAC are run in open spaces, where they still generate free space for the sale of various goods and services, contamination of sellers and consumers amounted to between 5,000 and 10,000 individuals as they congregated.

As they conduct their commercial operations, these frequently cause major environmental issues. Unimaginable noise pollution results from certain merchants shouting and blaring loudspeakers at maximum blast in an effort to market their goods and draw clients. This act does not exclude suppliers of herbal medicines. Some suppliers run their grinding machines on small power generating sets, which pose a significant noise threat because the grinding machines themselves make noise.

Aniefiok (2018), Ugbebor, Yorkor, and Nwogu (2017), Ibekwe, folorunsho, Ebuta, Amodu, and Nwegbu (2016), Anomohanram (2013), Oloruntoba, Ademola, Sridhar, Agbola, Omokhodion, Ana, and Alabi (2012), and many more research have been conducted on noise pollution in Nigeria. Abdullahi and Olayinka (2008). There are currently no published studies on the levels of noise pollution in AMAC's marketplaces. The study believes it is appropriate to evaluate noise pollution in and around markets in the Abuja Municipal Area Council, Federal Capital Territory, based on these considerations.

II. MATERIALS AND METHODS

- *Study Area*

The study area is the Abuja Municipal Area Council, one of the six Area Councils that make up Nigeria's Federal Capital Territory. The total area of the Territory is around 8000 km2, of which the Abuja Municipal Area Council (AMAC) has an area of roughly 1769 km2. Nigeria's geographic center is home to the Federal Capital Territory. The region is situated immediately north of where the Niger and Benue rivers converge (Adeoye, 2006). It is located between the Greenwich Meridian's longitudes of 6^0 45′E and 7^0 39′E and the Equator's latitudes of 7^0 20′N and 9^0 20′N.

The climate is tropical, hot, and muggy. Because of this, the ranges of its elements are different from those of the country's north and south. With an average annual rainfall of 1358.7 mm and a mean temperature range of 20.70C to 30.80C, the region experiences distinct wet (March–October) and dry (November–February) seasons (Balogun, 2001). In the research area, rainfall is essential to agricultural activities, and the majority of farming operations rely heavily on it (Balogun, 2001).

Gleysols, fluvisols, and the alluvial soil of the Iku plains all have an impact on the soil in the studied region. The degree of taxonomic variety in soils is complex. The depth of the water table determines the soil's drainage conditions. Poor drainage causes mottling, which changes the color of the soils.

The soil texture of the region is clayish and sandy loam, with sporadic marshy sections utilized for irrigated wetland farming. These are the ferruginous red tropical upland soils, which have a high silt content and are frequently formed from sandy rocks or crystalline acid. The cultivation of cereals and tubers is where they excel (Balogun, 2001).

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There is a lot of land in the study area that is suitable for farming. With a vast expanse of fadama land estimated to be over 40,000 hectares, the lush and fertile terrain is suited for growing a variety of crops, including rice (CIFIIIP, 2013).

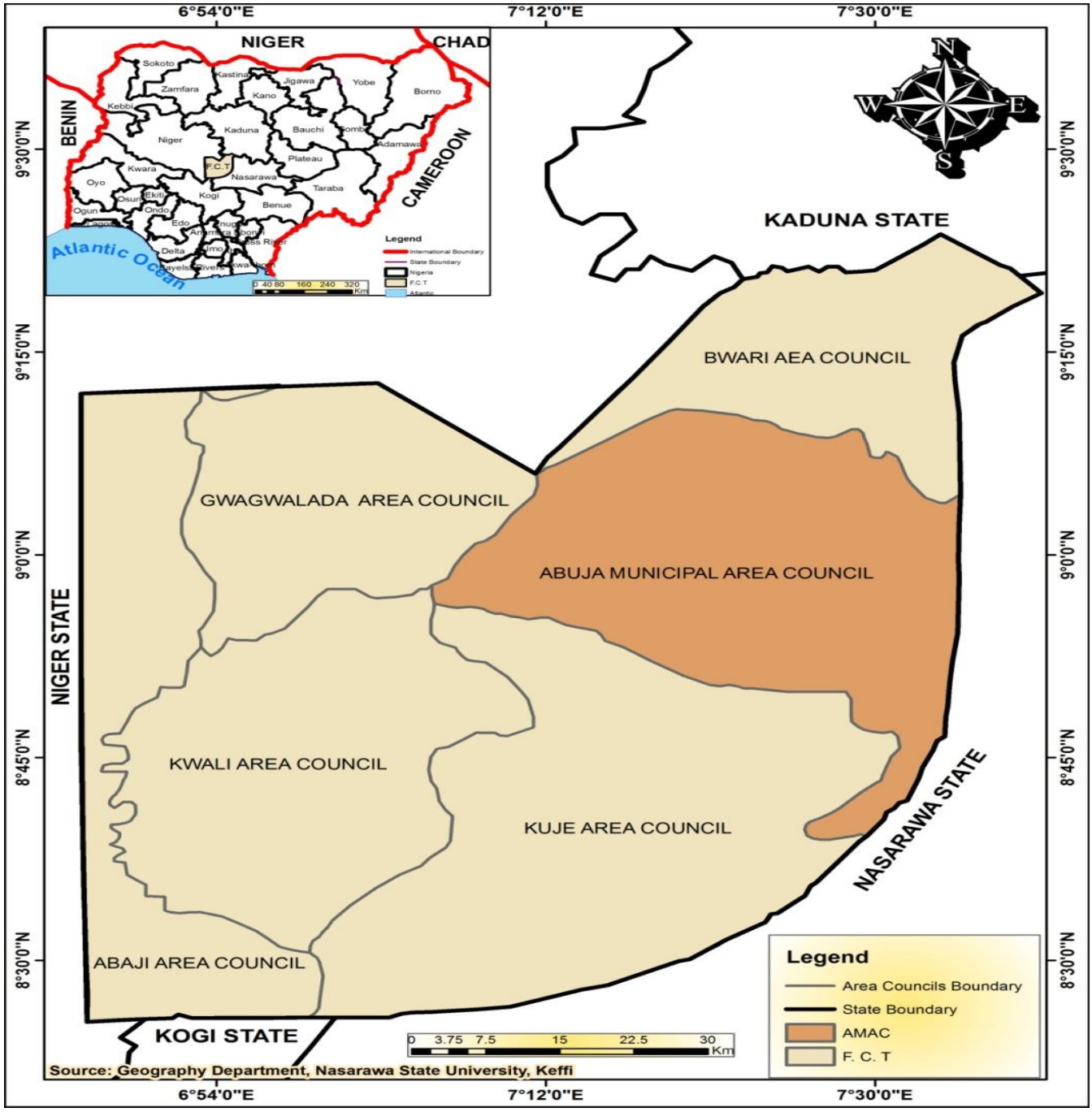

Fig 1: Map of the Study Area
Source: UniAbuja Gis Lab, 2019

Legumes (groundnuts, soybean, lima beans, bambara nuts, and pigeon peas), cereals (maize, millet, sorghum, and rice), solanaceous crops (peppers, tomatoes, garden eggs, and ginger), tree crops (guava, cashew, mango, orange, and paw-paw), and root and tuber crops (yam, sweet potatoes, cocoyam, and cassava) are among the many types of crops that are encouraged by the climate.

Cattle, pigs, goats, sheep, and poultry are the most commonly kept animals in the study area. Additionally, hunting and beekeeping are done (CIFIIIP, 2013). The majority of the land is used by tiny, rain-fed and irrigation farmers who cultivate a variety of crops, including millet, yam, rice, melon seed, cocoyam, cassava, pepper, tomato, okra, rice, onion, garden eggs, spinach, and beniseed (CIFIIIP, 2013).

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➢ *Field Work*

The measurements were taken at 3 different periods of the days, peak period (afternoon and evening) and off -peak period (morning). The measurement was conducted thrice per day for seven (7) days. Morning (07:00 am - 09:00 am), Afternoon (12:00pm - 02:00 pm) and Evening (05:00pm – 07:00 pm). The measurement was compared to the WHO/NESREA standard /noise level guideline to determine whether the sample areas are within or above WHO/NESREA acceptable standard.

➢ *Sampling Procedure*

Environmental noise levels at certain geographic locations (the markets) were measured in the field as part of the study's descriptive cross-sectional survey. The overall research includes thirteen (13) point locations of markets within Abuja Municipal Area Council (AMAC), which include both open space market and build up market areas.

Thirteen (13) markets are purposively chosen for the research work because they are among the major markets. Thirteen (13) markets of AMAC were chosen because the city has four stages of incremental growth, and the Federal Capital Territory is separated into districts, which are then grouped into development phases. They are the first, second, third, and fourth phases. Every phase is separated into cadastral zones and districts. The research study concentrate on the major markets within the first two phases (1 and 2) which is highly developed while paying less attention to the others (phases 3 and 4) because they are still under developed. Ten markets are selected from phases 1 and 2, while phase three and four (3and 4) is represented by two (2) because the markets present in the district are either local or just coming up because of the level of development. The following market were chosen; Asokoro Modern Market Magadishu Cantonment (AMM) (Build up), Maitama Farmer Market(MFM) (Build up), Wuse Market (WMM) (Build up), Garki Model Market (GM) (Build up), Garki International Market (GIM) (Build up), Utako Ultra-Modern Market (UUMM) (Build up), Wuye Ultra-Modern Market (WUMM) (Build up), Kaura Modern Market (KMM) (build up), Kado Fish Market(KFM) (build up), Sapeyi Fish and Modern Market Apo(SFMM) (build up), Karmo Market (KM) (open space), Nyanya Market (NM) (open space) and Gosa Market (GM) (open space).

➢ *Noise level Measurement*

Using a Testo 816 Digital sound level meter with an accuracy class of two to IEC 60651 precision incorporated, the process involved field measuring noise levels at different market locations. According to the noise measurement protocol, the measurements were made at a height of roughly three (3) meters above the ground (hand held, standing erect). The measurement falls between the 30-130 dB (A) range. The outcome was noted and tallied. Decibels (dB), the tenth part of the longest unit, are used to quantify the strength of sound. The smallest sound that a human ear can detect is one decibel.

Plate 1: Testo 816 Sound Level Meter

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➢ *Statistical Analysis*

The mean of each sample result was calculated using SPSS and a Microsoft Excel spreadsheet to analyze the data and identify any significant differences in the noise levels from the different marketplaces that were chosen for the study.

To ascertain whether noise variation in the research region was significant, the one-way Analysis of Variance (ANOVA) and the student t-test were employed as statistical analyses.

III. RESULTS AND DISCUSSION

➢ *Differences in Market Noise Levels by Space in the Research Area*

Table 1's data indicates that on Day 1, AMM recorded the lowest noise level measurements at 59.8 dB(A), whereas GM recorded the highest at 127.8 dB(A). The results presented shows that most of the values obtained in all the sample locations except for few point like AMM, GIM and WUMM are above the WHO/NESREA recommended Standard of 70/75 dB (A) for commercial area.

The result obtained in Day 2, shows that AMM, recorded the minimum noise level of 57.8 dB(A) while the maximum readings are obvious in NM, 120.5 dB(A). The results obtained shows that most of the values recorded from the sample locations points except for few point like AMM, GIM and WUMM are above the WHO/NESREA acceptable limit of 70/75 dB (A) for commercial area.

The result further shows that in Day 3, the minimum noise level was recorded in AMM, 59.8dB (A), while maximum value was recorded in GM with 122.5dB (A), NM. The result shows that most of the values obtained in all the locations points except for few points like AMM, GIM and WUMM are above the WHO/NESREA recommended Standard of 70/75 dB.

In Day 4; value obtained in AMM with 57.8 dB (A) was the lowest while the highest value was recorded in NM with 125.2 dB (A). The results recorded shows that most of the values presented are above the WHO/NESREA recommended Standard except for few places where the results are within the tolerable limit.

According to the figures acquired on Day 5, AMM recorded the lowest noise level reading at 57.0 dB (A), whereas NM recorded the highest noise level reading at 126.0 dB (A). The results recorded from the field work shows that most of the values tabulated are above the WHO/NESREA recommended Standard except for few places where the results are within the tolerable limit.

The AMM reported the lowest noise levels on Day 6 at 55.8 dB (A). With a noise level rating of 126.8 dB (A), KM had the highest noise level. NM and GM came next, with 125.4 dB (A) and 124.9 dB (A), respectively. The results presented shows that most of the values from the data gathering are above the WHO/NESREA recommended Standard except for few places where the results are within the bearable limit.

Furthermore, the value of noise recorded in Day 7 shows that WUMM, 59.8 dB (A) recorded the lowest noise readings while KM, 127.4 dB (A) was the highest. The results recorded is not different with the previous because most of the results gather from the field analysis are above the WHO and NESREA recommended Standard except for few places where the results are within the recommended standard.

Table 1: Spatial Data of Mean Noise Reading in the Study Area

S/N	Location	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	WHO	NESREA
1	MFM	80.1	85.1	85.3	76	78	80.9	76	70	75
2	AMM	63.8	61.2	61.4	64.3	66.4	66.1	65.1	70	75
3	WM	97.8	102.8	98.2	95.2	95.7	93.6	88.4	70	75
4	GMM	91.8	86.5	93.1	89.7	83.5	89.6	85.2	70	75
5	GIM	68.5	67.9	68.8	64.1	65.3	69.9	72.4	70	75
6	UUMM	91.5	98.6	92.4	91.2	89.3	90.7	91.8	70	75
7	WUMM	70.3	66.5	68.9	68.1	72.8	71.5	69.6	70	75
8	KMM	83.8	82.6	81.1	96.1	83.9	92.3	92.7	70	75
9	KFM	83.4	82.4	89	86.1	85.7	85	86.9	70	75
10	SFMM	78.7	82.6	80.3	84.5	85.2	84.2	87.5	70	75
11	KM	101.5	107.1	103.2	111.6	112.4	111.8	110.5	70	75
12	NM	108.5	114	110.3	111.1	113.9	113.3	111.1	70	75
13	GM	113.6	112.8	113.3	112.6	109.5	108.1	112.9	70	75

Source: Field Work, 2019.

➢ *Temporal Variation of the Noise Levels in Markets in the Study Area.*

The results obtained at MFM show that morning has the lowest value of 70.9 dB (A) while the values reading for afternoon is 83.7 dB (A) and evening is 86.6 dB (A) respectively. Also the noise level at AMM shows that morning reading 59.1 dB (A) recorded lowest value among the others (Afternoon, and evening,) while there is an increase in the afternoon with 65.3 dB (A) and the evening with 67.8 dB (A) respectively. The noise level at WM shows that evening recorded the highest noise value of 103.7 dB (A) while the lowest reading of 86.1 dB (A) was recorded in the

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afternoon. Also, in GMM the highest noise reading was recorded in the evenings with 95.8dB while morning with 80.9 dB (A) recorded the lowest follows by afternoon.

The lowest value of noise was recorded in the mornings with 63.6 dB (A) in GIM while the highest value was recorded in the evenings with 75.3 dB (A) follow by afternoons with the reading of 65.4 dB (A). it can be deducted from result on table 2, that mornings with 82. 2 dB (A) has the minimum reading in UUMM while the evening with 99.8 dB (A) has the maximum mean, Afternoons with 94.4 dB (A) is the 2nd highest with a little different of 5.4 dB (A) from the maximum. It is observed that from the result on table 2, that the noise level recorded in mornings is 64.9 dB(A) of WUMM made the lowest value compare to the afternoons and evenings which has 70.5 dB (A) and 73.6 dB(A) respectively. Evenings with 73.6 dB (A) is the highest value recorded.

The results recorded in WUMM shows that Mornings recorded lowest means value and highest is afternoons follow by evenings with a negligible difference of 0.2 dB (A). The noise level recorded in KFM shows that the maximum noise level was recorded in the afternoon with 90.9 dB (A), which is follow by evening with 89.9 dB (A), a negligible difference compare with the afternoon, while the morning with 76.5 dB (A) recorded lowest noise level reading value. Values obtained in SFMM within the periods are as follows morning, 70.4 dB (A), Afternoon, 89.0 dB (A) and evening 90.5 dB (A). Evening has the loudest value and morning has the lowest value.

It is observed that in KFM, the lowest noise value was recorded in the morning with 89.9 dB (A), when compare with afternoon and evening which have 116.8 dB (A) and 118.8 dB (A), making the evening value to be the highest follow by the afternoon. The result on table 2 shows that highest noise level value in NM is recorded in the evening with 120.9 dB (A) follow by Afternoon with 119.2 dB (A), a negligible difference compare to evening, Morning has the lowest value of 95.1 dB (A). The value of noise reading at GM are; Morning, 94.8 dB (A), Afternoon, 118.4 dB (A) and evening 122.1 dB (A). It is clearly seen that evening has greatest value when compare to morning and evening. The morning has the lowest value from figure 20.

Table 2: Temporal Data of Noise Reading in the Study Area

Days		MFM	AMM	WM	GMM	GIM	UUMM	WUMM	KMM	KFM	SFMM	KM	NM	GM
Day 1	morning	72	59.8	87.9	82.7	67.8	82.7	66.4	68.1	77.8	64.8	87.8	89.3	91.8
	afternoon	83.4	61.8	101.8	91.9	66.1	91.9	75.8	89.9	87.3	79.2	118.7	119.5	127.8
	evening	84.8	69.8	103.7	100.8	71.7	99.8	68.7	93.4	85.2	92	98.1	116.7	121.1
Day 2	morning	78.7	60.1	91.4	78.3	63.2	78.8	61.4	69.4	80.1	69.8	101.8	114.3	98.2
	afternoon	87.8	57.8	102.8	87.8	63.4	102.5	70.9	90.4	84.3	89.4	100.8	107.2	119.8
	evening	88.9	65.8	114.3	92.8	77.1	114.4	67.3	87.9	82.7	88.7	118.7	120.5	120.4
Day 3	morning	74.8	61.7	85.8	80.3	62.2	88.2	67.8	65.1	79.9	63.7	95.8	95.3	95.6
	afternoon	90.4	59.8	101.1	85.4	64.5	99.8	74.5	88.4	97.1	93.4	99.3	121.8	121.7
	evening	90.7	62.8	99.8	113.7	79.8	89.2	64.5	89.9	90.1	83.9	114.4	113.8	122.5
Day 4	morning	69.8	57.8	82.9	77.8	64.2	79.9	64.3	84.8	77.5	69.8	86.4	89.3	93.2
	afternoon	78.9	63.2	90.3	94.1	58.7	92.8	69.8	111	89.9	91.5	124.4	118.7	122.1
	evening	79.3	71.8	112.4	97.2	69.3	100.5	70.2	92.4	90.9	92.3	125.2	125.2	122.4
Day 5	morning	80.7	74	101.3	83.6	65.4	94.2	74	91.5	94.2	93.2	123.4	126	124.5
	afternoon	85.3	70.4	92.1	89.8	69.9	90.4	69.2	100.8	90.3	87.3	126.8	125.4	98.9
	evening	70.1	55.8	90	87.4	59.8	81.7	63.9	77.5	69.9	71.9	83.4	94.9	100.4
Day 6	morning	85.3	70.4	92.1	89.8	69.9	90.4	69.2	100.8	90.3	87.3	126.8	125.4	98.9

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	afternoon	87.6	72.1	98.7	91.7	80	99.9	81.4	98.4	94.7	93.4	125.3	119.7	124.9
	evening	66.3	61.4	78.1	79.3	68.2	84.5	63.1	81.6	78.4	80.4	79.9	90.3	97.2
Day 7	morning	79.6	69.9	89.4	89	70.1	89.5	59.8	89.2	93.4	89	124.2	115.8	114.6
	afternoon	82.1	63.9	97.8	87.2	78.9	101.4	86	107.2	88.9	93.2	127.4	127.1	126.8
	evening	80.7	74	101.3	83.6	65.4	94.2	74	91.5	94.2	93.2	123.4	126	124.5
NESREA/WHO	75	75	75	75	75	75	75	75	75	75	75	75	75	75

Source: Field Data, 2019

IV. DISCUSSION OF RESULT

It can be deduced from the study that mean noise level from Asokoro Modern Market (AMM), Wuye Ultra-Modern Market (UUMM) and Garki International Market (GIM) as showed on tables 1 and 2 are the lowest noise level while the highest value was recorded in Karmo Market (NM), Nyanya Market (NM), and Gosa Market (GM). Market noise levels are highest in the evening compared to the morning and afternoon, as indicated by the mean maximum noise levels of 95.1 dB (A), 119.2 dB (A), and 122.1 dB (A) recorded in the morning, afternoon, and evening, respectively. This implies that markets experience highest noise in the evening as compare to morning and afternoon. This is not healthy for traders, merchants even the buyers who stayed more than two (2) hours in the markets, this is ascribed to mobile vendors (such as those who sell music records, herbal remedies, and telecom equipment), people who utilize public address systems or megaphones to promote or publicize their goods, sirens from security vehicles, horns from cars and heavy-duty trucks, used of generators and grinding machines within the markets, shouting by the sellers to draw their customers attention to their products and people loading commercial vehicles.

Noise levels measured during the seven (7) days field monitoring, are generally high except for few places like the AMM, WUMM, GIM, which are low in the mornings, afternoons and evenings. The health of people could be at risk from the remaining ten (10) markets. The markets' high noise rating and substantial health impact were indicated by the noise exceedance factors calculated for each day of noise testing. The World Health Organization states that sounds that are 70 dB (A) or higher can typically cause temporary hearing impairment, whereas sounds that are 100 dB (A) or more can cause permanent impairment (Kiely, 1998). For traders, merchants, and buyers who spend more than two hours in the markets, the noise levels could pose major health risks, including hearing impairment, irritation, hypertension, vasoconstriction, tinnitus, and cardiovascular disorders.

It has been noted that, in contrast to the early hours, the noise levels were highest in the afternoon and evening. This is related to the fact that market activity, including that of sellers, merchants, and purchasers, is at its highest during these times. Wish to purchase or sell their goods at these hours since the day is almost over and it is difficult to carry heavy loads home, the grinding machines are at their peak hours of working, most generators are all powered at this period, most of the traders at this period keep shouting and ringing bells to attract the attention of their customers/buyers who believe the day is almost gone, the workers too have closed from work and they are rushing to get something from the markets before going home, Some buyers prefer going to markets at this period because the sellers give out their items at a given away price because they want to go home and cannot carry load home especially perishable goods. The noise level in the morning is less when compare to the afternoon and evening period because most of the vendors and merchants are yet to come to shops and many shops and tents are yet to be open or set up, generators, grinding machines, using of public address system that contributes a great deal to noise level are yet to be on, most of the markets transaction or activities is yet to commence in fully.

The majority of AMAC's markets in the Federal Capital Territory have noise levels comparable to those of other cities in Jordan, Spain, Brazil, Greece, and India (Ahmad et al., 2006; Amando and Jose, 1998; Zannin *et al.*, 2002; Georgioadou *et al.*, 2004; Panadya, 2003). These kinds of noise levels foretell major health consequences for persons conducting business in the market regions. Buyers, merchants, and traders who spend their entire day in the markets may have psychological symptoms like headaches, nausea, argumentativeness, mood swings, and anxiety as a result of these high noise levels. Long-term noise levels could have detrimental consequences on people's health who work in the market. Although they might not be aware of it, dealers and merchants at the market may experience elevated blood pressure, stress, and cortisol levels due to high noise levels. This result is consistent with research by Osha (2006), which shows that purchasing and selling have become a profession for the vendors and that some of them have been in the industry for a very long time, making the extended exposure to such a high The noise level is unhealthy. Additionally, the results align with the research conducted by Ibekwe *et al.*, (2016) and Ugbebor *et al.*, (2017). This suggests that a variety of human activities, including grinding machines, generators, ringing bells to draw clients, mobile sellers using public address systems, heavy traffic, security vehicle sirens, and moving vehicle horns, are the main causes of environmental noise in Nigerian marketplaces.

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It is concluded that, with a few exceptions, such as Asokoro Modern Markets, the evening and afternoon values exceeded the WHO/NESREA criteria for acceptable noise levels of 70–75 dB(A) in commercial areas. Garki International Market, and Wuye Ultra-Modern Market Which Mean values are within the permissible limit in the mornings, and afternoons except for evening period. This is connected to the fact that the markets are well organized with modern facilities, many shops like AMM are empty, little or no much buying and selling in this markets, so is difficult to hear noise from the markets, generators, mobile sellers, public address system, traffic jams, shouting by traders to attract customers are few or totally absence compare to the other ten (10) markets. The maximum values were identified at Karmo Market, Nyanya Market and Gosa Market in the afternoons and evenings. The afternoon and evening readings were noticeably higher than the morning period and the WHO/NESREA recommended standard, suggesting that market activity peaked during these times, even though the three (3) periodic readings (mornings, afternoons, and evenings) are all above the WHO and NESREA recommended standard.

It further supported the claim that, in comparison to the levels advised by the Federal Highway Administration (FHWA) and the World Health Organization (WHO), noise pollution in Nigerian cities is determined to be rather high (Oyedepo, 2013). The findings concurred with earlier research on noise levels examined in other global cities by Zeid *et al.,* (2000) and Zannin *et al.,* (2002).

According to statistics, there is a substantial difference in sound levels between the various marketplaces in the research locations; the table value at the α=0.05 confidence level is 21479, and the F-calculated value is 9.11423. The table value of 2.1479 is less than the computed value of 9.11623.

Table 3: Test of Significant in Sound Levels Across Different Markets in the Study Areas

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	10049	12	837.4169	9.11623	1.55E-06	2.147926
Within Groups	2388.36	26	91.86			
Total	12437.36	38				

V. CONCLUSION AND RECOMMENDATION

The results of the field study indicate that, with the exception of a small number of markets and time periods, such as AMM, GIM, and WUMM, where the noise levels are within the acceptable range, the majority of markets had noise levels above the 70dB (A) and 75dB (A) recommendations made by the World Health Organization (WHO) and the National Environmental Standards and Regulations Enforcement Agency (NESREA).

The loudest noise level mean was seen in the afternoons and evenings as compare to the mornings, the maximum values were recorded in GM, NM, and KM while the minimum was recorded in AMM, GIM and WUMM.

Therefore, the following are suggested in order to mitigate noise pollution in the research area:

- To help lower noise levels, the state or local governments could run awareness campaigns among consumers and sellers, educating them about the dangers and health disasters linked to noise pollution.
- To control noise pollution, immediate appeals for awareness, regulations through a vigorous health campaign, and appropriate enforcement of already-existing laws should be put into place.
- Laws should be passed by the government to limit the excesses of the sources of high noise levels. When designing new roads, estates, hotels, shopping malls, markets, schools, hospitals, and other commercial and residential buildings in general, professionals like town planners, architects, estate managers, and environmental engineers should keep the issues of environmental noise pollution in mind.
- The government should enact laws to restrict the excesses of the sources of excessive noise levels. Town planners, architects, estate managers, and environmental engineers should consider environmental noise pollution when designing new roads, estates, hotels, shopping centers, markets, schools, hospitals, and other commercial and residential buildings in general.
- It is necessary to create noise maps, which are extremely effective tools for informing the public about the findings of environmental noise assessments and for helping local and national governments come up with noise-reduction strategies. Town planners, engineers, and other experts and researchers can use the noise map itself, along with the noise descriptor values, to establish baseline data for project planning and execution. To help with noise control, it is recommended that noise maps be created for each of Nigeria's major cities.

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