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Determination of Environmental Noise Level in the Market and Open Places: A Case Study of Sabon Kasuwar Birnin Kebbi

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ABSTRACT

Environmental noise has become a pervasive concern in urban settings, affecting various aspects of daily life, including commercial spaces such as market. The aim of this work, is to investigate the level of environmental noise in the market and its consequential harm for both vendors and consumers. This study, explores the impact of environmental noise on vendor performance, customer experience, and overall market dynamics. Through survey and behavioral observations, the subjective responses of market participants to different noise levels using digital sound level meter noise volume device at the new market (Sabon Kasuwa) were examined. The investigation used acoustic measurement methods to assess the acoustic quality of some market area and results were obtained. The results show an of averagely the noise levels of 90.90 $dB(A)$, 83.0 $dB(A)$, and 78.0 $dB(A)$. These results were recorded in the morning, afternoon and evening respectively. The results are not healthy for both the vendors and buyers. All the values indicate reduced hearing sharpness, clarity in speech and intelligibility, distort in communication and fatigue as detrimental effects on market participants, as acknowledged by the respondents during their subjective evaluation.

Keywords*:* Sound, Noise Meter, Acoustic, Hearing Acuity and Speech Sharpness.

INTRODUCTION

Noise can be considered as a form of terrestrial pollution that increase quickly as an outcome of social, commercial, or industrial activity. It's an unpleasant sound that typically results from human activities. This form of pollution is one of the several global pollutions affecting the human activities socially. By definition, the term refers to the spread of noise that negatively affects the physical and mental well-being of both humans and animals. (Oloruntoba, *et al., 2012).* All aspects of sound production, propagation, and reception are included in sound, which is quantified as sound pressure. The environment and the noise source's output power both depends the sound pressure level. Human ear is a sense organ that is remarkably capable of processing a wide range of sounds. But sound turns into pollution when it gets in the way of our everyday lives.

Since human ears perceive changes in sound pressure as relative rather than absolute, the decibel (dB), a logarithmic scale, is used to measure sound pressure levels. Threshold of hearing called zero decibel (0 dB) is the smallest sound that a human ear can detect. While the threshold of hearing called threshold of pain, valued at 120 dB, is termed as the highest sound pressure level at which ear pain may occur. A small change of approximately 3 dB in the level of sound can be enough to make it noticeable in human ear. On the other hand, a 10 dB change in sound level can be perceived as twice as the loudness. (Defra, 2003). The A and C networks are the two weighting networks employed in sound measurement. On the other hand, an A-weighted scale (dB A) is used for environmental reasons since it approximates how the human ear perceives sound intensity (Alam, 2006).

One of the environmental threats that affects urban and rural communities in Nigeria today, is noise pollution. The Federal Environment Protection Agency (FEPA) of Nigeria has been forced to establish guidelines and permissible limits on the volume of noise that people can bear due to its incalculable negative effects on people from all walks of life. A noise can becomes pollution when those standards are exceeded. (Usikalu *et al.,* 2018). Nigerians are typically unaware of the severity of noise pollution and the damage it causes to the environment. This isn't the case, though, in other nations around the world where the required measures have been implemented to regulate and control this menace.

Measurements of the noise level in Birnin Kebbi town, Kebbi State, Nigeria, have revealed that most noise

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pollution is directly caused by human activity, which explains why many people unknowingly expose themselves to loud noises. The generators that CD and DVD vendors use to power their TVs and DVD players make markets noisy. Market areas are also noisy due to variety of factors, including cars that deliver products to warehouses and offer shade, trucks, lorries, and motorcycles. Humans may experience psychological, physiological, and hearing loss adverse effects from prolonged exposure to noise from any of such sources (Ugbebor and Raphael, 2015). According to Anomohanran and Osemeikhian (2008), the majority of the noise in Nigeria is caused by cars, commercial motorcycles, media outlets, and the use of electricity generators.

Hearing loss or impairment is a common sign of noise pollution (Hinchcliffe, 2002). Hearing loss is considered an occupational hazard, particularly if the victim works in a field where loud noises are produced during the production or processing of goods. A mix of noise and air pollution is linked to respiratory conditions, fatigue, and dizziness in school-aged children, among other physiological and psychological effects (Adetoun, 2011). Adults who are exposed to noise pollution have been linked to elevated blood pressure (Ebare, 2011) and cognitive impairments (Ntui, 2009).

Many research has been conducted on the impact of ambient noise, but not many on quantifying the noise level in the marketplace. Previous studies done in Agbor, Nigeria, reveal that commercial activities like trucks and lorries are the source of noise in most parts of the city (Anomohanran and Osemeikhian, 2008). However, it was observed in Ilorin, Nigeria, that the city's population growth—which increased by over fifty percent (50%) between 1980 and 2006—was contributing to the rise in noise pollution (Olayinka and Abdullahi, 2008). Additionally, they claimed that the main and most widespread source of noise in Nigeria is traffic and, level of noise in most of the communities in Nigeria is usually high in places of crowd like market places and truck garages. High level of noise has significant effect of human health and social wellbeing especially when the level is high.

This study intends to measure the environmental level of noise in the market and open places in the Sabon Kasuwar Birnin Kebbi in Kebbi State, Nigeria. The study will expose the level of hazardous disturbances and further justify the best time to visit the market for commuters and vendors. In addition to that, it will further be of immense benefit for the researchers to sensitize the commuters and vendors, and for health workers to put in place the necessary controls to the sources of noise there in the market.

MATERIALS AND METHODS

The materials used in this work are; UNI-UT353 Mini Digital Sound Level Meter Device (LCD Digital Sound Level Meter Noise Volume Device), DC Source, Thermometer, Meter rule, Global Positioning System (GPS) and Measuring tape.

The Study Area

The study area is Birnin Kebbi, a state capital of Kebbi State in Northwestern part of Nigeria. The city is located between latitude 12º27'13"N and longitude 4º12'01"E. It has an approximate population of about 366,200 people according to the 2006 census figures. It is located near the Sokoto River and has access to roads leading to the towns of Argungu (45 km northeast), Jega (35 km southeast), and Bunza (45 km southwest). The New market popularly known as (**Sabon Kasuwa**) is an open-air market located close to the old motor park, Birnin Kebbi local government, Kebbi State. Items that are regularly traded in the market include footwears, foodstuffs, clothing, herbal remedies, provisions, and Rice among other items. Sample site with latitude, longitude and elevation are tabulated in Table. 1.

Table 1: Table of sample site, their latitude, longitude and elevation

Sample Site	Latitude	Longitude	Elevation
Boutique	12.4318° N,	4.1956° E	764m
Retail trade sector.	12.4306° N,	4.1948° E	764m
Butcheries	12.4311° N,	4.1951° E	764m
Greengrocer	12.4314° N,	4.1949° E	764m
Grocery store	12.4310° N,	4.1945° E	764m
Clothes amending area	12.4312° N,	4.19457° E	764m

Methods of Analysis

This work was carried in Sabon Kasuwar Birnin Kebbi area, Kebbi State, Nigeria. To reduce the impact of random error, measurements of the noise level were made at three separate market locations, and average values were computed over the course of 6 market days. The sound pressure meter (Benetech GM1352), was used to measure the values at a pre-arranged location within the market, the picture of the meter is depicted in Figure 1. The meter provides instantaneous

real-time readings in compliance with regulatory noise estimation standards. In compliance with ISO 9613 noise measurement protocol, readings were obtained by positioning the meter three to ten meters above ground (EPA, 2000). The WHO and FEPA's standard levels of noise were compared to the average minimum and maximum noise levels recorded in the market. The measurement process was carried out at three different times of the day; 10.00am-to-11.00am, 01.00pm-to-03.00pm, and 4.00pm-to-6.00pm. Figure 2 shown the picture of the researcher in the market place.

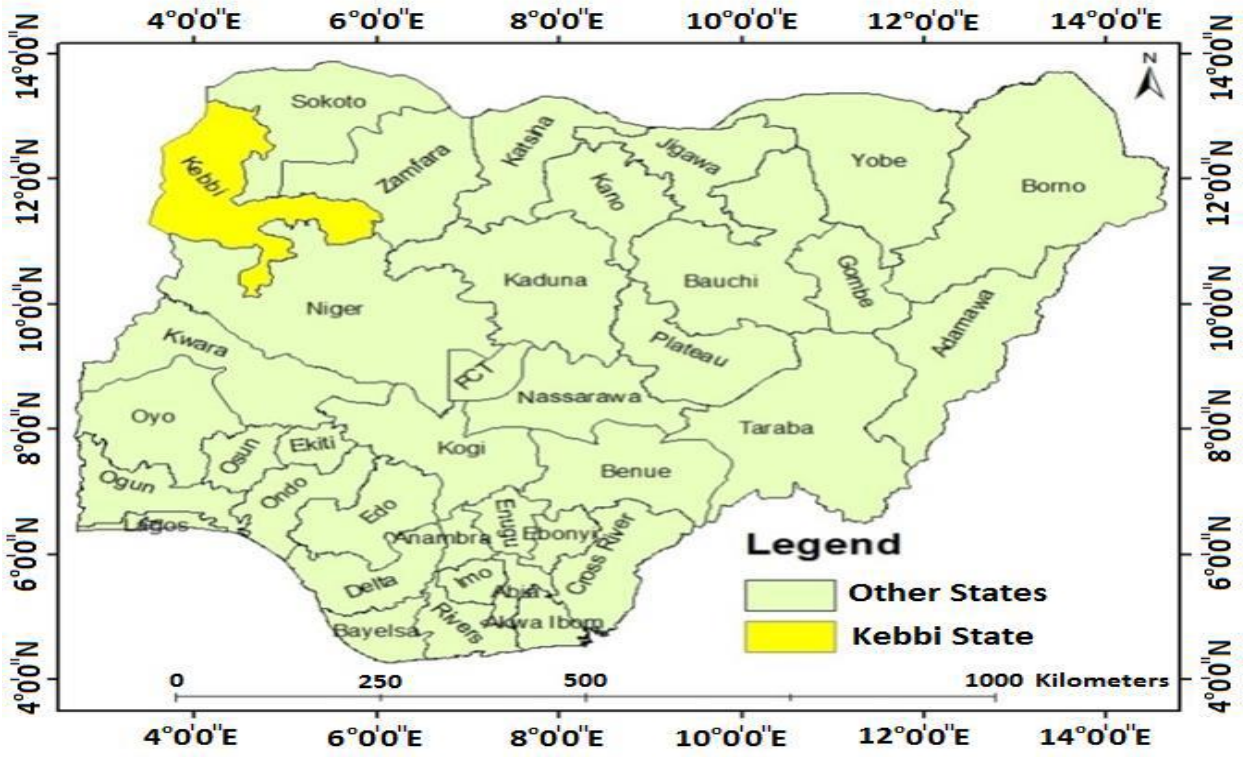

Plate 1: Map of Nigeria showing the study Area (Kebbi State).

Figure 1: Benetech GM1352.

Figure 2: Picture of the researcher during data collection.

Mathematical Equations

The level of sound intensity, ***β,*** measured in (dB) with an intensity I (WM^{-2}) can be measured using the following equations.

$$\beta(dB) = 10log_{10}(\frac{I}{I_0})$$

Where

$$\mathrm{I_O} = 10^{-12}WM^{-2}$$

$\mathrm{I_O}$ Is known as reference intensity, and it occurs at a frequency of 1000 Hz. It is the lowest sound intensity that a person with normal hearing can detect.

And

$$I = \frac{(\Delta p)^2}{2\rho v w}$$

RESULTS AND DISCUSSION

Values obtained for the level of noise for the 6 chosen locations in the market are presented in in Table 1. Times on which every result was measured is indicated on the Table (in the morning, afternoon, and evening respectively). It can be seen from the Table that the both the maximum and minimum values for each period were measured and recorded. Figure 3 shows the comparisons between minimum and maximum average noise levels throughout the durations.

Table 2: Measurement of the level of noise taken with their locations and periods.

Sample point areas	Measurement Periods Noise levels					
	Morning (10-11) am		Afternoon (01-03) pm		Evening (4-6) pm	
	Min (dB)	Max (dB)	Min (dB)	Max (dB)	Min (dB)	Max (dB)
Boutique	69.40	98.80	68.80	80.30	65.70	79.20
Retail trade sector.	66.20	89.30	63.40	82.60	56.50	78.80
Butcheries	67.40	96.50	64.60	83.10	60.20	81.10
Greengrocer	70.10	84.40	67.40	81.80	56.50	71.40
Grocery store	66.10	94.70	64.20	91.30	56.20	81.50
Clothes amending area	68.90	81.70	59.20	78.80	65.40	76.10
Mean Value	68.01	90.90	64.60	83.00	60.10	78.00

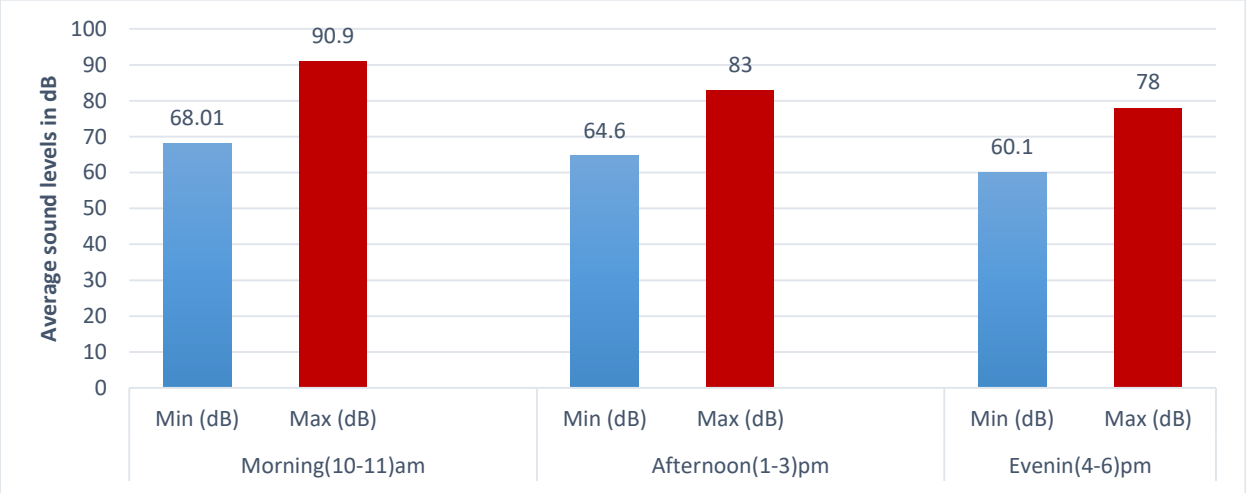

Figure 3.: Comparisons between the average maximum and minimum levels of noise.

DISCUSSION

This work measured the average levels of noise at some selected point areas in the New Market (Sabuwar Kasuwa), Birnin Kebbi, Kebbi State, Nigeria, and to determine whether the noise levels are within the advised ranges and to provide guidance if needed. It was also intended to investigate how market vendors and buyers were affected by the noise when they periodically gathered to go on with their businesses. As can be seen from Fig. 3.0, there was more noise in the morning than in the afternoon and evening. This is not unrelated to the fact that mornings are always the busiest times for business activity because vendors and customers arrive early and want to sell or purchase goods. The increase in commercial activity at that early hour of the morning is the reason for the noise pollution. Because the vendors and buyers must have completed a significant amount of business and are likely fatigued and satisfied, there was less noise in the afternoon than there was in the morning. Ideally less noise occurs in the evenings, when most vendors and buyers have probably left the market and gone home following the day's transactions. These values of level of noise 90.9 dB (A), 83.0 dB (A) and 78.0 dB (A) recorded in the mornings, afternoons and evenings hours often not healthy for the vendors and buyer especially for prolonged exposure (Osha, 2006).

CONCLUSION

Average environmental level of noise in the market and open place of Sabon Kasuwar Birnin Kebbi area, Kebbi State, has been carried out. The study has shown that the level of noise in the morning hours (10-11) am is extremely high, followed by the afternoon hours (01-03) pm and the evening hours (4-6) pm is the lowest. This means that the unhealthy time to visit the market is in the morning hours. The results also indicate that tend to patronage goods during the morning hours. However, young children (below 18 years) and people with hearing problems are advised to visit the market in the evening hours only. It's also advised that vendors who spend their entire working day in the market ensure they have a minimum of eight hours to recuperate in less noisy environments. Thus,

it is up to the policy makers working for the government and other stakeholders to improve the market conditions either by decongesting the nucleated shops, vendors or by spreading them out rather than concentrating them in the single unit.

REFERENCES

Adetoun, M.B., Blangiardo, M. and Briggs, D.J. and Hansell, A. L. (2011). Traffic air pollution and other risk factors for respiratory illness in schoolchildren in the Niger-delta region of Nigeria. *Environ. Health Perspect.* 119(10):1478-1482. https://doi.org/10.1289/ehp.1003099.

Akpomedaye, O. (2021). Analysis of Noise Pollution Level of Some Markets in Delta State, Nigeria. *International Research Journal of Modernization in Engineering Technology and Science.* 3(5):55-67.

Aniefiok, O. A., Ubon, E. A. and Augustine, A. U. (2013). Study of noise pollution during pre-carnival, carnival and post-carnival festivals in Calabar Municipality, Calabar, Cross River State, South-South Nigeria. *Global Journal of Science Frontier Research Physics and Space Science.* 13(1):108-120.

Aniefiok, O. A. (2018). Environmental Noise Pollution and Impact in Major Markets of Akwa Ibom State, Nigeria''. *International Research Journal.* 18(1):35-45.

Dev P. and Singh, V. (2011). Environmental noise pollution monitoring and impacts on human health in Dehradun city. *India Civil and Environmental Research*, 11(1):75-85.

Ebare, M.N., Omuemu V.O. and Isah, E.C. (2011). Assessment of noise levels generated by music shops in an urban city in Nigeria. *Journal of Public Health.* 125(9):660-664. https://doi.org/10.1016/j.puhe.

Hinchcliffe, R. (2002) Global perspective of noise-induced hearing loss as exemplified by Nigeria. *Journal Audiolog Medicine*. 11(1):1-24.

John, N. U., Yorkor, B. and Joy, N. N. (2017). Evaluating of Noise Levels in Oil Mill Market and its Environs, Port Harcourt, Nigeria. *British Journal of Applied Science and Technology.* 21(1):1-11.

John, O. E. and Mfonobong, E. A. (2017). Spatial temporal analysis of noise pollution from vehicular traffic in Uyo metropolis, Nigeria. *Sustainable Human Development Review*, 9(1):2-4.

Mangalekar, S. B., Jadhav, A. S. and Raut, P. D. (2012). Study of noise pollution in Kolhapur city, Maharashtra, India. *Journal Audiolog Medicine*. 2(1):65-69.

Michael, U. O. and Aniefiok, O. A. (2006). Industrial noise in Nigeria-- Measurements, analysis, dose and effects. *Journal of building Acoustics.* 13(1):21-33.

Ntui, A.I. (2009). Noise sources and levels at the University of Calabar Library, Calabar, Nigeria. *African Journal of Library Arch Information Science*, 19(1):53-63.

Oloruntoba, E.O., Ademola, R.A. and Sridhar, M.K.C. (2012). Urban environmental noise pollution and perceived health effects in Ibadan, Nigeria. *African Journal of Biomedical Research*, 15(2):77-84.

Ugbebor, J.N. and Rapheal, B.Y. (2015). Evaluating of construction noise at selected highways road construction sites in urban city of Port Harcourt and its effects on residential environment" *Journal of Environmental Science, Computer Science and Engineering Technology.* 4(2):1-10.

Usikalu, M.R., and Kolawole, O. (2018) "Assessment of noise pollution in selected locations in Ota, Nigeria. *International Journal of Mech Engine Technology*, 9(9):1212-1218.