



# Measurement and Analysis of Noise Levels: A Study of Selected Pubs in Calabar, Nigeria

Emmanuel Obi <sup>a</sup>, Ukoette Jeremiah Ekah <sup>a\*</sup>  
and Igwe Ewona <sup>a</sup>

<sup>a</sup> Department of Physics, Cross River University of Technology, Calabar, Nigeria.

## 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

This research involves the assessment of noise levels in pubs operating in Calabar, Nigeria, to investigate their compliance with the permissible noise level recommended by the National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigeria. A Bam and Kom (BK) Precision 732 digital sound level meter placed on a tripod was used for the measurement of noise levels for three consecutive months, from 6:00pm to 10:00pm. The measured data were subjected to descriptive statistics using excel spreadsheet and the results were presented in the forms of graphs, bar chart and in tabular form. Average equivalent noise level obtained for pubs A, B, C, D and E were 86.5dB, 75.7dB, 75.9dB, 90.0dB and 81.9dB, respectively. Results show that all the pubs under study were in excess of the permissible noise level recommended by NESREA.

Keywords: Noise; noise levels; noise pollution; NESREA; pubs.

\*Corresponding author: E-mail: [ukoettejeremiah@unicross.edu.ng](mailto:ukoettejeremiah@unicross.edu.ng), [ukoettejeremiah@crutech.edu.ng](mailto:ukoettejeremiah@crutech.edu.ng);

## 1. INTRODUCTION

“Noise pollution is the elevation of natural ambient noise level due to sound generated by human activities, which may have detrimental consequences to humans and animals. It is an unwanted sound that constitutes nuisance to the environment [1] and ranks third as the most hazardous form of pollution behind air and water pollution” [2]. “The Environmental and epidemiological consequences of noise pollution are chronic and has widespread complications in the long run” [3]. “It has been suggested that 12% or more of the global population is at risk of hearing loss from noise, which equates to well over 600 million people” [4].

“It is common knowledge that during the day, people are usually busy with their businesses and jobs. They work hard until there are through with their assigned target, daily. Due to this stress, quite a number of people visit leisure centres at the close of work and businesses, between 7:00pm to 10:00pm, for relaxation. Therefore, bars, pubs, clubs, and discotheques have become an important part of urban areas, often incorporated into residential buildings. Nevertheless, while patrons enjoy drinks, foods, and their great moments such as talking to friends in high spirits, the sounds produced by people talking, laughing, singing, and cheering, and the noises generated from the impact of glassware, beverage machines, loudspeakers, and/or the instruments of live bands would adversely influence these frequenters” [5]. “Amplified music from pubs has been increasingly causing nuisance” [5,6]. “With powerful audio systems capable of producing significant sound levels, particularly at low frequencies, these sources of noise present a challenge which should be monitored and put under control” [6].

Leisure noise has been studied extensively [7-17]. For instance, in [18], the authors conducted a prospective cross-sectional study, measuring noise levels in 43 bars, restaurants, and music clubs in Mekelle, Ethiopia. The measurements were done between 10:00 pm and 12:00am in each of the selected houses. The study showed mean loudness of 97dB for 10:00 pm and 101dB for 12:00am, with a standard deviation of 3 dB and 7 dB, respectively. The maximum loudness measured was 107 dB and 108 dB, respectively. The authors suggested that strict measures should be taken by implementing regional and national

regulations, which will limit noise exposure during leisure in Ethiopia. In [19], “the researchers analyzed the long-term noise indicators and time-based patterns of noise in different areas, with the aim of establishing conclusions that will be helpful to other areas of the city and testing the applicability of previous leisure noise models in the city of Málaga. The results showed that the noise levels in the leisure areas in Málaga were quite high at night, especially, during weekend nights, where they observed locations with noise levels over 75–80 dB until late hours of the night. They also made an analysis of the leisure noise models proposed in previous investigations and their performance in the case of Málaga, Spain”.

The authors in [20] probed “sound levels of 2376 restaurants and bars in New York City using a novel smart-phone application, categorizing them based on how quiet or loud they were. The outcome indicated that a not number of restaurants and bars have high sound levels that are not conducive to conversation and may be endangering the health of patrons and employees. Furthermore, the reported sound levels by the venue managers on their online public business pages underestimated the actual sound levels and the average sound levels in restaurants and bars were correlated by the neighbourhood and the type of cooking”. In [21], “indoor sound level spectra for different types of entertainment premises have been analyzed. While most of the spectra lie between two standardized curves proposed by the ISO 717-1:2013 (The International Organization for Standardization) standard, spectra recorded in discotheques showed a pronounced spectral level below 160 Hz as a result of an intensive use of subwoofers. This indicates a potentially inappropriate rating of sound insulation against such specific low-frequency noise by standardized spectrum adaptation terms. A modified spectrum adaptation term for a single-number rating of sound insulation under such circumstances was proposed”.

“In the foreseeable future, there will be more pubs and bars in Calabar. Many of the pubs and bars are located in the vicinity of the mixed business and residential areas and noises from these entertainment premises will continue to pose challenges to nearby residents, patrons and staff. So, how noisy actually are bars and pubs? How much noise is emanating from a typical bar or pub? How can we control noise impact from bars and pubs and its adverse effect? In Nigeria, the Federal Ministry of Environment, through the

National Environmental Standards and Regulations Enforcement Agency (NESREA), had put up the National Environmental (Noise Standard and Control) regulations” [22]. “The purpose of these regulations is to ensure maintenance of a healthy environment for everyone in Nigeria, the tranquility of their surroundings and their psychological well-being by regulating noise levels and generally, to elevate the standard of living of the people by-prescribing the maximum permissible noise levels a facility or activity to which a person may be exposed; providing for the control of noise and for mitigating measures for the reduction of noise” [22].

This research work is aimed at measuring and analyzing noise levels in five pubs in Calabar, Nigeria. The results of the analysis are compared with the recommended noise threshold for leisure noise, as stipulated by NESREA [22]. The result of the study will serve as a guide for the control of noise pollution in pubs operating in Calabar, Nigeria.

## 2. METHODOLOGY

### 2.1 Research Tools and Data Collection

“A Bam and Kom (BK) Precision 732 digital sound level meter equipped with 4 digits Liquid Crystal Display (LCD), a condenser microphone and an octave filter was used in the recording of noise levels. It has a resolution of 0.1 dB and an update cycle of 0.5 second. The system provides 30 to 130dB capability in three convenient measurement ranges. The ranges are low (30 to 80 dB), medium (50 to 100 dB) and high (80 to 130 dB), with an accuracy of  $\pm 1.5$  dB. The meter meets the International Electrotechnical Commission (IEC) 651 Type II standard and includes frequency weighting of A and C and fast and slow time weighting. The A-weighting was used because of its recommendation for

environmental and industrial studies” [16,23]. A digital stop clock was used in the measurement of the time at which the noise levels were taken while a tripod stand was used in placing the sound level meter.

Five pubs, based on their peculiarity, were used in the study. The five Pubs were assigned the alphabets A to E for ease of identification. Pub A was Potomas, pub B was Success Villa, pub C was Paladium, pub D was Delve while pub E was Suya park. The noise meter was placed on a tripod stand at a height of 1.5m. During measurements, the microphone was positioned in such a way that it is not in acoustic shadow with any obstacle in the field of the reflected waves. Maximum and minimum noise levels were collected from 7:00pm to 10:00pm at an interval of 5 minutes. Measurement was taken for three months, from October to December 2022.

### 2.2 Data Analysis

For each pub, measured maximum and minimum values were averaged for each time interval for the period of 3 months. The average values for each time interval are analyzed in the form of tables, graph plots and bar chart. The average equivalent weighted continuous sound energy (in decibels) of the pubs during the study period is then compared with the threshold for entertainment noise as stipulated by the National Environmental Standards and Regulations Enforcement Agency. All the analysis in this study were done through an excel spreadsheet.

## 3. RESULTS AND DISCUSSION

The results of this study are based on data collected in five pubs in the city of Calabar, Nigeria, over a period of 3 months. The data were subjected to descriptive statistics using an excel spreadsheet, as displayed in the table, graphs and bar charts below.

**Table 1. Mean values of Noise Levels from October to December 2022**

Time (hours)	Pub A (dB)	Pub B (dB)	Pub C (dB)	Pub D (dB)	Pub E (dB)
7:05PM	81.7	75.9	74.5	89.6	81.4
7:10PM	72.2	75.0	72.3	88.8	81.7
7:15PM	85.5	75.6	75.6	85.4	80.7
7:20PM	86.6	74.7	71.3	88.8	77.4
7:25PM	89.0	75.2	76.7	87.8	81.9

Time (hours)	Pub A (dB)	Pub B (dB)	Pub C (dB)	Pub D (dB)	Pub E (dB)
7:30PM	89.2	75.8	73.6	86.9	80.1
7:35PM	90.1	73.0	75.9	91.7	79.6
7:40PM	89.1	77.3	76.6	98.7	82.1
7:45PM	85.4	72.7	78.5	89.4	77.9
7:50PM	86.6	73.8	77.1	89.4	76.4
7:55PM	83.2	74.2	76.5	92.5	79.2
8:00PM	84.8	76.8	76.1	90.4	76.9
8:05PM	86.1	75.7	79.0	87.8	79.9
8:10PM	89.9	74.6	76.5	89.1	77.6
8:15PM	84.7	76.0	78.7	89.4	78.5
8:20PM	84.5	75.8	74.9	88.6	79.4
8:25PM	87.6	76.3	77.6	89.6	77.1
8:30PM	88.9	75.4	78.7	89.1	78.1
8:35PM	87.9	78.1	79.6	89.8	77.6
8:40PM	86.9	76.5	77.2	91.4	80.1
8:45PM	91.6	76.5	76.5	89.5	76.7
8:50PM	89.5	74.1	77.5	90.2	83.5
8:55PM	79.5	73.3	78.4	90.0	87.4
9:00PM	87.7	75.5	77.5	91.4	85.9
9:05PM	87.0	74.2	78.8	89.9	84.6
9:10PM	89.1	74.6	74.9	88.9	86.2
9:15PM	85.6	75.6	73.8	89.7	86.7
9:20PM	87.4	75.7	77.0	90.4	85.5
9:25PM	88.4	74.4	76.2	89.7	86.1
9:30PM	84.8	78.1	61.1	91.2	85.3
9:35PM	87.6	79.0	69.3	92.7	84.4
9:40PM	89.7	79.1	77.2	89.6	87.2
9:45PM	87.2	78.3	76.1	90.6	88.7
9:50PM	84.9	74.1	77.1	89.3	84.2
9:55PM	86.1	75.3	77.5	89.5	87.2
10:00PM	87.1	79.6	76.9	92.9	83.4

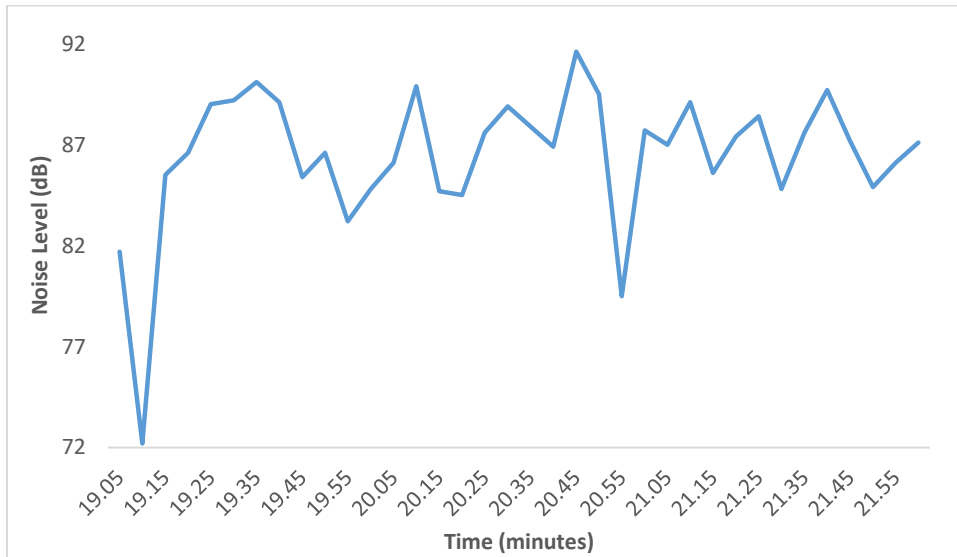
In pub A, noise sources were from the generator, interactions, music, car horns and stage entertainment. The average noise trend is shown in Fig. 1. The minimum average noise level was 72.2dB at 7:10pm while the average maximum noise level was 91.6dB at 8:45pm. In Fig. 2, the noise levels in pub B has been plotted. The minimum average noise level was 72.7dB and was observed at every 7:45pm. The maximum average noise level was 79.6dB at 10:00pm. The sources of noise in this pub were from interactions, generator and road traffic noise due to the proximity of the pub to the highway. Pub C had its noise source from a nearby pub that shared the same fence with it. The maximum

average noise level was 79.6dB at 8:35pm. It was observed that at every 9:30pm, when the nearby pub stopped its music momentarily, the noise level was minimum at this time. Hence, at 9:30pm, minimum average noise level was 61.1dB. This is described in Fig. 3.

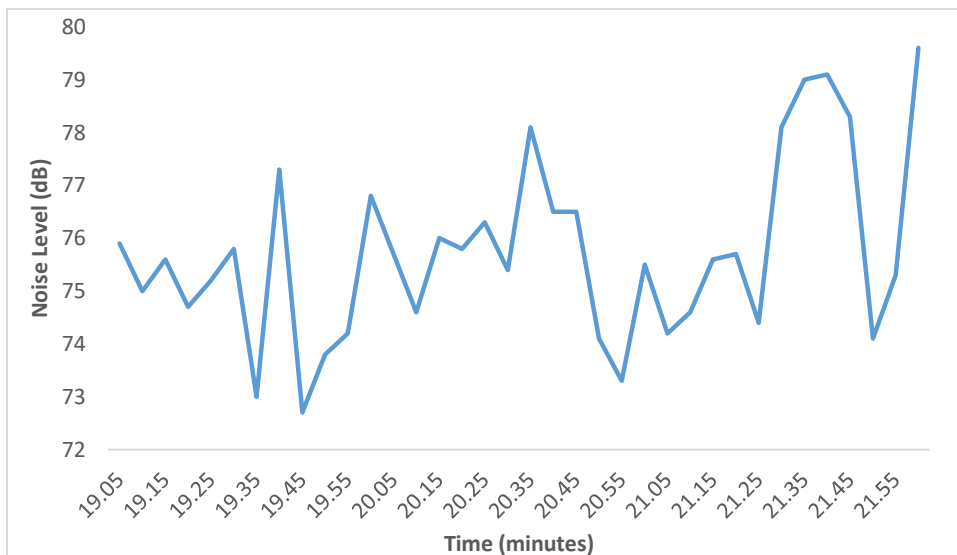
Noise levels in pub D is displayed in Fig. 4. The minimum and maximum average noise levels were 87.0dB and 92.9dB at 7:25pm and 10:00pm, respectively. The noise level from the music source was so loud that one could loudly hear conversations with each other. In pub E, noise sources were from suya buyers, interactions, and music. As displayed in graph E,

maximum noise level was 88.7dB and 76.4dB at 9:45pm and 7:50pm, respectively. Furthermore, Fig. 6 represent averages of noise levels measured in for each pub under study. Noise level was found to be highest at pub D, then pub A, followed by pub E, C and B. The mean noise level at pub A was 86.5dB, 75.7 for pub B, 75.9 for pub C, 90.0 for pub D and 81.9 for pub E.

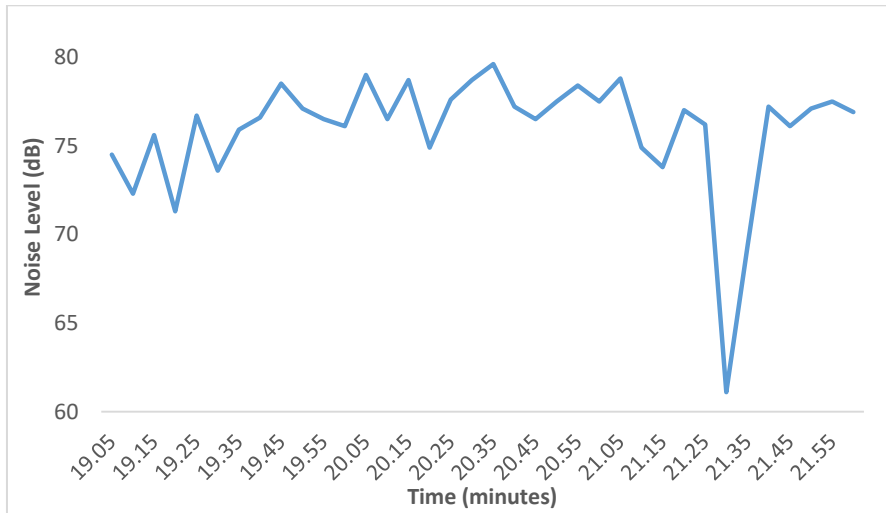
Values of standard deviation computed to check the spread of data points around the mean were low. This means that the set of data clustered around the mean. The standard deviation values obtained for the pubs under study were 3.47dB for pub A, 1.71dB for pub B, 3.35dB for pub C, 2.12dB for pub D and 3.75dB for pub E.



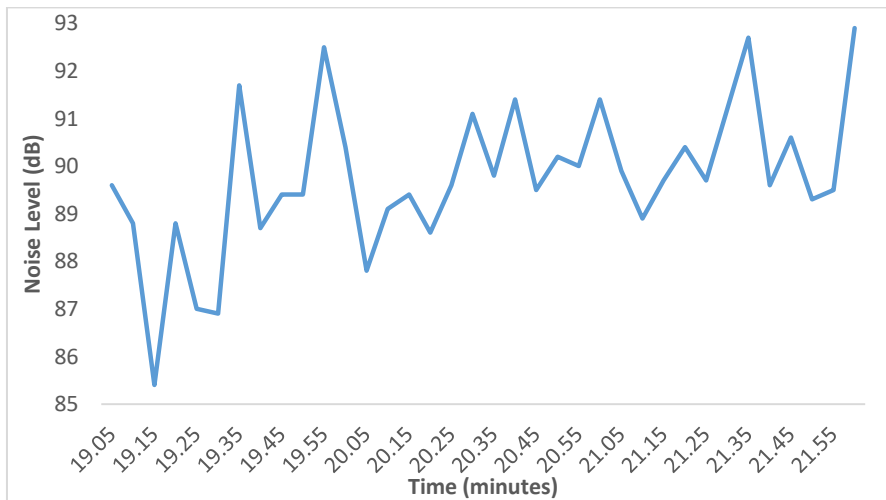
**Fig. 1. Plot of Average Noise Level against Time for Pub A**



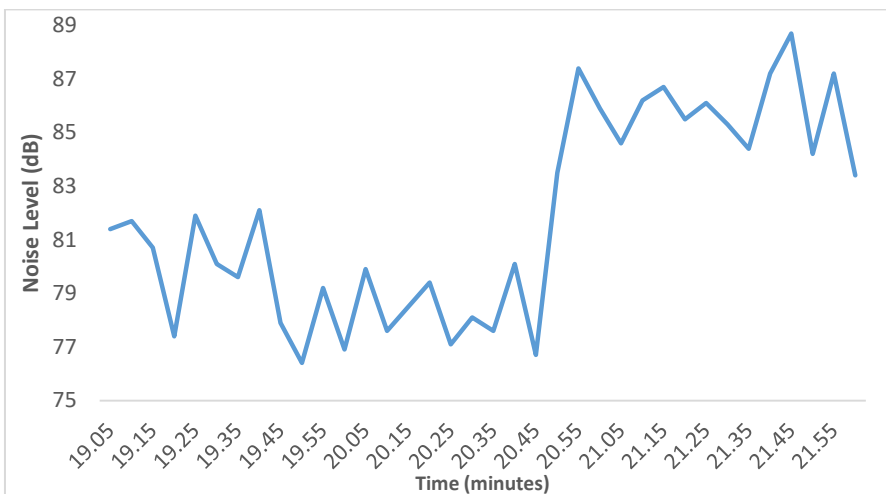
**Fig. 2. Plot of Average Noise Level against Time for Pub B**



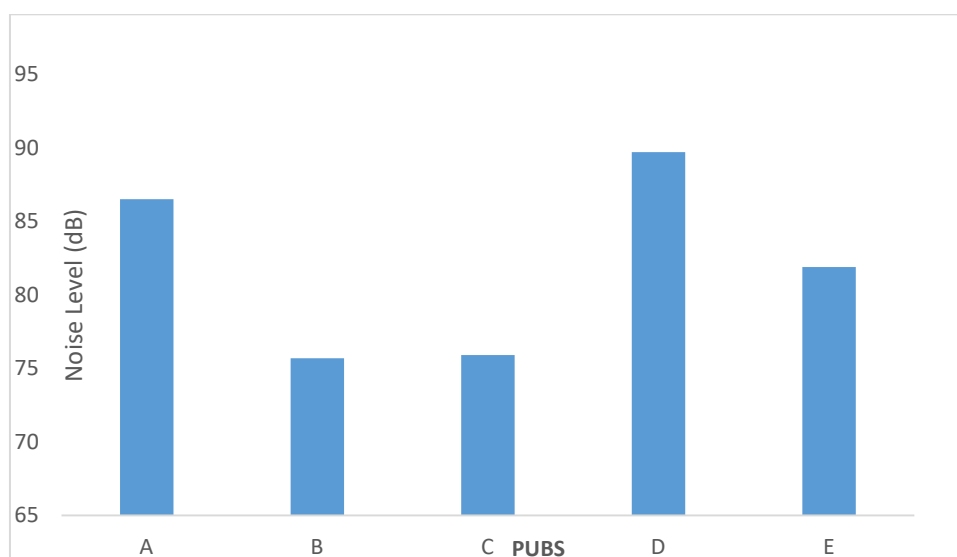
**Fig. 3. Plot of Average Noise Level against Time for Pub C**



**Fig. 4. Plot of Average Noise Level against Time for Pub D**



**Fig. 5. Plot of Average Noise Level against Time for Pub E**



**Fig. 6. Average value of Noise Levels for the five Pubs under study**

#### **4. CONCLUSION**

The purpose of this study was to identify whether pubs operating in Calabar, Nigeria, complied with the permissible noise level recommended by the National Environmental Standards and Regulations Enforcement Agency (NESREA). Results shows that pubs A, D and E were in excess of the permissible noise level while pubs B and C were slightly in excess of the permissible noise level.

#### **5. RECOMMENDATIONS**

In view of the findings above, we recommend that the government, through the relevant agencies, enforce compliance with the permissible noise levels recommended by NESREA. If this is not done, the customers and workers in pubs A, D and E will likely have serious health challenges in the nearest future. This enforcement should include other public places not covered in this research work, as this will provide a healthy environment for patrons.

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#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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