

ASSESSMENT OF NOISE POLLUTION LEVEL IN ABAKALIKI METROPOLIS, EBONYI STATE NIGERIA

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Abstract

World Health Organization classified noise as a major environmental pollution. Noise pollution has major impact on human health, such as physical, physiological, psychological and performance related effects. This study assessed the level of noise pollution in Abakaliki Metropolis. Eight sampling locations comprising residential and mixed residential (with commercial and entertainment) were monitored. The result showed that the mean level of noise pollution in the morning time (9 – 12 noon) was generally higher than the evening (5pm – 7pm). The mean noise level ranges from 46.85 dB(A) – 80.05 dB(A) in the morning period and 30.6 dB(A) -78.6 dB(A) in the evening. The mean noise level in the residential areas were lower than the mixed residential and commercial area, while mean noise level in mixed residential areas were above WHO permissible level of 55 dB (A). The study concluded that current noise level in the mixed residential pose serious health threat the residents of the area. It was recommended that Public enlightenment campaigns, increased electricity distribution, enforcement of environmental laws and continuous monitoring of noise level should be put in place in order to mitigate the menace of noise pollution in the area.

Keywords: Pollution, Noise, Environment, Public health, risk

1. INTRODUCTION

The World Health Organization (2005) has estimated that 25% death in developing countries are due to environmental problem. The children, woman and old people are reported to be more vulnerable than male adults (WHO, 2005). Noise pollution is recognized as a major environmental problem affecting the

quality of life in urban areas all over the world. World Health Organization declared noise in large cities as pollution (WHO 2004; WHO 2005). The level of noise pollution has continued to increase because of the increase in anthropogenic activities such as industrialization, urbanization (Ibekwe et al., 2016). Available data show that there are about 500 million cars in the world which is expected to be doubled by 2030 (WHO, 2000), and (Olayinka, 2013). This further increases the environmental noise level. Apart from public health effect. Noise pollution is affecting a range of animals across multiple habitats. Animals are altering their natural behaviors or relocating to avoid noisy areas. Changes in animal behavior can have flow-on effects for whole ecosystems (NIOSH (National Institute for Occupational Safety and Health) 1998; WHO 2000; Olayinka 2013)

Existing evidence indicating that noise pollution may have negative impacts on human health has justified research in order to provide better understanding of noise pollution problems and control (WHO 2011; WHO 2004). The effects of noise on human health and comfort are depended on duration and level of exposure. The public health effects associated with noise is divided into four categories; physical effects, such as hearing defects; physiological effects, such as increased blood pressure, irregularity of heart rhythms and ulcers; psychological effects, such as disorders, sleeplessness and going to sleep late, irritability and stress; and finally effects on work performance, such as reduction of productivity and misunderstanding what is heard (WHO, 2011; Oguntunde et al., 2019). Many surveys addressing the problem of noise pollution in many cities have shown the scale of discomfort that noise causes in people's lives (WHO, 2000; WHO, 2011). In comparison to other pollutants, the control of environmental noise has been hampered by insufficient knowledge of its effects on human and lack of defined criteria. Noise pollution is a significant environmental problem in many rapidly urbanizing areas and plays a major role as one of the environmental factors adversely affecting the general health problems of the population in the city (Vladimir & Madalina, 2019). This problem is not recognized properly despite the fact that it is steadily growing in developing countries. Noise has been established as a potential hazard to health. The situation of noise pollution in Abakaliki metropolis is similar to that in many urban areas. The population has increased, and the city has expanded continuously in all directions in the past two decades. Many significant changes have been experienced in terms of urbanization, industrialization, expansion of road-network, and infrastructure. The city is also witnessing high commercial activities due to overall increase in prosperity, fast development, and expansion of the economy. Hence, the primary objectives of this study is to carry out comprehensive assessment of the noise levels in the city, comparing with WHO permissible limit and suggest possible effective noise control measures for the city and Nigerian urban areas.

Several studies have emphasized that Noise pollution in urban areas have reached disturbing levels. Olayinka, (2013) reported that there is a close relationship between noise pollution and sustainable environment. He reported that 6 out of 42 locations in Ilorin metropolis were under the permissible limit of National institute of occupational health and safety, World Health Organization (WHO) and Housing and Urban Development (HUD). This entailed that current status of noise pollution in the area poses a severe danger to the health of the resident. (Akinsanmi *et al.*, 2019) reported that residential and industrial areas showed significant variation in their levels of noise and decreased with increasing distance from the industrial area. They maintained that there is a need for adoption of cleaner technologies by the industries and enforcement of environmental standards by regulatory agencies

Johue *et al.* (2018) reviewed that the level of noise within Warri and Effurun metropolitan cities and at all the periods of the day is more than the Nigeria Federal Ministry of Environment (NFME_{Env}) and World Health Organization (WHO) permissible limit of 55dB daily noise level criteria for residential areas. The survey opined the need to enact and enforce permissible noise levels/standards for residential neighborhoods of 55 dB by relevant environmental authorities both at Federal and state levels instead of applying 90dB standard meant for regulations in industrial settings. Abulude *et al* (2018) monitored level of noise from one hundred generators using a sound level meter in four locations (two residential, commercial, and industrial areas) showed the mean maximum and minimum value include Oke Eri Estate – (88.7 ± 10.3, 90.5 ± 15.2), Housing Estate (81.7 ± 9.2, 85.0 ± 9.5), Stadium Road (84.8 ± 10.0, 113.4 ± 17.5) and FUTA Road (81.9 ± 9.3, 90.0 ± 15.2). The study concluded that the areas were polluted with noise because the levels obtained were above the permissible limits.

Ozdemir *et al* (2014) reported that the most noise-polluted parks in Trabzon were the Meydan Park, Atapark and Fatih Park with measured Leq of dB (A) Meydan park (63.74), dB (A) Atapark (64.15) and dB (A) Fatih park (64.67). Urban parks in Trabzon's city center, surrounded by roads with heavy traffic and intense commercial activities, do not satisfy any of the standards of national legislation (Law: 60)

Oguntunde *et al.* (2019) maintained that there is no significant difference in the effects of the noise pollution level for all the times of the day considered. He noted that the noise levels are way far from the WHO recommendations. (Ibekwe *et al.*, 2016) recorded that the level of noise at Abuja metropolis ranged from 71-92dB(A); 42-79dB(A) and 69-90dB(A) in business/ parks, residential and market places respectively. The study emphasized that the Night measurements were similar 18dB(A)-56dB(A) and the day-night Leq (A)=77.2dB(A) and 90.4dB(A) for residential and business zones. They concluded that the night noise levels are satisfactory, but the day and day night levels are above the recommended tolerable values by WHO and therefore urgently call for awareness and legislative regulations.

2. MATERIALS AND METHOD

The study was carried out in Abakaliki metropolis, the capital territory of Ebonyi State, southeastern Nigeria (Figure 1). It is situated at 6.32° North latitude, 8.12° East longitude and 117 meters elevation above the sea level.

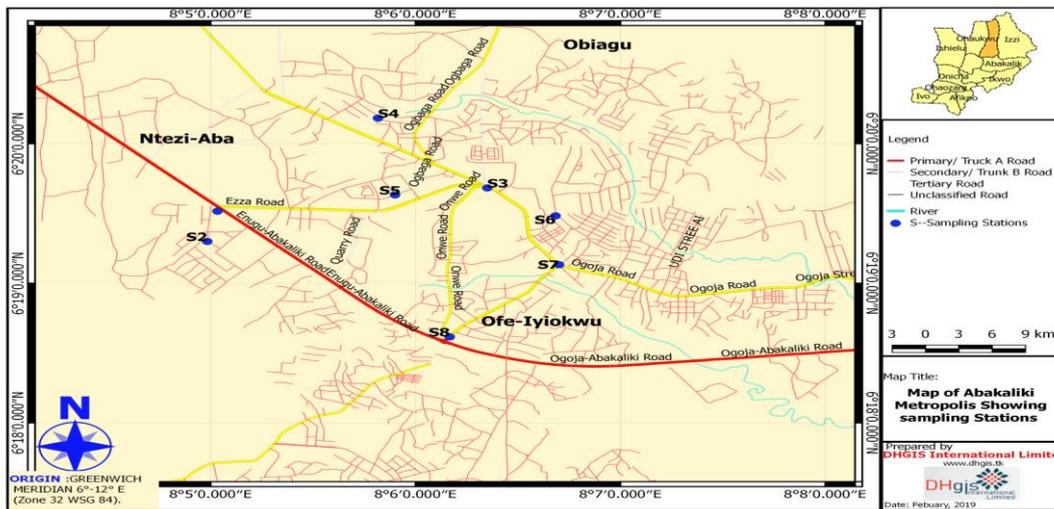


FIGURE 1 - MAP OF ABAKALIKI METROPOLIS SHOWING THE SAMPLING LOCATIONS.

Source: DhGIS international limited, 2019

Abakaliki is a big town in Nigeria and state capital of Ebonyi State Nigeria, having about 134,102 inhabitants. Two main seasons exist in the Abakaliki area, the dry season which spans from November to March and the rainy season which begins in April and ends in October with a short period of reduced rains in August commonly referred to as “August break”. Most hand dug wells and boreholes in this area are renewed during the peak of the rainy season. Temperature in the dry season ranges from 20 to 38°C, and results in high evapotranspiration. While during the rainy season temperature ranges from 16 to 28°C, with generally lower evapotranspiration. A number of hand dug wells are completely dried up in the peak of this season. The average monthly rainfall ranges from 31 mm in January to 270 mm in July, with the dry season experiencing much reduced volume of rainfall unlike the rainy season, which has high volume of rainfall. Average annual rainfall varies from 1,500 to 1,650 mm. These climatic conditions are responsible for the development of thick lateritic soils in the Abakaliki area and its environs (Ezeh & Anike, 2010). The Abakaliki metropolis is, geologically, underlain by the Abakaliki Shale Formation of the Asu River Group (Reyment RA, 1965). The study area was divided into eight sampling locations based on human activities taking place there. The sampling points are two residential area (GRA and Democracy Estate) and six mixed residents with commercial and entertainment (Presco, Government house, kpiri kpiri, water walks road, Vanco junction and Spirando). The area is known for huge agricultural produce such as rice and yam. There is presence of huge

economic activities and development projects in the metropolis. The Global Positioning System (GPS) readings of the sampling stations is shown with their respective coordinates (Table 1)

The environmental noise level measurements was taken with an auto digital sound level meter (model TM-102). A sound level meter is used for acoustic (sound that travels through air) measurements. Noise meter model TM-102 provide portable direct noise measuring device according to IEC 60651 specifications. It is an integrating averaging sound level hand-held meter with 35–130 dB(A) as a measuring range. The instrument is fitted with microphone interface that responds to sound pressure from the acoustic source and transforms it into an electric signal which can be interpreted by the measuring instrument. The sound meter was calibrated by a calibrator as defined by IEC 60942 for checking the accuracy of the hand-held indicating instruments. The Calibrator is a small, battery driven device and has a standard sound level of 94 dB with an accuracy of ± 0.5 dB. Data were keyed in excel sheet and analyzed using SPSS.

3. RESULT AND DISCUSSION

Data in Table 1 shows the level of noise pollution in Abakaliki Metropolis, Ebonyi State Nigeria. The sampling locations represent residential and mixed residential (with some commercial and entertainment). The residential areas include democracy estate and GRA, while the remaining six locations are mixed residential and entertainment.

TABLE 1 - LEVEL OF NOISE POLLUTION AT ABAKALIKI METROPOLIS, NIGERIA

S/N	Sampling Locations	GPS Reading	Level of Noise in dB(A)					
			Morning (9am-12am)			Evening (5pm -7pm)		
			L.min	L.max	Average	L.min	L.max	Average
1	Presco	6° 5' 31"N, 8° 5' 2" E	70.6	85.7	78.15	69.10	77.0	73.05
2	Democracy estate	6 19 18 N, 8 4 59 E	37.1	56.6	46.85	28.5	32.7	30.6
3	Government house	6 19 41 N, 8 6 21 E	67.7	81.0	74.15	52.2	75.6	63.9
4	Kpirikpiri	6 20 11 N, 8 5 49 E	56.0	72.6	64.15	48.9	62.0	55.45
5	GRA	6 19 38 N,, 8 5 54 E	37.1	57.9	47.5	29.5	42.3	35.9
6	Water Works Road	6 19 29 N, 8 6 41 E	61.5	82.2	71.85	58.0	70.1	64.05
7	Vanco Junction	6 19 8 N, 8 6 42 E	66.0	104.3	84.65	59.0	98.2	78.6
8	Spirando	6 18 37 N, 8 6 10E	68.5	91.6	80.05	60.0	82.0	71.0

Source: Authors' field work, 2019

3.1. Level of Noise Pollution at Abakaliki Metropolis

The result show that the level of noise pollution in the morning time (9 – 12 noon) were generally higher than the evening (5pm – 7pm). The noise level ranges from 46.85 dB(A) – 80.05 dB(A) in the morning period and 30.6 d B(A) – 78.6 dB(A) in the evening. For instance, the average noise level is Government House Area is 74.15d B(A) in the day time and 63.9 d B(A) in the evening peak. While in democracy estate, it was 46.85 and 30.6d B(A) day and night respectively.

This result showed that there are significant noise generating anthropogenic activities in day time than evening period. The daytime witness high vehicular movement and commercial activities as seen in the study locations. There is presence of intercity and long-distance vehicles, heavy duty trucks, bus terminals, markets and construction sites which are key factors that constitute noise pollution globally. Other causes of noise in the area include music from (entertainment). The lower level of noise recorded in during night peak in all the study areas is attributed the fact that there are less human activities, commercial and vehicular movement is the night. Similarly, most offices and market closes from evening time and people rest within this period.

This findings is agreement with Johuel Birma et al. (2018) who reported that the noise level of Warri and Effurn metropolitan cities are high in day time than evening period. The current findings are also similar to the study of Ibekwe et al. 2016; Oguntunde et al. 2019 and Abulude et al., 2018 who reported higher noise level in residential areas.

The mean level of noise pollution in the residential area were lower than the mixed residential. For instance, the average noise level of noise in democracy estate is 46.85d B(A) for morning and 30.6d B(A) in the evening. While that of GRA is 47.5d B(A) and 35.9d B(A). Morning and night respectively. These values are lower than those recorded in the other six locations (Presco, Government house, kpiri-kpiri, Water walks road, Vanco junction and Spirando) which are mixed residential (with some commercial and entertainment). Presco recorded 78.15d B(A) and 73.05d B(A) in the day and night respectively. While Spriando recorded 80.05d B(A) and 71.0d B(A) day and night respectively. This is justifiable as there are significant factors contributing to noise pollution in the mixed residential area compared to the residential which are basically generators.

3.2. Comparing the Noise Pollution Level at Abakaliki Metropolis and World Health Organization (WHO) Standard

The level of noise pollution in the mixed residential areas (mixed with some commercial and entertainment) is high and unsatisfactory in both morning and evening Peak. The mean noise values

recorded in Presco, government house, kpiri kpiri, water walks road, vanco junction and Spirando ranges from (64.15d B(A) – 80.05d BA) morning and (55.45d BA – 78.6d B(A) evening. These values all fall above the permissible level of WHO (55d B(A)). While the values recorded in residential areas were below WHO permissible level (Table 1, Figure 2)

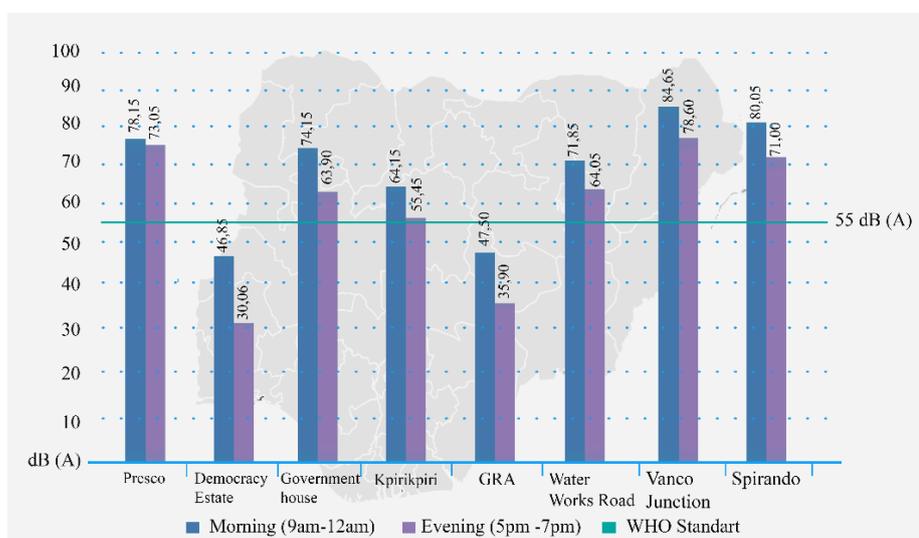


FIGURE 2 - LEVEL OF NOISE POLLUTION AT ABAKALIKI METROPOLIS, NIGERIA AND COMPARISON WITH WHO STANDARDS
Source: Authors work, 2019

This entails that the current level of noise in the mixed residential pose serious health hazard to residents of the area. According to (NIOSH (National Institute for Occupational Safety and Health) 1998; WHO 2000), workers within environment of high noise pollution up to 92 dB (A) must not expend more than 5.2 working hours per day. Conversely, workers and residents in the study area spend within the range of 12.14 hours daily in those areas. This has serious health consequence. The range of average noise level recorded in the same mixed residential areas does not appear to be wholly hazardous. This is because hearing impairment occurs at LA (eq) 8h 75 dB(A) or below is a prolonged case. Nevertheless, the mean value of noise in the areas is still unsatisfactory as such noise level could disturb normal hearing, predispose to psycho physical anomalies such as stress, headache, discomfort (WHO,2000; NIOSH (National Institute for Occupational Safety and Health) 1998). Persistent of high noise level has been reported to increase risk of cardiovascular accidents and systolic blood pressure including interference with brain cortical maturation (Eriksson *et al.*, 2007). This calls for the need to site residential areas and offer institutions such as schools in a serene environment, devoid of noise. This result agrees with the report of Ibekwe *et al.* 2016 and Johuel *et al.*, 2018 but differs from Oguntunde *et al.*, 2019) who noted that the noise pollution level in the area were below WHO permissible level. According to (WHO, 2011), noise pollution causes serious health hazard, and has far reaching consequences such as physical, physiological as well as psychological effects on human beings.

4. CONCLUSIONS AND RECOMMENDATION

The study showed that the level of noise in Abakaliki metropolis differed significantly among the study locations. The noise level in the mixed residential area have exceeded the tolerable recommended values by WHO. This presort a serious public health hazard to residents of the study area. The major effects of noise pollution include interference with communication, sleeplessness, stress, psycho effects and reduced efficiency. Hence there is a need for urgent actions to be taken in order to reduce noise pollution in the area especial in the mixed residential area. The values of noise recorded in the area represents the impact of various human activities on the environment.

It is recommended that the WHO maximum exposure of 8 hours should be strictly adhered. This will ensure good rest at homes after exposure to noise in workplace and offer protection to the inhabitants by providing time of recovery. Public enlightenment campaigns, increased electricity distribution by Electricity distribution and efficient Urban planning is further advocated. In addition, the level of noise pollution in the area should be constantly monitored because of unprecedented growth in population and development witnessed in the city. Finally, regulations and enforcement should be put in place to protect the area from illegal business premises and potential noise generating spots.

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