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RESEARCH ARTICLE

ASSESSMENT OF NOISE POLLUTION AND ITS ASSOCIATED PUBLIC HEALTH IMPLICATIONS AMONG TRADERS IN RELIEF MARKET, OWERRI, NIGERIA

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ABSTRACT

Noise in market places is a matter of public health concern. In this study, a systematic noise survey was conducted at different section of the Relief market, Owerri and a descriptive survey involving 400 traders from the market recruited through a random sampling technique was carried out using structured questionnaires.Chi square test was performed to determine the relationship between knowledge of noise pollution and educational attainment of the traders. Mean noise level at different times of the day showed the Market Park section with the highest mean (89.78 dB (A)) and Rochas Plaza section had the lowest mean (76.3 dB (A)) during the morning period (8-10am) compared to Main Market section with the highest mean readings of 77.88dB (A) and Fruits section and Market Park section with similar lowest mean readings of 60.28dB (A) during the evening period (4-6pm). 95% of the respondents had knowledge of noise pollution with 55% of them stating that market noise was a primary source of noise pollution. 95% of the respondents have been seriously exposed to noise pollution and 75% have suffered from health problems associated with noise pollution. There was a significant influence of educational attainment on the knowledge of noise pollution among the traders ($X2=15.6414$; $p < .05$). The results of the study have strong implication for the enforcement of noise regulations. Awareness campaign among the traders on the health implications of noise pollution as well as enforcement of the use of personal protective equipment among the traders is also recommended.

INTRODUCTION

Noise is one of the most common environmental pollutions often associated with human activities (Mackenzie and David, 2008) such as industrial, commercial, institutional and recreational activities. Noise pollution constitutes environmental hazards and poses a threat to public health and the environment. It is rated among the most hazardous form of pollutions in many metropolitan cities of the world after air and water pollution (World Health Organization, 2005). Noise has been broadly categorized into residential, commercial and industrial type and regulated according to World Health Organization (1999). Commercial noise is generated from business environments such as shops and market places, industrial noise are generated within industrial environment through the use of equipment and machineries while residential noise also known as domestic noise is generated from homes (Agbalagba *et al.,* 2013)

Commercial activities in market places in developing countries are associated with a lot of health and environmental issues including noise pollution. Noise in market places can be a matter of public health concern especially for merchants engaged in commercial activities within market places and residents. Noise emanating from market places is considered as commercial noise and capable of affecting the general public. Prolonged exposure to excessive noise has the ability to cause adverse health effects (physiological, psychological and hearing loss) in humans (Ugbegbor and Rapheal-Yorkor, 2015). Auditory noise effects include hearing impairment and other effects such as noise induced hearing loss (Talbott and Thompson, 1995) Psychological effects of noise include cardiovascular disorder, hypertension, sleep disturbance, and annoyance (Ibekwe *et al*., 2016). Individual's responses or reactions to noise are influenced by the susceptibility levels of the individual to sound level, frequency, duration of exposure and previous experience (Ugbegbor *et al.,* 2017)

The present study aimed to access noise levels in the Relief Market in Owerri, ImoState, Nigeria; and its potential impacts on public health. There is no sufficient information on noise pollution in market places in metropolitan city of Owerri. It is based on this fact that this study was carried out at the popular Reliefmarket in Owerri city in order to assess noise levels

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within the market area and its public health implications on the traders who carried out commercial activities therein.

MATERIALS AND METHODS

Study Location

This study is carried out at Relief market in Owerri capital city of Imo state. It is within longitude 7.035^{o} E and latitude 5.485^{o} N. It shares boundaries with Dan Anyiam Stadium Sport Complex by the North, Egbu Road by the South, and Chukwuma Nwoha by the East. It has different sections such as the RochasPlaza, Ngor Okpala House, Main Market, Market Park, Fruits Section, Tomato Market, Slaughter, and Car Wash. All Workers Microfinance Bank Nigeria Limited is a notable microfinance bank situated in the market. The daily market, attracts merchants from different parts of Imo State and beyond. The chaotic traffic jam the market causes constitute nuisance to free flow of traffic along Road. The location of the market has also put the lives of merchants at risk of noise pollution.

Study Population and Design

The study which was carried out between March and May 2018 utilized a descriptive study design. The respondents were traders operating at the market during the period of the study. Sampling size was calculated using the Cochrane's formula and sample of 400 was obtained.

Sampling Method

Field measurements of the noise level at different sections of the relief market was conducted on the 2nd of March, 2018. A systematic monitoring of noise levels was conducted at selected sections with the study area. Noise monitoring was carried out at 5 different locations within the 8 selected sections using a factory calibrated TECPEL model 330 series sound level meter (SLM) set at the slow response mode with A weighted dB (A);which gave instant real time readings according to regulatory noise measurement standards. Measurement of noise levels were carried out at specific times in the morning(8-10am), afternoon (12-2pm) and evening (4-6pm). A total of 152 data sets were obtained for the study. A hand held battery-powered factory calibrated global positioning system (GPS) was used to determine the geographic coordinates of the selected sections of the market.
Questionnaires were used to ascertain the knowledge of noise pollution and its sources; as well as its public health implications from the traders at the market. It was administered with the aid of two research assistants. In cases where a respondent was unable to fill the questionnaire due to low literacy, the questions were translated to the local language and answers were recorded as given. A total of 400 traders(respondents) were interviewed.

Statistical Analysis

Data was analyzed using the statistical package for social science (SPSS) version 20.0

Informed Consent

The study received ethical approval from the DEPARTMENT OF PUBLIC HEALTH, FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI. Consent was received from the market leaders of RELIEF MARKET before the study was carried out. Informed consent was also obtained from each participant prior to the interview.

Table 1 Assessment of Noise Pollution of Relief Market, Owerri

Source of Noise Pollution	Time	L1	L2	L3	L4	L5	Mean
Rochas plaza	8-10am	73.3	74.5	75.1	79.3	79.3	76.3
N05^{0}28.897	12-2pm	79.5	79.6	85.0	85.0	86.6	83.14
E007^{0}02.674'	4-6pm	57.2	65.7	67.0	65.2	58.0	62.62
Elevation: 224.ft	**Av.mean**						**74.02**
Ngor-Okpala house	8-10am	89.1	85.9	85.9	78.6	85.2	84.94
N05^{0}28.889	12-2pm	87.2	87.2	98.6	91.4	90.8	91.04
E007^{0}02.722'	4-6pm	65.2	69.2	70.3	71.4	75.1	70.24
Elevation: 224.ft	**Av.mean**						**82.07**
Main market entrance	8-10am	74.8	76.6	78.0	84.6	84.6	79.72
N05^{0}28.815	12-2pm	83.8	85.5	87.1	87.6	98.9	88.57
E007^{0}02.738'	4-6pm	80.7	75.4	78.0	75.2	80.1	77.88
Elevation: 231.ft	**Av.mean**						**82.06**
Fruits section	8-10am	83.5	86.4	87.2	85.9	86.0	85.8
N05^{0}28.799	12-2pm	84.3	84.3	85.3	89.0	89.0	88.38
E007^{0}02.7326'	4-6pm	65.7	54.2	57.0	64.4	60.1	60.28
Elevation: 24.3ft	**Av.mean**						**78.15**
Slaughter section	8-10am	85.2	83.3	85.9	86.5	88.0	85.78
N05^{0}28.865'	12-2pm	98.4	99.3	101.1	106.7	106.7	102.44
E007^{0}02.929'	4-6pm	68.4	79.3	82.4	70.1	66.1	73.26
Elevation: 224.ft	**Av.mean**						**87.16**
Market park	8-10am	74.8	86.7	94.8	96.5	96.1	89.78
N05^{0}28.793'	12-2pm	84.3	84.3	85.3	89.0	89.0	86.38
E007^{0}02.768'	4-6pm	65.7	54.2	57.0	64.4	60.1	60.28
Elevation: 224.ft	**Av.mean**						**78.81**
Car wash section	8-10am	78.4	80.4	84.3	79.0	81.6	80.74
N05^{0}28.891'	12-2pm	77.0	79.5	79.5	78.0	80.2	78.84
E007^{0}02.928'	4-6pm	68.6	62.8	64.1	66.4	65.3	65.44
Elevation: 2216. 4ft	**Av.mean**						**75.01**
All workers	8-10am	88.6	88.6	88.7	88.7	84.4	88.56
microfianance bank of	12-2pm	77.2	78.6	83.3	83.4	79.5	79.78
Nigeria Limited	4-6pm	67.3	76.8	66.6	66.6	68.3	68.66
N05^{0}28.746'							
E007^{0}02.757'	**Av.mean**						**79.00**
Elevation: 266.9ft							

L= Locations of source at different time

Table 2 Knowledge of noise pollution and exposure levels among the respondents

Variables	Frequency	Percentage
Know about noise pollution		
Yes	380	95.0
No	20	5.0
Total	400	100.0
If yes, source(s) of noise pollution		
Road traffic noise	30	7.9
Industrial noise	10	2.6
Aircraft noise	20	5.2
Market noise	220	57.9
Church noise	50	13.2
Conferences or ceremonies	50	13.2
Total	380	100.0
Seriously exposed to noise pollution		
Yes	370	97.4
No	10	2.6
Total	380	100.0
Duration of exposure (daily)		
Less 1 hour	10	2.6
1-2 hours	50	13.2
3- 4 hours	210	55.3
More than 5 hours	110	28.9
Total	380	100.0

Think long exposure to noise has health effect		
Yes	**350**	**92.1**
No	30	7.9
Total	380	100.0

Table 3 Public Health Implications of Noise Pollution

Variables	Frequency	Percentage
Have suffer any health problem associated with noise pollution		
Yes	300	75.0
No	100	25.0
Total	400	100.0
If yes, kind of health problem associated with noise pollution		
Hypertension	60	20.0
Hearing loss (deafness)	40	13.3
Sleep disturbances	80	26.6
Dementia	20	6.6
Psychological dysfunctions (noise annoyance)	100	33.3
Total	300	100.0
Noise pollution results to economic lost to society		
Yes	280	70.0
No	20	5.0
Not sure	100	25.0
Total	400	100.0
If yes, how does it occur?		
It accounts to low productivity losses	80	28.6
It accounts to sick leave variations	150	53.5
It accounts to noise reducing equipment costs	50	17.9
Total	280	100.0

Table 4 Relationship between Knowledge of Noise Pollution and Age of the respondents using Chi Square Test.

		Knowledge of Noise Pollution		Total
		Yes	No	
Age of respondents	≤20 years	7	3	10
	20-30 years	118	2	120
	31-40 years	165	5	170
	41-50 years	78	2	80
	51-60 years	11	4	15
	> 60 years	1	4	5
Total		380	20	400
Chi square (X^2) test = 92.5697; p-value < .00001*				

DF = 5 * **p-value** significant at < .05

Table 5 Relationship between Knowledge of Noise Pollution and Educational Attainment of the Respondentsusing Chi Square Test.

		Knowledge of noise pollution		Total
		Yes	No	
Educational Attainment	No Education	20	5	30
	Primary Education	122	8	130
	Secondary Education	178	7	180
	Tertiary Education	60	0	60
	Total	380	20	400
Chi square (X^2) test = 15.6414; p-value =.0013*				

DF = 3 * **p-value** significant at < .05

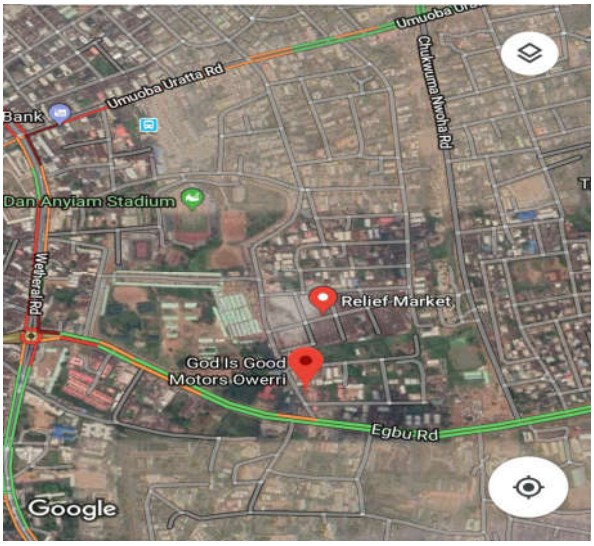

Figure 1 Map of Relief Market, Owerri Imo State, Nigeria **(source: Google maps)**

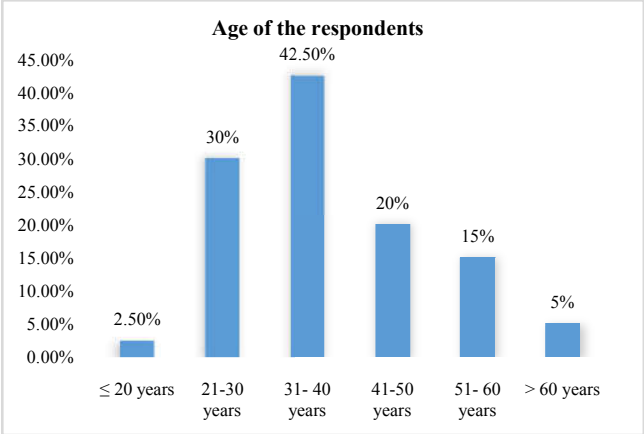

Figure 2 Age of the respondents

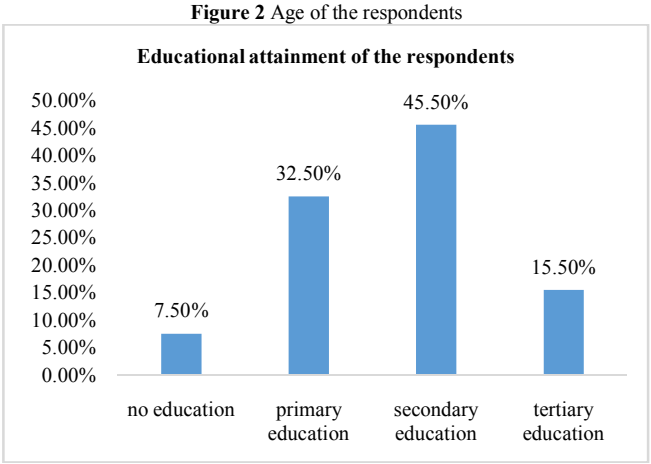

Figure 3 Educational Attainment of the Respondents

RESULTS

Assessment of noise levels at the relief market is represented in Table 1. Noise level measured during the study field monitoring of selected sections of the relief market showed the slaughter section had the highest average mean noise level recordings 87.16 dB(A) compared to Rochas Plaza which had the least recording 74.02. Mean noise level at the different times of the

day showed Market Park section with the highest mean (89.78) and Rochas Plaza had the lowest mean (76.3) during the morning period. Afternoon period noise monitoring has the Slaughter House with highest mean noise level (102.44) and Car Wash section (78.84) with the lowest mean. Evening period had the Main Market section with the highest mean (77.88) and Fruit section and Market Park section with similar lowest mean (60.28) all in dB (A).

A total of 400 traders were interviewed. The highest age range was 31-40 years (42.5%) and least age range was more than 60 years (1.2%). Majority of the respondents were males. Secondary education was the highest educational attainment of the respondents and majority of the respondents of the respondents were Christians (85%), with Islamism at 2.5%. Knowledge of noise pollution and exposure levels among the respondents was represented in Table 2. The public health implication of noise pollution was represented in Table 3 and 26.6% of the respondents reported sleep disturbance, hypertension (20%) and noise annoyance (33.3%) as health problems associated with noise pollution. 70% affirmed that noise pollution results to economic lost to the society; and of the 70%, 53.5% affirmed it account to sick leave variations and 28.6% affirmed it account to low productivity losses. Chi square test results for relationship between knowledge of noise pollution and age and educational attainment of the respondents was represented in TABLE 4 and 5 respectively. The results showed a significant influence of educational attainment and age of the respondents on the knowledge of noise pollution (results were significant at p-value < .05).

DISCUSSION

Noise level measured during the study field monitoring at selected sections of the RELIEF MARKET were generally high and potentially hazardous to human health. In this study, the sections monitored had mean average noise levels based of different times of the day and location exceeding the recommended guidelines of the world health organization on noise levels in industrial and commercial settings of 70 dB (A) with slaughter section showing the highest average mean noise level reading of 87.16 dB (A) and the Rochas PLAZA having the least readings of 74.02 dB (A) as compared to other sections. Similar results have been obtained from Ugbebor *et al*., (2017) and Aniefiok (2018) on studies on the evaluation of noise levels in selected markets in south-southern Nigeria.

Noise levels were higher during the morning and afternoon periods when compared to evening periods (Table 1). Similar results have been recorded by Aniefiok (2018) and this was attributed to the fact that commercial activities are always at its peak in the morning and afternoons as the vendors and buyers want to sell out or buy commodities at the early hours of the day thus leading to high level of noise at these hours. The noise levels recorded in this study is not healthy for traders as buying and selling have become a profession to them and they may be into the business of trading for a very long period making prolonged exposure unhealthy (Aniefiok, 2018).

In this study, male traders outnumbered the female traders and this finding can be attributed to the fact that men are breadwinners of the family especially in the African family settings and thus tend to engage in activities and jobs to period with provide and fend for their families. Majority of the traders were 31-40 years old (Figure 1). Secondary education was the highest educational attainment of the respondents (Figure 2) and similar results have been reported by Ihuoma *et al.,* (2019) on studies on poultry farm workers in Owerri SENATORIAL ZONE, Nigeria. Persons in the informal sectors tend to pause/stop in educational attainment at the secondary school level.

95% of the respondents affirmed their knowledge of noise pollution with 55% stating market noise as a primary source of noise pollution. Ugbebor *et al*., (2017) and Ibekwe *et al.,* (2016) pointed out that mobile sellers (music record sellers, herbal medicine sellers, telecom equipment sellers) use megaphone to advertised and announce their products. Loud shout sound from traders, manual loading of commercial vehicle, car horns and sirens, grinding machines and generators all contribute to the high intensity noise which emanates from the market. Also, 95% of the respondents affirmed to being seriously exposed to noise pollution; with 27% of these respondents being exposure for durations exceeding 5 hours. According to Ibekwe *et al.,* (2016), exposure levels of more than 5 hours to high intensity noise can lead to ear infections and consequently hearing loss as well as vasoconstriction, annoyance, hypertension and even cardiovascular diseases (Ugbebor *et al.,* 2017).

Noise pollution has public health implications (Aniefiok, 2018). Among the respondents, 75% affirmed to have suffered from health problems associated with noise pollution Of the 75%, 33% affirmed to psychological dysfunctions; 26% had sleep disturbance, 20% had resulting hypertension and 13.3% affirmed to having suffered from hearing loss due to noise pollution. Majority of the respondents affirmed that noise pollution results to economic loss to the society with 53% of the respondents stating it accounts for sick leaves and 28% affirming it accounts for low productivity losses among individuals and businesses. There was a significant influence of age of traders and education of traders on the knowledge of noise pollution respectively.

CONCLUSION AND RECOMMENDATION

The competitive nature of activities among traders in the relief market, Owerri Nigeria is known to generate high intensity noise. Noise is known as a key factor in attracting and drawing customers' attention at market places as is seen through ringing of bells, use of megaphones and shouting. Thus, results of this study showed that high noise levels prevailed at the relief market exceeding recommended standards. Traders are exposed to increased health risk of noise pollution and noise at marketplaces tend to be unavoidable. Thus, noise regulations should be enforced by the state and local government health departments. Awareness and assessments campaigns on the health effects of noise among traders should be carried out by environment health officers at the state and local government levels. Traders should be encourage on the use of personal protective equipment (ear plugs) during their stay at the marketplace. According to Akpan *et al.,* (2012) to emotional, physical, mental, psychological and social well-being which are the dimensional concept of quality of life as perceived by individuals, gives one a reason to look at the health consequences of noise and ways to limit them. Supply of

constant electricity will also reduce/eliminate the use of generators and creation of by-pass roads will reduce traffic jams around the market place.

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