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Assessment of Noise Level in Trans-Amadi Market in Rivers State

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Abstract

Noise level at Trans-Amadi market in Obio/Akpor Local Government Area of Rivers State was assessed. The aim of the study was to investigate the level of noise traders and buyers are exposed to at the market. The noise level measurement was conducted for three weeks at four different stations, from 9am to 7pm daily. A sound level meter placed at a height of 1.2 m was used to get the A-weighted noise level at the selected locations with readings taken at 2 hours' intervals. Noise indices such as peak noise level (L_{10}), background noise level (L_{90}), equivalent noise level (L_{eq})and noise pollution level (L_{NP}) were calculated, and values gotten were compared with regulatory standards. The average L_{10}, L_{90}, L_{eq} and L_{NP} values ranged from 87.93 dBA to 92.41 dBA, 78.73 dBA to 88.54 dBA, 85.23 dBA to 91.47 dBA and 94.28 dBA to 100.16 dBA, respectively. The calculated noise indices were all above the recommended 65 dBA for commercial areas. Therefore, it was concluded that Trans-Amadi market generates noise levels that are consistently loud and can cause auditory and health damage to traders and buyers.

Keywords: *Market noise, Noise indices, Hearing damage*

1. Introduction

Noise is a growing hazard that could result to health damage if left unchecked (Sincero and Sincero, 2006; Kiely, 2007). According to Medupin and Ekop (2010), noise is an unwanted sound that disrupts the activities of balance of human and animal life. It is an unwanted sound dumped into the environment without regard for the adverse effect it may have. Noise emanates from different activities carried out daily by individuals and organizations. Sources of noise can be formal such as manufacturing industries, informal such as generators, metal works and vehicles repairs, and non-occupational such as leisure activities, video clubs and religious activities. Noise sources can further be categorised as domestic source such as movement of utensils, radio, and television, natural source such as sound of animals, and commercial source such as markets, trade centres and roadsides selling.

In comparison to other pollutants, the control of noise has been hampered by insufficient knowledge of its effects on human and lack of defined criteria. In Nigeria, there is no legal framework upon which noise pollution can be abated. The Federal Environmental Protection Agency (FEPA) only provided daily noise exposure limits for workers in industry such as 90 dBA for 8h exposure. However, because it is now well established that noise is a potential hazard to health, communication and enjoyment of social life (Olayinka, 2013), there is need for abatement plans for noise generation areas.

In this study, consideration is given to the problem of noise generation in the market.

Markets in Nigeria are known to be busy and noisy. Asides from buyers and sellers communicating, a typical Nigerian market consists of wheel barrow pushers, hawkers, grinding machines, abattoirs, etc. Surrounding the market could also be a motor park, a busy road with relatively high traffic density, small commercial music stores, etc. These components make the Nigerian market very noisy.

Market noise contributes significantly to community noise, yet only few studies have been done on assessment of market noise since it usually goes unnoticed (Anomohanran, 2013; Olayinka, 2013; Akinkuade and Fasae, 2015; Jibiri et al., 2015). These studies revealed that the equivalent noise levels of market areas are usually higher than the recommended value of 65 dBA. Hence, it was suggested that people should not spend more than four hours per day in busy markets. Also, it was recommended that those whose major sources of income involve selling in busy markets could consider the use of ear protective devices. Furthermore, it was advised that those whose daily activities confine them to such unhealthy noise level areas should make sure they have at least ten hours of daily recovery time in areas where the sound level is less than 65 dBA.

Generally, noise pollution has adverse effect on human health. Depending on its decibel value and duration, the effects of noise on human health are divided into four categories, namely 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 effects on work performance, such as reduction of productivity and misunderstanding of information (Olayinka, 2013).Steady exposure to noise of more than 80dBA can have harmful physiological effects (Tripathy, 2008; Medupin and Ekop, 2010; Akinkuade and Fasae, 2015). Elevated noise level can cause changes in the immune system, birth defects, hearing impairment, hypertension, heart disease, annoyance, sleep disturbance, and stimulate aggression and other anti-social behaviours (Kryter, 1994; Passchier-Vermeer and Passchier, 2000). Noise can result in an increased risk of depression and psychological disorders, migraines, and even emotional stress (Niemann, 2006).Noise has been linked to stresses and health related stroke and heart attack. In addition, noise can interfere with communication and reduce concentration (Kiely, 2007; Jibiri et al., 2015).

Daily, hundreds of people, depending on the market size, visit a market in search of an item or more. Accordingly, they are exposed to noise which can be annoying and can create a measure of discomfort and health issues to the receptors. Hence, a study of market noise will help determine the noise level the receptors are exposed to daily. This will create awareness to the government on the need to monitor the noise levels in markets through good legislations.

The aim of this study was to investigate the level of noise people are exposed to as they visit the Trans-Amadi market. To achieve this, the various sources of noise in Trans-Amadi market were identified and the noise level measured using a sound level meter. From the measured noise level, relevant noise indices were calculated. Both the noise level and the calculated noise indices were compared with available regulatory standards.

2. Materials and methods

2.1.Study area

The study was carried out at Trans-Amadi market in Obio/Akpor Local Government Area, Port Harcourt, Rivers

State (Fig. 1). Four stations (S1, S2, S3 and S4) around the market were chosen for measurements with coordinates of 7°02'44"E and 4°48'48"N, 7°02'43"Eand 4°48'51"N, 7°02'41"Eand 4°48'49"N, and 7°02'38"Eand 4°48'50"N, respectively. Trans-Amadi market is one of the busiest markets in Port Harcourt. The market is located at a very strategic position. It is close to the Trans-Amadi round-about with four roads, thus making it a very busy area. The market was chosen because it is frequently visited by residents of Port Harcourt. This is because meats and foodstuff are gotten at a cheaper rate in this market compared with others.

Fig.1 Map of Trans-Amadi market.

2.2. Noise level measurement

The noise level in Trans-Amadi market was measured using a sound level meter. The basic parts of the sound level meter include a microphone, an amplifier and a digital display, showing readings in decibels. Other details describing the sound level meter include IEC 61672 002 CLASS 2, IEC 60651 1979 TYPE 2 and ANSI 51.4 1983 TYPE 2. A News way GPS was used to determine the coordinates of the chosen sampling stations.

The measurement of noise levels was done for three (3) weeks. Sampling was carried out from 9am to 7pm for each day to cover the daily period spent by traders at the market. Data recording was done every 2 hours. The sound level meter was placed at approximately 1.2m above ground level. Four (4) stations within the market area with the likelihood of maximum noise nuisances were chosen for sampling as follows: S1 (the entrance to the market along the Woji road with coordinates of 7°02'44"E and 4°48'48"N); S2 (the abattoir of the market with coordinates of 7°02'43"Eand 4°48'51"N); S3 (the centre of the market with coordinates of 7°02'41"Eand 4°48'49"N); and S4 (the entrance to the market along Trans-Amadi road with coordinates of 7°02'38"Eand 4°48'50"N).

2.3. Estimation of noise indices

Noise indices such as equivalent noise level, noise pollution level and statistical percentile levels were used to analyse the field data. The equivalent noise level(L_{eq}), defined as the average rate at which energy is received by the human ear

during a specified period, was calculated using Equation (1)

$$L_{eq} = 10 \log_{10}\left[\frac{1}{T}\sum_{i=1}^{n} 10^{0.1L_i} t_i\right] (1)$$

where T is the period over which L_{eq} is determined, n is the number of samples, L_i is the noise level at the i^{th} sample and t_i is the fraction of total time. The noise pollution level (L_{NP}) which is used to adequately describe the degree of annoyance caused by noise was calculated using Equation (2).

$L_{NP} = L_{eq} + k\sigma$ (2) where k is a constant usually taken as 2.56 and σ is the standard deviation of noise levels. The statistical percentile levels($L_{10}$and L_{90}) indicate how frequently particular noise level was exceeded for 10% and 90% of the time. L_{10} is also called the maximum noise level while L_{90} is also known as the background noise level. A graphical method (Probability curve) was employed to estimate$L_{10}$and L_{90}. The Hazen formula, Equation (3), was used to estimate the probability of exceedance (Percentile) which was plotted against noise level to obtain the Probability curve from which $L_{10}$and L_{90}were estimated.

$$P = \frac{2m-1}{2n} * 100 \quad (3)$$

where P is the percentile, m is the rank of noise level and n is the number of samples.

3. Results and discussion

3.1. Noise measurements

Table 1 shows the result of noise level measurement from the four stations of Trans-Amadi market. The noise level at Station 1 ranged 76.4 - 93.9 dBA with a mean value of 84.1±3.86 dBA, Station 2 ranged 86.9 - 93.7dBA with a mean value of 90.4±2.07 dBA, Station 3 ranged 74.0-93.9 dBA with a mean value of 87.8±4.76 dBA, and Station 4 ranged 75.2 - 89.2 dBA with a mean of 83.2±3.62 dBA. Generally, the recorded average noise level at the Trans-Amadi market was in the order of Station 2 > Station 3 > Station 1 > Station 4. Station 2 which recorded the highest average noise level of 90.4 dBA is by the abattoir section of the market. The major sources of noise at this station include the sharpening and clinking of knives in preparation to slaughter animals, men shouting during slaughtering process, and chants of victory after each animal has been slaughtered. According to Agarwal (2005), exposure to this noise level for more than 8 hours per day could result in hearing damage. The second to the highest average noise level of 87.8 dBA was recorded at Station 3, the centre of the market. The reason for the loud noise level in this station is the use of loudspeakers by traders to market their products, and the use of generators as well as electric grinders. Stations 1 and 4, the entrance to the market along Woji and Trans-Amadi roads respectively, had lower average noise levels of 84.1 dBA and 83.2 dBA, respectively. The sources of noise at these stations are mainly conversation between friends as well as bargaining of product price between buyers and sellers. The average noise level at Stations 3, 1 and 4 is above 80 dBA and hence according to Agarwal (2005) could cause annoyance. Only shouted speeches could be understood in such environment, and no more than 16 hours per day exposure time is recommended. According to Tripathy (2008), the maximum recommended noise level for commercial areas is 65 dBA, hence, the Trans-Amadi market is noisy and the implication on traders who are exposed to the noise on a daily basis is that

it can lead to annoyance and hearing damage.

Table 1 Noise levels at selected stations of Trans-Amadi market for different weeks

Time of Day	S1 Noise Level (dBA)			S2 Noise Level (dBA)			S3 Noise Level (dBA)			S4 Noise Level (dBA)		
	Wk1	Wk2	Wk3	Wk1	Wk2	Wk3	Wk1	Wk2	Wk3	Wk1	Wk2	Wk3
09:00	83.0	82.5	85.2	90.9	89.2	90.8	87.5	89.9	90.5	79.2	84.6	89.2
11:00	85.9	81.9	85.7	89.0	90.8	93.7	81.6	90.5	88.6	84.8	87.3	85.6
13:00	76.4	85.7	86.7	86.9	91.8	92.4	74.0	91.6	85.8	75.2	84.0	81.0
15:00	84.4	93.9	82.7	87.4	87.7	91.2	88.9	87.5	83.6	88.1	79.6	80.7
17:00	86.7	77.8	83.8	87.2	91.9	91.8	93.9	89.7	86.3	79.4	82.2	82.8
19:00	87.6	81.4	81.9	91.8	90.1	92.9	91.2	93.9	85.2	82.6	85.2	86.6

3.2. Noise indices

Figure 2 shows the average noise indices estimated for the selected four stations of Trans-Amadi market. L_{90} which is the background noise was in the order of Station 2 > Station 3 > Station 1 > Station 4. Station 2 with the highest average L_{90} of 88.54 dBA has a maximum value of 90.84 dBA and a minimum value of 86.93 dBA. Station 4 with the least average L_{90} of 78.73 dBA has a maximum value of 80.73 dBA and a minimum value of 75.60 dBA. L_{10} which is the peak noise was in the order of Station 3 > Station 2 > Station 1 > Station 4. Station 3 has the highest average peak noise value of 92.54 dBA, a maximum value of 93.67dBA and a minimum value of 90.31dBA. Station 4 has the lowest average value of 87.93 dBA with maximum and minimum values of 88.94dBA and 87.09dBA, respectively. Generally, all the stations have $L_{90}$and L_{10}values greater than the permissible value of 65 dBA which can lead to annoyance and hearing damage.

L_{eq} was in the order of Station 2 > Station 3 > Station 1 > Station 4. Station 2 recorded the highest L_{eq} value of 91.47 dBA while Station 4 recorded the lowest value of 85.23 dBA. This means that for the period of time the sampling was done, the fluctuating noise observed at Stations 2 and 4 can be represented as a continuous noise source generating 91.47 dBA and 85.23 dBA, respectively for 10 hours. This is greater than the recommended 65 dBA for commercial area in day time (Tripathy, 2008), and according to Agarwal (2005) could cause annoyance and even hearing damage if exposed to for 8 hours.

The noise pollution level (L_{NP}) has a maximum value of 100.16 dBA at Station 3. This is because the difference between the peak noise and the background noise at Station 3 is large compared with other stations, indicating a wider range of fluctuation hence a higher noise pollution level. A minimum L_{NP} of 94.26 dBA was observed at Station 4, indicating a lower peak noise and smaller range of fluctuation. Generally, L_{NP} at Trans-Amadi market was in the order of Station 3 > Station 1 > Station 2 > Station 4. According to Agarwal (2005), these values are classed as very annoying. Hence, Trans-Amadi market produces noise levels that are generally very annoying and can cause hearing damage to receptors if exposed to for a protracted time.

Figure 3 presents the estimated overall average noise indices atTrans-Amadi market. The overall average background noise level at the market was

estimated as 82.11 dBA while the overall average peak noise level was calculated as 90.49 dBA. Both noise levels are greater than the permissible value of 65 dBA, implying that the market noise level can be harmful to buyers and sellers, and only shouted speeches can be understood. The overall average equivalent continuous noise level at the market was projected as 88.32 dBA which is greater than there commended 65 dBA for commercial area in day time, hence can cause annoyance. The overall noise pollution level at the market was predicted as 96.57 dBA which according to Agarwal (2005) can cause great annoyance, and according to Tripathy (2008) can cause hearing damage if exposed to for more than 2 hours.

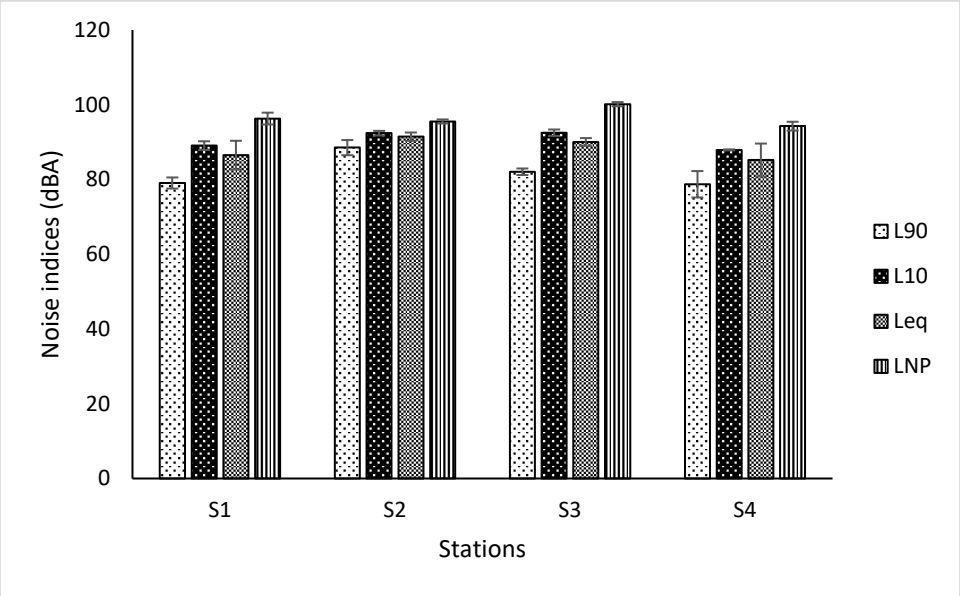

Fig. 2 Average values of noise indices at the selected stations of Trans-Amadi market

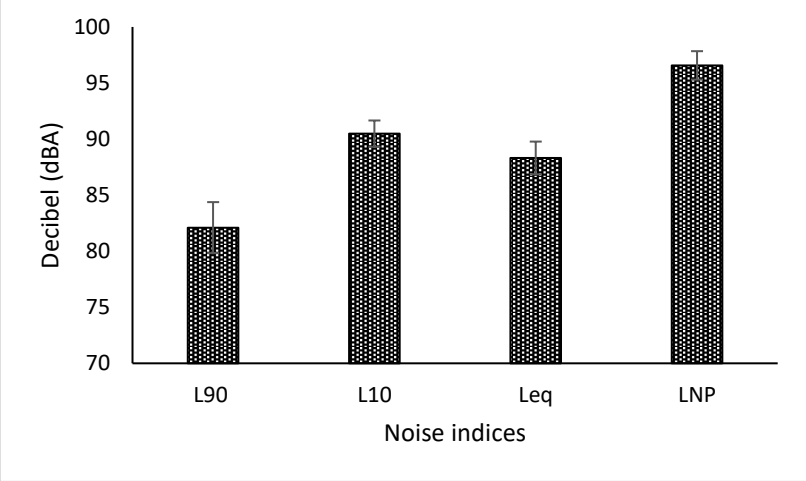

Fig. 3 Overall average values of noise indices at Trans-Amadi market

4. Conclusions

The assessment of noise level at Trans-Amadi market has been carried out. The results obtained revealed that the background noise (L_{10}) values ranged from 87.93 dBA to 92.41 dBA, indicating that

10% of time spent at the market receptors are exposed to a noise level of at least 87.93 dBA which can cause auditory shock. Also, the peak noise levels (L_{90}) have a maximum value of 88.54 dBA and a minimum value of 78.73 dBA, implying that 90% of time spent at the market receptors will be exposed to a noise level of at least 78.73 dBA which is loud. The equivalent noise level (L_{eq}) ranged from 85.23 dBA to 91.47 dBA, signifying that the equivalent noise level over the 10 hours sampling time is 85.25 dBA on the minimum. This infers that the receptors at the market will be annoyed. The noise pollution level (L_{NP}) ranged from 94.28 dBA to 100.16 dBA, denoting the possibility of high degree of annoyance to receptors at the market. Overall, this study revealed that Trans-Amadi market generates noise levels that are consistently loud and damaging to receptors. Therefore, it is recommended that the use of loud speakers to market products should be discouraged, and grinding machines and generators should be isolated and enclosed in noise proof stores to reduce the noise level and make the market place less annoying and damaging to buyers and sellers.

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