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ASSESSMENT OF ENVIRONMENTAL NOISE IN SOME SELECTED AREAS OF JALINGO, TARABA STATE NIGERIA

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Abstract

Jalingo the capital city of Taraba State has experienced rapid development and high influx of people with the implication of increased generation of noise, hence the need to evaluate the noise pollution level of the city. Measurement of equivalent noise level was carried out in 19 locations within the city using a sound level meter. Results showed that the day time mean equivalent noise level of the city ranges from 72.2 dBA to 98.7 dBA. And the night time mean equivalent noise level of the city is of good quality as it ranges from 48.2 dBA to 58.7 dBA. The night time therefore serves as a recovery time for those who are exposed to high noise level during the day. Results also showed that Timber Shade has the highest day-night noise value of 96.7 dBA while Yelwa market has a value of 70.2 dBA. The study showed that about 95% of the 19 locations has unsatisfactory day time noise levels due to various forms of activities, the 19 locations have either good quality or satisfactory night time noise levels owing to the fact that most business and industrial activities close by evening which significantly reduces the noise level.It is therefore recommended that those whose jobs and businesses places them at areas with unhealthy noise level should use protective covering such as ear mugs to shield themselves from the harmful exposure to noise, because working under noisy environment can profoundly affect a person's health and ability to perform well.

***Keywords*:** Noise pollution, Human Health, Traffic Noise, Equivalent noise level anddB Scale.

Introduction

Environmental noise is any unwanted and harmful outdoor sound created by Human activities that adversely affect the normal state of people. Noise means wrong sound in the wrong place at the wrong time [1]. Sound is usually measured in decibel. Decibel is the standard of measurement for sound of which whisper measures 20dB while a noise in a quiet office measures 40dB, the normal conversation measures 60dB and a sound level greater than 80 dB is noise [2]. Noise polluted environments can be as a result of vehicle traffic, factory activities and construction around neighborhoods these can be frustrating and disturbing resulting into stress and annoyance. The World Health Organization (WHO) has identified noise pollution as a risk factor for poor health and one of the most important types of environmental pollution in large cities [3]. Generators, heavy industry machines and vehicular traffic are the main reason why most Nigerian cities experience noise pollution [4]

Many studies have assessed the effects of noise pollution in several areas. According to these studies, there is a detrimental effect on increasing exposure to noise from different sources, a study conducted in Ekiti State, Nigeria showed that noise can cause stress, anxiety, sleep disturbance, annoyance and hearing impairment [5]. The most important measurement of noise is its loudness; this loudness depends on the physical sound pressure that is measured on the sensitivity of the human ear to it while the sensitivity of the human ear depends on the frequency of the sound. Hearing losses are the most common effects of noise pollution [6]. There is a significant correlation between noise and stress in the environment to the extent that noise pollution is seen as hazard due to sound; its consequence in modern day development is immeasurable. Noise cause disruption in environmental tranquility and adversely affect both human health and the climate. Electrical power generating systems, pressure and noise from vehicular traffic, noise from industries, heavy machinery and construction sites are common pollution sources that has direct bearing to climate change. An environment that is comfortable has less distraction and annoyance for tasks to be carried out without hindrance physically or mentally [7].

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Among the very many hazards being experienced by urban areas, pollution as a result of noise is of significantly high level and may impact the society with high cost[8]. Due to increase in mechanization in developing nations, large volume of complex machinery and increased production, noise is an increasing source of danger and discomfort. Although environmental noise is not yet fully accepted as a cardiovascular risk factor [9], public health authorities and organizations are alarmed by the striking emerging evidence for the adverse cardiovascular effects of environmental noise exposure. The European Network on Noise and Health (ENNAH project) funded by the European Union's Seventh Framework Program highlighted in the final report the alarming epidemiological evidence for an increased incidence of cardiovascular diseases (CVD) due to environmental noise exposure [10]. The ''cardiovascular burden'' of noise is substantial in Europe, reflected by 900,000 cases of hypertension, 43,000 hospital admissions, and more than 10,000 premature deaths per year related to coronary heart disease and stroke, all related to noise-triggered adverse effects [11]. Recent research has shown that transportation noise exposure may lead to obesity and increase risk for type 2 diabetes mellitus [12,13,14]. The suggested mechanisms include an effect of noise-induced stress and disturbance of sleep on appetite regulation, alterations in the glucose regulation, decreased levels of insulin, and reduced insulin sensitivity [15, 16, 17]. Although, induction of oxidative stress is regarded as a critical factor in the pathogenesis of diabetes mellitus, and in light of the emerging evidence on noise and oxidative stress [18, 19], it is most likely that oxidative stress also contributes in the pathway between noise and diabetes. Few studies have also investigated the relationship between noise and the incidence of cancer. Since recent findings imply that exposure to noise potentially causes oxidative stress [19], this makes investigations of the effect of noise on the risk of cancer very pertinent. Currently, some studies have addressed the connection between noise and cancer in a Danish cohort of 30,000 women and 27,000 men [20, 21]. Exposure to noise from road and railway traffic showed a noticeable association with risk for estrogen receptor-negative breast cancer [22].

Study Area and Locations

The study was conducted at 19 locations within Jalingo city the capital of Taraba State, Nigeria in September, 2018. The study area is located at latitude 8º89"29' N and longitude 11º37"71' E and it is situated at an elevation of 384 meters above sea level. The table below shows the locations where the noise level data was acquired.

Table 1: Locations of the Study Area

S/No.	**Location**
1	Yelwa Market
2	T-Junction
3	Main Market
4	Hammaruwa Roundabout
5	Salejo Complex
6	Michelin Roundabout
7	Mayo Gwoi Market
8	Timber Shade
9	Abuja Phase II Junction
10	FGGC Traffic Junction
11	Kofai Market
12	ATC Roundabout
13	Doruwa Market
14	Jankada Traffic Junction
15	ATC Market
16	Roadblock Roundabout
17	Jalingo Motor Park
18	Mile Six Market
19	Nukkai Market

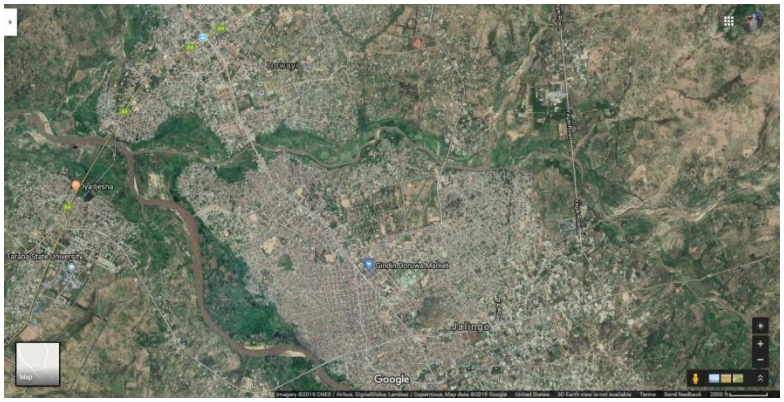

Fig. 1: Google Map showing study location

Material and Methodology

The measurement of the sound level was carried out using a model noise meter which is a type 1 integrated sound meter. The instrument is very suitable for environmental noise. The instrument was mounted at a height of 1 meter above the ground for all the 19 locations for consistency of measurement with the antenna pointing to the source of sound. The instrument was set at the A-weighting network and the equivalent noise level (LEQ) which is the constant noise level that expands, the same amount of energy over the same period was measured for the various locations. The "A" weighting network was used because it is most commonly employed for industrial and environmental studies. The rate of hearing loss tends to follow the "A"– scale in that one could tolerate higher levels of low frequency noise for a longer period without hearing impairment [7].

The measurement was carried out for the 19 locations at four different times of the day which are: 8:00-9:00am, 10:00-11:00am, 4:00pm-5:00pm and 9:00pm-10:00pm. The measured equivalent noise level was used as input data in the calculation of the Day-time noise level (LD) and the Night-time noise level (LN). These calculations were then carried out using the equations below.

$$L_D = 10log_{10}\left[\frac{1}{2}\left(antilog\,\frac{L_{AeqM}}{10} + antilog\,\frac{L_{AeqA}}{10}\right)\right] \quad \ldots\ldots\ldots\ldots (1)$$

$$L_N = 10log_{10}\left[\frac{1}{2}\left(antilog\,\frac{L_{AeqE}}{10} + antilog\,\frac{L_{AeqN}}{10}\right)\right] \quad \ldots\ldots\ldots\ldots (2)$$

$$L_{DN} = 10log_{10}\left[\frac{1}{24}\left(15 \times antilog\,\frac{L_D}{10} + 9 \times antilog\,\frac{L_{N+10}}{10}\right)\right] \quad \ldots\ldots\ldots\ldots (3)$$

Where L_{AeqM} is the equivalent sound pressure for the morning measurement, L_{AeqA} is the equivalent sound pressure level for the afternoon measurement, L_{AeqE} is the equivalent sound pressure level for the evening measurement, L_{AeqN} is the equivalent sound pressure level for the night measurement, L_N is night time noise level, L_D is day time noise level, L_{DN} is day-night noise level.

Results and Discussion

The record of the noise level for the 19 locations as represented in table 1 shows the day time sound level, night time sound level, day-night sound level as well as the locations and coordinates where the data was obtained.

Table 2: Results of the equivalent noise levels for 19 locations in Jalingo

S/N	LOCATIONS	COORDINATES	MEAN L_D (dBA)	MEAN L_N (dBA)	MEAN L_{DN} (dBA)
1	YELWA MARKET	N 8.884911 E 11.367923	72.2	48.2	70.2
2	T-JUNCTION	N 8.889364 E 11.361346	76.7	50.3	74.7
3	MAIN MARKET	N 8.894454 E 11.359125	79.7	49.3	77.7
4	HAMMARUWA ROUNDABOUT	N 8.908476 E 11.354930	82.0	53.8	80.0
5	SALEJO COMPLEX	N 8.903546 E 11.358562	79.2	49.7	77.2
6	MICHELIN	N 8.901802 E 11.359619	82.7	52.3	80.7
7	MAYOGWOI	N 8.913581 E 11.347930	80.3	49.7	78.3
8	TIMBER SHADE	N 8.923067 E 11.322358	98.7	49.3	96.7
9	ABUJA PHASE II JUNCTION	N 8.924097 E 11.342395	86.0	53.2	84.0
10	FGGC JUNCTION	N 8.929264 E 11.340844	80.3	53.0	78.3

11	ROAD-BLOCK ROUNDABOUT	N 8.935835 E 11.337110	87.7	58.7	85.7
12	JALINGO MOTOR PARK	N 8.937844 E 11.338350	75.2	52.5	73.2
13	MILE SIX MARKET	N 8.957562 E 11.367596	78.3	48.6	76.3
14	NUKKAI MARKET	N 8.923545 E 11.324005	80.3	50.8	78.5
15	KOFAI MARKET	N 8.911510 E 11.316725	82.2	49.7	80.2
16	ATC ROUNDABOUT	N 8.907644 E 11.315754	80.7	52.3	78.7
17	DORUWA MARKET	N 8.900788 E 11.361738	83.0	51.7	83.0
18	JANKADA JUNCTION	N 8.909639 E 11.353493	84.8	55.2	82.8
19	ATC MARKET	N 8.906048 E 11.315136	77.2	49.7	75.2

Noise quality description for day time and night time duration is given below as obtained in [23].

Table 3: Noise Quality Description

DAY TIME		**NIGHT TIME**	
Leq (dBA)	**Noise Quality Description**	**Leq (dBA)**	**Noise Quality Description**
0-30	Excellent Quality	0-30	Excellent Quality
31-40	Very Good Quality	31-40	Very Good Quality
41-60	Good Quality	41-50	Good Quality
61-75	Satisfactory Quality	51-65	Satisfactory Quality
76-90	Unsatisfactory Quality	66-75	Unsatisfactory Quality
90-110	Hazardous Quality	76-90	Hazardous Quality
>110	Not Allowed	>90	Not Allowed

Table 4: The day time and night time noise quality level of the 19 locations in Jalingo

S/N	**LOCATIONS**	**L_D (dBA)**	**DESCRIPTION**	**L_N (dBA)**	**DESCRIPTION**
1	YELWA MARKET	72.2	Satisfactory Quality	48.2	Good Quality
2	T-JUNCTION	76.7	Unsatisfactory Quality	50.3	Satisfactory Quality
3	MAIN MARKET	79.7	Unsatisfactory Quality	49.3	Good Quality
4	HAMMARUWA ROUNDABOUT	82.0	Unsatisfactory Quality	53.8	Satisfactory Quality
5	SALEJO COMPLEX	79.2	Unsatisfactory Quality	49.7	Good Quality
6	MICHELIN	82.7	Unsatisfactory Quality	52.3	Satisfactory Quality
7	MAYOGWOI	80.3	Unsatisfactory Quality	49.7	Good Quality
8	TIMBER SHADE	98.7	Hazardous Quality	49.3	Good Quality
9	ABUJA PHASE II JUNCTION	86.0	Unsatisfactory Quality	53.2	Satisfactory Quality
10	FGGC JUNCTION	80.3	Unsatisfactory Quality	53.0	Satisfactory Quality
11	ROAD-BLOCK ROUNDABOUT	87.7	Unsatisfactory Quality	58.7	Satisfactory Quality
12	JALINGO MOTOR PARK	75.2	Unsatisfactory Quality	52.5	Satisfactory Quality
13	MILE SIX MARKET	78.3	Unsatisfactory Quality	48.6	Good Quality
14	NUKKAI MARKET	80.3	Unsatisfactory Quality	50.8	Satisfactory Quality
15	KOFAI MARKET	82.2	Unsatisfactory Quality	49.7	Good Quality
16	ATC ROUNDABOUT	80.7	Unsatisfactory Quality	52.3	Satisfactory Quality
17	DORUWA MARKET	83.0	Unsatisfactory Quality	51.7	Satisfactory Quality
18	JANKADA JUNCTION	84.8	Unsatisfactory Quality	55.2	Satisfactory Quality
19	ATC MARKET	77.2	Unsatisfactory Quality	49.7	Good Quality

Using Table 3 as a guide, Table 4 shows that Timber shade has the highest day time equivalent noise value of 98.7 dBA, this high value is related to the tumult of activities during the day and the very many number of active timber working machines at the place coupled with high vehicular movement on the roads on a daily basis. This result is in agreement with [24], that most environmental noise results from road and commercial activities. The day time equivalent noise level of Road Block Roundabout is next to Timber Shade with the value of 87.7 dBA. This area is also characterized by high traffic, commercial and business activities. T-Junction (76.7 dBA), Main Market (79.7 dBA), ATC Market (77.2), Mile Six Market (78.3 dBA), Salejo Complex (79.2 dBA) and Jalingo Motor Park (75.2 dBA) have comparatively lower values of equivalent noise levels which are still unsatisfactory. Abuja Phase II Junction and Jankada Junction have fairly high equivalent noise levels of 86.0 dBA and 84.8 dBA, which are attributable to the flux of activities ranging from high traffic, commercial

activities employing the use of electric generating sets etc. Yelwa Market (72.2 dBA), has a satisfactory equivalent noise level which suggest that individuals whose work are around the market face no risk of harm from noise pollution. All locations but Yelwa Market have unsatisfactory equivalent noise levels in the day time which poses health threats due to noise pollution to the individuals within that location. From table 3 above, it shows that all locations have either a satisfactory or good quality of equivalent noise levels in the night time with Yelwa Market having least value.

Exposure to high noise levels over prolonged period of time can cause Noise-Induced Hearing Loss (NIHL), which is as a result of damage to the hair cells of the cochlea in the inner ear [25, 26]. These hair cells are important structures that convert sound energy to electrical signals that are transmitted to the brain. The damage is irreversible once it occurs [26]. Generally speaking, chronic exposure to noise levels of over 85 dBA for 8 hours/day over 10 years can cause permanent damage to the ear [25, 27]. This suggest that individuals whose work or residence confine them to Abuja Phase II Junction (86.0 dBA), Road Block Roundabout (87.7 dBA) and Timber Shade (98.7 dBA) for over 8 hours/day are susceptible to Noise-Induced Hearing Loss. Though workers or residents at the above 3 mentioned locations are vulnerable to hearing loss, recreational activities such as playing in a band, listening to loud music from headphones/earpieces or concert increases the risks of Noise-Induced Hearing Loss [26, 28].

Another study implied that exposure to noise levels above 80 dBA are associated with increased aggressiveness when combined with alcohol, provocation or existing anger and hostility [29]. 12 out of the 19 locations are therefore prone to crime, violence and possibly abuse of whichever form. Other studies have shown that people living in unhealthy noisy environment were at risk of neuroticism, subjective noise sensitivity and annoyance. The participants of the study reported difficulty falling asleep, increased fatigue, poorer sleep quality and the need for increased use of sleeping agents [30].

Conclusion and Recommendation

Environmental noise level measurements were carried out in 19 locations in Jalingo, Taraba State, Nigeria. The study showed that about 95% of the 19 locations have unsatisfactory day time noise levels due to various forms of activities. At the same time, the 19 locations have either good quality or satisfactory nighttime noise levels owing to the fact that most business and industrial activities closes by evening which significantly reduces the noise levels.

It is therefore recommended that those whose jobs and businesses places them at areas with unhealthy noise level should use protective covering such as ear mugs to shield themselves from the harmful exposure to noise, because working under noisy environment can profoundly affect a person's ability to perform well. Noise can cause impaired concentration, decrease motivation and increase rates of errors and can thus lead to preventable accidents at workplace [29]. More also, communication may be affected which will most likely lead to misunderstanding of instruction which will further cut short employees effectiveness and accuracy.The government is called upon to improve the traffic situation in the city so as to prevent traffic build up in certain locations.

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