

Air Quality Perception, Health Cost Implications and NESREA Standard Compliance of Noise Pollution levels among Medium and Large Scale Agro-allied Industries in South West, Nigeria

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ABSTRACT

The study evaluated air quality perception, health cost implications and standard comparison of noise pollution levels among medium and large scale agro-allied industries in Southwest, Nigeria. Specifically, the study evaluated perception of air quality level of M&LSAI managers; examined the health cost implications of industrial air and noise pollution in M&LSAI; and ascertained noise pollution level within and around M&LSAI in comparison with permissible limit from NESREA. Multi-stage sampling techniques was employed in selection of 287 MLS agro-allied industries. Data for this study were obtained from primary sources with the use of semi-structured questionnaire. The objectives were analysed using descriptive statistics and inferential statistics such as one-way sample t test and independent t test. From the result, greater proportion (44.6% and 43.1%) of medium and large scale agro-allied industry managers had perceived air quality level to be acceptable with moderate health concern and that members of sensitive groups may experience certain health effects within the agro-allied industry. The result on the noise pollution level in M&LSAI revealed that medium scale agro-allied industries an average noise level of 97.14dB and 65.3dB average noise level around the industry. In the same vein, large scale agro-allied industries produced an average noise level of 110.06dB within the industry and 65.4dB average noise level around the industry. With respect to health implications, medium scale agro-allied industries, majority (90.5%, 91.0%, 88.7%) perceived the following health issues viz: wheezing, chest pain, dry throat, headache and nausea; increased fatigue; and coughing to be health consequences of air pollution as they have occurred 3.43, 2.59 and 3.18 times respectively while stress (86.5%) was recorded to have occurred 2.50 times in the industry. Similarly, majority (100.0%, 100.0%, 75.4%, 78.5%, 100% and 100.0) of large scale agro-allied industries perceived wheezing, chest pain, dry throat, headache and nausea; increased fatigue; shortness of breath; chest tightness; irritation of eyes, nose and throat; and coughing to be health consequences of air pollution as they have occurred 3.74, 2.51, 3.03, 2.58, 2.69 and 3.57 times in the industry respectively while high blood pressure (100%) and stress (100.0%) were perceived to be health consequences of noise pollution in the study area and were recorded 2.23 and 2.98 times respectively. Also, given the national minimum wage of ₦30,000 on the average, medium scale agro-allied industries spend 65.0% less the national minimum wage on health management with regards to air and noise pollution quarterly while large scale agro-allied industries spend 199.0% above the national minimum wage for health management with regards to air and noise pollution quarterly. The study recommended the Nigerian government strengthens regulatory frameworks, enhance monitoring capabilities, and provide incentives for industries to invest in cleaner technologies.

INTRODUCTION

Air quality among industries in Nigeria is a significant concern due to the country's rapid industrialization and urbanization. Nigeria is the largest economy in Africa and has experienced substantial growth in various industries such as oil and gas, manufacturing, construction, and transportation (Nwankwo, 2021). The

industrial activities in Nigeria have contributed to air pollution, leading to deteriorating air quality in many urban areas. The perception of air quality among these industries in Nigeria varies depending on several factors (Naveen & Surinder, 2017). Some industries may prioritize profit-making and disregard environmental regulations, resulting in poor air quality. These industries especially medium and large scale agro-allied industries (M&LSAI) who are among the largest producers of air and noise pollution often face criticism from environmental activists, local communities, and governmental bodies. However, many M&LSAI are becoming more aware of the importance of maintaining good air quality and are taking steps to reduce their emissions (Jie Wang et al., 2023). This shift is partly driven by increasing pressure from regulatory bodies, public awareness campaigns, and international agreements on climate change and sustainable development (Muhammad, Arbaiy & Syahir, 2022).

M&LSAI in Nigeria are beginning to adopt cleaner technologies, invest in pollution control measures, and implement environmental management systems. This includes the installation of air pollution control equipment, such as scrubbers, filters, and catalytic converters, to reduce emissions. Furthermore, some industries are actively engaging in corporate social responsibility initiatives to address air pollution concerns. They may collaborate with local communities, non-governmental organizations (NGOs), and government agencies to develop sustainable practices and mitigate the impact of their operations on air quality. Despite these efforts, challenges remain in ensuring widespread adoption of clean technologies and compliance with environmental regulations. Limited enforcement capacity, inadequate monitoring systems, and corruption pose significant obstacles to improving air quality perception among M&LSAI in Nigeria (Hettige et al., 2018).

According to Oludele, Olumuyiwa and Nurudeen (2015), air and noise pollution among M&LSAI in Nigeria have significant health implications for both workers and nearby communities. The pollutants emitted by M&LSAI can have detrimental effects on respiratory health, cardiovascular health, and overall well-being. Particulate matter (PM) is a common pollutant emitted by M&LSAI and is known to cause respiratory problems such as asthma, bronchitis, and lung cancer. Prolonged exposure to PM can also lead to cardiovascular diseases, including heart attacks and strokes. Sulfur dioxide (SO₂) and nitrogen oxides (NO_x) are pollutants emitted by M&LSAI that contribute to the formation of smog and acid rain. These pollutants can irritate the respiratory system, leading to respiratory symptoms and exacerbating existing respiratory conditions. Volatile organic compounds (VOCs) are another group of pollutants emitted by M&LSAI that can have both short-term and long-term health effects. Short-term exposure to high levels of VOCs can cause eye, nose, and throat irritation, headaches, nausea, and dizziness. Long-term exposure to VOCs has been linked to an increased risk of cancer, liver damage, and damage to the central nervous system (Mohammed et al., 2022) Carbon monoxide (CO) is a colourless and odourless gas emitted by M&LSAI that can be particularly dangerous in enclosed spaces. Inhaling high levels of CO can lead to headaches, dizziness, nausea, confusion, and even death. In addition to air pollution, noise pollution from industrial activities can also have adverse health effects (Martin et al., 2021). Prolonged exposure to high levels of noise can lead to hearing loss, stress, sleep disturbances, and increased risk of cardiovascular diseases. These health implications highlight the urgent need for M&LSAI in Nigeria to prioritize air and noise pollution control measures.

In Nigeria, the National Environmental Standards and Regulations Enforcement Agency (NESREA) sets standards for noise pollution levels in industrial areas. Permissible limits from NESREA is 85dbA within and 55 dbA around industry. These standards aim to protect the health and well-being of workers and nearby communities. However, studies (Oketola & Osibanjo, 2007; Manyong, 2021) have shown that many M&LSAI in Nigeria do not conform to these standards, resulting in high levels of noise pollution. This is particularly concerning as prolonged exposure to excessive noise can have significant health implications. Research has found that noise pollution levels within and around M&LSAI in Nigeria often exceed the recommended limits set by NESREA (Linus, 2022). This is primarily due to the lack of proper noise control

measures and inadequate enforcement of regulations. Excessive noise levels can lead to various health problems. The most common health effect of noise pollution is hearing loss, which can be temporary or permanent depending on the intensity and duration of exposure. Workers in M&LSAI with high noise levels are particularly vulnerable to this risk. In addition to hearing loss, prolonged exposure to excessive noise can also cause stress, sleep disturbances, and increased risk of cardiovascular diseases such as hypertension and heart disease. Noise pollution has also been linked to decreased productivity, impaired cognitive function, and reduced overall well-being. It is crucial for M&LSAI in Nigeria to prioritize noise pollution control measures to protect the health of their workers and nearby communities. This can include implementing engineering controls such as soundproofing and insulation, using quieter machinery and equipment, and adopting proper maintenance practices. Furthermore, strict enforcement of NESREA standards is necessary to ensure compliance by M&LSAI. Regular monitoring and assessment of noise pollution levels should be conducted, and appropriate actions should be taken against non-compliant M&LSAI. By addressing noise pollution and adhering to NESREA standards, M&LSAI can create a safer and healthier working environment for their employees and contribute to the overall well-being of nearby communities. In view of this, the study seeks to answer the following research questions:

1. How do M&LSAI managers perceive air quality level within and around the industry?
2. What are the health cost implications of industrial air and noise pollution in M&LSAI? and
3. What is the noise pollution level within and around M&LSAI compared with permissible limit from NESREA?

Objectives of the study

The broad objective of the study is the evaluation of air quality perception, health cost implications and standard comparison of noise pollution levels among medium and large scale agro-allied industries in South west, Nigeria. Specifically, the study

1. evaluated perception of air quality level of M&LSAI managers;
2. examined the health cost implications of industrial air and noise pollution in M&LSAI; and
3. ascertained noise pollution level within and around M&LSAI and compared with permissible limit from NESREA.

Hypothesis of the study

The null hypothesis of the study is:

HO₁: there is no significant relationship between noise pollution level of medium and large scale (and pooled) agro-allied industries and permissible limit from the National Environmental Standards and Regulatory Agency within and around industry (NESREA);

RESEARCH METHODOLOGY

The study was carried out in South west Nigeria. South west Nigeria is made up of six states which include: Ekiti, Lagos, Ogun, Oyo, Osun and Oyo states. South west Nigeria falls within latitudes 6⁰ N, 4⁰ S and longitudes 4⁰ W, 6⁰ E; covering about 114, 271kilometre square (Adepoju et al., 2011). It is bounded in the North by Kogi and Kwara States, in the East by Edo and Delta States, in the South by Atlantic Ocean and in the West by Republic of Benin. The current estimated population of South west Nigeria is 32,231,332 people (Worldometer, 2021). The estimated population of Lagos, Ogun, Oyo, Ekiti and Kwara states is given as 14,862,111; 3,751,140; 5,580,894; 2,210,957; 2,365,353 and 3,460,877 respectively. Multi-stage sampling techniques was employed in selecting 287 MLS agro-allied industries. Data for this study were obtained from primary sources with the use of semi-structured questionnaire. The objectives for the study

was achieved using both descriptive and inferential statistics such as one-way sample t test and independent t test.

Model Specification

One sample T-Statistics

This section presents the results of the traditional one-sample T-test (Hogg & Tanis, 2010). The (unreported) null hypothesis is

$H_0: \mu = \text{Hypothesized value}$ (Permissible limits from NESREA: 85dbA within and 55 dbA around) and the alternative hypotheses,

$H_a: \mu \neq \text{Hypothesized value}$ 1

$H_a: \mu < \text{Hypothesized value, or}$ 2

$H_a: \mu > \text{Hypothesized Value}$ 3

The T-Statistic is the value used to produce the p -value (Probability Level) based on the T distribution. One sample T statistic was used to compare noise pollution level with permissible limits from NESREA. The formula for the T-Statistic is:

$$T - \text{Statistic} = \frac{\bar{X} - \text{Hypothesized value}}{SE_{\bar{x}}} \dots\dots\dots 4$$

Where \bar{x} = is the average of the data values (mean pollution level from MLS agro-allied industries)

SE = is the estimated standard deviation of the distribution of sample means for an infinite population. And it is given by

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}} \dots\dots\dots 5$$

Independent t-test statistic

The t-test was adopted in this study to compare noise pollution within industries and in areas around M&LSAI (about 0.5 kilometres away) (Ansong et al., 2015). The formula for the t-test statistic for hypothesis testing is presented as follows:

$$t = \frac{\bar{X}_m - \bar{X}_a}{\sqrt{\frac{S_m^2}{n_m} + \frac{S_a^2}{n_a}}} \dots\dots\dots 6$$

Where:

X_m = mean noise pollution level of MLS agro-allied industries;

X_a = mean noise pollution level of areas around MLS agro-allied industries;

S_m^2 = variance of noise pollution level of MLS agro-allied industries;

S_a^2 = variance of noise pollution level of areas around MLS agro-allied industries;

n_m = number of MLS agro-allied industries; and

n_a = number of areas around MLS agro-allied industries

RESULTS AND DISCUSSION

I. Perception of air quality of industrial air pollution by M&LSAI managers;

Perception of air quality level (PAQL)

The result of the perception of air quality level (in ascending order) by medium and large scale agro-allied industry managers in South west Nigeria is depicted on Table 1 and shows that greater proportion (44.6% and 43.1%) of medium and large scale agro-allied industry managers had perceived air quality level to be acceptable with moderate health concern and that members of sensitive groups may experience certain health effects within the agro-allied industry. The implication from the perceived air quality index parameters revealed air quality level to be moderate cum low which was confirmed by the mean perception score of 3.68 and 3.70 with a standard deviation of 1.446 and 1.569 respectively among M&LSAI. However, 20.3% and 29.2% of medium and large scale agro-allied industry managers respectively perceived that the air quality level within the industry is unhealthy and in fact perilous, affirming the possibilities that everyone within the industry as a result of the poor AQL may be susceptible to certain negative health effects and the entire population is more likely to be affected. Similarly, the finding on air quality level around the agro-allied industries show an average proportion (57.2% and 52.3%) of medium and large scale agro-allied industry managers to have perceived air quality level to be excellent or rather considered satisfactory, posing little or no risk. The implication from the perceived air quality index parameters in Table 1 revealed air quality level to be great as well as good which was confirmed by the mean perception score of 2.77 and 2.92 with a standard deviation of 1.611 and 1.544 respectively. However, 22.5% and 23.1% of medium and large scale agro-allied industry managers perceived air quality level around the industry to be unhealthy and actually unsafe, affirming the possibilities that everyone within the industry may begin to experience health effects and the entire population is more likely to be affected.

The reason for these differences in perception is based on the type of agro-allied industries in the study area, type of industrial plants/generators used, frequency of use of industrial plants/generators, type of waste generated and disposal mechanism of waste generated which may have adverse effect on air quality level. From the study, it can also be deduced that the quality level ranges from moderate, low and unhealthy within the industry and good, moderate and low around the industry. This was complemented by Figure 1 which generated an air quality benchmark for both medium and large scale agro-allied industry managers to have a perceived air quality level of 3.69 within the industry and 2.85 around the industry with a benchmark mean cut off point of 3.50. Therefore, the PAQL generated within and around the M&LSAI was 0.19 above and 0.65 below the acceptable perceived air quality level.

Table 1: Perception of air quality level by medium and large scale agro-allied industry managers in South west Nigeria

Perceived AQI	World Air Quality Scale	Medium Scale Agro-allied Industry				Large Scale Agro-allied Industry			
		Within the industry		Around the industry		Within the industry		Around the industry	
Parameters (ascending order)		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage

Great	The air quality is excellent	33	14.9	57	25.7	8	12.3	12	18.5
Good	Air quality is considered satisfactory and air pollution poses little or no risk	45	20.3	70	31.5	10	15.4	22	33.8
Moderate	Air quality is acceptable with moderate health concern	52	23.4	27	12.2	10	15.4	8	12.3
Low	Members of sensitive groups may experience some health effect	47	21.2	18	8.1	18	27.7	8	12.3
Unhealthy	Everyone may begin to experience health effects	32	14.4	36	16.2	10	15.4	12	18.5
Dangerous	The entire population is more likely to be affected	13	5.9	14	6.3	9	13.8	3	4.6
Mean	PAQL Within=3.69; Around=2.85	3.68		2.77		3.70		2.92	
Std. Deviation		1.446		1.611		1.569		1.544	

Source: Field Survey, 2022. Mean cut off point=3.5.

This suggests that air quality level within and around the industry as perceived by medium and large scale agro-allied industry managers is 5% (PAQL *within*=105.0%) higher than the bench mark and 19% (PAQL *around*=81.0%) lower than the benchmark, suggesting a more favourable air quality level around the industry rather than within the agro-allied industries as confirmed in tandem with the studies of Mishra (2003); and Zhang et al. (2014).

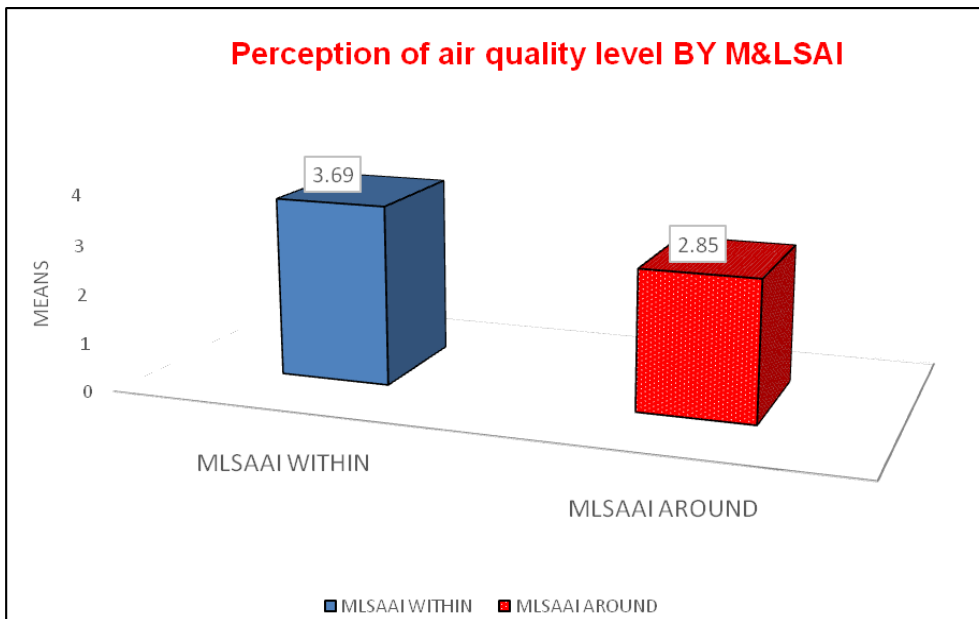


Figure 1: Perception of Air quality level by M&LSAI in South West Nigeria. Source: Field Survey, 2022.

II. Perceived health and cost implications of industrial air and noise pollution within M&LSAI in Southwest Nigeria

The result on Table 2 shows the perceived health implications of air and noise-based pollution as well as the number of occurrences in the study area. With respect to medium scale agro-allied industries and with reference to air pollution, majority (90.5%, 91.0%, 88.7%) perceived the following health issues viz: wheezing, chest pain, dry throat, headache and nausea; increased fatigue; and coughing to be health consequences of air pollution as they have occurred 3.43, 2.59 and 3.18 times respectively while stress (86.5%) was recorded to have occurred 2.50 times in the industry. Similarly, majority (100.0%, 100.0%, 75.4%, 78.5%, 100% and 100.0) of large scale agro-allied industries perceived wheezing, chest pain, dry throat, headache and nausea; increased fatigue; shortness of breath; chest tightness; irritation of eyes, nose and throat; and coughing to be health consequences of air pollution as they have occurred 3.74, 2.51, 3.03, 2.58, 2.69 and 3.57 times in the industry respectively while high blood pressure (100%) and stress (100.0%) were perceived to be health consequences of noise pollution in the study area and were recorded 2.23 and 2.98 times respectively. The result implies that the following health consequences: wheezing, chest pain, dry throat, headache and nausea; increased fatigue; coughing and stress for medium scale agro-allied industries is perceived as the ill health outcomes of any employee within the industry with an average occurrence tendency of 2.9 times (approximately 3 times) while the following health consequences: wheezing, chest pain, dry throat, headache and nausea; increased fatigue; shortness of breath; chest tightness; irritation of eyes, nose and throat; coughing, high blood pressure and stress for large scale agro-allied industries is perceived as the ill health outcomes of any employee within the industry with an average occurrence tendency of 2.9 times (approximately 3 times).

The economic implications of the health consequences of air and noise pollution on Table 2 reveals for M&LSAI a total sum of ₦161,715.00 with an average of ₦11,551.07 per industry manager (quarterly) is likely to be spent if all health issues were experienced but since the perceived health consequences for medium scale agro-allied industries and associated health cost is generally wheezing, chest pain, dry throat, headache and nausea (₦1,445.0); increased fatigue (₦825.0); coughing (₦1,645.0) and stress (₦2,585.0), a sum total of ₦6,500.00 and a grand total of ₦19,500.0 for an average of three possible occurrences is likely to be spent for air and noise pollution associated health issues quarterly and ₦58,500 annually (i.e. ₦4,875.0 monthly). For large scale agro-allied industries, the perceived health consequences and cost is generally

wheezing, chest pain, dry throat, headache and nausea (₦1,445.0); increased fatigue (₦825.0); shortness of breath (₦350.0); chest tightness (₦1300.0); irritation of eyes, nose and throat (₦5,955.0); coughing (₦1,645.0), high blood pressure (₦5,800.0) and stress (₦2,585.0) giving a sum total of ₦19,905.0 per manager quarterly and a grand total of ₦59,715.0 also for an average of three possible occurrences. This is an indication that large scale agro-allied industries on the average spends approximately three times more than medium scale agro-allied industries on the treatment of perceived health issues from the industry which may be traced to the fact that large scale agro-allied industries have higher likelihoods to pollute more than medium scale agro-allied industries based on their scale of operation. By extension, it can also be deduced that on the average, medium scale agro-allied industries spend 65.0% (₦19,500.0) less the national minimum wage (₦30,000.0) while large scale agro-allied industries spend 199.0% above the national minimum wage (₦30,000.0) for health management with regards to air and noise pollution quarterly. This is to say, 65% of the minimum cost it requires to employ an individual/labour in the country, is what medium scale agro-allied industry managers may likely spend in health related treatments as a result of perceived air and noise pollution while almost double the minimum cost (199.0%) of what is required to employ an individual/labour in the country, is what large scale agro-allied industries may likely spend in health related treatments as a result of perceived air and noise pollution.

This result is similar with a health survey carried out by Thambiran and Diab (2011) which showed the symptoms such as sore throat, shortness of breath, skin irritation, wheezing, sneezing, chest tightness, nausea etc. in an assessment for people (over 30- 60 years) to find health problems due to vehicular pollution. Woodcock, Givoni, and Morgan (2013) observed that air pollution has an association with both short-term and long-term mortality as well as morbidity effects on the exposed population. Emissions produced within industries and related sources have a variety of effects on human health, varying from eye irritation and nausea to chronic lung diseases, cancer, or heart failure (Mao et al. 2012). According to Mao et al. (2012), the health effects associated with air pollutants in epidemiological studies include mortality and a range of morbidity outcomes including hospitalization for cardiovascular or respiratory disease, emergency room and urgent care visits, asthma exacerbation, acute and chronic bronchitis, restrictions in activity, work loss, school absenteeism, respiratory symptoms, decreased lung function etc. In another study, Wang et al. (2018) opined that worldwide, indoor smoke from agro-allied industrial solid fuel combustion causes about 21% of deaths from lower respiratory infections, 35.0% of deaths from chronic obstructive pulmonary disease and about 3% of deaths from lung cancer. Carbon monoxide reduces the capacity of blood to carry oxygen. Symptoms associated with exposure to carbon monoxide include dizziness, nausea, headache, loss of consciousness and death. Persons with coronary artery disease and fetuses are particularly susceptible (Thambiran & Diab, 2011).

Noise pollution is one of the environmental nuisances created by industrialization and urbanization. Noise is gradually becoming ubiquitous, yet an overlooked form of pollution. It may not appear to be as harmful as other forms of pollution, but it is a problem that affects human health and wellbeing as well as environmental quality. Joyce et al. (2013) in his study found the following health implication of noise pollution viz: hearing problem, high blood pressure, stress, ulcer, aggression, the poor concentration which may lead to accidents and poor academic performance. Adenife and Azodo (2019) asserted in his study that people who work in industries sustain a progressive hearing loss more than their counterparts in non-industries. A study by Martin et al. (2021) on “Impact of Noise Pollution on Human Cardiovascular System” revealed that apart from Noise Induced Hearing Loss (NIHL), exposure to continuous or high levels of noise can cause several adverse health effects to the cardiovascular system. In the study, the effects of industrial noise on the cardiovascular system were assessed in workers of locked factories, which were exposed to industrial noise levels exceeding 80 dB. Exposure to noise disturbs sleep proportional to the amount of noise experienced, this effect of noise on sleep can, in turn, cause more severe and chronic health issues, and also, noise activates the body’s stress response which consequently initiates several reactions in the body. Prolonged effect of noise on stress hormones might be the possible mechanism by which

environmental noise adversely affects the cardiovascular system. Similar results were found by Oyedepo et al. (2020). Oyedepo et al. (2020) concluded that the noise may result in loss of hearing, stress, high-blood pressure, loss of sleep, distraction affecting productivity, and a general reduction in the quality of life.

Table 2: Health and cost implications of industrial air and noise pollution within M&LSAI in South west Nigeria

Type of pollution	Perceived type of Health Issues	Medium Scale Agro-allied Industry				Large Scale Agro-allied Industry				M&LSAI	
		Reported cases		Number of Occurrences		Reported cases		Number of Occurrences			Average of
		Frequency	Percentage	Mean	Mean TC (₦)	Frequency	Percentage	Mean	Mean TC (₦)		
Air pollution based	Aggravated respiratory diseases such as Emphysema, Bronchitis and Asthma	20	9.0	0.23	45,670.00	20	30.8	0.78	49,800.00	47,735	
	Lung related problems	15	6.8	0.21	23,240.00	15	23.1	0.71	25,600.00	24,420	
	Wheezing, chest pain, dry throat, headache and nausea	201	90.5	3.43 ^a	1350.00	65	100.0	3.74 ^a	1540.00	1,445	
	Increased fatigue	202	91.0	2.59 ^a	760.00	65	100.0	2.51 ^a	890.00	825	
	Shortness of breath	49	22.1	0.89	350.00	49	75.4	3.03 ^a	350.00	350	
	Chest tightness	51	23.0	0.76	1200.00	51	78.5	2.58 ^a	1400.0	1,300	
	Irritation of eyes, nose and throat	103	46.4	0.84	5690.00	65	100.0	1.69	6220.00	5,955	
	Coughing	197	88.7	3.18 ^a	1640.00	65	100.0	3.57 ^a	1650.00	1,645	
	Non-fatal heart attacks	16	7.2	0.21	3500.00	16	24.6	0.72	3450.00	3,475	
	Noise pollution based	Noise Induced Hearing Loss	6	2.7	0.08	12,300.00	6	9.2	0.26	13,100.00	12,700

	High Blood pressure	82	36.9	0.95	5600.00	65	100.0	2.23 ^a	6000.00	5,800
	Heart related problems	5	2.3	0.02	50,000	5	7.7	0.34	52,000	51,000
	Sleep disturbances	46	20.7	0.47	2400.00	46	70.8	1.62	2560.00	2,480
	Stress	192	86.5	2.50 ^a	2500.00	65	100.0	1.98	2670.00	2,585
Both	Total TC (?)				156,200.00				167,230.00	161,715.00
	Average Economic Cost (?)				11,157.14				11,945.00	11,551.07

Source: Field Survey, 2022. Mean cut off point=2.0; superscript ‘a’ on specific mean values indicates critically reoccurring health issues

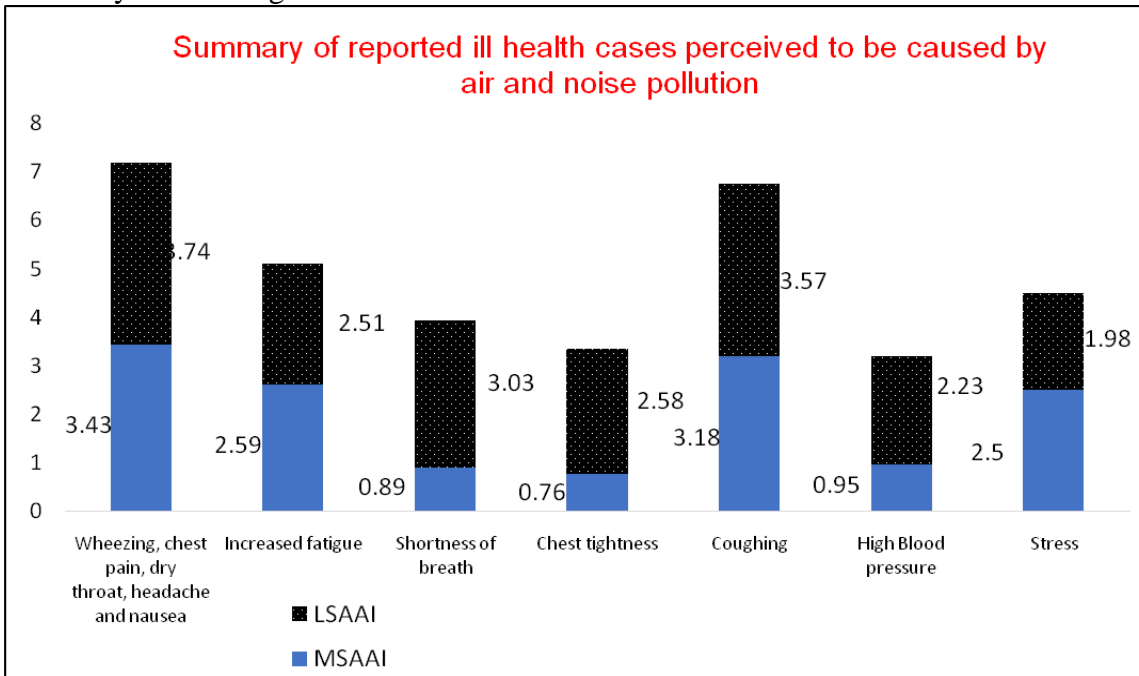


Figure 2: Descriptive information (Stacked Column Chart) of reported health implications of air and noise pollution among M&LSAI in South west Nigeria. Source: Field Survey, 2022.

Figure 2 which summarizes reported health implications of air and noise pollution among M&LSAI in South west Nigeria shows that wheezing, chest pain, dry throat, headache and nausea ranked first, coughing ranked second, increased fatigue ranked third, stress ranked fourth, shortness of breath ranked fifth, chest tightness ranked sixth while high blood pressure ranked seventh. This portrays the less severity in the health consequences of air and noise pollution possibly on the short run as these may spur unknown complications if the right measures are not adopted on the long run.

III. Comparison of Noise Pollution Levels within M&LSAI with permissible limits from NESREA and with areas around M&LSAI (0.5 kilometres Away)

Figure 3 shows a descriptive information of noise pollution level within and around M&LSAI in South west Nigeria. The result reveals that medium scale agro-allied industries produce a minimum noise level of 24dB, maximum noise level of 137dB and an average noise level of 97.14dB within the industry and 15dB minimum noise level, 82dB maximum noise level and 65.3dB average noise level 0.5km around the

industry. In the same vein, large scale agro-allied industries produce a minimum noise level of 55dB, maximum noise level of 140dB and an average noise level of 110.06dB within the industry and 21dB minimum noise level, 92dB maximum noise level and 65.4dB average noise level around the industry. Given the NESREA noise pollution standards of 85dB within industry and 55dB (10km) around industry, it is crystal clear that medium and large scale agro-allied industries produce noise that may likely be unhealthy either for the employees or the environment at large and that they do not comply with NESREA health confined noise pollution standards. Both medium and large scale agro-allied industries produce 12.14dB and 25.06dB of noise above NESREA standard respectively. This may be due to the inefficient stability of electricity in the area and the compulsory need to utilize industrial plants/generators for daily economic/contractual supply activities. Also, is the need for consumer satisfaction either in making apt delivery or environmental conduciveness of human resources. The aloof aims of few laws and regulatory provision on noise pollution in the study area, bogged down by the lack of proper implementation and huge gaps in the legal, institutional, and management standards between evolving local standards in the study area may also be the cause.

It was also evident that the noise from industries produce lots of externalities especially affecting proximal residential areas. The permissible noise level of 55dB is expected in residential area but residential areas situated near agro-allied industries in this case, experienced 10.3dB and 10.4dB noise pollution rate above NESREA pollution standards. This may cause residential disturbances mainly during their rest and recreation as they (residents) may often react by window shutting as reported during direct personal interviews. Other residents reported stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity as consequences for proximal habitation to agro-allied industries.

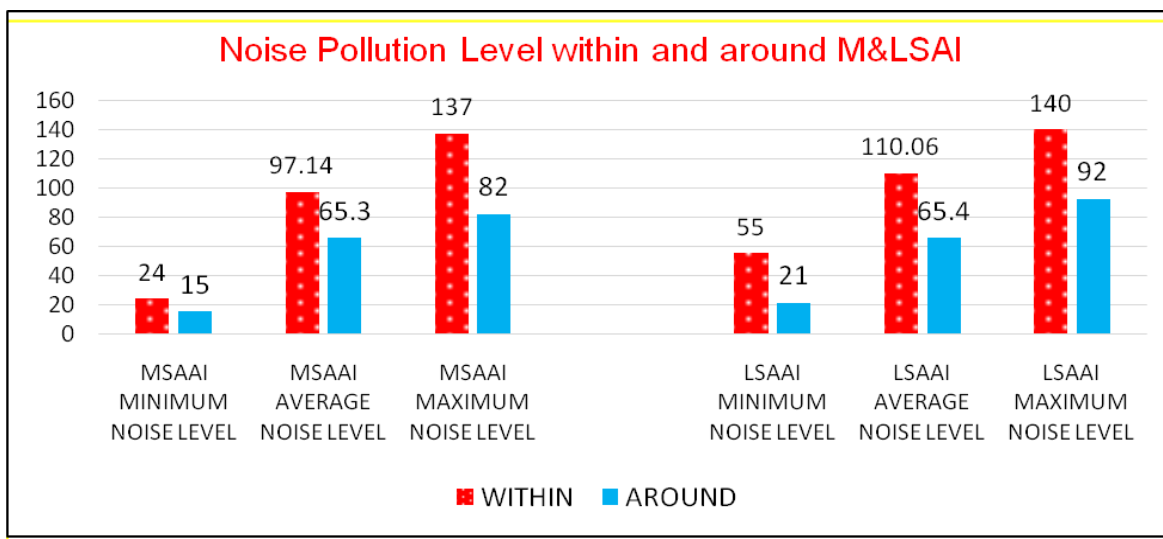


Figure 3: Noise Pollution Level within and around M&LSAI in South west Nigeria. Source: Field Survey, 2022.

Comparison of Noise pollution level with Permissible limit from NESREA

The Independent t test comparison of noise pollution level with permissible limit from NESREA within and around M&LSAI in South west Nigeria is presented on Table 3. With respect to MSAAI, a significant difference exists between the noise pollution level within and NESREA permissible noise limits ($t=5.091$; $p<0.05$). There was also significant difference existing between noise pollution level around MSAAI and NESREA permissible noise limits ($t=-27.528$; $p<0.05$). Similarly, with respect to LSAAI, the result revealed that a significant difference exists between the noise pollution level within and NESREA permissible noise limits ($t=7.362$; $p<0.05$). There was also significant difference existing between noise pollution level around LSAAI and NESREA permissible noise limits ($t=-10.400$; $p<0.05$). Finally, considering the pooled

M&LSAI, a significant difference exists between the noise pollution level within industry and NESREA permissible noise limits ($t=7.451$; $p<0.05$). There was also significant difference existing between noise pollution level around pooled M&LSAI and NESREA permissible noise limits ($t=-32.628$; $p<0.05$). Therefore, the null hypotheses that there is no significant relationship between noise level of M&LSAI (and pooled) and permissible limit from the National Environmental Standards and Regulatory Agency within and around industry (NESREA) was rejected and the alternate hypotheses accepted.

Comparism of Noise pollution level with Permissible limit from NESREA

Table 3 shows the comparism of Noise pollution level with Permissible limit from NESREA within and around M&LSAI in South west Nigeria

Table 3: Comparism of Noise pollution levels within and around M&LSAI in South west Nigeria with Permissible limits from NESREA

Parameters	MSAAI			Mean Difference	LSAAI			Mean Difference	M&LSAI		
	t statistic	Degree of freedom	Sig. (2-tailed)		t statistic	Degree of freedom	Sig. (2-tailed)		Mean	t statistic	Sig. (2-tailed)
Within	5.091***	221	0.000	12.140	7.362***	64	0.000	25.062	100.07	7.451***	0.000
Around	-27.528***	221	0.000	-10.300	-18.113***	64	0.000	-10.400	43.74	-32.638***	0.000

Source: Field Survey, 2022. *** Significant at 1%; ** Significant at 5%; * Significant at 10% Test value within=0.85; Test value around=0.55.

CONCLUSION AND RECOMMENDATIONS

The study concluded that the perceived air quality level of medium scale agro-allied industry is acceptable with moderate health concern and that members of sensitive groups may experience certain health effects within the agro-allied industry. The noise pollution level in M&LSAI revealed higher noise levels within and around the industry above the NESREA standards and that wheezing, chest pain, dry throat, headache and nausea; increased fatigue; and coughing are health consequences of air pollution affecting MSAI managers while LSAI managers perceived wheezing, chest pain, dry throat, headache and nausea; increased fatigue; shortness of breath; chest tightness; irritation of eyes, nose and throat; and coughing to be health consequences of air pollution as high blood pressure and stress were concluded to be health consequences of noise pollution in the study area. To address these challenges effectively, it is crucial for the Nigerian government to strengthen regulatory frameworks, enhance monitoring capabilities, and provide incentives for industries to invest in cleaner technologies. Additionally, public awareness campaigns and educational programs can play a vital role in shaping the perception of air quality among industries and fostering a culture of environmental responsibility. By adopting cleaner technologies, implementing pollution control equipment, and complying with environmental regulations, industries can mitigate the negative health effects of their operations and contribute to a healthier environment for industries workers and communities.

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