International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 8 Issue 11 November - 2024, Pages: 349-359

A Study Of Noise Pollution From Agglomerated Grinding Mills In Selected Markets In Anambra State, Nigeria

[1]N. M. Okafor and [1]F. I. Ikegbunam

[1]Department of Environmental Management, Faculty of Environmental Sciences, Chukwuemeka Odumegwu Ojukwu University Uli, Anambra State

Abstract: *This study examined the agglomeration of grinding mills as a source of noise pollution in Anambra State. The study was anchored on Wave Theory and Relational Event Theory. A survey research design was adopted. The population of the study consisted of 242 mill operators purposively selected from 6 markets from the 3 senatorial zones of Anambra State, with a sample size of 242. Data were obtained from both primary and secondary sources. An MS6701 Digital Sound Level Meter of range of 30-130 dBA was used to measure the noise levels for three days (morning, afternoon and evening periods). Person's product moment correlation, Goodness-of-fit Chi-Square Test, and one sample T-test were used to test hypotheses at a 5% level of significance. Noise levels were measured at intervals of 0m, 10m, 20m, 30m, 40m, 50 m and 100 meters away from the grinding mills. The results showed that noise levels decreased as one moves away from the grinding mill source, and decreases further as one moves further away and that operators are not aware of any occupational health and safety risk involved in exposure to noise in their workplaces. It was, therefore, concluded that grinding mill operations contribute to noise pollution in their area of operation. The study recommended the use of some safety gadgets like eco-barriers, ear muffs, earplugs, and ear canal caps by the operators and, the locating grinding mill operations outside the major markets to help reduce exposure to high noise levels to the public.*

Keywords: Noise Pollution, Agglomerate, Grinding Mills, Markets, Anambra state.

INTRODUCTION

Agglomerated grinding mills occupy a niche in both rural and urban environments, especially in developing economies. These processing units are contributing to household grain crop processing and finishing; and in the informal trade on agro products such as cassava, corn/maize flour, cowpea, pigeon pea, and a host of other local brews and beverages. In this regard, they are assisting in reducing unemployment, and poverty and improving the livelihood of society following little skills required to operate these food processing machines (Bisong, Umana, Onoyom-Ita & Osim, 2005; Adeyemi 2018; Oguntunde, Okagbue & Odetunmi,2019). Consequently, they have given rise to a large inflow of both old and young into the food grinding sectors of the market.

Furthermore, food processing and grinding sectors composed of different types and sizes of machines, are being operated by the old and young, and both sexes. While these processing units are contributing to enhancing the economic well-being of society, they are posing severe environmental and health challenges that could undermine the prospect of the sector (Schneider, Broekema & Carson, 2020). These include dust, dirt, offensive odour, noise and turbid wastewater/effluent discharges into the immediate environments. Others are smoke, oil and grease, and solid wastes of all sorts, ranging from plastics/rubber cans to plastic nylons. In addition, the hosting structure/staging structure serves as breeding grounds for variable pests such as ants, cockroaches, rats, lizards, wall geckos, mosquitoes and flies. Foul odour and dirty waters from the mills pollute the environment. Among the various problems emanating from these mills, high noise levels generated from the mills during processing are one of the most disgusting and disturbing problems. The World Health Organization (WHO) Director General, Tedros Adhanom Ghebreyesu, claims that occupational noise has additional negative effects, such as increased morbidity and mortality from hearing damage brought on by noise, which raises the possibility of workplace accidents. One of the biggest occupational dangers is still exposure to noise while at work causing hearing loss, with a prevalence rate of 16%, varied by sub-region from 7 to 21%. Occupational noise is responsible for 16% of adult worldwide hearing loss that is incapacitating (Obianyo, 2014).

In Anambra State, these food processing mills are found around Gbalingba and Sammy Sparkle areas of Eke Awka; at Umudioka on the border between Aforigwe Primary School and Aforigwe Market, at Oye-Agu Abagana Market close to Otingbododo road to Ukpo, where it shares activity location with grain dealers and wood dealers. At Nkwo Enugwu-Ukwu, beside the Civic Centre. And around Ose-Okwuodu, they are found beside John Holt on the Marine Road, Onitsha; and towards the first gate beside Ibru Fish and Gimbaz Road, Ochanja. These food processing millers can also be found at the street ends where they render services to bean cake producers, makers of pap, moimoi, soya milk, tomatoes, pepper, 'agidi,' chicken feeds, among others. Their contributions are invaluable and indispensable.

Many studies have identified grinding machines as the most common market-based source of noise pollution and the grinding sections are the noisiest in the commercial environment (Azodo, Ismaila, & Owoeye, 2018a; Babawuya, Bori, Bako, Yusuf, Jibrin, Elkanah,2016; Iqbal &Lodhi, 2014; John &Dewan, 2015; and Nwogu, Eze, Okonkwo & Agu, 2017). Interest in noise pollution and control studies in agglomerated commercial Units such as food processing mills in urban and rural areas in Nigeria is lacking especially as it concerns the study area. The inadequacy in literature implies that there is a gap that requires to be filled. Based on this premise, this study was necessitated.

Aim and Objectives of the Study

This study aims to examine agglomerated grinding mills as a source of noise pollution in selected markets in Anambra State. The specific objectives are:

1. to measure noise levels generated by the agglomerated grinding mills at their location and distances away from them
2. to discuss the level of awareness of exposure to persistent noise levels by the operators of the grinding Mills

REVIEW OF RELATED LITERATURE

Conceptual framework

The Conceptual framework of this study hinges on Environmental Quality, Environmental Pollution and noise pollution. Noise is a quality-of-life problem.

Environmental quality refers to the state or condition of the environment, taking into account various characteristics and factors that can affect the well-being of humans and other species. It encompasses both natural and built environments (Wikipedia, 2023). "Environmental quality" also refers to a collection of ecological characteristics, whether broad or particular, that affect humans and other living things. It is a method of evaluating how well an environment satisfies the requirements of one or more species as well as any requirements or goals pertaining to humans. (Saranya,2023). Environmental quality is defined as the ability of the environment to meet basic human needs (Zivikovic & Milutinovic, 2022).

Environmental pollution is characterized by the presence or introduction of substances into the environment that cause harm or discomfort to living organisms (WHO, 2022). These substances can be of natural or anthropogenic origin, leading to alterations in the ecosystems and posing threats to human health (UNEP, 2022). Examples include emissions from industrial processes, the discharge of pollutants into water bodies, and the release of airborne contaminants (MEA, 2005). Environmental pollutants are substances (solid, liquid, or gas) or energy (heat, sound, or radioactivity) that are introduced to the environment at a rate that is higher than their capacity to be dispersed, diluted, decomposed, recycled, or stored in a harmless form. The three primary types of pollution are air, water, and land pollution. These types of pollution are usually classified based on environmental conditions.

Noise pollution refers to the presence of unwanted or harmful sound that disrupts normal activities and poses significant health risks to humans and animals (World Health Organization (WHO, 2021). Sound pollution, also known as noise pollution, is the spread of sound waves that have a variety of negative effects on animal and human activity, the majority of which are moderately harmful.(Wikipedia (2022). Any undesired or unsettling sound that hurts the health and welfare of people or other living things is regarded as noise pollution. (The National Society of Geography, 2023) (2020, Helen Millar).

Noise at Work Place

According to Gibson and van Der Vaart (2008) and Onyebueke (2013), noise pollution has dominated acoustic research up to this point, with assessments of levels and their effects on the human population starting in the workplace several decades ago. Studies on occupational noise have mostly concentrated on corporate and large-scale industries, with little attention paid to small businesses in Third World countries. In general, there are far more micro and small-scale businesses than large companies, and they collectively employ a much higher number of people. The recent surge and quick growth of small and medium-sized businesses (SMEs) is a byproduct of modern capitalist development. Compared to larger companies, SMEs are more efficient at creating jobs, are innovative, and have faster growth.

DeBeers (2002) According to Sonibare, Ademola, Adeniran, Adetayo, Fakinle, Sunday, Latinwo, Ismala, Jimoda, Adekilekun, Arotinwa, and Abel (2014), the results of the scant research that is currently available in Nigeria indicate that small and medium-sized enterprises emit significantly higher levels of noise than large-scale industries. According to Sridhar and Omokhodion (2003), the two least important issues for small businesses are noise control and worker protection.

Three hospitals in Ibadan, one of which was a teaching hospital with about 800 beds and the other two being general hospitals with about 200 beds each, had their noise levels measured. Using a type 2 digital integrated sound level metre, the noise levels at certain sites were monitored. The teaching hospital's pediatric clinics and wards recorded the greatest noise levels, 68–73db (A) and 55–77db (A), respectively, when compared to facilities of a similar calibre for adults. Moreover, high noise levels between 74 and 89 dB (A) were noted in the operating rooms. In the teaching hospital, Service facilities such as the boiler room, laundry room, and generator room were found to have noise levels exceeding 80 dB (A). Because general hospitals only offer a limited number of these services, the corresponding sites there were quieter. It is known that noise levels found in this study can interfere with sleep. The amount of noise in areas where patients are cared for is largely determined by staff conversations. The noise levels in operating rooms are particularly affected by the use of hospital equipment for patient care. If this is highlighted as a crucial component of patient care, it can be lessened. According to Stansfeld and Matheson (2003), workers in service areas may require hearing protection and routine audiometric assessments, and noise levels in those areas need to be closely monitored. According to Akinrinola (2011), Egunjobi (1983), and Scheider (2002), at least 70% of Nigeria's active labour force is employed in the informal sector, which also generates more than 58% of the country's gross national income. Among the noteworthy micro and small-scale businesses situated in or near residential areas in urban Nigeria are those that grind food, mould concrete blocks, mill wood, cut aluminium, and weld iron. The machines these businesses use produce high noise levels that are harmful to people's health and well-being, especially for the elderly, the sick, and children. Therefore, in addition to the financial benefits, the SMEs' explosive expansion, lack of regulation, and extreme informality foreshadow detrimental effects on the environment and the health of their workforce.

The research conducted by Sonibare et al. (2014) showed that some large-scale enterprises' observed noise levels were lower than those produced by small-scale tanneries. This probably prompted the writers to request that the relevant authorities take swift action, including creating and enforcing noise regulations for the small-scale sector. In agreement with the authors cited above, Oguntoke, Tijani, Adetunji, and Obayabgona (2019) proposed that after assessing noise levels at particular small-scale block factories, additional study focus ought to be placed on the acoustic characterization of numerous other small-scale businesses. Considering of the disproportionately high noise levels, workers' preference for residential areas over other places, workers' failure to wear protective equipment, and SMEs' exclusion from compliance monitoring, more research is required to inform the establishment of appropriate legislation in Nigeria. This will significantly shield the health of employees and nearby citizens from the negative consequences of frequent exposure to loud noises, both auditory and non-auditory (NIOSH, 1996).

Level of Awareness

According to a report published by the Ministry of Labour and Employment, Government of India, in 2020, there were a total of 340,882 registered factories in India under the Factories Act of 1948. The report also highlights that the Occupational Safety and Health (OSH) awareness level in factories in India remains a major challenge, with a large number of accidents and fatalities reported every year.

The report indicates that the major causes of accidents in factories include falls, electrocution, machinery-related accidents, and explosions. The report also highlights that the number of occupational diseases is increasing in the country, with many cases going unreported.

To address this issue, The National Policy on Safety, Health, and Environment at Workplaces was introduced in 2009, and the Occupational Safety, Health, and Working Conditions Code, 2020 was introduced in 2020 as some of the various steps the Indian government has taken to improve occupational health and safety in factories. Additionally, the report suggests that there is a need for greater awareness among employers and workers regarding OSH in factories in India. The government has also launched various training programs and awareness campaigns to improve OSH awareness and practices in the country.

Theoretical Framework: Wave and Relational Event Theories

Wave theory is a fundamental concept in physics that explains how waves behave and interact with the environment. Ernst Florens Friedrich Chladni postulated the wave theory of sound in the late 18th and early 19th centuries. He is sometimes labelled as the father of acoustics for his work in the field (Wikipedia 19th March 2023). However, the study of sound and acoustics has a long history dating back to ancient times, and many scientists and scholars like Robert Boyle, Christian Huygens, Augustin-Jean Fresnel, Lord Rayleigh, Pythagoras and Hermann von Helmholtz have all contributed to the development of the theory of sound waves. Pythagoras conducted experiments on the properties of vibrating strings and discovered the mathematical relationships between musical intervals. Aristotle correctly suggested that sound waves propagate through the motion of the air. Later, in the 17th century, Robert Boyle and Robert Hooke studied the nature of sound waves and the relationship between the pitch of a sound and the frequency of its vibration (Wikipedia,2022, March 27)

According to Timon (2022), waves are anomalies that move through time and space while transferring energy and not matter. When a sound is produced, it creates pressure waves in the air that propagate outward from the source. (Medwin & Clay 1998). Wave theory explains the properties of waves, including their frequency and velocity. The distance in phase between two successive points in a wave is its wavelength. The number of waves that pass a location in a specific length of time is known as its frequency. The wave's height, or amplitude, is a measure of the energy the wave is carrying. The speed at which a wave moves through a medium is known as its velocity.

Understanding how sound waves move through the atmosphere and interact with their surroundings is made easier with the aid of wave theory. Air pressure waves are produced when sound is produced, and these waves spread outward from the source. The characteristics of these waves, such as frequency, wavelength, and amplitude, affect how sound is perceived by human ears (Cemetery, Wood, and Cena, 2023).

Empirical Review

Erasto, Majaja, Kizima, and Ibrahi (2021) measured and evaluated the noise level in small and medium-sized maize milling businesses in Morogoro, Tanzania, and the Dar es Salaam corridor group (DCG). They also obtained feedback on noise issues from employees and the local community and made recommendations for noise control measures. 41 SMEs had noise measurements taken between 89 and 103 dBA in DSM and between 92 and 103 dBA near the milling machines at Morogoro. The 85 dBA safe threshold for an 8-hour work shift was surpassed by these measurements. There was also a lot of noise in the area just next to the milling operations. Potential health concerns were noted by machine workers and neighbours related to noise from the machines. The use of worn-out machine bearings, loose or untightened machine parts, faulty machine system installation, and incorrectly made and unbalanced milling hammers were all found to be causes of excessive noise. Potential technical and administrative fixes for these issues were proposed. The study concluded that the majority of maize milling SMEs create a lot of noise, which is harmful to both the surrounding community and the workers themselves. To lessen this issue, they recommended that administrative and technical solutions be put into practice.

Jiang, Zhang, and Lili (2020) evaluated noise exposure and its effects on hearing impairment in employees of a Chinese chemical fibre manufacturing facility; Stata 17.0 was used to conduct a meta-analysis. There were 39 studies total in this analysis, involving 50,526 workers from different industries. In comparison to the control group (12.5%), the noise-exposed group had a greater incidence of high-frequency noise-induced hearing loss (HFNIHL) (36.6%). The 95% confidence interval (CI) for the pooled odds ratio (OR) for HFNIHL was 4.10–6.49. Sensitivity analysis proved this meta-analysis's findings. Subgroup analysis revealed heterogeneity in the findings across the various studies, with respect to age, gender, length of employment, and industry type. The cumulative noise exposure (CNE) and duration of work were found to be the primary risk factors for HFNIHL by the dose-response analysis. The results of the study indicated that Chinese workers had a high detection rate of HFNIHL. The first 15 years of noise exposure are a time of increasing risk for HFNIHL, and the risk increases quickly when CNE reaches 90 dB(A) year. For this reason, taking appropriate preventative measures to minimise hearing loss is necessary to lower the risk of occupational HFNIHL

Adenife and Azodo (2019) examined the extent of industrial noise intrusion from five companies in 40 nearby homes in Anambra state, Nigeria, as a result of the design and settlement patterns. Three measurement areas were taken into consideration: the use of electric power generators, the reliance of job operations on the Power Holding Company of Nigeria (PHCN), the country's on-grid connection, and off-work hours. A digital sound level meter was used for all measurements, which were carried out in accordance with the Nigerian Environmental Standards and Regulation Enforcement Agency. Every assessed residence's measured noise levels were analyzed to get the A-weighted equivalent sound pressure level (LAeq). The generated LAeq value ranges for factory operations during generator usage were 63.2 - 78.7 dBA, for PHCN use it was 44.5 - 62.9 dBA, and for off-work hours it was 41.1 - 59.7 dBA on the result. In accordance with World Health Organization principles and data analysis revealed that notable unacceptable noise levels were only present during generator use, resulting in problems with temporal hearing impairment and moderate to severe levels of annoyance. The US Department of Housing and Urban Development sets acceptable noise levels in residential areas. $P < 0.05$ was found to be significant in every instance by the multiple independent t-test analysis of the LAeq categories. According to the study's findings, residential areas may be seriously endangered by the densely populated and mixed-use growth of businesses and homes nearby.

In a study published in 2020, Akintunde, Julius, and colleagues mapped the University of Jos' noise level dispersion and evaluated the noise level on campus at various locations on various days and throughout various hours of the week. The outcomes were contrasted with the WHO's recommended noise thresholds. The main sources of noise were located. The peak days, hours, and places of the noise level were determined, and recommendations for mitigation were made. Seventeen monitoring locations were selected from the University of Jos based on land usage. Using a sound level meter, three readings were collected every hour for a week: in the morning, at noon, and in the evening. Microsoft Excel and the Statistical Package for the Social Sciences were utilized to analyze the data. ArcGIS software was used to interpolate the spatial distribution of noise levels in the research region using the IDW (Inverse Distance Weighted) approach. The primary sources of noise in the study region were traffic and students. Every location where noise levels were measured had high levels above the acceptable ranges, except the staff quarters, where the morning average was 53.4 dB. This value was above the 50 dB standard limit for educational spaces but below the 55 dB standard for residential areas. According to this study, to regulate and limit noise pollution, the university should reassign incompatible land uses, build soundproof walls, and plant trees all throughout campus.

A new method for delivering uncertainty-based data preparation has been used to construct an ARIMA-based model of environmental noise pollution, according to a study by Muhammad, Arbaiy, and Syahir (2022). The outcomes show that the model's accuracy can be raised by implementing the recommended data preparation technique. Anticipating construction site noise pollution is essential to preventive actions and pollution that puts people in danger. It takes a high level of prediction accuracy for the projected model to approach the true value. For forecasting models to achieve high predicting accuracy, they must be grounded in trustworthy past data. Predictive models produced using different methods are less accurate because of the ambiguity and uncertainty inherent in the data. To remove data uncertainty, the data must be handled accurately. Although they are simple to use, standard data processing procedures do not offer a reliable way to handle this ambiguous data. Consequently, this paper presents a way to handle uncertain data for forecasting purposes. An ARIMA-based model of environmental noise pollution has been developed using a novel method for providing uncertainty-based data preparation. The standard deviation method was applied in the data preparation phase. In order to reduce errors, it is essential to manage the fuzzy data before developing the prediction model. The results of the experiment demonstrate that the recommended approach to data preparation can improve the accuracy of the model.

Mohammed, Woli, Ibrahim and Orilonize (2022) investigated the increasing noise pollution in Nigeria's Offa, Kwara State. Nine different locations had their noise levels tracked using a sound level metre. The investigation reveals that the Federal Environment Protection Agency (FEPA) and the World Health Organisation (WHO) have set limits and standards for noise pollution and that these limits were exceeded in some areas of Offa. According to the investigation, high vehicle traffic caused by traffic congestion in the city led to a notable increase in noise pollution in Owode Market and Oja Ale.

Research from Domina concurs with Frenzilli and associates (2019). Continuous loud noise exposure changes the way the brain interprets speech, possibly making it harder to distinguish speech sounds. A 12-hour loud noise exposure causes immediate DNA alterations in specific brain areas of the rat as well as long-lasting neurotransmitter and immune-histochemical alterations. They came to the conclusion that exposure to loud noises is a harmful stimulus for particular brain regions, primarily due to a decrease in catecholamine innervation across a number of brain regions. According to the study, both adults and children with autism are negatively impacted by noise pollution. Hyperacusis, or an unusual sensitivity to sound, can occur in individuals with autism. When exposed to loud noises and noisy surroundings, people with autism who suffer from hyperacusis may feel uncomfortable physically as well as experience unpleasant emotions like fear and anxiety. Patients with autism tend to avoid noisy environments, It may cause them to become socially isolated and negatively impact their quality of life. Both occupational and ambient noise exposure are associated with detrimental health effects, both non-auditory (neuropsychiatric, psychological, cardiovascular metabolic) and auditory (hearing loss, tinnitus). Public health activities are becoming more and more necessary in order to better regulate exposure to occupational and ambient noise. People in susceptible groups, such as those with autism, maybe more affected. Educating teenagers and young adults about the detrimental effects loud noise exposure has on their health is particularly crucial. Regrettably, excessive noise pollution—particularly exposure to loud noise during leisure—is frequently viewed as desirable, particularly by younger people (disco music, electronic music events).

RESEARCH METHODOLOGY

A survey design was adopted for this study. In this study, a pilot survey has been done in this study covering urban and rural markets in the three (3) senatorial zones of Anambra State. Thereafter, 6 selected markets were visited and data was collected with a sound recorder and hand-held GPS. Primary and secondary data sources are the two sources of data that are pertinent to this study. Primary data were data obtained directly from the field and included data gathered from field measurement, interview, focused group discussion and key informant interviews and those elicited from questionnaire administration while secondary data sources were obtained from published sources such as journals, academic articles, textbooks, bulletins, internet materials, news articles, research projects, magazines, conference/seminar papers and other research records available on noise and occupational safety and environment among others. The sampling frame for this study comprises 60 known markets in Anambra state. These markets have been known for their grinding services in the state. Ten percent of 60 which is 6 were chosen to be the sample size of the study. The 6 markets are Nkwo Igboukwu, Nkwogbe, Ihiala; Ose Okwodu and Ochanja, Onitsha; EkeAwka, and OyeAgu Abagana. The total number of agglomerated grinding mills in various sections of the six markets is put at 242. Various primary tools were used to collect basic information. These include the use of a camera which helps in taking pictures, and GPS for the location of the coordinates of the study area, especially the sample locations; others are digital sound level meters GM1351. Decibels were used to take the sound pressure level reading in the grinding mills, and field notes and pens were used to take down the various distances away from the noise source and observations at the study area. Semi-structured questionnaires containing both open and close-ended questions were used to collect data from grinding mill operators, grain sorters and Sievers in the selected markets. The questions in the questionnaire were developed to address the specific objective of the study. For this study, the noise measurement method used by Omsokhodion and Kolude (2005) was adopted. When the mills were operating under load, the sound pressure level of the workstation was measured using a GM1351 decibel metre (see plate 3.1). Additionally, measurements were made at distances of 10, 20, 30, 40, 50, and 100 metres from the workstation. The GM1351 decibel meter measures sound levels between 30dBA-130dBA with an accuracy of 1.5DB, the GM1351 decibel meter when powered on and put on the "MAX HOLD" function, holds the highest sound pressure level reading until a higher reading is picked up by a plate of the instrument is shown below.

PLATE 1: GM 1351 DECIBELS METER

A structured questionnaire was used to collect data from the grinding mill workers on the duration of exposure, use of hearing protective devices, knowledge of noise hazards (such as tinnitus, headache, annoyance, tiredness) etc. The questionnaire that was used for this study was adopted from that used in a similar study in Ghana (Quaye & Kanda 2003). Section B of the questionnaire was adopted from that used by (Oka, 2018). While section C is the Nigeria Centre for Disease Control (NCDC) hearing loss assessment was taken by Audiology professionals (2016). The demographic characteristics/ description of grinding/milling operators were analysed by the use of descriptive statistical tools such as percentage, frequency and mean scores. One sample T-test was used to analyse hypothesis (Ho_1) while (Ho_2) was tested using a goodness-of-fit chi-square Test at a 0.05% level of significance. Results were evaluated using the Statistical Package for Social Sciences (SPSS) version 22. The WHO and NESREA's acceptable safety environmental noise levels served as the standard reference for assessing the degree of severity of the values obtained. The sound metre, also known as the sound level metre, is a device that measures sound pressure level and is commonly used in noise pollution studies to quantify various noise classes, such as industrial, aircraft, and other environmental noise. Decibels (dB), a logarithmic method of measuring sound pressure, loudness, and intensity, are used as the unit of measurement (Nnatu, 2021).

DATA PRESENTATION AND ANALYSIS

Analysis of bio-data of respondents

Table 1: Marital Status of the Respondents

Marital Status	**Nkwo Igbo**		**Nkwo Ogbe**		**Ose**		**Ochanja**		**Eke Awka**		**Oye Agu**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Married	12	48	48	70.6	33	45.8	6	35.3	3	37.5	20	50
Single	6	24	12	17.6	24	6.1	8	47.1	5	62.5	16	40
Divorced	2	8	2	8	5	6.9	1	5.9	0	0	3	7.5
Widowed	5	10	8	11.8	10	13.9	2	11.8	0	0	1	2.5
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: field survey, 2024

From Table 1 above, it shows the marital structure of the respondents. From the table, it is seen that in Nkwo Igbo Ukwu market, 48 percent of the respondents are married, 24 percent are single while 8 percent and 20 percent are respectively divorced and widowed. This implies that the market has more married respondents than other statuses. Nkwo Ogbe respondents have 70.6 percent as married while single and widowed respondents constitute 17.6 percent and 11.8 percent respectively. This implies that married men constitute the greatest part of the respondents. Also, in Ose market, there are more married respondents (45.8 percent) than in every other category. Single respondents constitute 33.3 percent while divorced and widowed respondents each constitute 6.9 percent and 13.9 percent respectively. In Ochanja and Eke Awka markets, there are more single respondents (47.1 and 62.5 percent respectively), followed by married respondents (35.3 and 37.5 percent respectively). Divorced and widowed in Ochanja constitute 5.9 percent and 11.8 percent. There are no divorced and widowed respondents in Eke Awka market. In Oye Agu Abagana, 50 percent of the respondents are married, while 20 percent are single. Divorced and widowed constitute 7.5 and 2.5 percent respectively.

Table 2: Age distribution of the respondents

Age Bracket	Nkwo Igbo		Nkwo Ogbe		Ose Okwodu		Ochanja		Eke Awka		Oye Agu Abagana	
	F	%	F	%	F	%	F	%	F	%	F	%
21-30 years	7	28	15	22.1	18	25.0	8	47.1	1	12.5	16	40.0
31-40 years	10	40	31	45.6	23	31.9	4	23.5	3	37.5	12	30.0
41-50 years	5	20	12	17.6	27	37.5	5	29.4	4	50	9	22.5
Above 50 years	3	12	10	14.7	4	5.6	0	0.0	0	0	3	7.5
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: Field Survey, 2024

Table 2 above shows the age structure of the respondents. From the Table, the age distribution of the respondents across the six markets shows that the most active age range is from 21 years to 50 years, there are only a few who are above 50 years. Among these, those between the ages of 21 to 40 are more than those between 41 to 50 years. This implies that the majority are young and vibrant and are still within the youthful age range.

Table 3: Educational levels of respondents are hereby presented below

Educational status	Nkwo Igbo		Nkwo Ogbe		Ose-Okwuodu		Ochanja		Eke Awka		Oye Agu	
	F	%	F	%	F	%	F	%	F	%	F	%
No formal education	2	8	0	0.0	8	11.1	1	5.9	0	0.0	15	37.5
Primary School	5	20	15	22.1	11	15.3	2	11.8	0	0.0	9	22.5
Secondary School	10	40	25	36.8	20	27.8	6	35.3	5	62.5	10	25.0
Tertiary Institution	8	32	28	41.2	33	45.8	8	47.1	3	37.5	6	15.0
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: Field Survey, 2024

Table 3 above shows that the modal/predominant educational levels are primary school, secondary school and tertiary education; only very few have no formal education. This suggests the ability to read and write for the majority of the respondents. This is presented in Figure 4.1.3 below

Table 4: Length of years spent milling /grinding operation

Length of years spent in milling operation	Nkwo Igbo		Nkwo Ogbe		Ose		Ochanja		Eke Awka		Oye Agu	
	F	%	F	%	F	%	F	%	F	%	F	%
1-5 years	6	24	12	17.6	19	26.4	2	11.8	0	0.0	10	25
6-11 years	4	16	15	22.1	9	12.5	8	47.1	2	25.0	20	50
12-16 years	5	20	19	27.9	22	30.6	2	11.8	5	62.5	4	10
17-21 years	5	20	10	14.7	11	15.3	1	5.9	1	12.5	2	5
22-26 years	3	12	8	11.8	8	11.1	0	0.0	0	0.0	2	5
27+ years	2	8	4	5.9	3	4.2	4	23.5	0	0.0	2	5
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: Field Survey, 2024

Looking at Table 4 above, the years of experience of the respondents show that in all the markets except Eke Awka, there are many who have worked for 1 to 21 years. This can be justified by the size of the market (Eke-Awka). Eke-Awka is the smallest of the six selected markets. This can be viewed from the main four factors of production. (labour, Capital and land). The market lacks enough space for grinding mills to occupy a niche in it. The millers that were able to find a space for their operation are just very few and they have not spent quality years in the business. The years of experience are presented in Figure 4.1.4 below

Table 5: No of persons in the household number of persons in the household

No of persons in the household	Nkwo Igbo		Nkwo Ogbe		Ose Okwodu		Ochanja		Eke Awka		Oye Agu Abagana	
	F	%	F	%	F	%	F	%	F	%	F	%
1 member	7	28	11	16.2	15	20.8	11	64.7	2	25.0	16	40.0
2-5 members	6	24	30	44.1	18	25.0	6	35.3	1	12.5	11	27.5
6-9 members	11	44	27	39.7	39	54.2	0	0.0	5	62.5	12	30.0
10+ members	1	4	0	0.0	0	0.0	0	0.0	0	0.0	1	2.5
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: Field Survey, 2024

Table 5 above shows the number of persons in a household. It can be seen that across the markets, between 1 to 9 members are very active, while there are almost no markets where above 9 members participate, except in Nkwo Igo Ukwu and Oye Agu Abagana markets.

Table 6: Roles played in the milling operations

Role played	Nkwo Igbo		Nkwo Ogbe		Ose Okwodu		Ochanja		Eke Awka		Oye Agu Abagana	
	F	%	F	%	F	%	F	%	F	%	F	%
Machine Operator	20	80	64	94.1	67	93.1	15	88.2	7	87.5	30	75
Sieving	5	20	4	5.9	5	6.9	2	11.8	1	12.5	10	25
Electrician	0	0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
Others	0	0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: Field Survey, 2024

The majority of the respondents are operators while the rest do the work of sieving. There are no electricians and other workers, found in the milling units. This can be seen in the chat in Figure 6 below

Table 7: The members of the family engaged in the milling Business as a source of labour

Family members used as labourers	Nkwo Igbo		Nkwo Ogbe		Ose Okwodu		Ochanja		Eke Awka		Oye Agu Abagana	
	F	%	F	%	F	%	F	%	F	%	F	%
1-2 members	20	80	64	94.1	68	94.4	17	100	7	87.5	30	75
3-4 members	5	20	4	5.9	4	5.6	0	0	1	12.5	10	25
5-6 members	0	0	0	0.0	0	0.0	0	0	0	0.0	0	0
7+ members	0	0	0	0.0	0	0.0	0	0	0	0.0	0	0
Total	**25**	**100**	**68**	**100**	**72**	**100**	**17**	**100**	**8**	**100**	**40**	**100**

Source: field survey, 2024

The distribution of family members used as labourers shows that only between 1 to 4 family members are used as labourers across the markets. This is understandable, as not everyone in the family will have the same interest in the milling business as the rest, while some would prefer to seek for source of income in other businesses.

Test of Hypotheses

International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 8 Issue 11 November - 2024, Pages: 349-359

Hypothesis One

There is no significant relationship between distance from the source of noise and mill noise level. Pearson-moment correlation was used. This is presented in Table 8 below.

Table 8: Names of market and distances away from the mills

Names of markets	At 0 point	10 meters	20 meters	30 meters	40 meters	50 meters	100 meters
Nkwo Igboukwu	89.2	85.1	81.3	76.2	70.0	60.0	55.2
Nkwo Ogbe	92.0	85.6	80.1	73.3	62.7	51.5	58.2
ose okwuodu	97.2	90.0	85.0	95.0	68.4	68.5	99.2
Ochanja	87.3	80.5	76.1	70	65.1	61.2	52.4
Eke- Awka	79.2	70.1	65.2	255.3	44.6	47.2	68.2
Onye –Agua bagana	88.3	73.2	58	50.2	44.5	55.1	64.7

Source: Field Survey, 2024

Table 9: Pearson-moment Correlations

		Distance in meters	Mill noise level
Distance in meters	Pearson Correlation	1	-.789**
	Sig. (2-tailed)		.000
	N	40	40
Mill noise level	Pearson Correlation	-.789**	1
	Sig. (2-tailed)	.000	
	N	40	40

. Correlation is significant at the 0.01 level (2-tailed).

Source: field survey, 2024

To determine if there is a correlation between noises from the source and mill noise level. Pearson-moment correlations were used as seen in Table 9. HO_1, which states that there is no significant relationship between the distance from the source of noise and mill noise level, there is a significant difference with .001 while the Pearson value is -789, negative significant relationship. This simply means that as distance is increasing, the perceived noise is decreasing. Or mill noise decreases with an increase in distance away from the source. Therefore, we reject the null hypothesis which states that there is no significant relationship between distance from the source of noise and the noise mill level. This is opposite (out of line) with the research work done by (Ekott, Bassey., and Obisung.,2021) they modelled the relationship between Noise Levels and Distance from A 500KVA Power Generator. The results obtained from the models developed in this work, L (Modeled) were compared with the results obtained from the physical measurements L (measured). The results revealed that the maximum noise level of a 500KVA power generator (i.e. source or x=0m) was 97.44dBA. The corresponding distance, xc in meters at which its adverse effects were covered in the residential areas was 0 _<<_87. Also, the corresponding distances in meters in which it can be sited from the residential areas 88_< _<. The results revealed that the equivalent continuous noise level, L_{eq} decreases as x increases. It was that there was no significant difference between L (measured) and L(modelled).

From the Table 8 above, shows that sound is more at (0meter) source than a few meters away. This is understandable as most of the mills are operated with internal combustion engines. These Engines are the major producers of noise in the milling area. The table above has shown that the noise level measured at Ose okwuodu at the source (0meter) reads 97.8Db, this shows the highest sound recorded. It implies at the source, sound tends to be more; It equally proves that Ose-okwuodu produces the highest noise from the six selected markets. There are other factors that could contribute to Ose-Okwuodu Mill being the highest noise-producing mill among the six markets. Such factors are the population of the mills, the type of structure common in the milling Units and the type of milling machine common among the millers. From the same table above, it was shown that Onye Agu Abagana records the lowest sound level of 44.5 dB at 40 meters away from the source. This can be explained by some facts that sound decreases as far as there is an increase in the distance away from the source (0 meters). The reading at 30 meters, shows that sound diminished completely at 40 meters but increased once again at 50 meters away from the source. At 50 meters away from the source, there could be an intrusion of sounds from other sources apart from the grinding mills, which could have been attributed to the increase from 44.1 dB to 55.1 dB at 50 meters and 64.7 at 100 meters away from the source.

Hypothesis Two

Grinding mill operators are not aware of any occupational health and safety risk of persistent exposure to noise in their workplaces. One sample T-test (test value 27.5)

Table 10: One-Sample T-Test Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Total awareness score	243	25.0823	8.66654	.55596

Source: field survey, 2024

Table 11: One-Sample Test

	Test Value = 27.5					
					95% Confidence Interval of the Difference	
	T	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Total awareness score	-4.349	242	.000	-2.41770	-3.5128	-1.3226

Source: field survey, 2024

Grinding mill operators are not significantly aware of any occupational health and safety risk of persistent exposure to noise in their workplaces.

This hypothesis was tested by comparing the mean responses of the grinding mill operators (respondents) with the mean cut–off mark which is 2.50, to know if the overall mean response is significantly above or below 2.50. There are eleven items (questions) under awareness and four ranges (No awareness, low awareness. medium awareness, and high awareness) and there were 11 items answered by the respondents under the level of awareness. Therefore, the minimum score is 11 and the maximum score is 44. (4x11=44). The mean value is 27.5. Therefore, people who scored 27.5 are aware of the occupational health and safety risk of persistent exposure to noise in their workplace, while those below 27.5 are not aware.

From the test above, the total mean score is 25.0823. So, they are not aware. Thus, we accept the H_2 which states that Grinding mill operators are not significantly aware of any occupational health and safety risk of persistent exposure to noise in their workplaces. The mill operators are ignorant of the problems associated with the nature of their job. This is similar to the research work done by (Awosan, Ibrahim, Yunusa, Isah, Ango, and Michael, 2018). The research work revealed that mill operators and traders in the Kebbi central market are not aware of the challenges excessive noise pollution poses to their health (Awosan, et al, 2018).

Conclusions

Similar to numerous other nations, Nigeria's food processing industry plays a vital role in the country's nutritional dynamics. They are responsible for transforming raw materials into final or semi-finished goods. Anambra State is home to a good number of processing-related businesses. Among these businesses are food processors and millers, who are widely dispersed throughout the state and are largely responsible for the noise pollution that is observed there. In a bid to organize this set of agents of food processors, they are gathered in an area, which is formally called agglomeration. This process has caused huge noise pollution within the environment where they are found, and thus, formed the crux of this study which looked at noise pollution from agglomerated grinding mills in selected markets in Anambra State, Nigeria. The study's conclusion demonstrated that these economic agents do, in fact, contribute to noise pollution in the area because the noise levels in those areas exceed the benchmark established by local standards, increasing the risk to the public's health and safety.

Recommendations

The following recommendations are put forward:

- that the implementation of engineering controls, such as machine guards and efficient ventilation systems, can reduce the impact of noise pollution and thereby protect the operators of grinding mills in the designated markets in Anambra State.
- Since noise has a greater impact on children, the state government should make sure that millers and sievers and their young children stay out of these noisy environments. Alternatively, daycare centres for the children of millers and sievers should be located approximately 100 metres from the parents' places of employment.

References

Azodo. A.P., & Adejuyigbe, S. B. (2019). Examination of noise pollution from generators on the residents of Obantoko, Ogun state, Nigeria. *Asian Journal of Engineering, Sciences & Technology, 3*(1), 31–41.

Azodo, A. P., Idama, O., Mezue, T. C., & Owoeye, F. T. (2018b). Evaluation and analysis of environmental noise from petrol-fuelled portable power generators used in commercial areas. *Journal of Experimental Research*, *6*(2), 8–13. Retrieved from *http://www.er-joumal.com/papers/Azodo%20A_March_2018_Page_8-13.pdf*

Azodo, A. P. Ismaila, S. O., & Owoeye, F. T. (2018a). Investigation of occupational noise exposure and its physiological effect on landscape gardeners. In Proceedings of the 2018 International Conference on SET: A driving force for sustainable development tagged COLENG 2016, Federal University of Agriculture, and Abeokuta, Nigeria. (TextBook)

Egunjobi.1 (1986)Urban environmental noise pollution in Nigeria. *Habitat Int.* 10(3):235–244.

Elise, E. M., Kempen, V., Kruize, H., Hendrick, C.,Boshuizen, C. B., et al. (2002). The association between noise exposure, blood pressure and Ischaemic heart disease. Environmental Health Perspectives, 110, 307–317.

Environmental Protection Agency. (1978). EPA Document, November, 550/9-79-100, USA Protective noise levels.

European Commission. (1996). Future noise policy. Green paper. Brussels: European Commission.

European Commission. (2002). Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise. Brussels.

European Environmental Agency. (1999). Environment in the European Union at the turn of the Century. Copenhagen: EEA, Environmental Assessment Report No 2.

Latinwo, I., & Solomon, B. O. (2004). Impact of Tanneries on Ambient Noise Levels in Kano, Nigeria. *Journal of A Jeam-Rajeev*, 8, 1–8.

Obianyo, P. (2014). An Address of Welcome to the Opening Ceremony of a 3-Day Seminar Organized at Awka by the Environmental Health Officers Association of Nigeria, Anambra State Chapter, 10- 12th Nov.

Ocheli, Ogbe & Aigbadon (2021). Implication for Gully Erosion Hazards. https://doi.org/10.21203/rs.3.rs-201366/v1

Official website of Anambra State Government. Retrieved from https://anambrastate.gov.ng/local-government-areas/.

Saranya (2023). Environmental Quality - Importance and Factors Affecting the Quality *of Life. Www, research gate.org.*

Singh, A., & Kohli, J. S. (2012). Effect of pollution on common man in India: A legal perspective. *Advances in Life Sciences and Technology*, *4*(1), 35–41.

Stansfeld, S., & Haines, M. (2002). Noise exposure from various sources - cognitive effects on children. Bonn: WHO.

Sonibare, J. A., Adeniran, J. A., Fakinle, B. S., Latinwo, I. O., Jimoda, L. A., & Olu-Arotiowa, O. A. (2014). Ambient noise from off-grid diesel engines and electric power generators in an urban environment. *Management of Environmental Quality: An International Journal*.

Vanguard News. (2018, February). Full list of 21 LGAs in Anambra state and their chairmen. https://www.vanguardngr.com/2018/02/full-list-of-21-lgas-in-anambra-state-and-their-chairmen/

World Health Organization. (2000). WHO-working group. Evaluation and use of epidemiological evidence for environmental health risk assessment: WHO guidance document. Environmental Health Perspectives, 108(10), 997-1002.

World Health Organization. (2012). Environmental Health Indicators for the European Region. Update of methodology. Bonn: WHO.

World Health Organization. (2017). WHO-second technical meeting on noise and health indicators. Results of the testing and piloting in Member states, 18-19 Dec. 2003. Bonn, Germany.

World Health Organization. (1999). In Berglund, B., Lindvall, T., & Schwela, D. H. (Eds.), Guidelines for community noise. Geneva: WHO.

World Health Organization. (1992). On Being in Charge: A Guide to Management in Primary Health Care. Geneva: WHO.

World Health Organization. (2021). From *http://www.who.int/docstore/pehlnoise/guidelines2.html*.