Poultry Abattoir Health Risk on the Adjoining Land Uses of Muda Lawal and Nursing Quarters of Bauchi State, Nigeria

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ABSTRACT

The study is motivated by the spread of waste from poultry abattoir in the Muda Lawan Market in Bauchi Municipal Area and its attendance consequences on the environment and its health impact on the local population. Mixed research method was used to collect data for the study. One hundred questionnaire were administered to elicit information from the poultry butchers, market users and market neighborhood. The distance between the abattoir and the adjoining land uses was determined using GPS. The abattoir air quality was assessed using Aeroqual series potable gas measuring device twice daily Morning and evening. Data obtained were analyzed using inferential statistical in SPSS version 25. Chi-square was used to determine the relationship between the dump site location and reported health issues. Air pollutant value obtained was compared with WHO and NIOSH threshold. The result revealed that the poultry abattoir is located very closed to the waste dump site 43.84m and 112 meters away from the market center, ATBU medical college, Aliko Dangote college of Nursing and Urban College Secondary School. Air pollutant dictated in the dump site include; Methane (CH_4), Hydrogen Sulfide (H_2S), Oxygen (O_2) and Carbon Monoxide (CO). All the four (4) gasses revealed constant emission during morning (6.30am) and Evening (6.30 pm) except oxygen. CH_4 had the ratio value of 2,000ppm (0.1%), H_2S had the ratio 1,000 ppm (0.1%), CO had the ratio 3,000 ppm (0.3%) and O2 has the ratio of 16,000 ppm (16.0%) morning and 19,000 ppm (19.0%) evening. The four (4) gasses dectated does not exceed the threshold limit of WHO/NIOSH. The study found that people living near the poultry abattoir and its dump site are at risk of respiratory, skin and gastrointestinal diseases. Respondents expressed concerned on gastrointestinal (12.2%) and skin disease (13.3%) as the most prevailing disease among butchers and residence than skin diseases (1.0%). Market users and Resident respondents expressed concern on foul odor (72%) and filthy environment full of animal tissues (64%). The study also showed that people were unhappy (74.5%) with how waste is currently being managed in the market. The Chi-Square value confirmed significant relationship ($P > 0.05$) between distance to abattoir waste dumpsite and reported health issues. The study concluded that the continuous emission of Hydrogen sulfide, methane, Carbon monoxide and associated gasses in the abattoir waste dumpsite is below the threshold limit of national institute for occupational safety and health (NIOSH) therefore, it does not portrayed any serious environmental risk to human but to the environment contributing to greenhouse gas emission. The study recommended among others that the Bauchi Local government Authority (LGA), BASEPA and relevant NGO's should formulate policy that will specifically control the continuous proliferation of poultry abattoir waste and its attendance consequences to human health and the environment.

Key Words: Abattoir, Poultry, Market, Health and Risk

INTRODUCTION

An abattoir is a facility or premises approved and registered by the controlling authority for hygienic slaughtering and inspection of animals, processing and effective preservation and storage of meat products for human consumption (WHO, 2007). It is ultimately derived from the French verb abattre, which means "to strike down" or "fell" (Agbola, 2001) and it has existed as long as there have been settlements too large for individuals to rear their own stock for personal consumption (Agbola, 2001). Abattoirs may be classified into categories depending on available facilities; Rural areas: Slaughter Slabs; and Townships: Slaughterhouses (Akinbode 2014). The animals most commonly slaughtered for food are cattle (beef and veal), sheep (lamb and mutton), pigs (pork), and poultry (Zbag, et al., 2019). Horses are also slaughtered for meat mostly in Europe (Akinro, et al., 2009) and parts of Nigeria.

Abattoir also known as slaughter house, is a place that is considered for butchery and dressing of animals so as to provide meat for the consumption of the general populace. The animals when being killed and dressed will be cut into pieces for individuals to buy for consumption. (Akinro, et al., 2009) defined abattoir as any place that is approved and registered by the supervisory authority in which animals are slaughtered and dressed for human consumption. Chukwu, (2011) (2004) reported that the first stages in meat processing take place in the abattoir (slaughterhouse). These comprise of slaughtering, bleeding, hide or hair

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removal, evisceration, offal removal, carcass washing, trimming, and carcass dressing. Further stages that can be termed as secondary operations also occur on the same premises which include cutting, deboning, grinding, and processing into consumed products.

According to Food and Agricultural Organization (FAO 1988), it is expected that to assess an abattoir, the travel distance should not be more than 1.6mm for a slaughter slap and 3km for a moderate to standard abattoir. The abattoir capacity will also be dependent on the mix of animals being slaughtered (WHO, 2000). It has also been on record by World Health Organization (WHO) that, the minimum of $1800m^2$ is required to accommodate all requirements for a small and medium size abattoir. According to FAO, an abattoir should not be located close to dwelling, school, churches, mosques, commercial buildings, hospital etc. The site should be accessible from a permanent road to allow a ready transport to both livestock and meat. Most of the slaughter houses are not properly located with consideration to access to water supply and proper waste disposal; this has led to problem of how to dispose both liquid and solid waste.

A standard abattoir just like any other service facility needs basic functional facilities to operate smoothly but that is not the case in most of the existing abattoirs in Nigeria especially the poultry abattoir in Bauchi metropolis, Slaughterhouses are regulated by law to ensure good standards of hygiene, the prevention of the spread of diseases and the minimization of needless animal cruelty. The slaughterhouse had to be equipped with a specialized water supply system to effectively clean the operating area of blood and offal, veterinary scientists, refrigeration technology and good waste disposal facility. And in its location, a slaughterhouse should be located in an area which is reasonably free from objectionable odors, smoke and dust. Adequate dust-proof access-ways connecting the slaughterhouse with public roads shall be available.

However, poultry abattoir dumpsite or waste dump sites are a major contributor to the world's anthropogenic greenhouse gas (GHG) emissions because an enormous amount of Methane (CH_4) & Carbondioxide (CO_2) and are generated from the degradation process of deposited organic waste in the abattoir landfills (Chukwu, 2011) and indeed constituted a major aesthetic pollutant in the environment. Poultry abattoir/ waste dump sites operation is usually associated with contamination of surface and groundwater by leachate from the dump site associated with pungent odour, loud disturbing noise from butchers and buyers in the abattoir while dumping the waste and during evacuation by the use of wheel borrows, volatile organic compounds (Maqbool, Bhatti, Malik, Pervez, and Mahmood, 2011). The storage of feathers, poultry intestine and leachate in open drainages can influence the levels of odors experienced in a abattoir dump site. Residents living close to abattoir or dump sites have shown concern due to several hazardous pollutants (Animals organ and blood) emanating from abattoir dupe site operations (Palmiotto, Fattore, Paiano, Celeste, Colombo and Davoli, 2014). Some other pollutants associated with deposition of animal tissue on landfills include fur litter, sludge, excess rodents, unexpected landfill fires due methane emission, etc. (Gerber et al., 2010).

The factors that influences the by-product or emissions from poultry abattoirs include the kind and quantity of animal's waste (Organ, Feather and Faces) deposited, the age of the abattoir and the dump site and the climatic conditions of the dump sites. Complex chemical and microbiological reactions within the dumpsite often lead to the formation of several persistent organic pollutants (such as dioxins, polycyclic aromatic hydrocarbons), gaseous pollutants, heavy metals and particulate matter (Wesson et al., 2010). However, poor physical development, which includes human activities (abattoirs) that are generally known all over the world to pollute the environment either directly or indirectly from their various processes and on various fronts (water pollution, air pollution, land pollution, odor, etc) continue to degrade the environment. Abattoir waste, just like any other waste, can be harmful to humans and the environment. The nonchalant attitude of the operators has the ability to damage our environment if good certain steps are not taken.

Research Method

Study Area

Muda Lawal Market is geographically located between latitudes 10°19'25.95" and 10°19'54.18" north of the Equator and longitudes 9°50'16.81" and 9°50'40.69" east of the Greenwich meridian (Figure 1). However, Muda lawan market is situated in Bauchi Municipal area Bauchi Local Government at approximately 10 to 15m adjacent to specialist hospital Bauchi in the north, 30-meter east of Abubakar Tafawa Balewa University Teaching Hospital Bauchi, Northeast of Wunti Mark*et al*ong Bauchi-Kano road. The poultry abattoir of Muda Lawan market does not have a defined Dumpsite that is officially designated nor does it has a specified slaughter house.

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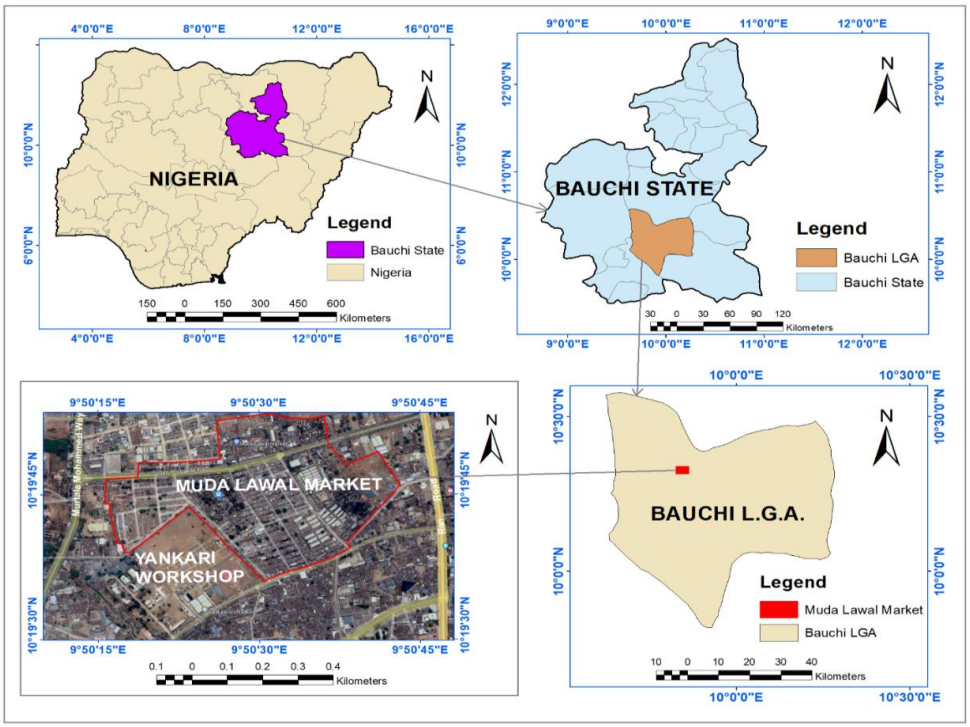

Figure 1: Study Area

Method of Data Collection

Sources of data

Data for this study was Collected through the use of questionnaire, focus group discussion and face to face interview as well as field observation. In addition relevant literatures were sourced from text books and internet journal articles to buttress the arguments and justified the findings of this work.

Institutional survey

The government agencies (Mini Institutional Survey of agriculture) and trade unions in charge of abattoirs were also accessed to elicit information about the abattoir.

Reconnaissance survey

A reconnaissance survey was conducted with the view to identifying the operational procedure of the poultry abattoir and the location, size, sanitary facilities, abattoir proximity to main market, hospital and residential areas closed to the abattoir. In addition, other market users operating closed to the abattoir as well as other functional institutions that are closed to the abattoir were all identified. Similarly, location potentials and constraints were observed and taken notes including obstacles to be encountered in the area during the research work.

Sampling techniques

Data for this study was collected using stratified random sampling techniques in line with Brewer, (1999) prediction-base inferences to identify the number samples to be chosen.

Sample size

Sample size was determined by Yamane's formula modified by Krejcie and Morgan (1970). Krejcie and Morgan in their 1970 article "Determining Sample Size for Research Activities" Krejcie and Morgan (1970) recommended the use of 0.50 as an estimate of the population proportion to maximize variance, which will also produce the maximum sample size. So at 95% confidence level, P = 0.5, $(1 -) \approx n = \frac{N}{1+Nd2}$ which is Slovin or Yamane formula. This implies that Yamane formula is a special case of Krejcie and Morgan (1970) formula or Cochran's (1970) formula. Hence, Krejcie and Morgan's, Cochran's and Yamane's formulas coincided when estimating sample size using a 95% confidence coefficient and P = 0.5. giving a total of 100 questionnaires was administered from a population of 140.

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In effect, when X^2 p(1 −p) = t^2 σ^2 , the general formula for determining sample size becomes $n = \frac{N}{1-N(\frac{d}{dt\sigma})}$ This allows the adjusted Yamane's formula applicable at different population proportion levels and confidence levels. Hence Sample Size Determination table of Krejcie and Morgan adopted from Anokye, M. A. (2020) was used Table 1.

A control population was equally chosen from residence living far away from the market for comparison.

n = N/(1+N(e)2. Where; $n = \frac{N}{1-N(\frac{d}{dt\sigma})}$ ……1

n= minimum returned sample size
N = the population size
σ = the number of standard deviations that would include all possible
t= t-value for the selected alpha level of confidence level
e= the degree of accuracy expressed as a proportion=0.05

Research design

This study adopted a quantitative research approach through a descriptive survey design. The survey design was appropriate because it allows the researcher to collect data from a relatively large sample of butchers in a systematic manner to ascertain the health and environmental risks of residents living close to a poultry abattoir in Bauchi metropolis. The quantitative approach will provide measurable evidence that can be statistically analyzed to reveal patterns and relationships. By using a descriptive survey, the study will not only identify the various types of pollutants emitted but will also ascertain the relationship between abattoir dumpsite and the health status of the butchers/residents and environmental parameters. This design was justified because it will enable the researcher to generalize findings across the environment of the abattoir and those living around within the study area and provide a reliable basis for policy and practice.

Data collection

Four (4) Veterans (Research Assistance) among the butchers who are literate were trained by the researcher on how to collect the data for this study using structured questionnaire. The questionnaire was structured into three section; section A for the butchers, Section B for resident living close to the abattoir and those living far from the abattoir and section C for market official (Community base associations operating in the market). Prior to the question administration, a pre-test questionnaire was issued to the proposed respondents (butchers, residence, market users and market official) with the view to ascertain the relationship between abattoir dumpsite and the health status of the butchers/residents and environmental parameters using the survey tool. Field observations were equally carried out as a means of data collection. Topical issues related to health of resident living close to the abattoir were asked in the questionnaire such as the most frequently experience ailment.

Air pollutant measurement

Air pollutantat the abattoir dump site for four (4) consecutive days twice daily (morning 6.30 am) and (Evening 6.30 pm) the concentration of gaseous pollutants were measured using Aeroqual series (200 U.S.A). Aeroqual series is a portable gaseous pollutants measuring device having a string built-in sampling pump that sucks up air vertically and horizontally up to about 100 feet (30m). the monitor combines a PID (photoionization detector with sampling pump having a detection range of 0 – 2000 ppm. This device uses lithium ion battery and it is turned on at sampling to measure the concentration of pollutants of interest and the result is displayed on the screen of the equipment. The result remain on the screen until one presses a "start" key to commence another round of sampling to calibrate the device, the "enter" button is pressed and until the word zero appears next to ZERO CAC. This routine always runs for up to 5 – 10 times (depending on the gas sensor installation) and then the device deeps to indicate conduct of this research, the device malfunction slightly perhaps due to poor handling or misuse, specific air parameters failed to be activated, only methane, Hydrogen sulfide, carbon monoxide, and oxygen were measured.

Air sample procedure at the abattoir dump site

Air sampling was proposed to cover for the following air parameters; SO_2, NO_2 PM, PM_2 H_2S CO, Methane (CH_4) and NH_3. Since these pollutants constitute large proportion of emission from abattoirs generally. However, in the case of this research due to technical error that occurred during the data collection on air emission device, only H_2S, CH_4, CO and O_2 were covered. Air samples were measured twice daily morning (6.30am) and evening (6.30pm) for four (4) consecutive days

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using Aeroqual Series Gas Monitor. The device was set to measure the concentration of all the gaseous pollutants liable to be liberated in the dump site, but due to technical problem developed by the Gas Monitor NH_3, NOS, SO_2 & PMs were not measured. However, during the four days sampling, preference was given to the actual time the abattoir operations are taken place (morning 6.30 – 7.00am) and when abattoir operations are closed (6.30 – 7.00 pm). The rationale of doing these is to provide a full coverage of possible period when abattoir ration is likely to pollute the ambient air quality of the environment.

Method of data analysis

Data obtained were analyzed with the aid of Statistical Package for the Social Sciences version 25 developed by International Business Machines Corporation, Armonk City, NY, USA. Inferential statistics were used to present the results using contingency tables and Chi-square**.**

RESULT AND DISCUSSION

Socio-Demographic Profile of the Respondents

The demographic profile of respondents in table 1 revealed significant insights into the composition of the study sample. A considerable majority (89.8%) of the respondents were male, while only 9.2% were female. This indicates that male participants were more engaged in the survey, possibly due to their dominant role in the abattoir and related occupations. The gender imbalance may also suggest that environmental and occupational hazards disproportionately affect male respondents, or that females have lower participation in activities associated with abattoir operations. These findings were in consonance with Helen *et al*., (2022) in a study of Kaduna Abattoirs in their study they reported also that male gender participated more than female gender in abattoir operations and demand of meat products dictates the possible location of abattoir than government criteria.

Age distribution highlights that the largest group (53.1%) fell within the 18-30 years category, followed by 31.6% in the 31-40 years range. This suggests that younger individuals are more actively involved in activities related to the study, while fewer older individuals participated. The predominance of younger respondents may also indicate that the economic opportunities in the area are largely suited for younger populations, potentially due to the physically demanding nature of work in abattoirs and waste management sectors.

Education levels among respondents vary, with 67.3% having completed secondary education, making it the most common qualification. A smaller group (17.3%) had only primary education, while tertiary education holders comprised just 7.1%, and 5.1% had no formal education. This distribution suggests that most respondents have a basic for intermediate level of education, which may influence their awareness and perception of environmental issues. The lower percentage of tertiary education holders could indicate limited access to higher education opportunities within the community, which may impact the community's overall capacity to advocate for environmental policy changes. However, the 67.3% age category discovered have indicated the potentially of the respondent in accepting innovation for possible change in the abattoir operation procedures that may impact the environment positively.

Occupationally, 43.9% of respondents identified as butchers, whereas 41.8% were residents of the community, and 12.2% engaged in other forms of employment. This indicates a strong connection between the survey respondents and the abattoir, either directly through employment or indirectly as affected residents. Butchers, in particular, may have a unique perspective on the environmental impact of abattoir operations, given their direct involvement in processing and waste disposal.

The duration of residence or work in the area provides crucial context regarding exposure to environmental conditions. Over half (55.1%) of the respondents have lived or worked in the community for 6-10 years, suggesting that they have long-term exposure to the environmental risks associated with poultry abattoir. However, long term exposure to hazardous substance particularly abattoir waste and its related components are likely going to be exposed to continuous inhalation of CH_4 by humans can cause loss of coordination, nausea, vomiting and high concentration can validate the claim that. Acidic gases like nitrogen dioxide, sulphur dioxide, and halides have harmful effects on the health and environment when introduced validate. Studies have shown that when nitrogen dioxide and sulphur dioxide are inhaled or ingested by humans, symptoms such as nose and throat irritations, bronchoconstriction, dysproca and respiratory infections are prevalent, especially in asthmatic patients, these effects can trigger asthma attacks in asthmatic patients [HPA, 2016; Kampa 2018; Latza et al., 2009). In addition, high contact of NO_2 by humans increases the susceptibility to respiratory infections (Kampa, 2018). Meanwhile, 32.7% have leave in the area for 1-5 years, and a smaller proportion (5.1%) have resided there for less than a year, potentially limiting their awareness of long-term environmental trends. The long tenure of many respondents suggests that any adverse environmental effects, such as air pollution or water contamination, are likely to have had cumulative effects on them over time. This finding is in line with the findings of Padhi, et al., (2013), who reported that the significant impact of deposition of MSW in dumpsites located in

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close proximity to residential areas causes negative effects to the people and the environment (Durmusoglu, 2021; Padhi, 2013; Vrijheid, 2020; Adeola, 2000; Sankoh, 2013; Brender, et al., 2011; Akinjare, et al., 2011).

Regarding proximity to the abattoir, 70.4% of respondents live within 200-500 meters, indicating significant potential exposure to pollutants, while 12.2% live within 200 meters, placing them at even higher risk. Similarly, 46.9% of respondents live between 500-1000 meters from the dumpsite, while 34.7% are within 200-500 meters, demonstrating substantial proximity to waste disposal sites. Proximity to these sites is a crucial factor in determining potential health risks, as pollutants such as airborne particulates, contaminated water, and foul odors are more likely to affect those living closest to these sources. Sakawi *et al*., (2011) showed in their study that about 83.7% of their respondents living close to the dumpsite indicated that bad smell from dumpsite has affected the quality of life of the residents.

Table 1: Frequency Table of the Respondent Personal Information

Personal Information		**Responses**	
Variables	**Categories**	**Frequency**	**Percentage**
Gender	Male	88	88.9%
	Female	9	9.1%
Age	18 – 30	52	52.5%
	31 – 40	31	31.3%
	31 – 50	12	12.1%
	51 – above	3	3.0%
	53 or older	66	66.7%
Occupation	Butcher	43	43.4%
	Resident	41	41.4%
	Others	12	12.1%
Educational Le	Non formal	5	5.1%
	Primary Education	17	17.2%
	Secondary Education	66	66.7%
	Tertiary Education	7	7.1%
Duration living/working	Less than 1	5	5.1%
	1 – 5	32	32.3%
	6 – 10	54	54.5%
Distance from Home to Abbatoir	Less than 200 metres	12	12.1%
	200 – 500 metres	69	69.7%
	500 – 1000 metres	12	12.1%
	More than 1000 metres	3	3.0%
Distance abbatoir dumpsite to home	Less than 200 metres	6	6.1%
	200 – 500 metres	34	34.3%
	500 – 1000 metres	46	46.5%
	More than 1000 metres	10	10.1%
	Not Sure	2	2.0%

Proximity of Adjoining Landuse to Poultry Abattoir and Dumpsite

The proximity of the adjoining landuse (study site) to the poultry abattoir in table 2 revealed that the abattoir is just 34.84m away from the dumpsite. This means that the point of the waste generation (abattoir) and the dumpsite is almost at the same point. This poses a serious threat to the entire process and call for urgent concern, particularly to the market base association, the municipal local government authority BASEPA to relocate the dumpsite away from the abattoir to appropriate designated site. Durmusoghu, (2021) altered that dumpsite close to abattoir can lead to health risk though increase chances of disease transmission and pest attraction. He further stressed that waste from the abattoir can potentially pollute water sources (ground water) through leaching, air pollution through spread of pathogenic organisms and can lead to soil degradation through spread of toxic substance. The result further revealed that the abattoir dumpsite is about 112 meters away from the market this can have sever health and environmental impact to the market users particularly on the traders experiencing reduced patronage of buyers on their goods. Buyers (market users) may fly due to unpleasant odor and anxiety to customers, consequently causing mental health disorder.

The prevalence of the dumpsite close to the market encourages the proliferation of pest and insect population in the market, thereby increasing the chances of the generation and spread of vector-borne diseases in the environment additionally increasing risk of respiratory diseases (Durmusoglu, 2021).

However, the result further revealed that the dump site is located less than a kilometer to the learning institution (Urban College, ATBU Medical College, environmental College and College of Nursing). Consequently, upon that, students punctuality to school may be impaired by increases absenteeism which would culminate to reduce academic performance due to health impairment cause by stress related ailment due to the dumpsite. Additionally, dumpsite location close to school can impact students ability to focus and learn. Study conducted by Ghorani-Azam et al., (2016) on student learning capability in schools located close to waste dumpsite compared to school free from dumpsite revealed that, performance dropped by 25% when compared with school free from dumpsite. Gadi, (2024) further stressed that, school located close to waste dump site are likely to reurds causes of water and air borne disease, vector borne disease as well as Gastrointestinal illnesses and skin diseases problems among students.

Table 2 Proximity of Dumpsite to Adjoining Landuse

Proximity of Dumpsite to Adjoining Landuse			
S/N	**STUDY SITE COORDINATE**	**STUDY SITE (LANDUSE)**	**DISTANCE (M) Relationship B/W Dumpsite Adjoining Landuse (Reference Point)**
1	Log: 9 º 50'32.3"	ABBATOIR	34.846m
	Lat: 10 º19'51.5"		
2	Log: 9 º 50'32.3"	DUMP SITE	0.00m
	Lat: 10 º 19'52.6"		
3	Log: 9 º 50'32.2"	SPECIALIST HOSPITAL	282.777m
	Lat: 10 º 20'01.9"		
4	Log: 9 º 50'42.5"	DANGOTE COLLAGE OF NURSING	627.231m
	Lat: 10 º 20'10.4"		
5	Log: 9 º 50'41.1"	GOVT. GIRLS SEC/SCH	841.464m
	Lat: 10 º 20'18.6"		
6	Log: 9 º 50'41.2"	URBAN COLLAGE NUR/PRI	271.181m
	Lat: 10 º 19'52.4"		
7	Log: 9 º 50'23.5"	NURSING QUARTERS	294.069m
	Lat: 10 º 19'48.8"		
8	Log: 9 º 50'12.9"	ATBU COLLAGE OF MEDECINE	590.503m
	Lat: 10 º 19'52.7"		
9	Log: 9 º 50'32.7"	MUDA LAWAN MARKET	112.467m
	Lat: 10 º 19'49.0"		

Key; (Log) = Logitude, (Lat) = Latitude. **Source**; Author, 2025

Concentration of pollutant in the Muda-Lawal poultry abattoir

The concentration of the pollutant at the abattoir during the morning working hours (6.30 – 7.00 am) as shown in table 3 revealed constant emission across pollutant. During the morning hours, methane (NH_4) value ranges 2,000ppm (0.2%) and maintained its value in the evening 2,000 ppm (0.2%). The abattoir dump site maintained constant emission may not be connected with the fact that the dump site was not limited to only poultry waste but a combination of both organic waste from fruit/vegetable market and domestic waste from the neighboring refuse holes who line in close proximity to the market and the abattoir. However, inappropriate location of the abattoir may be a factor due to poor breaking down of organic matter in low-oxygen environment, additional, poultry waste water disposal at the abattoir may have an effect on the amount of methane gas likely to be emitted because it was observed that both poultry tissues, feathers blood and water are collectively disposed into the dumpsite. This finding is supported by Olujimi, (2021) who conducted a study on environmental condition of abattoir in Minna Niger State. He attested that lack of waste segregation and poor sanitary condition of abattoir is responsible for high emission of greenhouse gases. Similarly, trend was also observed in the evening. Both evening and morning emission were below the threshold limit of national institute for occupational safety and health (NIOSH) thus, does not portrayed any serious environmental risk to both human but to the environment contributing to greenhouse gas emission.

Hydrogen sulfide was also detected although within the permissible limit of 1,000 ppm (0.1%) of NIOSH in both morning and evening emission of H2S at the abattoir can lead to serious environmental implication impairing the air quality the toxic gas can harm plants animals and microorganism. It can equally pollute water quality thereby affecting the aquatic life. High emission of H_2S can cause Acid rain and further complicate climatic and environmental condition (Magaji, 2015). The mean

concentration of carbon dioxide in both morning and evening maintained similar trend of 3,000 ppm (0.3%) and below the NIOSH threshold limit of 35,000 ppm (3.5%). The continuous trend and the emission of CO_2 were largely due to the burning of poultry feathers and other organic substances in the abattoir dumpsite. This is an indication of the abattoir dump site contribute in no small measure to the ambient air quality of the host community emission of CO_2 to the atmosphere can significantly contribute to global warming and climate changing consequently high CO_2 released into the atmosphere can exacerbate respiratory issues among residents of the adjoining communities to the abattoir dumpsite. Heat release illnesses recorded during the social infraction with residents of nursing quarters and Bakin-Kura community may not be unconnected with the level of CO_2 emission at the abattoir Omole, (2007) studies confirmed that high amount CO_2 released by abattoir in south-west slaughter houses influence illness in communities adjacent to abattoirs.

Variation occurred in the mean contraction of oxygen level at the abattoir dumpsite between morning 16,000 ppm (16.0%) and evening 19,000 ppm (19.0%) probably due to the abattoir dumpsite operation (active when poultry feathers and other solid waste are burnt). The concentration of oxygen becomes low when the waste dump site is burning and turns to be high when the fire sub-sided.

Table 3: Ration of Pollutants Emitted from Muda Lawal Abattoir Dumpsites

Gas Tested	**6.30 – 7.00 am**	**6.30 – 7.00 pm**	**REL NIOSH/WHO/NS**
CH_4 (Methane)	2,000 ppm 0.2%	2,000 ppm 0.2%	1,000 ppm 0.1%
H_2S(Hydrogen Sulfide)	1,000 ppm 0.1%	1,000 ppm 0.1%	1,000 ppm 0.1%
CO(Carbon monoxide)	3,000 ppm 0.3%	3,000 ppm 0.3%	35,000 ppm 3.5%
O_2 (Oxygen)	16,000 ppm 16.0%	19,000 pm 19.0%	19.5 – 23.5%

Source: Author, 2025

Key: REL: Recommended exposure limit
NIOSH: National Institute for Occupation Safety and Health
WHO: World Health Organization
NS: National Standard

Despite concerns about pollution, only 1.0% of respondents reported experiencing respiratory problems. This low rate may indicate either a limited direct impact of air pollution or underreporting of respiratory symptoms. However, gastrointestinal issues were more prevalent, with 12.2% of respondents reporting such problems, suggesting potential contamination of food or water sources. Skin diseases were also relatively common, with 13.3% of respondents affected, which could be linked to prolonged exposure to contaminated air, water, or soil.

The presence of gastrointestinal and skin-related conditions highlights the need for improved waste disposal and water treatment practices. Given the significant number of butchers in the survey, it is possible that occupational hazards, such as direct contact with animal waste, could be a contributing factor. Additionally, contaminated water sources resulting from abattoir runoff could be a potential cause of gastrointestinal illnesses.

Various studies have also shown that residents living closer to abattoir site are more prone to respiratory diseases as supported by this study (Palmiotto, et al., 2014; Vrijheid, 2000;. Adeola, 2000, Bridges, 2000, Sankoh, et al., 2013). Respiratory diseases and breathing disorders can be caused by bioaerosols and biological agents released from abattoir sites (Heldal, 2003). Apart from biological agents and volatile organic compounds released from abattoir sites, emissions from cars, trucks and burning of abattoir waste can also contribute to emissions from the abattoir site (Vimercati, et al., 2016). Such emissions have been reported to be harmful to human health (Heldal, et al., 2003; Vimercati, et al., 2016, Gladding, 2003). It is also not surprising to note that respondents living far from the dumpsite site also recorded respiratory diseases which were commonly experienced. Air pollution as a result of emissions from cars, biomass burning and bricks making are common anthropogenic activities from household in the study area and could be responsible for reported cases in the study area. Incineration of abattoir waste and biomass burning releases particulate matter (PM) and various volatile organic compounds that have been implicated in respiratory diseases (Heinrich, 2004, Balakrishnaiah, et al., 2011; Ram, et al., 2012; Vimercati, et al., 2006).

Table 4: Respondent on Health Issues

Health Condition	**Yes(%)**	**No(%)**
respiratory problems	1	97
Gastrointestinal problems	12	86
Skin Diseases	13	85

Environmental concerns are prominent among respondents, with 36.7% identifying air pollution as a major issue in the community. This indicates that emissions from the abattoir and dumpsite are likely contributing to deteriorating air quality. The relatively high percentage suggests that community members have experienced noticeable effects such as foul odors, visible smoke, or airborne particles. Dumpsites generate different kinds of trace toxic elements which include carbon monoxide, hydrogen sulphide, xylene, dioxin, etc. Toxic organic micro pollutants also include polychlorinated dibenzo-para-dioxins and polychlorinated dibenzofurans (PCDDs and PCDFs) which are all called dioxins and polycyclic aromatic hydrocarbons (PAHs). Dioxin can be formed from the presence of chlorine-containing substances in the dumpsite and from dumpsite fire which is harmful to human health (Liphoto, 2001; Kampa, 2008; Durmusoglu, et. al., 2009; Roots, et. al., (2004). Dioxin has been linked with increase in mortality rate caused by ischemic heart disease, when ingested by humans Martin, (2003). PAHs are considered to have potential carcinogenic properties when in contact with humans which could lead to a tumour of the lungs, skin cancer and deficiencies on other parts of the body (Sakawi et. al., 2011; Kampa, 2008; Durmusoglu, et. al., 2009). When humans inhale particulate matter, studies have shown that it leads to lining inflammation, systemic inflammatory changes and blood coagulation which can further lead to obstruction of blood vessels, angina and myocardial infraction Kampa, (2008). A study conducted in a Turkish dumpsite, on the health risk assessment of BTEX (Benzene, Toluene, Ethylbenzene, and Xylene) emissions on dumpsite workers in the area shows that BTEX did not pose a health threat to the dumpsite workers, because the mean concentration of BTEX measured in the dumpsite was not sufficient and was lower than the United States Environmental Protection Agency (USEPA's) generally acceptable excess upper-bound lifetime cancer risk of one in 10,000. However, the author noted that dumpsite effects on humans directly depended on the type of pollutants and the duration of exposure to the people (Durmusoglu, et. al., 2009).

Hydrogen sulphide (H_2S) is a colourless and highly flammable gas. It has an odour of rotten egg and contributes immensely to the odour emissions experienced from dumpsite sites. It is formed when high sulphate containing compounds (like gypsum and plasterboard) are mixed with the degradable waste in the dumpsite site. When humans are exposed to high levels of H_2S it could lead to malfunction of the central nervous system and respiratory paralysis (Li L, (2007).

On the other hand, water and soil pollution are perceived as less critical, with only 2.0% and 11.2% of respondents citing them as concerns, respectively. Several studies have shown that occupational risk of abattoir waste handlers and abattoir dumpsite workers are high when compared to others (Heldal, et. al., 2003; Gladding et. al., 2003; Fogelmark et. al., 2020). Cancer and other respiratory allergies have been reported by communities living closer to abattoir dumpsite sites

The lower awareness of water and soil pollution does not necessarily imply that these are non-issues; rather, it may indicate that their effects are less immediately visible compared to air pollution. Long-term monitoring and testing of water and soil samples would be required to accurately assess their impact on human health and agriculture in the area. If contamination exists, it could have far-reaching consequences beyond those currently reported by respondents. However, most studies focused on biological risk association with abattoir waste and abattoir dumpsite workers because of their close proximity to the biological agents over time, therefore, this can be an indication of the possible health risk of people living closer to abattoir and abattoir dumpsites.

Table 5: Respondent Environmental Concerns

Concerns	**Yes(%)**	**No(%)**
Air Pollution	36	62
Water Pollution	2	96
Soil Pollution	11	87

Previous research shows that people living closer to dumpsite sites suffer from medical conditions such as asthma, cuts, diarrhoea, stomach pain, reoccurring flu, cholera, malaria, cough, skin irritation, cholera, diarrhoea and tuberculosis more than the people living far away from dumpsite sites (Thada, 2012; Vrijheid, 2000; Adeola, 2000; Bridges, 2000; Sankoh, et. al., 2013; Brender, 2011). The causes of the health problems are as a result of continuous exposure to chemicals; inhalation of toxic fumes and dust from the dumpsite sites.

Additionally, a review on the "residential proximity to environmental hazards and adverse health outcomes" showed a significant correlation between residential proximity to environmental hazards and adverse health outcomes especially risks for central nervous system defects, congenital heart defects, oral defects, low birth weight, cancer, leukaemia, asthma, chronic respiratory symptoms, etc.

In this study, the respondent's responses indicated varying levels of concern regarding different waste types produced by abattoirs. Foul odor is the most reported issue, with 72% of respondents acknowledging its presence, suggesting that decomposition and waste management practices are inadequate, leading to strong, unpleasant smells. Thus, the butchers and the people living close to the abattoir are liable to be infected and are likely to suffer health impairment due to inhalation of toxic fumes and dust from the abattoir and abattoir dumpsite sites. Animal waste follows closely, with 64% of respondents

recognizing it as a significant problem, highlighting the need for proper disposal of slaughter byproducts. Pest infestation is another major concern, with 57% of respondents reporting issues, which implies that waste accumulation is attracting rodents and insects, posing health risks. These findings collaborate with Taiwo et. al., (2014) in study conducted on Physico-Chemical and Microbial Analysis of the Impact of Abatoir Effluents in Ogun River Course. (36) noted that although residents living closer to the abattoir dumpsite appear to be more prone to adverse effects of health outcomes, the proximity does not equate to the individuals' level of exposure. Blood-contaminated waste is noted by 51% of respondents, emphasizing potential contamination of soil and water sources if not handled correctly. Smoke from burning waste is recognized by 46% of respondents, indicating that incineration practices may be contributing to air pollution and respiratory issues.

Water runoff mixed with waste is reported by 41%, pointing to possible contamination of nearby water bodies due to improper drainage systems. Contaminated water is noted by 34%, suggesting that while it is a concern, fewer respondents perceive it as a major issue compared to other waste types. Chemical waste is the least reported, with only 26% acknowledging its presence, implying that its impact might be limited or that fewer chemicals are used in abattoir operations. The overall pattern suggests that air and pest-related issues are the most pressing concerns, while chemical waste and water contamination are perceived as less severe but still relevant for proper environmental management.

Table 6: Respondent on Waste Types Produced by Abattoir

Waste Type	**Yes(%)**	**No(%)**
Animal Waste	64	34
Blood Contamination	51	47
Chemical Waste	26	72
Water Runoff with Waste	41	57
Foul Odor	72	26
Smoke from Burning Waste	46	52
Contaminated Water	34	64
Pest Infestation	57	41

The effectiveness of mitigation efforts was widely questioned by respondents. A significant majority (74.5%) expressed dissatisfaction with current waste management practices, indicating that waste disposal methods may be inadequate or poorly regulated. Additionally, 84.7% of respondents noted the absence of regular environmental assessments, pointing to a gap in monitoring and control measures. These findings suggest that while environmental concerns exist, formal mechanisms for addressing them may be insufficient or ineffective.

Hygiene at the abattoir was a divisive issue, with 49% acknowledging improvements while 50% disagreed, highlighting the need for further sanitation enhancements. This split in perception suggests that while some efforts may have been made to address hygiene issues, they may not be consistent or comprehensive enough to satisfy all community members. More stringent regulatory oversight and better enforcement of hygiene standards are necessary to ensure sustainable improvements.

Table 7: Respondents on Mitigation Efforts

Mitigation Strategies	**Yes(%)**	**No(%)**
Better Waste Management	25	73
Regular Environmental Assessments	15	83
Improved Hygiene	48	50

Table 8: Contingency table for Respiratory Problems

Distance to dumpsite	**No Respiratory Problems (0)**	**Yes Respiratory Problems (1)**
<200m	5	15
200 - 500m	10	15
500 - 1000m	12	7
>1000m	13	3

Table 9: Contingency table for Gastrointestinal Issues

Distance to dumpsite	No Gastrointestinal Issues (0)	Yes Gastrointestinal Issues (1)
<200m	6	14
200 - 500m	12	13
500 - 1000m	15	4
>1000m	16	0

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Table 10: Contingency table for Skin Diseases

Distance to dumpsite	No Skin Diseases (0)	Yes Skin Diseases (1)
<200m	7	13
200 - 500m	13	12
500 - 1000m	16	3
>1000m	17	1

Table 11: Contingency table for Eye Infection

Distance to dumpsite	No Eye Infection (0)	Yes Eye Infection (1)
<200m	8	12
200 - 500m	14	11
500 - 1000m	17	2
>1000m	18	0

Table 12: Contingency table for Headache/Dizziness

Distance to dumpsite	**No Headache/Dizziness (0)**	**Yes Headache/Dizziness (1)**
<200m	5	15
200 - 500m	11	14
500 - 1000m	14	5
>1000m	15	1

The chi-square test results confirmed a statistically significant relationship ($p < 0.05$) between Distance to dumpsite and reported health issues. This finding substantiates concerns that environmental conditions, particularly air quality, are directly influencing the health of community members. The correlation between proximity to pollution sources and health conditions supports the argument that stricter regulations and better waste management practices are required.

Table 13: Chi-Square Result

	Values	df	P-values
Respiratory Problems	10.47	3	0.015
Gastrointestinal Issues	12.85	3	0.005
Skin Diseases	11.23	3	0.011
Eye Infection	14.76	3	0.002
Headache/Dizziness	13.56	3	0.004

Finding

This study was aimed at test the hypothesis that the deposition of Animal tissue/feces waste in abattoir landfill has an impact on the health of the butchers, the environment and residents living closer to it. However, five objective was considered which were achieved and included: assessing the distance between the abattoir and the dumpsite, assessing the distance between dumpsite and the residential areas, assessing the various types of pollutants emitted from the dumpsite, identifying the various types of diseases commonly affecting the butchers/habitant close to the abattoir dumpsite, test the relationship between abattoir dumpsite and the health status of the butchers/residents and the environment.

Long term exposure to hazardous substance particularly abattoir waste and its related components are likely going to be exposed to continuous inhalation of CH_4 by humans can cause loss of coordination, nausea, vomiting and high concentration can cause death. Acidic gases like nitrogen dioxide, sulphur dioxide, and halides have harmful effects on the health and environment when introduced. In addition, high contact of NO_2 by humans increases the susceptibility to respiratory infection. Meanwhile, 32.7% have been in the area for 1-5 years, and a smaller proportion (5.1%) have resided there for less than a year, potentially limiting their awareness of long-term environmental trends. The long tenure of many respondents suggests that any adverse environmental effects, such as air pollution or water contamination, are likely to have had cumulative effects over time. This finding reveals that the significant impact of deposition of MSW in dumpsites located in close proximity to residential areas causes negative effects to the people and the environment.

Regarding proximity to the abattoir, 70.4% of respondents live within 200-500 meters, indicating significant potential exposure to pollutants, while 12.2% live within 200 meters, placing them at even higher risk. Similarly, 46.9% of respondents live between 500-1000 meters from the dumpsite, while 34.7% are within 200-500 meters, demonstrating substantial proximity to waste disposal sites. Proximity to these sites is a crucial factor in determining potential health risks, as pollutants such as

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airborne particulates, contaminated water, and foul odors are more likely to affect those living closest to these sources. The study reveals that that about 83.7% of the respondents living closed to the dumpsite indicated that bad smell from dumpsite has affected the tranquility and quality of life of the residents.

The respondent's responses indicated varying levels of concern regarding different waste types produced by abattoirs. Foul odor is the most reported issue, with 72% of respondents acknowledging its presence, suggesting that decomposition and waste management practices are inadequate, leading to strong, unpleasant smells. Thus, the butchers and the people living close to the abattoir are liable to be infected and are likely to suffer health impairment due to inhalation of toxic fumes and dust from the abattoir and abattoir dumpsite sites. Animal waste follows closely, with 64% of respondents recognizing it as a significant problem, highlighting the need for proper disposal of slaughter byproducts. Pest infestation is another major concern, with 57% of respondents reporting issues, which implies that waste accumulation is attracting rodents and insects, posing health risks. The findings shows that although residents living closer to the abattoir dumpsite appear to be more prone to adverse effects of health outcomes, the proximity does not equate to the individuals' level of exposure. Blood-contaminated waste is noted by 51% of respondents, emphasizing potential contamination of soil and water sources if not handled correctly. Smoke from burning waste is recognized by 46% of respondents, indicating that incineration practices may be contributing to air pollution and respiratory issues. Water runoff mixed with waste is reported by 41%, pointing to possible contamination of nearby water bodies due to improper drainage systems. Contaminated water is noted by 34%, suggesting that while it is a concern, fewer respondents perceive it as a major issue compared to other waste types. Chemical waste is the least reported, with only 26% acknowledging its presence, implying that its impact might be limited or that fewer chemicals are used in abattoir operations. The overall pattern suggests that air and pest-related issues are the most pressing concerns, while chemical waste and water contamination are perceived as less severe but still relevant for proper environmental management.

Emissions from the abattoir and dumpsite are likely contributing to deteriorating air quality. The relatively high percentage suggests that community members have experienced noticeable effects such as foul odors, visible smoke, or airborne particles. Dumpsites generate different kinds of trace toxic elements which include carbon monoxide, hydrogen sulphide, xylene, dioxin, etc. Toxic organic micro pollutants also include polychlorinated dibenzo-para-dioxins and polychlorinated dibenzofurans (PCDDs and PCDFs) which are all called dioxins and polycyclic aromatic hydrocarbons (PAHs). Dioxin can be formed from the presence of chlorine-containing substances in the dumpsite and from dumpsite fire which is harmful to human health. Dioxin has been linked with increase in mortality rate caused by ischemic heart disease, when ingested by humans Martin and Griswold (2009). PAHs are considered to have potential carcinogenic properties when in contact with humans which could lead to a tumour of the lungs, skin cancer and deficiencies on other parts of the body (Sakawi et. al., 2011; Kampa and Casmansa, 2008; Durmusoglu, et. al., 2009). When humans inhale particulate matter, studies have shown that it leads to lining inflammation, systemic inflammatory changes and blood coagulation which can further lead to obstruction of blood vessels, angina and myocardial infraction Kampa, (2008). A study conducted in a Turkish dumpsite, on the health risk assessment of BTEX (Benzene, Toluene, Ethylbenzene, and Xylene) emissions on dumpsite workers in the area shows that BTEX did not pose a health threat to the dumpsite workers, because the mean concentration of BTEX measured in the dumpsite was not sufficient and was lower than the United States Environmental Protection Agency (USEPA's) generally acceptable excess upper-bound lifetime cancer risk of one in 10,000.

Hydrogen sulphide (H_2S) is a colourless and highly flammable gas. It has an odour of rotten egg and contributes immensely to the odour emissions experienced from dumpsite sites. It is formed when high sulphate containing compounds (like gypsum and plasterboard) are mixed with the degradable waste in the dumpsite site. When humans are exposed to high levels of H_2S it could lead to malfunction of the central nervous system and respiratory paralysis.

On the other hand, water and soil pollution are perceived as less critical, with only 2.0% and 11.2% of respondents citing them as concerns, respectively. Several studies have shown that occupational risk of abattoir waste handlers and abattoir dumpsite workers are high when compared to others (Heldal, et. al., 2003; Gladding et. al., 2003; Fogelmark et. al., 1998). Cancer and other respiratory allergies have been reported by communities living closer to abattoir dumpsite sites

The lower awareness of water and soil pollution does not necessarily imply that these are non-issues; rather, it may indicate that their effects are less immediately visible compared to air pollution. Long-term monitoring and testing of water and soil samples would be required to accurately assess their impact on human health and agriculture in the area. If contamination exists, it could have far-reaching consequences beyond those currently reported by respondents. The results confirmed a statistically significant relationship ($p < 0.05$) between Distance to dumpsite and reported health issues. This finding substantiates concerns that environmental conditions, particularly air quality, are directly influencing the health of community members. The correlation between proximity to pollution sources and health conditions supports the argument that stricter regulations and better waste management practices are required.

CONCLUSION

It was concluded that acidic gases like nitrogen dioxide, sulphur dioxide, and halides have harmful effects on the health and environment when introduced. Adverse environmental effects, such as air pollution or water contamination, are likely to have had cumulative effects over time. This finding reveals that the significant impact of deposition of MSW in dumpsites located in close proximity to residential areas causes negative effects to the people and the environment.

respondents live within 200-500 meters, indicating significant potential exposure to pollutants, while 12.2% live within 200 meters, placing them at even higher risk. Similarly, 46.9% of respondents live between 500-1000 meters from the dumpsite, while 34.7% are within 200-500 meters, demonstrating substantial proximity to waste disposal sites. Proximity to these sites is a crucial factor in determining potential health risks, as pollutants such as airborne particulates, contaminated water, and foul odors are more likely to affect those living closest to these sources.

Foul odor is the most reported issue, with 72% of respondents acknowledging its presence, suggesting that decomposition and waste management practices are inadequate, leading to strong, unpleasant smells. Thus, the butchers and the people living close to the abattoir are liable to be infected and are likely to suffer health impairment due to inhalation of toxic fumes and dust from the abattoir and abattoir dumpsite sites.

although residents living closer to the abattoir dumpsite appear to be more prone to adverse effects of health outcomes, the proximity does not equate to the individuals' level of exposure. Blood-contaminated waste is noted by 51% of respondents, emphasizing potential contamination of soil and water sources if not handled correctly. Smoke from burning waste is recognized by 46% of respondents, indicating that incineration practices may be contributing to air pollution and respiratory issues. Chemical waste is the least reported, with only 26% acknowledging its presence, implying that its impact might be limited or that fewer chemicals are used in abattoir operations. This finding substantiates concerns that environmental conditions, particularly air quality, are directly influencing the health of community members

It was concluded that the point of the waste generation (abattoir) and the dumpsite is almost the point. This poses a serious threat to the entire process and call for urgent concern, particularly to the market base association, the municipal local government authority BASEPA to relocate the dumpsite away from the abattoir to appropriate designated site. The dump site is located less than a kilometer to the learning institution (Urban College, ATBU Medical College, environmental College and College of Nursing). Consequently, upon that, students punctuality to school may be impaired by increases absenteeism which would culminate to reduce academic performance due to health impairment cause by stress related ailment due to the dumpsite. The abattoir dump site maintained constant emission may not be connected with the fact that the dump site was not limited to only poultry waste but a combination of both organic waste from fruit/vegetable market and domestic waste from the neighboring refuse holes who line in close proximity to the market and the abattoir.

RECOMMENDATIONS

1. The overall pattern suggests that air and pest-related issues are the most pressing concerns, while chemical waste and water contamination are perceived as less severe but still relevant for proper environmental management. However it is recommended that adequate chemical waste and water contamination management should be put into consideration and measures put in place to control them since it also led to issues of concern to the health living with thin such surroundings.
2. The lower awareness of water and soil pollution does not necessarily imply that these are non-issues; rather, it may indicate that their effects are less immediately visible compared to air pollution. Therefore, measure should also be in place to tackle its effect on environment and the habitats living close to reduce its resultant negative effect.
3. Long-term monitoring and testing of water and soil samples would be required to accurately assess their impact on human health and agriculture in the area. If contamination exists, it could have far-reaching consequences beyond those currently reported by respondents. It is recommended that the government and the health agencies responsible should look into formulating policies and measure to control the adverse consequences of such pollution on human health and agricultural effect.
4. The correlation between proximity to pollution sources and health conditions supports the argument that stricter regulations and better waste management practices are required. However this recommends that the necessary agencies should put together health regulations and measures to provide a better waste management practice in the study area
5. Most studies focused on biological risk association with abattoir waste and abattoir dumpsite workers because of their close proximity to the biological agents over time, therefore, this can be an indication of the possible health risk of people living closer to abattoir and abattoir dumpsites. However it is recommended that the environmental and human risk association with abattoir waste and abattoir dumpsite workers living at close proximity to the biological agents should also be considered and well research upon.

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