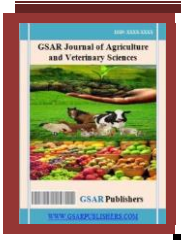

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WASTE MANAGEMENT PRACTICES AMONG POULTRY FARMERS IN ENUGU STATE, NIGERIA

By

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Abstract

The study investigated waste management practices among poultry farmers in Enugu State, Nigeria. Multistage sampling procedure, and purposive sampling technique was used in the selection of one hundred and twenty (120) respondents for the study. Data was analyzed using frequency, percentage, mean scores and standard deviation. Results show that the poultry waste management practices of the farmers include use poultry wastes as manure for improving plant growth (93.3%) and pit disposal of dead birds (75.8%). Data also show that the effects of poultry waste on farmers include skin irritation ($\bar{x}$= 2.10; SD = 0.99) and loss of appetite ($\bar{x}$=2.07; SD = 0.89. Results show that the uses of poultry waste products were increase the nutrient content of the crop ($\bar{x}$= 2.85; SD = 0.44) and source of income ($\bar{x}$= 2.78; SD = 0.59). Data show that the environmental effects of poultry wastes revealed by the respondents include: soil toxicity ($\bar{x}$= 1.93; SD = 1.05) and air pollution through emission of dust, microorganism and organic compounds ($\bar{x}$= 1.92. Also, result show that strategies for improving poultry waste management include: timely provision of efficient waste management information practices by NGOs and government agencies ($\bar{x}$= 2.63; SD = 0.56), and recycling poultry wastes ($\bar{x}$= 2.59; SD = 0.63). While poultry farmers in Enugu State use waste for manure and income generation, challenges such as health effects and environmental pollution persist. Non-governmental agencies and government agencies should enhance waste management education and recycling initiatives aimed at improving sustainable practices.

Keywords: *Poultry Framers; Waste Management Practices*

Introduction

The contribution of livestock production to Nigeria's GDP experienced an increase of 2.3 percent in the year 2023 compared to the same period of the previous year (Statista Research Department, 2023). This shows that livestock keepers in Nigeria are making efforts to handle the projection that by 2050, a projected demand for livestock products such as poultry meat in Nigeria will increase by 214% (Erdaw, 2023).

In Nigeria, poultry is a lucrative enterprise and is the second-largest industry in Africa, with over 180 million birds producing 454 billion tons and 3.8 million tons of meat and eggs, respectively (Poultry World, 2022). It is the most commercialized livestock sub-sector in Nigeria, with about 30% of the total agriculture contribution (Erdaw, 2023). The poultry sub-sector provides over 14 million employments to the Nigerian population and contributes nearly 58.2% of total of Nigeria's animal production (Ogunyemi and Orowole, 2020). It is easier to acquire and maintain than other livestock, which has helped rural farming households to raise about 80% of the total poultry production (FAO, 2020).

Poultry is the second most widely eaten meat among animal source foods and accounted for about 40% of the meat production that cut across various cultures, religions, and traditions (FAO, 2018). Poultry production is an important part of farming in Nigeria and as such, it contributes a substantial part to the economy, as well as contributing nutritionally to the livelihood of the people (Olutumise et al., 2023). The authors further stated that poultry generates income, provides food, improves the social status, and is a liquid household asset. It serves as a source of protein and micronutrients, with the potential to improve food security and significantly reduce poverty, especially in low-income

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and developing countries (Campbell et al., 2018). From 2001 to 2020, poultry meat production grew from 14 to 20 million tons, whereas the production of eggs increased from 7.2 to 9.3 million dozen eggs (FAOSTAT, 2022). This clearly shows increasing demand for poultry products and consequently increased poultry waste production (Ali et al., 2020). This challenge is aggravated by the large-scale accumulation of waste which poses disposal and pollution problems (Akporube et al., 2023).

The waste generated from poultry production is in solid and liquid forms from hatcheries, poultry farms and abattoirs (Prabakaran & Ezhil Valavan, 2021). The solid waste could be manure, wood shavings, feathers, empty shells, infertile eggs, dead embryos, shells from cracked and broken eggs, offal, blood, and on-farm mortalities (Nowak et al., 2017). The liquid waste is mainly from the wastewater from poultry farms and abattoirs. These wastes give rise to environmental hazards such as pollution from the production of greenhouse gases, ammonia, ammonia, aerosols, etc., and human health risks due to the spread of bacteria and diseases (Zhang et al., 2023).

There are several methods of disposing poultry waste. These include burial, rendering, incineration, compositing, and conversion of poultry waste to livestock feed, the use of manure as fertilizer for crops, and the production of energy(biogas) (Akporube et al., 2023). Unfortunately, some of these innovative modern methods for waste disposal such as processing into feed for animals, green disposal, gasification, and biogas production involve a certain level of biotechnology and hence, have not been optimized for wider use across most parts of Nigeria. Despite this bottleneck, the demand for poultry products, including chicken and eggs, has continuously increased due to population growth, urbanization, and changing dietary patterns (Bawa et al., 2023). The rapid growth of the poultry industry in recent years has raised concerns about its environmental and social impacts, including greenhouse gas emissions, water pollution, land degradation, and deforestation (Payandeh et al., 2017). According to World Bank (2022), about 2.24 billion tonnes of solid wastes were estimated to be generated in 2020. The source estimates that annual waste generation (poultry wastes inclusive) will be increased to 73%, resulting in about 3.88 billion tonnes of waste by 2050.

According to Bawa et al. (2023), the environmental and health impacts of poultry manure disposal methods in Nigeria have intensified. Intensive poultry farming practices have led to high levels of ammonia emissions, which contribute to air pollution. Ammonia has been identified as the major air pollutant, causing discomfort among farmers, including sneezing, eye irritation, coughing, headache, stomach ache, and diarrhea (Wyer, 2022). The importance of waste management in developing countries like Nigeria cannot be over-emphasized because of its attendant health, safety, environment and socioeconomic challenges. Waste management is a bottleneck in Nigeria because of weak or lack of enforcement of environmental regulatory policies and legislation. This may be connected with challenges like inadequate environmental awareness, poor land-use, missing recycling, producers' irresponsibility, corruption, inadequate-funding, technology and development.

Based on this background, there is need to investigate waste management practices amongst poultry farmers in Enugu State, Nigeria to aid unravel the existing situation. Specifically, the study sought to describe farmers waste management practices; ascertain poultry farmer perceived effect of poultry waste from poultry farms on farmers; ascertain poultry farmer perceived uses of poultry waste; identify farmer perceived environmental effects of indiscriminate waste disposal; and ascertain strategies from improving waste management practices among poultry farmers.

Methodology

This study was carried out in Enugu State, Nigeria. The State lies between latitude: 9° 04' 39.90" N and longitude:8° 40' 38.84" E. It occupies a total land area of 7,616.0km2. The State has seventeen local government areas and is divided into six agricultural zones namely Agwu, Agbani, Enugu, Nsukka, Enugu Ezike and Udi.

The population of the study comprised all poultry farmers in Enugu State. Multistage sampling procedure, and purposive sampling technique was used in the selection of the respondents for the study. In the first stage, five (5) local government areas (LGAs) (Nsukka, Udenu, Enugu south, Nkanu East and Nkanu West) were purposively selected from the seventeen (17) LGAs in Enugu State. The purposive selection of the LGAs was because of the dominance of poultry farmers in the LGAs. In the second stage, two (2) town communities were randomly selected from each of the LGAs giving a total of ten (10) town communities for the study. In the third stage, one (1) village community was randomly selected from each of the town communities, giving a total of ten (10) villages communities for the study. In the fourth stage, twelve (12) poultry farmers were selected using snow ball sampling procedure, giving a total of 120 respondents for the study.

Data for the study were collected from the respondents through the use of structured interview schedule comprising closed and opened-ended questions in line with the objectives of the study.

To collect information on farmers' waste management practices (Objective one), respondents were required to answer yes, or no to questions on the various waste management practices of the farmers. Some of the management practices includes recycling, dumping of wastes into a landfill, composting the wastes.

Information on perceived effect of poultry waste on farmers (objective two), was ascertained by asking the respondents to indicate effects of poultry waste on farmers. The respondents were asked to indicate to what extent they agree or disagree. The extent to which the options provided constitute effect of poultry waste on the farmers were measured on a four-point Likert-type scale of disagree=0, strongly disagree=1, agree=2

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and strongly agree=3. The scores were added to 6 which were further divided by 4 to get a cutoff mean of 1.5. Variables equal to or above 1.5 were considered as a major effect while variables below 1.5 were regarded as minor effect. Some examples of the effects of poultry waste on farmers includes respiratory issues, skin infection, symptoms like headache etc.

Objective three ascertained poultry farmers perceived uses of poultry waste. The respondents were asked to indicate the extent to which the options provided are perceived uses of poultry waste on a four point Likert-type scale as follows: very useful =3, moderately useful =2, useful =1 and not useful=0. The scores were added to get 6 which was divided by 4 to get the cut off mean of 1.5. Variables equal or above 1.5 were considered as a having a major use while variables below 1.5 were be the minor uses. Some perceived uses include energy production, it is used as fertilizer, it serves as animal feed.

Objective four: This identified farmers perceived environmental effects of poultry farm wastes. Respondents were required to indicate the extent they agreed to the perceived environmental effect of inappropriate waste disposal on a four -point Likert-type scale of disagree=0, strongly disagree=1, agree=2 and strongly agree=3. The scores were added to 6 which were further divided by 4 to get a cutoff mean of 1.5. Variables equal to or above 1.5 were considered to have major environmental effect of poultry waste while variables below 1.5 have minor environmental effects of poultry waste. Some of the environmental effects include land degradation, air pollution.

Objective five: This ascertained the strategies for improving waste management practices among poultry farmers. The respondents were to indicate to what extent they agree or disagree on a four-point Likert-type scale of disagree=0, strongly disagree=1, agree=2 and strongly agree=3. The scores were added to 6 which were further divided by 4 to get a cutoff mean of 1.5. Variables equal to or above 1.5 were considered as a major strategy while variables below 1.5 are the minor strategies. Some of the examples includes provision of adequate training, provision of new waste management technology.

Variables in objectives 1 were presented using frequency and percentage while the variables in objectives 2 ,3 ,4, and 5 were analyzed using mean scores and standard deviation. The IBM-SPSS Statistical software package version 22 was used for data analysis.

Results and Discussion

Poultry waste management practices of the farmers

Table 1 shows that the majority (93.3%) use poultry wastes as manure for improving plant growth, 75.8% practice pit disposal of dead birds, 70.8% dry the poultry droppings and bag them for future use, 69.2% practice composting of poultry droppings, while 60.0% use landfilling techniques to manage poultry waste.

On the other hand, 38.3% of the farmers burn hatchery debris and dead birds, 24.2% practice deep stalking of poultry waste, while 18.3% bury poultry wastes. Generally, the results show that the poultry farmers basically preserved poultry wastes by drying in bags and in some cases direct application to their crop farms. The implication is that the farmers in the area use poultry waste (droppings) as a major source of manure for crop production. Poultry litter and manure waste contain rich nutrients such as nitrogen, phosphorus, potassium, and some other macro- and micronutrients for crops, and they can help increase the content of available nutrients in the soil (Żołnowski et al., 2022). Thus, it is traditionally used as organic fertilizer or soil amendment in agriculture to improve both the physical and chemical attributes of soils after proper treatment (Dalólio et al., 2017). In addition, it can also be used as a material for the production of animal feed or biogas after anaerobic digestion (Zhang et al., 2023).

Table 1: Poultry waste management practices of the farmers

Waste management practices	Frequency	Percentage
Burying of the waste product from your poultry	22	18.3
Deep stalking of poultry waste	29	24.2
Composting as waste management practices for disposal of waste	83	69.2
Burning of hatchery debris and dead birds	46	38.3
Landfilling techniques for waste management, which is disposition of waste into an area of land	72	60.0
Vermiculture technique ,which is the use of specially selected earthworm species to degrade waste	20	16.7
Use as manure for improving plant growth	112	93.3
Drying the poultry droppings and bagging for sale in future	85	70.8
Pit disposal of dead birds	91	75.8
Disposal of waste in fish ponds	37	30.8
Treatment of feathers chemically or biologically with microbes to improve the nutritive value of feather waste which can be used	27	22.5

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in animal feed

Effects of poultry waste on farmers

Table 2 shows the effects of odour and indiscriminate disposal of poultry wastes on farmers. From the Table, effects of odour and indiscriminate disposal of poultry waste on farmers include: skin irritation ($\bar{x}$= 2.10; SD = 0.99), loss of appetite ($\bar{x}$=2.07; SD = 0.89), difficulty in breathing ($\bar{x}$= 2.07; SD = 0.81). Other effects of odour on farmers were: eye irritation ($\bar{x}$= 1.98; SD = 0.93), headaches and nausea ($\bar{x}$= 1.96; SD = 1.04), changes mood of farmers ($\bar{x}$= 1.90; SD = 0.86), stomach pain and constipation ($\bar{x}$= 1.88; SD = 0.97), psychological distress ($\bar{x}$= 1.88; SD = 1.00), respiratory infection e.g. asthma and atopic dermatitis ($\bar{x}$= 1.80; SD = 1.07), cough and phlegm to poultry farmers ($\bar{x}$= 1.68; SD = 1.03). The findings corroborate with a study by Gržinić et al. (2023) which revealed that poultry farms generate fastidious odours containing dimethylamine, ammonia, ketones, aldehydes, organic acids, phenol and other compounds which can have adverse effects on the quality of life and health of farm workers and surrounding population. According to the authors, continuous exposure to phenol induces necrosis of skin tissues and causes irritation to the liver and cardiovascular system. The implication of this is that although poultry farmers are making tremendous efforts to checkmate the gap in the demand and supply of poultry products in the area, the health hazards associated with poultry production poses a major challenge and may over time discourage farmers.

Table 2: Effects of poultry waste on farmers

Perceived effect of poultry waste on the farmers	Mean	Std. Deviation
Respiratory infection e.g. asthma	**1.80**	1.066
Headaches and nausea	**1.96**	1.040
Loss of appetite	**2.07**	0.896
Stomach pain and constipation	**1.88**	0.966
Cough and phlegm to poultry farmers	**1.68**	1.029
Difficulty in breathing	**2.07**	0.807
Burning sensation	**1.54**	0.961
Increased stress level of a person	**1.77**	1.035
Pollution from dumpsites can cause cancer	0.93	1.010
Hyper-reactiveness of farmers	1.04	0.999
Poultry waste emits greenhouse gases which could cause infections	**1.58**	0.904
Inappropriate waste disposal affect the mood of farmers	**1.90**	0.864
Depression	**1.68**	0.963
Spread of diseases like typhoid and cholera	1.28	0.987
Eye irritation	**1.98**	0.930
Psychological distress	**1.88**	1.009
Skin irritation	**2.10**	0.991
leads to cardiovascular diseases	1.23	1.002

Mean cutoff= ≥1.5

Uses of poultry waste products

Entries in Table 3 show uses of poultry waste products to include: Increase the nutrient content of the crop ($\bar{x}$= 2.85; SD = 0.44), source of income ($\bar{x}$= 2.78; SD = 0.59), improves soil structure ($\bar{x}$= 2.78; SD = 0.49), improves physical properties of the soil ($\bar{x}$= 2.66; SD = 0.64), feed supplement for other animals such as pigs and cow ($\bar{x}$= 2.62; SD = 0.80). Other uses of poultry wastes include: improve the water holding capacity of a soil ($\bar{x}$= 2.54; SD = 0.82), improves soil aeration ($\bar{x}$= 2.54; SD = 1.00), cooking and generation of electricity ($\bar{x}$= 1.92; SD = 1.03). The major uses of poultry wastes as revealed by the farmers revolve around its use as supplement for crop production. It may be correct to state that poultry waste has been identified as a good source of rare plant nutrients. Poultry waste are the most valuable manures which are used as a fertilizer because of its low water content and composition of variety of micro nutrients including large amounts of N, P, K, salts and also trace elements (Richa et al., 2020).

Table 3: Uses of poultry waste products

Uses of poultry waste products	Mean	Std. Deviation
Source of income	**2.78**	0.597
Used to improve soil structure	**2.78**	0.493
Feed supplement for other animals such as pigs and cow	**2.62**	0.801
Increase the nutrient content of the crop	**2.85**	0.442
It improves soil aeration	**2.43**	1.001
It can be converted into biogas which can be used for cooking and generation of electricity	**1.92**	1.034
It improves the physical properties of the soil	**2.66**	0.642
It helps to improve the water holding capacity of a soil	**2.54**	0.819

Cutoff mark: ≥1.5

Environmental effects of indiscriminate disposal of poultry waste

Table 4 shows the environmental effects of poultry wastes. From the Table, environmental effects of poultry wastes revealed by the respondents include: Soil toxicity ($\bar{x}$= 1.93; SD = 1.05), air pollution through emission of dust, microorganism and organic compounds ($\bar{x}$= 1.92; SD = 1.00), water pollution which kill fishes and other aquatic animal ($\bar{x}$= 1.62; SD = 1.06), land degradation ($\bar{x}$= 1.56; SD = 1.02). The findings show that waste from poultry production causes

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different levels of nuisance with emphasis on increased soil toxicity amongst others. This suggests that farmers in the area are engaged in intensive poultry farming business which has led to the production of large quantities of waste materials such as poultry litter. The implication is that farmers tend to apply excess poultry litter to their farms and this poses a serious threat to soil and water quality. Additionally, Gržinić (2023) stated that poultry manure also contain microorganisms and pharmaceuticals (such as antibiotics) used in poultry production, which can contaminate soil and water, leading to antimicrobial resistance.

Table 4: Environmental effects of indiscriminate disposal of poultry wastes

Environmental effects of poultry wastes	Mean	Std. Deviation
Air pollution through emission of dust microorganism and organic compounds	**1.92**	1.001
Soil toxicity	**1.93**	1.055
Water pollution which kill fishes and other aquatic animal	**1.62**	1.063
Leads to soil nutrient imbalance	1.47	1.263
Improper waste disposal takes up valuable space in the atmosphere	1.30	1.248
Waste are combustible and can cause fire explosion	1.38	1.078
Land degradation	**1.56**	1.019
Damages vegetation	1.36	1.143
Waste decrease the biodiversity of an area	1.30	1.127

Cutoff mark: ≥1.5

Strategies for improving poultry waste management

Table 5 shows that the poultry farmers strategies for improving poultry waste management include: Timely provision of efficient waste management information practices by NGOs and government agencies ($\bar{x}$= 2.63; SD = 0.56), recycling poultry wastes ($\bar{x}$= 2.59; SD = 0.63), provision of workshops or training sessions for farmers on how to improve your waste management practices ($\bar{x}$= 2.58; SD = 0.64), abiding by the government laws governing the use and management of waste ($\bar{x}$= 2.58; SD = 0.56), formation of farmer cooperative societies ($\bar{x}$= 2.54; SD = 0.58), construction of public Composting facilities by government ($\bar{x}$= 2.52; SD = 0.69). Other strategies for improving poultry waste management include: provision of adequate contact with extension ($\bar{x}$= 2.50; SD = 0.69), subsidizing poultry waste recycling facility by government ($\bar{x}$= 2.49; SD = 0.72), provision of new waste management technologies to improve your current practices ($\bar{x}$= 2.47; SD = 0.67), Using poultry waste as livestock feed ($\bar{x}$= 2.26; SD = 0.87), collaboration with other poultry farmers to share ideas for effective waste management practices ($\bar{x}$= 2.21; SD = 0.92), Turning poultry waste to valuable source of power ($\bar{x}$= 2.01; SD = 1.05). The findings revealed that all the variables are major strategies for improving poultry wastes management in the areas, however in policy making aimed at improving poultry waste management practices, emphasis should first be based on those strategies that have standard deviation closer to zero including: Timely provision of efficient waste management information practices by NGOs and government agencies, abiding by the government laws governing the use and management of waste, formation of farmer cooperative societies amongst others.

Table 5: Strategies for improving poultry waste management

Strategies for improving poultry waste management	Mean	Std. Deviation
Provision of adequate contact with extension	**2.50**	0.686
Recycling poultry wastes	**2.59**	0.628
Timely provision of efficient waste management information practices by NGOs and government agencies	**2.63**	0.564
Subsidizing poultry waste recycling facility by government	**2.49**	0.722
Formation of farmer cooperative societies	**2.54**	0.578
Provision of workshops or training sessions for farmers on how to improve your waste management practices	**2.58**	0.644
Construction of public Composting facilities by government	**2.52**	0.686
Provision of new waste management technologies to improve your current practices	**2.47**	0.673
Collaboration with other poultry farmers to share ideas for effective waste management practices.	**2.21**	0.916
Using poultry waste as livestock feed	**2.26**	0.874
Turning poultry waste to valuable source of power	**2.01**	1.049
Abiding by the government laws governing the use and management of waste	**2.58**	0.560

Cutoff mark: ≥1.5

Conclusion and Recommendations

The majority of the poultry farmers use poultry wastes primarily as manure for improving plant growth and also practice pit disposal of dead birds. Poultry wastes offer significant benefits including increasing nutrient content of crops and serving as source of income. However, there are health effects on farmers such as skin irritation and loss of

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appetite, as well as environmental impacts including soil toxicity and air pollution from poultry waste. There is need for enhanced efforts by non-governmental organizations and government agencies to provide timely and efficient waste management information to poultry famers, in addition to construction of public composting facilities, subsidizing waste recycling facilities, introducing new waste management technologies and promoting waste reuse as livestock fee.

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