Ondo University Journal of Agriculture and Social Sciences 2024, 2(1): 25–41

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Original Article

Waste management strategies adopted by poultry farmers to prevent environmental pollution in Ondo State, Nigeria

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ABSTRACT

This research investigated the waste management practices adopted by poultry farmers in Ondo State, Nigeria, with an emphasis on mitigating environmental pollution. It aimed to quantify the amount of poultry waste generated on farms, outline the disposal methods employed by farmers, assess their awareness of the health risks and environmental impacts of poor waste disposal, and analyze their attitudes toward waste management. A multistage sampling technique was utilized to gather data from 120 respondents. The data were analyzed using descriptive statistics (frequency and percentage) and the Multinomial Logit Regression Model (MLRM). Findings indicate that a majority of the farmers (53.3%) were male, with an average age of 45 years (Standard deviation: 2.90). About 61.7% of these farmers managed their operations on a part-time basis. More than half (71.3%) of the respondents generate only small quantities of wasted feed, suggesting relatively efficient feed management. The most frequently generated waste was litter (54.9%), and composting (42.9%) emerged as the most prevalent disposal method. The regression analysis identified several significant predictors of waste disposal method choice, including the farmer's age, the average amount of waste produced, frequency of cleaning, the type of management system, and household size. The research findings suggest that the level of education among farmers, regular cleaning of poultry waste, and gender are positively associated with the preference for burning waste. Meanwhile, the experience in farming, type of poultry system, and the amount of waste produced significantly influence the decision to opt for the burial method for waste disposal. Additionally, the quantity of waste generated has varied but minor impacts on the choice of disposal methods, indicating practical waste management challenges. It is recommended that poultry farmers promote the adoption of efficient waste management practices by offering cost-effective facilities and ensuring their accessibility.

HIGHLIGHTS

- Waste quantity varies but has minor impact on disposal methods
- Older respondents are less inclined to all disposal methods
- Number of birds grown greatly impacts waste disposal choice
- Experience indicates better waste management strategies

Article History:
Received: 24th July, 2024
Accepted: 26th September, 2024
Available online: 11th November, 2024

Keywords:
Environmental pollution; poultry farmers; waste management strategies; adoption

1. Introduction

The global poultry industry contributes significantly to national development goals, poverty alleviation, and employment creation (Ravindran and Mnkeni, 2016). Despite being one of Nigeria's most developed animal industries (Oluremi and Jeremiah, 2016), poultry farming can be environmentally hazardous due to the emission of large quantities of waste, causing air, water, and land pollution (AkinsolA *et al*., 2018). Poultry waste emits gases like ammonia (NH_3), carbon dioxide (CO_2), methane (CH_4), ozone (O_3), and nitrous oxide (N_2O), contributing 5-10% to global anthropogenic emissions and global warming (Hoglund-Isaksson, 2012). Therefore, the Environmental Protection Act of 1990 defines waste broadly, including unwanted materials from poultry farms such as excreta, bedding, feathers, and other debris. Poultry production generates various wastes, including hatchery waste, manure, litter, and mortalities, with processing adding offal, wastewater, and bio-solids. In Ondo State, brooding ash and wastewater from farm operations add to the waste burden, exacerbated by increasing poultry densities (Hale *et al*., 2020).

Poultry production in Nigeria exceeds 140 million birds, positioning the country as a leading poultry producer among West African nations (Ogunsipe *et al*., 2012). In Ondo State, the poultry industry is a significant employer. Historically, the industry's growth can be attributed to the high energy and protein content of poultry products, rapid turnover, and a short incubation period of 21 days (Bello *et al*., 2015). The industry plays a crucial role in addressing protein deficiencies in Nigeria, providing livelihoods, and creating employment in both urban and rural areas (Olutumise *et al*., 2023; Olutumise, 2023). Commonly reared poultry types include chickens, ducks, guinea fowls, turkeys, pigeons, and, more recently, ostriches, with chickens, turkeys, and guinea fowls being the most commercially important (Akani and Benson, 2014). Again, Nigeria faces a food supply challenge with a population growth rate exceeding 3% and food production growth between

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https://doi.org/10.52493/j.oujas.2024.1.104

1.0% and 1.5%, resulting in a shortfall of 1.5% to 2% annually. Additionally, there is an imbalance in food supplies, with plant sources contributing over 75% and animal sources only 25%, primarily due to the underdevelopment of the livestock industry (Al-Jadabi, Laaouan, El Hajjaji, Mabrouki, Benbouzid and Dhiba, 2023).

Properly managed, poultry waste can be beneficial, serving as a soil conditioner, feed supplement, or fuel source through direct combustion or biogas conversion (Prabakaran and Valavan, 2021). However, it can also pose environmental hazards, particularly the liquid waste that contaminates water sources (Nkwachukwu *et al*., 2010). Livestock waste contributes significantly to soil fertility, with animal manure accounting for substantial nitrogen and phosphate in fertilizers (FAO, 2008). Manure enhances soil stability, reduces compaction, and serves multiple uses, including fuel, construction material, and livestock feed (Agegnehu *et al*., 2017; Chia *et al*., 2020). Proper manure handling and management can replace or supplement commercial fertilizers (Tao and Mancl, 2008). Poultry litter, a mix of droppings and bedding, contains valuable nutrients.

However, there is limited knowledge and poor adoption of integrated waste disposal systems among poultry farmers in Ondo State. Advanced waste management practices include manure storage systems, composting facilities, and temperature control systems, which are not widely implemented, leading to poor waste management attitudes among farmers. The rapid growth in poultry production has not been matched by advancements in waste management practices despite its beneficial soil nutrients. As the poultry population increases, the volume of waste has also risen, with Nigeria's annual production of commercial poultry manure estimated at approximately 932.5 metric tonnes (Adewumi *et al*., 2011). This poses significant environmental and health risks, necessitating an evaluation of waste management strategies among poultry farmers in Ondo State to identify current practices and recommend improvements. Poultry waste, particularly liquid waste, poses substantial environmental challenges by seeping into the ground and contaminating surface and groundwater. Effective waste management practices are crucial to mitigate these harmful effects. If not immediately utilized, poultry waste should be properly stored to minimize its environmental impact (Nkwachukwu *et al*., 2010; Adeoye *et al*., 2014). The study's overall goal is to assess the waste management practices used by poultry producers and the specific objectives are to examine the socioeconomic characteristics of the poultry farmers in the study area; identify various poultry wastes generated in respondents' farms in the study area; describe the poultry waste disposal method used on the farms of the respondents in the study area and determine factors influencing the choice of waste disposal method used by poultry farmers in the study area.

2. Methodology

The research was conducted in Ondo State, Nigeria, located between latitudes 5°45'N and 7°52'N and longitudes 4°20'E and 6°03'E. The state is bordered by Edo and Delta states to the east, Ogun and Osun states to the west, Ekiti and Kogi states to the north, and the Bight of Benin of the Atlantic Ocean to the south. Ondo State covers approximately 15,000 square kilometres and has a population of 3,441,924 people according to the 2006 census. It consists of eighteen Local Government Areas (LGAs), with Akure being the capital and largest city. Other major towns include Ondo, Owo, Ore, Okitipupa, Ikare, Idanre, and Ile-Oluji. The majority of the population is Yoruba, but there are also residents from other parts of Nigeria and foreign nationals. Agriculture is the predominant occupation in the state. Primary data were collected using structured questionnaires and interviews. A multistage sample technique was used, with the first step selecting Ondo state based on the fact that the poultry industry is a significant employer in the state (Bello *et al*., 2015). The second stage involved selecting three local government areas from among the state's eighteen LGAs: Akure South, Ondo West, and Owo. The third stage requires an unbiased selection of 40 respondents from each LGA, for a total sample size of 120 poultry producers. The respondents were recruited using the snowball sampling approach. The data were analyzed using descriptive statistics and multinomial logistic regression model (MLRM).

The multinomial logistic regression model was employed to analyse the factors influencing waste management methods adopted by poultry farmers. This approach is suitable for explaining choices among a set of mutually exclusive alternatives with binary outcomes, using multivariate discriminant analysis (Maddala, 1983; Green *et al*., 1998; Adams *et al*., 1997; Adam and Njogu, 2023; Olutumise *et al*., 2021). The logistic model transforms a non-normally distributed endogenous dataset through a logarithmic function, constraining probability values to a range between 0 and 1. This transformation is formally referred to as the logarithm of the odds of $y = 1$.

The MLRM addresses outcome variables with mutually exclusive binary choices (0, 1). In contrast, the MLRM technique employs the Relative Risk Ratio (RRR) or Conditional Odds Ratio (COR) to assess the likelihoods of restricted models and the log odds of various potential outcomes (Long, 1997; Sharyn, 2015).

A key assumption in MLRM is the independence of irrelevant alternatives, meaning that factors associated with one choice do not affect the probability of selecting another, even if the alternatives are similar (Long, 1997). Consequently, a shift in the appeal of one of two closely substitutable alternatives is expected to leave the relative probabilities of selecting the remaining alternative, in comparison to a third option, unchanged.

In this study, the determinants of the choice of poultry waste disposal methods were operationalized using the MLRM. The dependent variables were the different disposal techniques employed by poultry producers, whereas the independent variables were the socioeconomic characteristics of the farmers (X_i). The dependent variables took a discrete value 1, 2, 3, 4, or 5 for the identified disposal methods. The utility (U) derived from the choice of disposal method was specified as a linear function of the farmer's specific characteristics (Baruwa and Omodara, 2018). The attributes of the farm (X) are as shown in the equations below:

$$U_1\ (\text{method of disposal } I) = B_i X_i + \varepsilon_i \quad (1)$$

$$U_2\ (method\ of\ disposal\ J) = B_j X_j + \varepsilon_j \quad (2)$$

$$U_3\ (\text{method of disposal } K) = B_k X_k + \varepsilon_k \quad (3)$$

$$U_4\ (\text{method of disposal } L) = B_l X_l + \varepsilon_l \quad (4)$$

$$U_5\ (\text{method of disposal } M) = B_m X_m + \varepsilon_m \quad (5)$$

The method of disposal (dependent variable) is the chosen method of disposal: I, J, K, L and M which correspond burial, burning, composting, flushing and incinerating, respectively.

$$U_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \varepsilon_i \quad (6)$$

Where β is the coefficient of the independent variables, X represents explanatory variables as: X_1 = Age of respondents (years), X_2 = Marital status, X_3 = Farming experience of a farmer (years), X_4 = Waste clearance frequency, X_5 = Sex (male = 1; female = 0), X_6 = Types of the management system (battery cage or deep litter system), X_7 =Types of birds reared, X_8 = Household size (numbers), X_9 = Primary Education status, X_{10} = Secondary education status, X_{11} = Quantities of waste generated (kg), X_{12} = Number of birds reared (quantity) and ε_i = disturbance error.

3. Results and Discussion

3.1. Socioeconomic characteristics of respondents

Table 1 presents the analysis of the respondents' socioeconomic characteristics in the study area. The results indicate that 32.5% of participants are aged between 41-50 years, with an average age of 45.2 years. This suggests that the respondents are predominantly middle-aged, which could positively influence their decision-making in poultry farming, particularly in choosing effective waste disposal methods (Olutumise *et al*., 2021). Additionally, the gender distribution reveals that 53.3% of participants are male and 46.7% are female, highlighting that poultry farming attracts both genders, though males predominate. This trend might reflect males' quicker adaptation to risks associated with farming. Results on marital status show that almost two-thirds (62.5%) of the respondents are married, with only 8.3% being single, suggesting that marital responsibilities could enhance commitment to effective waste management practices. Regarding educational background, all respondents have some level of education, with 54.7% holding a bachelor's degree. This high educational level may likely facilitate access to information, enhancing their decision-making capabilities concerning sustainable disposal practices (Olutumise *et al*., 2023). Results on ownership of the farms from Table 1 indicate that 60% of respondents own their farms, while 40% operate on rented properties. Experience levels among the farmers vary, with 35% having 6 to 10 years of experience in the industry. This level of experience is indicative of a well-informed group, capable of implementing superior waste management strategies in their operations (Adewumi *et al*., 2011; Adam and Njogu, 2023).

Table 1: Socioeconomic characteristics of respondents (n = 120)

Variable	Frequency	Percentage	Mean	Std. Deviation
Age				
21-30	12	10.0		
31-40	32	26.7		
41-50	39	32.5		
51-60	26	21.7		
61 – 70	11	9.2	44.83	2.90
Sex				
male	64	53.3		
Female	56	46.7		
Marital Status				
Married	75	62.5		
Single	10	8.3		
Widowed	10	8.3		
Divorced	25	20.8		
Educational Status				
Primary	20	16.7		
Secondary	20	16.7		
NCE	19	15.8		
HND	26	21.7		
B.SC	38	31.7		
Ownership of poultry farm				
Self- owned	72	60.0		
Rented	48	40.0		
Years of experience				
Less than 5yrs	38	31.7		
6 – 10	42	35.0		
11 – 15	9	7.50		
16 – 20	19	15.8		
Above 20 years	12	10.0		

3.2. Farm operation characteristics of the respondents

Table 2 illustrates the operational modes of respondents within the study area. It reveals that a significant proportion (61.7%) of respondents manage their poultry farms on a part-time basis, suggesting they likely engage in additional occupations beyond poultry farming. The table also details the farming systems employed; 54.2% of the farmers utilize both battery cage and deep litter systems. Furthermore, the table categorizes the types of birds raised by the farmers. 29.2% of respondents specialize in raising only layers, while a minimal 0.8% focus on rearing cockerels. Additionally, the results on flock size indicate that half of the respondents (50%) maintain flocks of over 1500 birds, suggesting a predominance of commercial-scale operations.

Table 2. Farm operation characteristics of the respondents

Birds reared	Frequency	Percentage
Mode of Operation		
Part-time	74	61.7
Full time	46	38.3
System practiced		
Battery cage	24	20.0
Deep litter	31	25.8
Both	65	54.2
Types of bird-reared		
Broiler	16	13.3
Layers	35	29.2
Cockerels	1	0.9
Broilers and Layers	34	28.3
Layers and Cockerels	3	2.5
Broilers and Cockerels	10	8.3
Broilers, Layers, and Cockerels	11	9.0
Turkey and Noiler	20	16.
Flock Size		
Below 500	22	18.3
501 – 1000	17	14.2
1001 – 1500	21	17.5
Above 1500	60	50.0

Table 3. Type and level of poultry waste generated in respondents' farms in the study area

Variables	Extremely large quantity		Large quantity		Small quantity		Not generated		Mean
	F	%	F	%	F	%	F	%	
Dungs	4	7.3	13	23.6	16	29.1	22	40.0	10.9
Wasted feed	4	3.5	6	5.2	82	71.3	21	18.3	21.9
Broken eggs	2	1.8	2	1.8	64	56.6	45	39.8	18.7
Feathers	12	10.6	2	1.8	20	17.7	79	69.9	17.3
Entrails	8	7.1	4	3.5	9	7.5	92	81.4	15.4
Organs of slaughtered birds	4	3.5	0	00.0	15	13.3	94	83.2	11
Dead birds	4	3.5	2	1.8	61	54.0	46	40.7	19
Hatchery wastes	2	1.8	6	5.3	4	3.5	101	89.4	13.5
Processing wastes	4	3.5	2	1.8	13	11.5	94	83.2	14.2
Bio-solids	4	3.5	6	5.4	21	18.9	80	72.1	15.6
Litter	11	9.7	62	54.9	33	29.2	7	6.2	30.2

Multiple response exists

3.3 Waste generated by respondents' poultry farms in the study area

Table 3 summarizes the types and quantities of poultry waste produced by respondents, essential for crafting optimal waste management strategies. The primary waste type reported is dung, with 40% of respondents indicating no generation, while others report varying amounts from small to extremely large quantities. A high percentage of respondents (71.3%) generate only small quantities of wasted feed, suggesting relatively efficient feed management. Broken eggs (56.6%) and feathers (17.7%) constitute minor waste issues, with most farmers reporting none or small quantities, indicating minimal impact on overall farm efficiency. Regarding more specific waste types, a significant majority of respondents do not generate entrails (81.4%), organs (83.2%), hatchery (89.4%) and processing wastes (83.2%), implying external processing or effective internal waste handling. Dead birds (54.0%) are also minimally reported, underscoring robust health management practices on the farms. Litter is the waste that is reported in the most inconsistent ways overall. This is evident when comparing the percentage of people who generate it (6.2%) versus those who generate it in small to large quantities (93.8%). This underscores the importance of managing litter effectively.

3.4 Disposal method used by respondent based on preponderance

Table 4 illustrates how wastes were disposed of by respondents on their farms. The result indicates that composting (40%) is the predominant method adopted by respondents utilizing it. This suggests that the majority of respondents prefer composting as their primary waste disposal strategy, often converting waste into manure. Their high adoption of composting as a waste management strategy may be tied to it being relatively easier or maybe they are also crop farmers so it may be easier for them to incorporate in their soil to boost its fertility.

Table 4. Disposal method used by respondent based on preponderance in the study area

Disposal method	Frequency	Percentage
Burial	5	4.2
Burning	8	6.7
Composting	48	40.0
Flushing	30	25.0
Incineration	29	24.1
Total	120	100.0

3.5 Multinomial Logistic Regression Analysis

Table 5 presents findings from the MLRM Analysis, which explores factors influencing waste disposal methods among respondents. Those who favour burning as their disposal method are significantly influenced by variables such as cleaning frequency (1.0153, P-value: 0.09), gender (3.1949, P-value: 0.026), and primary education (3.19063, P-value: 0.031), all notable at the 5% significance level. An increase in cleaning frequency and primary education correlates positively with the choice of burning, with gender being significant at the 5% level and cleaning frequency at the 10% level. The analysis further indicates that for the incinerating method, variables like age, type of poultry system, and household size are critical at the 5% significance level. An increase in age tends to positively influence the choice of incineration, while larger household sizes decrease the likelihood of selecting this method. Regarding the burial method, the data shows that the amount of waste generated is significant at the 10% level. Factors such as farming experience, the type of poultry system, and the average quantity of waste significantly impact the decision to use burial for waste disposal at a 5% significance level. For the flushing method, age, primary education, and secondary education play significant roles at the 5% level. Older respondents and those with primary education are more likely to choose flushing, while those with secondary education are less likely, indicating varied impacts of education levels on disposal method preferences.

3.6 The Marginal Effect of Significant Variables on Alternative Waste Disposal Method

Table 6 illustrates the marginal effects of key variables on the selection of various waste disposal methods:

Age: An increase in age correlates with a decrease in the likelihood of choosing specific disposal methods, with reductions noted as follows: composting by 1.7%, burning by 1.6%, incinerating by 1.5%, burial by 2.1%, and flushing by 1.6%. This suggests that older farmers are less likely to select these methods. These results imply that older respondents are generally less

Table 5: Distribution of respondents based on multinomial logistics regression result showing factors influencing the choice of disposal

Variables	Burning			Incinerating			Burial			Flushing		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Age	0.03037	0.07792	0.697	0.08439**	0.03859	0.029	0.13621	0.09045	0.132	0.12033**	0.05091	0.018
Marital status	0.26093	0.52203	0.617	-1.3597	0.97628	0.164	-0.5392	0.52225	0.302	-1.0828	1.13958	0.342
Farming exp.	-0.0665	0.11695	0.57	-0.0438	0.06	0.465	-0.1087	0.13962	0.436	0.02609	0.06745	0.699
Cleaning freq.	1.0153*	0.59926	0.09	-0.0337	0.38628	0.93	-0.5029	0.90644	0.579	0.36726	0.42366	0.386
Sex	3.1949**	1.43456	0.026	-0.9342	0.59868	0.119	-1.1651	1.32323	0.379	0.4526	0.65804	0.492
Poultry system	0.30203	0.7145	0.673	-0.9309**	0.37278	0.013	0.35441	0.79009	0.654	-0.0385	0.39956	0.923
Types of bird	-0.5586	0.64227	0.384	-0.7113**	0.36275	0.05	-0.1201	0.65021	0.853	-0.3942	0.37864	0.298
Household	0.08774	0.28491	0.758	-0.3728**	0.17627	0.034	-0.1997	0.3776	0.597	-0.1014	0.17808	0.569
Primary Edu.	3.19063**	1.47542	0.031	0.51332	1.06891	0.631	-15.782	1560.28	0.992	2.09674**	1.00591	0.037
Secondary Edu.	0.20212	1.47989	0.891	-1.3265	0.818	0.105	-0.5211	1.3474	0.699	-2.7573**	1.2814	0.031
Waste quantity	-0.0001	0.00055	0.827	-0.0004	0.00041	0.345	0.00074*	0.00038	0.055	-6E-05	0.00026	0.829
flock size	-3E-05	8.1E-05	0.745	-0.0001	1E-04	0.275	-1E-04	8.3E-05	0.253	3.1E-05	5.4E-05	0.565
Constant	-11.185	5.54098	0.044	4.98108	2.45607	0.043	-4.1761	5.75955	0.468	-5.4153	3.58276	0.131

Using the composting method as a base category; From Table 5: * means 10% significant level, ** means 5 % significant level, and *** means 1% significant level.

inclined towards all disposal methods, potentially due to a preference for simpler, less labour-intensive methods.

Marital Status: Marital status impacts disposal method preferences, showing a decrease in the probability of selecting composting by 17.1%, burning by 13.6%, incinerating by 19.5%, burial by 16.4%, and flushing by 16.2% as marital commitments increase. Marital status positively affects the likelihood of choosing all disposal methods, suggesting that married individuals might be more responsible or have more resources to invest in proper waste disposal.

Primary Education: Attendance at primary school increases the likelihood of opting for composting by 79%, while it decreases the likelihood of choosing burning by 19.8%, incinerating by 5.8%, burial by 8.9%, and flushing by 1.23%. Primary education significantly increases the likelihood of choosing composting, while decreasing the likelihood for other methods. This reflects an understanding of the benefits of composting and the perceived complexities of other methods.

Secondary Education: Those with secondary education show an increased likelihood of choosing composting by 26.8%, burning by 25.1%, incinerating by 26.5%, burial by 26.4%, and flushing by 31.8%. Secondary education increases the likelihood of choosing all disposal methods, reflecting a better understanding and ability to implement various waste management practices.

Farming Experience: Greater farming experience slightly increases the likelihood of selecting composting by 0.6%, burning by 0.68%, incinerating by 0.5%, burial by 0.9%, and decreases it for flushing by 0.1%. Larger household sizes are more likely to choose burial and other methods, possibly due to more available labour and resources for waste management.

Cleaning Frequency: Higher cleaning frequency correlates with a lower probability of selecting composting by 4%, but an increase for burning by 89%. It also reduces the likelihood of incinerating by 2%, burial by 0.6%, and flushing by 0.4%. More frequent cleaning is associated with a lower likelihood of choosing most disposal methods, possibly due to already effective waste management practices that reduce the need for specific disposal methods.

Poultry System: Changes in the poultry system type can increase the likelihood of choosing composting by 5%, burning by 2%, incinerating by 9%, burial by 10%, and flushing by 3%. The type of poultry system influences the likelihood of choosing various disposal methods, with all showing a positive marginal effect, suggesting that diverse systems are conducive to different waste management practices.

Table 6: Distribution of Respondent Base on the Marginal Effect of Significant Variables on Alternative Waste Disposal Method

Variable	Composting Effect	burning effect	incinerating effect	Burial effect	Flushing effect
Age	-0.177	-0.166	-0.015	-0.021	-0.016
Sex	-0.436	-0.193	-0.051	0.0341	-0.3690
Marital status	0.171	0.136	0.195	0.164	0.162
Primary Edu.	0.797	-1.98	-0.58	-0.892	-1.231
Secondary Edu.	0.268	0.2510	0.265	0.264	0.318
Farming Exp	0.006	0.0068	0.005	0.009	0.001
Household Size	0.036	0.002	0.045	0.361	0.204
Cleaning frequency	-0.044	-0.894	-0.020	-0.006	-0.043
Poultry system	0.055	0.027	0.095	0.171	0.037
Types of bird	0.106	0.107	0.101	0.079	0.077
Waste quantity	- 0.000	0.00002	0.0004	-0.00002	0.00001
Flock size	9.83	7.05	0.0000	0.000105	0.12e

Types of Birds: The sorts of birds raised somewhat improve the chance of choosing composting by 10.6%, burning by 10.7%, incineration by 10.1%, waste burial by 7.9%, and flushing by 7.7%. The type of poultry birds bred exhibited a stronger positive marginal impact from composting and burning, as well as a shift from incineration to flushing. The number of birds grown at a time will definitely and significantly affect how the waste is disposed of.

Waste Generated: The quantity of waste generated inversely affects the likelihood of choosing composting by 0.01% and burial by 0.02%. Conversely, it increases the probability of selecting burning by 0.02%, incinerating by 0.04%, and flushing by 0.001%. The quantity of waste generated has minimal but varying effects on the choice of disposal methods, reflecting practical considerations of waste management.

Conclusion and Recommendation

This study investigated poultry waste generation and disposal strategies in specific areas of Ondo State, Nigeria. Poultry farmers breed a variety of birds and produce a substantial quantity of waste, such as litter, wasted feed, dead birds, feathers, and dung. The study discovered that primary education of farmers, frequent cleaning of poultry waste, and gender positively correlate with the choice of burning, whereas farming experience, type of poultry system, and average quantity of waste have a significant impact on the decision to use the burial method for waste disposal. Older respondents and those with elementary education are more likely to choose flushing, but those with secondary education are less likely, demonstrating that education levels have different effects on disposal technique preferences. Furthermore, the kind of birds bred and the quantity of waste generated boost and reduce the possibility of using composting methods, respectively. The amount of waste generated has small but diverse effects on the choice of disposal techniques, reflecting practical waste management issues in terms of its minor role in raising the likelihood of choosing burning, incineration, or flushing methods of disposal. Based on these findings, the study proposes several recommendations including increasing efforts to educate poultry farmers about modern waste management techniques; supporting the adoption of effective waste management practices by providing facilities at reduced costs and ensuring they are easily accessible and advocating for government policies that safeguard the environment and promote pollution-free practices among poultry farmers in the state.

Acknowledgement

The author acknowledges Miss. Akinola Ifedayo Eunice for helping in data collection; the constructive comments of the member of staff of the Department of Agricultural and Resource Economics, Federal University of Technology, Akure that refined the study through their contributions and Mr. Ilesanmi Julius Olumide for his enormous support to ensure the study is published.

References

Adam, R., & Njogu, L. (2023). A review of gender inequality and women's empowerment in aquaculture using the reach-benefit-empower-transform framework approach: A case study of Nigeria. *Frontiers in Aquaculture*, *1*, 1052097.

Adams, R. J., Wilson, M., & Wang, W. C. (1997). The multidimensional random coefficients multinomial logit model. *Applied psychological measurement*, *21*(1), 1-23.

Adeoye, P. A., Hasfalina, C. M., Amin, M. S. M., Thamer, A. M., & Akinbile, C. O. (2014). Environmental implication of poultry waste generation and management techniques in Minna, semi-arid region of Nigeria. *Annual Research & Review in Biology*, *4*(10), 1669-1681.

Adewumi, A. A., Adewumi, I. K., & Olaleye, V. F. (2011). Livestock waste-menace: Fish wealth-solution. *African journal of environmental science and technology*, *5*(3), 149-154.

Agegnehu, G., Srivastava, A. K., & Bird, M. I. (2017). The role of biochar and biochar-compost in improving soil quality and crop performance: A review. *Applied soil ecology*, *119*, 156-170.

Akani, K.A., & Benson, O. (2014). Poultry wastes management strategies and environmental implications on human health in Ogun State of Nigeria. *Adv. Econ. Bus*, *2*, 164-171.

Akinsola, G. O., Osasona, K. K., Akinsuyi, M. A., & Oluwasegun, J. B. (2018). Climate Variability and Livestock Production in Nigeria: Boon or Bane.

Al-Jadabi, N., Laaouan, M., El Hajjaji, S., Mabrouki, J., Benbouzid, M., & Dhiba, D. (2023). The dual performance of Moringa oleifera seeds as eco-friendly natural coagulant and as an antimicrobial for wastewater treatment: a review. *Sustainability*, *15*(5), 4280.

Baruwa, O., & Omodara, O. D. (2018). Poultry waste management practices and policy implications for environmental sustainability in urban areas of Osun State, Nigeria. *Applied Trop. Agric*, *23*(1), 25-34.

Bello, K. O., Adetoye, A. M., & Irekhore, O. T. (2015). Assessment of the use of cassava as alternative energy feedstuff in livestock feeds in Nigeria. *International Journal of Applied Agriculture and Apiculture Research*, *11*(1-2), 67-76.

Chia, W. Y., Chew, K. W., Le, C. F., Lam, S. S., Chee, C. S. C., Ooi, M. S. L., & Show, P. L. (2020). Sustainable utilization of biowaste compost for renewable energy and soil amendments. *Environmental pollution*, *267*, 115662.

Food and Agricultural Organization (2008). Poultry In The 21st Century: Avian Influenza And Beyond. Proceedings Of The International Poultry Conference, Bangkok, 5–7 Nov. 2007, Edited By O. Thieme And D. Pilling. Fao Animal Production And Health Proceedings No. 9. Rome.

Green, G. H., Boze, B. V., Choundhury, A. H., & Power, S. (1998). Using logistic regression in classification. *Marketing Research*, *10*(3), 5.

Hale, R. C., Seeley, M. E., La Guardia, M. J., Mai, L., & Zeng, E. Y. (2020). A global perspective on microplastics. *Journal of Geophysical Research: Oceans*, *125*(1), e2018JC014719.

Höglund-Isaksson, L. (2012). Global anthropogenic methane emissions 2005–2030: technical mitigation potentials and costs. *Atmospheric Chemistry and Physics*, *12*(19), 9079-9096.

Maddala, G.S (1983). Introduction to Econometrics, Macmillan Publishing Company New York.

Nkwachukwu, O. I., Chidi, N. I., & Charles, K. O. (2010). Issues of roadside disposal habit of municipal solid waste, environmental impacts and implementation of sound management practices in developing country "Nigeria". *International Journal of Environmental Science and Development*, *1*(5), 409-418.

Ogunsipe, M. H., Agbede, J. O., Igbasan, F. A., & Olotuntola, O. D. (2022). Cassava fiber meal and Roxazyme® G2 supplementation on the performance and haemato-biochemical profile of broiler chickens. *Iranian Journal of Applied Animal Science*, *12*(4), 771-782.

Oluremi, A., & Jemimah, Q. (2016). Management of waste by-products in medium-scale commercial poultry facilities in Peri-Urban Ibadan, Nigeria. *Russian Journal of Agricultural and Socio-Economic Sciences*, *53*(5), 103-107.

Olutumise, A. I. (2023). Intensity of adaptations to heat stress in poultry farms: A behavioural analysis of farmers in Ondo state, Nigeria. *Journal of Thermal Biology*, *115*, 103614.

Olutumise, A. I., Ajibefun, I. A., & Omonijo, A. G. (2021). Effect of climate variability on healthcare expenditure of food crop farmers in Southwest, Nigeria. *International Journal of Biometeorology*, *65*(6), 951-961.

Olutumise, A. I., Oladayo, T. O., Oparinde, L. O., Ajibefun, I. A., Amos, T. T., Hosu, Y. S., & Alimi, I. (2023). Determinants of Health Management Practices' Utilization and Its Effect on Poultry Farmers' Income in Ondo State, Nigeria. *Sustainability*, *15*(3), 2298.

Prabakaran, R., & Valavan, S. E. (2021). Wealth from poultry waste: an overview. *World's Poultry Science Journal*, *77*(2), 389-401.

Ravindran, B., & Mnkeni, P. N. S. (2016). Bio-optimization of the carbon-to-nitrogen ratio for efficient vermicomposting of chicken manure and waste paper using Eisenia fetida. *Environmental Science and Pollution Research*, *23*, 16965-16976.

Tao, J., & Mancl, K. (2008). Estimating manure production, storage size, and land application area. *Fact Sheet Agriculture and Natural Resources AEX-715-08, The Ohio State University Extension. ohioline. osu. edu/aexfact/pdf/0715. pdf*.