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Empirical Assessment of Environmental and Health Risks in Intensive Poultry Production in Kwara State, Nigeria

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Abstract

The study was designed to assess the environmental and health risks arising from intensive poultry production in Kwara State, Nigeria. A total of 120 poultry farmers in Kwara State under the Poultry Association of Nigeria (PAN) were selected randomly for the study, and structured questionnaires were administered. The data collected were analyzed using descriptive statistics, chi-square test, and the linear regression. The study revealed that about 79.5% of the poultry farmers were literate, having completed at least a tertiary educational level. In addition, the results showed that the environmental and health issues were significant during production and processing. It was further revealed that the type of battery cage used and educational level of the farmers were positively significant, while the year of establishment was negatively significant when it comes to the adoption practices. This implies that the higher the level of education, the more likely farmers adopt improved practices. Moreover, it was observed that the majority of the poultry farmers do not abide by the environmental and public health laws and regulations; therefore, it is recommended that government should enforce strict supervisory agencies of the sanitation/health policies aiming at environmental preservation and protection.

Keywords:
adoption, environment, health, poultry, risk

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INTRODUCTION

According to the Animal Production and Health Division, Food and Agriculture Organization of the United Nations, FAO (2007), recently, the poultry industry in the world has made tremendous changes to meet the increasing demand for inexpensive and safe supply of meat and egg. This increasing demand has been accompanied by structural changes within the sector, which is characterized by the emergence and growth in commercial and industrial farming establishments as well asthe intensification of poultry operations (FAO, 2007; Shashank, 2013). Poultry production in Nigeria consists of local and exotic breeds, and these local or backyard breeds of poultry constitutes about 84% of total poultry production. Notwithstanding, the exotic or foreign breeds contribute about 14% to the total poultry production in Nigeria (Adene & Oguntade, 2006). Obioha (1996) observed that of all the poultry species, the fowls (chicken) are the most common and important in the tropics. These are reared under the free-range systems and the intensive or semi-intensive systems. Intensive poultry management systems are usually found in urban areas, where there are markets for egg and meat, and this system recommends standard practices such as disease control methods, housing, and feeding depending on breed of choice. (Abubakar et al., 2007; Tadelle, 1996; Alabi et al., 2014).

The poultry sector is very important; it supplies food and raw materials, generates employment, and serves as a basis for research works. Poultry meat and eggs are a good source of vitamins and minerals. They supply rich protein and are palatable and generally acceptable. Poultry birds mature earlier than most breeds of livestock (cattle, swine, goats, etc.) and can bring economic returns within about 10–12 weeks, which is relatively short compared to other livestock. Poultry production systems are influenced by some factors. These factors are: housing (Natukunda et al., 2011), feed source (Byarugaba et al., 2002), health and disease (Simainga et al., 2011), and environment. Intensive poultry farming is a highly efficient system which saves land, feed, labor and other resources, and increases production. In this system, the poultry farm environment is very well controlled by the farmer. Therefore, production takes place all year round and does not depend on the seasons. According to the World Watch Institute (2006), about 74% of the global total poultry meat and 68% of total poultry eggs worldwide are produced from intensive poultry farming system.

As with any production process, the production of poultry products results in wastes such as the manure from bird excrement, hatchery wastes, litter from bedding materials such as sawdust, wood shavings, and so on, offal, various kinds of feed, medications and pesticide packages, cleaning materials, used ventilation filters,as well ason-farm mortalities (FAO, 2008; Akanni & Benson, 2014). If recycled and managed properly, most of these byproducts can provide valuable organic and inorganic nutrients. Yet, they also give rise to potential environmental and human health concerns and act as vectors for insects and vermin, and pathogenic microorganisms (FAO, 2008; Akanni et al., 2014; Hossen, Hoque & Nahar, 2015). Specific concerns that are well documented in different studies include degradation of surface water and/or nearby groundwater, owing to increasing nutrients such as nitrogen and phosphorus (and potassium in some locations). Also of concern is the issue of air quality affected by dust particles, hydrogen sulfide, ammonia and other volatile organic substances discharged from poultry production facilities. Due to the global concern aboutclimate change and the health effects, the effect of greenhouse gas emissions is now a major concern (FAO, 2008; Akanni et al., 2014).

According to Alabi et al. (2014), a study by the Environmental Protection Agency in 2007 reported that chicken droppings usually contaminate the litter spread in poultry houses and poses great environmental threats during the process of disposing the litter. This is because improper disposal leads to air pollution from unpleasant odors, breeding of flies, and water pollution. To manage the nuisance of odor created by the poultry industry, studies (Environmental Protection Agency, 2007) suggest that poultry farms are to be located at least 500

meters away from human settlements. Accordingly, pollution associated with poultry production has been of great concern, and many authorities and several studies have suggested a thorough pollution control measure by states, where non-compliant poultry farmers are fined or even jailed (Alabi et al., 2014; Anosike, 2007).

The planning, construction, and operation of the poultry installation of any size should consider the issues involved in storing, managing, and using waste byproducts. This is because of the effects of these wastes on the human health and the environment. On a global scale, much research (FAO, 2008; Hossen et al., 2015) has been conducted on intensive poultry management systems and its environmental impact; and ways to reduce, manage, and use these poultry wastes. Such as the use as manure, animal feed components and for fuel energy. However, many poultry farmers do not comply with the environmental laws and public health laws. The majority of these poultry farmers do not recycle their by-products, and because of not doing this, some discharge into the river, bury, and burn the poultry wastes, thus causing environmental and health hazards to the people and community around. Therefore, this study seeks to answer the following questions: What are the types of environmental concerns arising from intensive poultry production? What are the patterns of public health issues arising from intensive poultry production? and, what are the determinants of adoption of the improved practices by the farm for mitigating the environmental and health risks?

The main objective of this study was to assess the environmental and health risks in intensive poultry production in Kwara State, Nigeria. The specific objectives were to: identify the type of environmental concerns arising from intensive poultry production; assess the patterns of public health issues arising from intensive poultry production; and examine the determinants of adoption of the improved practices by the farm for mitigating the environmental and health risks.

Hypothesis:

H_0: There is no significant difference between the expected frequencies and observed frequencies in each category.

H_1: There is a significant difference between expected frequencies and observed frequencies in each category.

Decision rule: Reject H_0 if significant value is less than α=0.05.

MATERIALS AND METHODS

Study area

The study area was Kwara State. Kwara State

Figure 1. Map Highlighted Section: Kwara State, Nigeria
https://guardian.ng/news/group-cautions-can-against-divisive-politics-in-kwara/

was created on 27th May 1967. Kwara State is located in the North-central part of Nigeria. It lies in the middle belt of Nigeria. The State is situated between latitudes 8° and 10° North and longitude 3° and 6°. It covers an area of about 32,500sq/km and has River Niger as its natural boundary along its Northern and Eastern margins. It shares a common boundary with Niger State in the North, Kogi State in the East, Oyo, Ekiti and Osun States in the South, and an international boundary with the Republic of Benin in the West (Fig. 1). The climate of the state is characterized by almost equal wet and dry seasons (i.e., each lasting 6 months). The total annual rainfall ranges from 800mm to 1,200mm in the Northwest and 1000mm to 1500mm in the southeast part of the state. The common rivers are Oshin, Awon, Asa, and Moro. The state has a mean temperature of 30° C to 35°C. Kwara State consists of 16 Local Government Areas. They are: Asa, Baruten, Edu, Ekiti, Ifelodun, Ilorin East, Ilorin South, Ilorin West, Irepodun, Isin, Kaiama, Moro, Offa, Oke Ero, Oyun, and Patigi.

Sampling techniques, methods of data collection and analysis

A total of 120 poultry farmers in the state registered under the Poultry Association of Nigeria were selected randomly for the study. The Local Governments Area in which the poultry farms are located is: Asa, Ilorin East, Ilorin South, Ilorin West, Moro, Ekiti, Ifelodun, Isin, Offa, Oke-ero and Oyun. Primary data were obtained with the use of structured questionnaires from the sample farms. Descriptive analysis, chi-square, and linear regression were employed for the study. Descriptive statistics such as frequency distribution, percentage, tables, mode, and mean were used to identify the type of environmental concerns arising from intensive poultry production and assess the patterns of health risks arising from intensive poultry production.

Chi-square test

The chi-square test was used to determine whether there is a significant difference between the expected frequencies and observed frequencies in one or more categories.

Linear regression

The linear regression was used to model the relationship between the dependent and independent variables by fitting a linear equation to the observed data. The regression was used to examine the determinants of adoption of the improved practices by the farms in mitigating the environmental and health hazards.

$$Y = \alpha+\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\varepsilon$$

α = Intercept
β_1 - $\beta 8$ = Parameters (Coefficients)
Y = Sum of adoption practices
X_1= Farm size
X_2 = Number of flocks
X_3 = Total cost of production
X_4 = Educational level
X_5 = Year of establishment
X_6 = Type of poultry
X_7 = Farm produce
X_8 = Type of battery cage
ε = Error term

RESULTS AND DISCUSSIONS

Socio-economic features of the poultry farmers

Table 1 shows the socio-economic features of the poultry farmers; these includethe year of establishment, educational level, farm size, number of flocks, type of poultry and type of intensive system etc. of the poultry farmers.

From Table 1, it can be observed that the majority of the farms wereestablished in 2011-2015. About 0.9% of the farmers had primary education, 16.1% had secondary education, and 79.5% had tertiary education, while 3.6% had no formal education. This indicates a high level of literacy among the poultry farmers. Importance of education in managing businesses more productively with a tendency of adopting new technology and innovation cannot be over-emphasized. Education leads to acquisition of new skills and efficient allocation of limited resources (Awosanya, 2002). Most of the poultry farmers do not fully utilize their farm land. Most of them only make use of a fraction of their farm land, while the other part is left unused or used for another purpose. About 50% of the farmers

Table 1
Socio Economic Features of the Poultry Farmers

Items	Frequency (%)
Year of establishment	
1994-1999	8(6.7)
2000-2005	27(22.9)
2006-2010	31(26.2)
2011-2015	54(44.1)
Educational level	
Primary	1(0.9)
Secondary	22(16.1)
Tertiary	93(79.5)
No formal education	4(3.6)
Farm size	
0.06 hectares	5(0.96)
0.25 hectares	8(4.8)
0.5%	58(50)
1 hectare	39(34.6)
2 hectares	7(6.73)
3 hectares	3(2.88)
Number of flocks	
< 2000	46(38.4)
>2000	74(61.5)
Types of flock	
Layers	46(38.3)
Broilers	3(2.5)
Cockerels and broilers	5(4.2)
Cockerels and layers	3(2.5)
Broilers and layers	18(15.0)
Cockerels, broilers and layers	45(37.5)
Types of poultry	
Chicken	85(73.0)
Chicken and Turkey	29(25.2)
Chicken and Guinea fowl	3(0.9)
Turkey and Guinea fowl	3(0.9)
Types of produce	
Eggs only	32(26.7)
Meat only	7(5.8)
Eggs and meat only	23(19.2)
Eggs and point of lay	2(1.7)
Eggs and day old chicks	10(8.3)
Meat and day old chicks	4(3.3)
Egg production, meat production and point of lay	24(20)
Egg production, meat production and day old chicks	15(12.5)
Egg production, meat production, day old chicks and point of lay	3(2.5)
Types of intensive system	
Deep litter system	19(15.0)
Battery cage system	60(48.6)
Deep litter and cage system	41(36.4)
Type of cage	
California design	2(2.2)
Multiple deck system	77(84.6)
Single deck system	11(12.1)
Multiple and single deck system	1(1.1)

operate on a farm size of 0.5 hectares, while 34.6% operate on farm size of 1 hectare. The modal flock size of the farmers is 2000 birds. 38.4% of the farmers have a flock size less than 2000, while 61.5% of the farmers have a flock size of 2000 and above. The mean flock size is 2199 birds. About 38.3% and 2.5% of the farmers has a flock type of layers and broilers, respectively. 4.2% have cockerels and broilers, while 2.5% had cockerels and layers. 15.0% had broilers

Table 2
Perceived environmental concerns associated with poultry during production

Environmental concerns	High Frequency (%)	Medium Frequency (%)	Low Frequency (%)	Negligible Frequency (%)	Chi-square (df)	p-value
Fecal waste	53 (44.2)	47(39.2)	14(11.7)	6(5.0)	55.000(3)	0.001
Water waste		6(5.0)	69(58.0)	44(37.0)	50.739(2)	0.001
Feed waste		3(2.5)	65(54.6)	51(42.9)	53.311(2)	0.001
Carcass waste	8 (6.7)	31(26.1)	70(58.8)	10(8.4)	83.521(3)	0.001
Cracked/stale egg waste		8(6.9)	88(75.9)	20(17.2)	96.276(2)	0.001
Dust	14 (12.5)	28(25.0)	44(39.3)	25(22.3)	46.125(4)	0.001

and layers, while 37.5% had all the three types of birds. A high level of both broilers and layers are being raised by the poultry farmers.

Most of the poultry farmers are into egg production, less is involved in point of lay and day old chicks. About 26.7% of the farmers produce eggs only, 5.8% produces meat only, 19.2% produces both eggs, and meat, 1.7% produces eggs and point of lay. In addition, about 8.3% of the farmers produce eggs and day old chicks, 3.3% produces meat and day old chicks, 20% produces eggs, meat, and point of lay, 12.5% produces eggs, meat and day old chicks, while 2.5% produces eggs, meat, day old chicks, and point of lay. The majority of the farmer in the study area adopted the use of the battery cage system. About 15.0% use deep litter system and 48.6% indicated battery cage system only, while 36.4% stated both deep litter and battery cage systems. The predominance of the battery cage system in the study area maybe due to the fact that it is easy to manage and also reduce the number of egg cracks. About 84.6% use the multiple deck design as the type of the battery cage system for their poultry production.

Environmental concerns arising from poultry during production

These are wastes generated on the farms during poultry production. These wastes include fecal, water, feed, carcass, disposal of cracked egg, and so on.

From Table 2, a high level of fecal waste (44.2%) during production was observed. About 39.2% were rated medium, 11.7% were rated low, and 5.0% were rated as being a negligible environmental problem during poultry production of the various farms. Therefore, mismanagement of the fecal waste can lead to the growth of worms, offensive smell, and contamination of surface water and ground water through runoff into the water body, when not properly disposed. About 58.0% and 37.0% of the water waste has low and negligible environmental problem during poultry production as stated by the farmers. This indicates that there is a low level of water waste during production and this doesn't pose much threat to the poultry farmers. Feed waste has about 54.6% as low and 42.9% as a negligible environmental problem during poultry production. The carcass has 6.7% as high, 26.1% as medium,

Table 3
Perceived Environmental Concerns Arising from Poultry During Processing

Environmental concerns	High Frequency (%)	Medium Frequency (%)	Low Frequency (%)	Negligible Frequency (%)	Chi-square (df)	p-value
Feed waste	3(3.3)	10(10.9)	48(52.2)	31(33.7)	54.696(3)	0.0009
Carcass waste	6(6.5)	27(29.3)	49(53.3)	10(10.9)	50.000(3)	0.0005
Feathers and organs of slaughtered birds	40(43.0)	29(31.2)	10(10.8)	14(15.1)	24.720(3)	0.0078
Water waste	1(1.1)	11(11.8)	44(47.3)	37(39.8)	54.398(3)	0.0006
Cracked/stale egg waste		3(3.3)	60(66.7)	27(30.0)	54.600(2)	0.0004
Dust	3(3.6)	4(4.8)	33(39.3)	44(52.4)	61.238(3)	0.0006

Table 4
Recycling and Non-recycling Methods for the Environmental Problems Generated on the Farm

Recycling methods	Not used at all Frequency (%)	Used occasionally Frequency (%)	Used all time Frequency (%)	Non recycling methods	Not used at all Frequency (%)	Used occasionally Frequency (%)	Used all time Frequency (%)
Conversion into biofuel	92(98.9)	1(1.1)	6(6.3)	Sell	16(14.4)	81(73.0)	14(12.6)
Composting as manure	32(33.3)	58(60.4)	2(2.2)	Discharge into water	84(83.2)	17(16.8)	
Process as animal feed component	71(77.2)	19(20.7)	27(28.7)	Bury	27(24.1)	58(51.8)	27(24.1)
Use as fertilizer	31(33.0)	36(38.3)		Burn	31(27.7)	52(46.4)	29(25.9)
				Dump	1(4.0)	12(48.0)	12(48.0)

58.8% as low, and 8.4% as being a negligible environmental problem during poultry production. Accordingly, both feed and carcass waste has a high percentage of environmental concerns and hence were rated low during poultry production, which indicates that they can be easily managed and disposed properly.

About 75.9% of cracked/stale egg waste was rated low and 17.2% as being negligible environmental concerns during poultry production. Dust has 12.5% as high, 25.0% as medium, 39.3% as low, and 22.3% as being a negligible environmental problem during poultry production. This indicates that cracked/stale egg waste and dust during poultry production can be easily maintained. Also from table 2, it can be gleaned that the p-value for fecal waste, water, waste, feed waste, carcass waste, cracked/stale egg waste, and dust during production are all equal to 0.001, which is less than the α-level (α=0.05); accordingly, the null hypothesis can be rejected. Therefore, the environmental problems during poultry production are all significant at the 0.05 (5%) level of significance. This indicates that the variations in farmers that faces high level, medium level, low level, and negligible fecal waste and other wastes during poultry production are not the same. Most farmers that rated these wastes as being a low environmental problem does not mean the wastes are not having an effect on the environment. For example, a wet fecal waste if not managed properly gives rise to the growth of worms and maggots and also ammonia gas from the wet waste, which can lead to a chronic respiratory problem.

Environmental concerns arising from poultry during processing

These are the wastes generated on the farms during poultry processing. These wastes include feed, carcass, feather, and organ of slaughtered birds, cracked/stale egg etc.

From Table 3, it can be observed that the majority of the farmers rated their feed waste as low with 52.2% and 33.7% as being negligible environmental problems during poultry processing. About 53.3% of the farmers rated carcass waste as low and 10.9% of them as being a negligible environmental problem during poultry processing. The majority of the farmers stated that feathers and organs of slaughtered birds have 43.0% higher and 31.2% medium environmental problems during poultry processing. In addition, about 47.3% and 39.8% of the farmers stated that water waste has low and negligible environmental problems during poultry processing. About 66.7% and 39.3% indicated cracked/stale egg waste has low and negligible environmental problem during processing. Finally, more than 52.4% stated dust as being negligible during processing.

All of these figures indicated that environmental problems (wastes) of the poultry farms during processing are either low or negligible, which means that they can be easily maintained and managed properly. Also, from table 3, the p-value for fecal waste, carcass waste, feather and organs of slaughtered birds, water, waste, cracked or stale egg waste and dust during poultry processing are 0.0009, 0.0005, 0.0078, 0.0006, 0.0004, 0.0006, respectively which are all less than the α-level (α=0.05). Therefore,

the null hypothesiscan be rejected. Therefore, the environmental concerns during processing are all significant at the 0.05 (5%). Most farmers that rated these wastes as being a low environmental problem does not mean the wastes do not have any effect on the environment.

Recycling and non-recycling methods (managements) of the environmental concerns generated on the farm

These are the management of the poultry waste which can include conversion into biofuel, composting as manure, and process inanimal feed component. The non-recycling management strategies include selling, burning, burying, dumping, and discharging into water.

Most of the poultry farms have devised a series of management strategies to be able toget rid of their poultry wastes so as to mitigate their effects on the environment. From Table 4, it can be observed that the majority of the farmers do not practice the recycling method of disposing their poultry waste; instead, they practice the non-recycling method by dumping, burning, swelling, and even burying the poultry wastes. It was discovered that 51.8% of the farmers bury their waste. This may, however, lead to groundwater contamination and thus constitutes a source of risk to human life according to Carr, 1994. About 46.4% burns their poultry waste, which could cause atmospheric pollution that might pose some danger to human and animals' lives. Also about 48.0% dump the wastes generated on their farms. This may, however, be washed off into nearby pits, streams, and rivers, and thus cause a damaging effect to both the human and aquatic lives.

Only about 60.4% of the farmers' compost comprised manure, which could also lead to an environmental issue when the manure is applied to the land in excess of the receiving crop threshold level and the ability to utilize the nutrients as justified by Charles, 2008.

Health problems associated with poultry during production

These are the health hazards that do occur during poultry production. They include accidental hazards, for example, sprains, strains, burns, etc., biological hazards which include antibiotic resistance, bacterial infection, etc.

From Table 5, it can be observed that about 50.8% of the farmers rated biological health hazard during poultry production as low, while 34.2% said it is at a medium level. About 45.8% of them stated chemical health hazard as medium and 45.0% as a low health hazard.

About 43.2% and 47.5% of the farmers rated respiratory hazard as medium and low health hazards, respectively during poultry production. About 48.3% of them stated that physical hazard is low during poultry production, while 35.8%

Table 5
Perceived Health Hazards Associated with Poultry during Production

Environmental hazards	High Frequency (%)	Medium Frequency (%)	Low Frequency (%)	Negligible Frequency (%)	Chi-square (df)	p-value
Biological (diseases transmitted from birds to humans, antibiotic resistant, bacteria etc.)	1(0.8)	41(34.2)	61(50.8)	17(14.2)	68.102(3)	0.0005
Chemical (respiratory problems resulting from dust, skin and eye diseases due to exposure to gases)	1(0.8)	55(45.8)	54(45.0)	10(8.3)	79.492(3)	0.0003
Respiratory problem (chronic respiratory diseases and phlegm)	2(1.7)	51(43.2)	56(47.5)	9(7.6)	79.356(3)	0.0001
Physical (noise, exposure to heat and cold, musculo-skeletal problem etc.)	5(4.2)	43(35.8)	58(48.3)	14(11.7)	62.000(3)	0.0006
Accidental (sprains, strains, eye and skin irritation, burns etc.)	1(0.8)	42(35.0)	69(57.5)	8(6.7)	97.932(3)	0.0004

said it isat a medium level. The accidental hazard is indicated as low by 57.5% of the farmers, while 35.0% of them said it's at a medium level.

Also, from Table 5, the p-value for biological, chemical, respiratory, physical, and accidental hazards are 0.0005, 0.0003, 0.0001, 0.0006, and 0.0004, respectively are all less than the α-level (α = 0.05). Hence, the null hypothesis can be rejected. Therefore, the health hazards during production are all significant at the 0.05 (5%) alpha level. This shows that most farmers that rated these hazards as being a low health problem does not mean they do not have an effect on the environment.

Health hazards associated with poultry during processing

These include zoonotic disease such as Avian Tuberculosis, Avian influenza and so on, exposure to ammonia gases, musculoskeletal problem, and so on.

From Table 6, it can be observed that the majority of the farmers,that is, 53.0% and 21.4%, rated zoonotic disease as low and negligible health hazards during poultry processing. About 50.4% of them stated exposure to gases such ammonia is at a low level. 58.0% of the farmers stated that chronic respiratory problem and phlegm arealso at a low level during poultry processing; about 72.9% stated musculoskeletal problem as low; and 48.7% stated sprains, strains, and eye irritation also as low during poultry processing. In a broad sense, all the health hazards occurring during processing can be easily managed and maintained. Also from Table 6, the p-value for zoonotic, exposure to gases, chronic respiratory problem and phlegm, muscles and sprains, strains, eyes, and skin irritation hazards are 0.0002, 0.0005, 0.0001, 0.0003, 0.0004, respectivelyand are all less than the α-level (α=0.05), hence we reject the null hypothesis. Therefore, the health hazards during processing are significant at the 0.05 (5%) level of significance. This implies that most farmers that rated these hazards as being a low health problem does not mean they do not haveanyeffect on the environment. A low incidence of Avian Tuberculosis if not treated accordingly can lead to death of the infected individual.

Improved practices used for mitigating environmental and health issues of the poultry farms

These include practices such as the use of disinfectant, giving of antibiotics, timely vaccination and sanitation, isolation or slaughtering of infected birds, the use of protective masks, gloves and so on. for maintaining the environmental and health issues of the poultry.

From Table 7, it can be observed that about 95.8% of the farmers' practice proper and timely vaccination all time while only 4.2% practice occasionally. About 90.0% of the farmers give antibiotics to their birds while about 82.2% isolate the infected birds. More 40.0% of the farmers practice slaughtering of infected birds while 21.7% do not. About 57.1% of them make use of protective masks and nose guards occasionally, while only 10.1% do not. About 33.9% of the farmers put on gloves all time, and 57.6% use them occasionally, while 8.5% do not use them at all. More than 56.3% of the farmers use farm clothes and 80.8% of them make use of

Table 6
Health Hazards Associated with Poultry during Processing

Health hazards	High Frequency (%)	Medium Frequency (%)	Low Frequency (%)	Negligible Frequency (%)	Chi-square (df)	p-value
Zoonotic diseases		30(25.6)	62(53.0)	25(21.4)	21.586(2)	0.0002
Exposure to gases		47(39.5)	60(50.4)	12(10.1)	28.879(2)	0.0005
Chronic respiratory diseases and phlegm	1(0.8)	43(36.1)	69(58.0)	6(5.0)	99.241(3)	0.0001
Musculo-skeletal problem		21(17.8)	86(72.9)	11(9.3)	81.017(2)	0.0003
Sprains, strains, eye and skin irritation and burns	2(1.7)	43(36.1)	58(48.7)	16(13.4)	61.034(3)	0.0004

Table 7
Improved Practice Used for Mitigating Environmental and Health Issues of the Poultry Farms

Improved Practices	Not used at all Frequency (%)	Used occasionally Frequency (%)	Used all time Frequency (%)
Proper and timely vaccination		5(4.2)	115(95.8)
Giving of antibiotics		12(10.0)	108(90.0)
Isolation of infected birds	2(1.7)	19(16.1)	97(82.2)
Slaughter of the infected birds	26(21.7)	46(38.3)	48(40.0)
Wearing of protective mask and nose guards	12(10.1)	68(57.1)	39(32.8)
Regularly putting on of gloves	10(8.5)	68(57.6)	40(33.9)
Always putting on overall and farm clothes	1(0.8)	50(42.0)	67(56.3)
Proper and timely sanitation		7(5.8)	113(94.2)
Use of disinfectant		23(19.2)	97(80.8)

Table 8
Linear Regression Result of Determinants of Adoption of the Improved Practices by the Farm for Mitigating Environmental and Health Risks of the Poultry Farms

Variables	Coefficients	Standard error	t-value	Significance value (p≤10%)
Constant	294.107	112.994	2.603	0.01
Farm size	-0.035	0.142	-0.256	0.79
Number of flocks	-0.009	0.000	-0.066	0.94
Total cost of production	-0.008	0.000	-0.063	0.95
Educational level	0.338***	0.418	2.618	0.01
Year of establishment	-0.314**	0.056	-2.513	0.02
Type of poultry	0.007	0.209	0.058	0.95
Farm produce	0.122	0.070	0.963	0.34
Type of battery cage	0.222*	0.626	1.885	0.06
R^2 = 27%				

***p<0.01, **p<0.0 and *p<0.1

disinfectant in their various poultry. This implies that the majority of the farmers actually make use of these practices in their various farms in mitigating the environmental and health issues concerning their farms.

Determinants of adoption of the improved practices by the farm for mitigating environmental and health risks of the poultry farms

From Table 8, the result shows that educational level, year of establishment, and type of battery cage are significant at 1%, 5%, and 10% level of significance, respectively. The educational level is positive and significant at 1%, which implies that the higher the level of educational attainment, the more the farmers will adopt the practices. Education is very crucial in managing businesses more productively with a tendency of adopting new technology and innovation. According to Awosanya (2002), education leads to acquisition of new skills and efficient allocation of limited resources. Year of establishment is negative and significant at 5% due to the fact that the farms that were recently established adopted the improved practices less than those established earlier. Type of cage is positive and significant at 10%, which implies that a higher percentage of the farmers use the multiple cage system (84.6%), which is a more sophisticated cage than the other type of cage and the fact that the constant variable is also positive and significant at 5% and 10% implies that there are other explanatory variables that influence the adoption practices which are not captured in the model. Such variables may be too subjective to be captured in this econometric model.

The ANOVA (Table 9) was also used to test for the significance level of the regression model. The null hypothesis was rejected.The model is significant at the 0.01 of alpha levels. Furthermore, the result of R^2 value (27.4%) indicates that 27 percent of the variation expressed

Table 9
ANOVA Table for the Linear Regression Result

Model	SS	df	Mean squares	F-value	p-value
Regression	102.541	8	12.818	2.788	0.01
Residual	271.268	59	4.598		
Total	373.809	67			

in the model is explained by the explanatory variables and about 72.6% are left unexplained.

CONCLUSION AND RECOMMENDATIONS

From the results obtained, both the environmental and health issues of the poultry farms were significant, and the improved practices adopted by the farms were used by the poultry farmers. Accordingly, the study concludes that the environmental and health issues are affecting the production and processing of poultry farms. From the results obtained, it was observed that the majority of the poultry farmers does not abide by the environmental and public health laws and regulations;therefore, it is recommended that the poultry farmers should employ the recycling method in the management of their waste products by convertingthem into biofuel, composting them into manure, using themas fertilizer, processing them into animal feed component, and so on. These are of great benefits to the population at large. Government should, then, enforce strict supervisory agencies of the sanitation/health policies aimingat environmental preservation and protection.

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