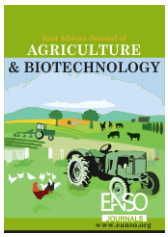

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Original Article

Effects of Climate Change on Poultry Production in Ebonyi State, Nigeria

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ABSTRACT

Three agricultural zones of Ebonyi State, Nigeria, were considered for this study. Using Pearson Product Moment Correlation (PPMC) to establish the relationship between the variables and how one independent variable influences the dependent variables. The study aimed at examining the effects of climate change on poultry production. The study's primary objectives were to assess the socioeconomic characteristics of poultry farmers, ascertain the extent of climate awareness, determine the effect of climate change on poultry production, determine climate change adaptation strategies for coping with it, and identify the constraints encountered in poultry production. Four local government areas in the state of Ebonyi were the locations of data collection from September to October 2021. A multistage sampling procedure was used for the collection of respondents. The study found that 56.9% of the respondents were female, 42.2% were in their active age 30 to 40, 54.9% had a Bachelor's degree, 64.7% had spent more than years of farming experience, and 29.4% were managers of their poultry production. Farm size had little effect on poultry production; climate change had an effect on feed consumption and has caused the spread of pests and diseases and the death of young ones. According to the study's findings, the respondents were in agreement that changing to intensive livestock management and collecting runoff water in ditches during periods of drought constituted adaptation to climate change. It was determined that climate change had an enormous and negative effect on poultry production through insect infestation and disease outbreak. Therefore, relevant Nigerian government agencies should offer financial assistance to poultry farmers along with adaptation training.

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INTRODUCTION

Poultry are birds of several different species that have become domesticated for the production of meat, egg, and other related products like manure (Mozdziak, 2019). When compared to other domesticated animals, poultry animals such as chickens, turkeys, quails, swans, pigeons, guinea fowl, peafowl, and pheasants provide not only economic services but also significantly contribute to human food as a major supplier of meat, eggs, and raw materials to industries (feathers, waste products), source of income for people and source of employment (Agyare et al., 2018). Products from poultry such as meat and eggs provide a potential source for meeting the basic and dietary needs of humans (Food and Agricultural Organization, 2023**)**. Padhi (2016) observed that indigenous household chickens are very important in a subsistence economy where they provide major income to even the poorest household in the world. Alade and Ademola (2013) noted that Poultry production is a major source of protein which has empowered poultry farmers in developing economies to secure means of survival and livelihood. It is obvious that poultry production is practised traditionally and is held by smallholder marketers and farmers breeding for their own consumption in most regions of Nigeria (Aboki, 2013).

The majority of scientists believe that over time, the global warming has increased considerably, changing the climate (Onoja et al., 2011). The Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change) was founded by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) to investigate this matter. The Intergovernmental Panel on Climate Change gathers researchers from different countries and areas of activity with the objective of generating and organising information to forecast future scenarios of temperature, drought, flood, wind, and rainfall variation. Based on these scenarios, the possible socioeconomic and environmental impacts generated by Climate change, as defined by IPCC, is the variation between a region's typical climate conditions (such as rainfall, temperature, and wind) and a different but recurring set of those conditions. It is caused by an increase in greenhouse gas emissions (GHGs) in the atmosphere, which weakens the ozone layer and causes global warming (IPCC, 2021).

According to the International Food Policy Research Institute (2018), more frequent floods and droughts increase the risk of immediate crop failures and long-term decreases in processing for both crops and animals. Rain-fed agriculture's dominance, the lack of funding for adaption measures, the baseline warming of the climate, and increased susceptibility to extreme (Oijstaeiten et al., 2020**)** in Africa make agriculture more vulnerable to climate change. Global demand for animal protein will double by 2040 under the combined effect of population growth, urbanisation and changing consumption patterns, with developing countries accounting for more than 50% of the growth in 30 years (Oniah et al., 2018).

The climatic environment is one of the many limiting factors of production efficiency in tropical and subtropical areas, and the broiler feed intake is depressed when the ambient temperature rises (Dumas et al., 2016**).** Climate change changes how diseases are spread globally, has an impact on how poultry are fed, and encourages disease outbreaks, all of which have a negative impact on the amount of meat and eggs produced by poultry as well as on production costs. Appropriate Nigerian government

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agencies, financial assistance and training on climate change adaptation should be given to poultry farmers. According to Elijah and Adedapo (2006), conditions with excessive rainfall and relative humidity are ideal for the growth of parasites that in turn trigger outbreaks of diseases and, inevitably, lower egg production. The researchers also found that temperature decreases the amount of feed that poultry birds consume since it takes more energy to maintain the heat caused by high temperature, hence, a decrease in the rate of feed intake. But wealthy nations have been able to lessen the negative consequences of climate change by using strategies such natural advantage, high adaption techniques, high technology, mechanized farming system, and wealth status (Akanwa and Joe-Ikechebelu, 2019). The Nigerian government in 2015 expressed the desire to improve and promote local production by placing a ban on smuggling and the reduction of importation of livestock from foreign countries without taking into consideration the effects of the country's climate (Amata, 2022).

According to Elijah and Adedapo (2006), the environment has a significant impact on how well poultry function, in addition to inherited capacity. They made note of the impact that climate change has on chicken feed intake and the spread of poultry diseases, both of which may inevitably result in lower production of poultry products in terms of meat and eggs. Because birds can simply withstand some degree of range of temperatures, poultry flocks are notably more exposed to climatic change (Mozdziak, 2019). For instance, high humidity and temperature might have a negative impact on the production of chickens. Increasing body temperature, consuming less food, and using it more efficiently, losing weight, experiencing increased mortality, and producing fewer eggs of higher quality (Abioja and Abiona, 2021).

Farmers have mentioned a decline in birds' output over the past few years. In recent years, farmers observed decreased poultry productivity that coincided with rising ambient temperatures (Adesiji, et al., 2013). The challenges posed by climate change fit broadly into one of two categories: loss of productivity or increasing costs. Regarding productivity, there is an increased risk of heat stress due to optimal seasonal temperatures, thereby causing a decrease in the reproduction activity within the poultry (Santos et al., 2022).

Given that the demand for poultry-related goods and services is increasing as a result of the country's decreased reliance on imported goods, it is necessary to investigate how the climate affects poultry farming. In light of this, the researchers investigated how the weather affected poultry output in Ebonyi state, Nigeria.

Significance of the study

In Nigeria, poultry farming is a crucial component of the agriculture sector since it helps to address the issue of food insecurity, creates a large number of job opportunities, and promotes national economic development. However, the finding of this study would be of immense benefit to poultry farmers, government, policymakers, poultry stakeholders, public and private institutions, and the society at large:

For the government, it will be a reference document for policy formulation and implementation regarding poultry production in the State. For the policymakers, it will provide empirical insight in policy-making and documentations and serves as a working guide in consultancy services in poultry production in the State. It will also inform farmers about the negative effects of climate change and proven adaptation strategies to be adopted.; to poultry stakeholders, it will inculcate in them climate change information responses and expectations as well as benefits accrued to poultry production; to public and private institutions, it will serve as a meaningful guide to support poultry farmers and assist them overcome climatic tendencies; and to the society at large, it will give them an overview and overall outlook in poultry business.

METHODOLOGY

Three agricultural zones of Ebonyi State, Nigeria, were considered for this study. The State is

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located in the Southeast Nigeria between latitudes 5°40 and 6°54N and longitudes 7°30 and 8°30E. The state of Ebonyi is predominantly an agricultural area. It ranks among Southeast Nigeria's top producers of rice, yam, potatoes, maize, beans, and cassava. The main crops grown in Edda are rice and yams, and the state has a thriving poultry industry both in terms of output and egg quality (Egbe, 2015).

All of the poultry farmers in the state of Ebonyi made up the study's population. In order to gather primary data from the respondents in four local government areas of Ebonyi state during the months of September and October 2021, a well-structured questionnaire and focus group discussions were used. The study's respondents were chosen using a sampling method with multiple stages. Based on their predominance in the production of chicken, the first stage comprised the deliberate selection of four Local Government Areas, including Ikwo, Abakalik, Izza north and south. The second stage involved a random selection of four wards from ten wards that made up each Local Government Area. The third stage involved the purposive selection of four villages making twenty-five villages in all. The last stage involved a purposive selection of 25 poultry farmers from each of the selected four villages giving a total of 100 respondents

Descriptive statistics were used to analyse the data, while Stochastic Frontier Production Function was used to estimate the Maximum Likelihood Estimates of parameters in Cobb-Douglas stochastic production function for the effects of climate change adaptation strategies on the technical efficiency of poultry production.

The model is specified as:

Ln Y = β0+ β1lnX1+ β2lnX2+ β3lnX3 + β4lnX4+ β5lnX5+ β6lnX6+ β7lnX7+β8lnX8+ β9lnX9 + (vi - ui) vi ~ N (0,σ 2 v)

Where: β = parameters estimate; Σ = the sign of summation; Y = the value of poultry output in kilograms; X1= the total labour used in poultry production in man hours; X2 is the total farm area (poultry house) used for poultry production in meters; X3 is the total cost of feed used for poultry production in naira; X4 is the total capital used for poultry production in naira; X5 is the total cost of drugs and vaccines used for poultry production in naira; X6 is the total cost of litter used for poultry production in naira; X7 is the total cost of equipment used Given that Ui= non-negative random variables with a non-zero mean and constant variance are believed to account for technological inefficiency in production, Vi= are random variables that are supposed to be independent of Ui, identical, and normally distributed with zero Mean, constant variance, and Ui=non-negative random variables are frequently considered to be independent of Vi, resulting in U being the non-negative truncated mean. These assumptions are used to account for technical inefficiencies in production (at zero) U of half normal distribution with |N (0, σ2v)|.

The inefficiency of production, Ui, is modelled in terms of the tactics that poultry producers believe will affect how efficiently they produce chickens in response to climate change.

The Model of Technical Inefficiency Effects

The following is a definition of the technical inefficiency effect, i:

μi = δ0 + δ1 I1 + δ2 I2 + δ3 I3 + δ4 I4 +δ5 I5 + δ6 I6

In this case, the inefficiency effect I1 = Maintaining resistant breeds, I2 = Vaccinating birds promptly and further, I3 refers to raising and selling brood, I4 to planting trees surrounding chicken houses, I5 to increased room per bird, I6 to increased water service, and I7 to improved hygiene. δ_0 and δ_i = coefficients (unknown parameters to be estimated along with the variance parametersδ^2. The variance of the random errors, and that of the technical inefficiency effects and the overall variance of the model are related; $\delta^2=\delta_v^2 + \delta_\mu^2$.

The δ^2 indicates the goodness of fit and the correction of the distributional form assumed for the composite error term.

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The ratio $\gamma=\delta_u^2/\delta_v^2$ measures the total variation of output from the frontier, which can be attributed to technical inefficiency. The estimates of the parameters of the stochastic frontier production function and the inefficiency model were obtained simultaneously using the program frontier version 4.1

The technical efficiency is defined in terms of the ratio of observed output (Y_i) to the corresponding frontier output (Y_i) conditioned on the level of input used by the farmers. Hence the technical efficiency (TE_i) of the poultry farmers will be expressed as follows:

$TE_i = y_i/y_i^* =$ f (X_i, B) exp (V_i-μ_i)/f (Xi; β) exp V=exp (-μi)

Where Y_i = Observed output, Y_i^* = Frontier output and TE_i = Ranges between 1 and 0

RESULTS AND DISCUSSION

The International Food Policy Research Institute (2018) demonstrates that more frequent floods and droughts increase the chance of immediate crop failures and long-term decreases in processing for both crops and livestock. Rain-fed agriculture's dominance, the lack of funding for adaption measures, the baseline climates' warming, and the increased risk of extreme events.

The finding agrees with that of Okitoi et al. (2007), which reported that women were the primary owners of poultry in Western Kenya. Furthermore, 39.2% of the respondents were between the ages of 30 to 39, indicating that the poultry farmers were within the active age for engaging in poultry production. The study carried out on the effects of climate change on poultry production in Ondo state Nigeria by Adesiji et al. (2013) found that 42.2% of the respondents were in their active age, 30 to 40 years. The age bracket could mean that farmers were mature enough to understand the effects of climate change on poultry production. The result also depicts that the majority (54.9%) of the respondents had a Bachelor's degree, implying that the respondents had acquired enough education that could enable them to understand how climate change affects poultry production and its mitigation in order to enhance poultry production and its sustainability.

The average farm size ($\bar{x}$ = 2.17), as indicated in *Table 2*, suggests that it has little effect on the respondents' poultry production. This may be because chicken farmers, particularly those in the research area, are small-scale farmers who may not require a huge farm size for their output. Similarly, *Table 2* shows that the average household size ($\bar{x}$=1.47) did not significantly affect the respondents' poultry output in the research area. This finding could be the result of the fact that the amount of capital invested by the operators, rather than the size of the household, determines poultry production. This suggests that productivity will still be very low even if farmers have access to vast farm sizes as long as there is not enough money for a start-up. Moreover, *Table 2* indicates that the stocking capacity ($\bar{x}$ =1.84) of the chicken output in the research area had no appreciable impact on how the respondents' poultry businesses were run. This could mean that in order to prevent overpopulation, which could result in the spread of diseases and possibly even death, farmers produce birds in accordance with the stocking capacity of their poultry houses. Abudabos et al. (2013) reported that broiler chicken development performance suffered when stocking density was increased, for example, from 28 to 40 kg of body weight/m2.

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Table 1: Socioeconomic characteristics of the respondents

Socioeconomic characteristics		Percentages (%)
Gender	Male	43.1
	Female	56.9
	Total	100.0
Age (years)	<30	25.5
	30-39	39.2
	40-49	29.4
	>50	5.9
	Total	100.0
Educational Qualification	Diploma `	9.8
	High Diploma	5.9
	Bachelor	54.9
	Master	3.9
	PhD	25.5
	Total	100.0
Farming experience (years)	<3	5.9
	03-Oct	29.4
	>10	64.7
	Total	100.0
Position	Manager	29.4
	Vice Manager	8.9
	Section head	25.5
	Supervisor	11.8
	Other	23.5
	Total	100.0

Source: Authors' Computation

Table 2: Mean rating of the socioeconomic characteristics of the respondents

Statement	Mean	SD
Farm size	2.17	.60151
Household	1.47	.48129
Stocking capacity	1.84	.67508
Decision rule: >2.5 for agree and <2.5 for disagree		

Source: Field survey, 2021 and Authors' computation Cut-off point = 2.0

The mean value ($\bar{x}$=2.56), which is presented in *Table 3* depicts that the respondents pointed out that birds' consumption of feeds was negatively affected by climate change. Changes in climate or temperature have a significant impact on poultry production and the income from poultry production of farmers whose survival depends on agriculture, among other things (IPCC, 2007). The respondents reported that they had suffered insect infestation and the spread of diseases, which resulted in the death of their birds as a result of rainfall variations. High relative humidity and rainfall encourage the growth of parasites that spread diseases and pests, which significantly lowers the quality of poultry products like eggs and meat and causes possible deaths of the birds (Adesiji et al., 2013). Also, from the mean score ($\bar{x}$=2.58) In *Table 3*, the respondents concurred that the deaths of chicks were brought by pest infestation and the spread of diseases. This could be a result of the impact of high relative humidity and rains, which produce unfavourable conditions leading to an epidemic of poultry diseases that existed in the study area, and as a result, young birds died. This was confirmed in the study by Elijah and Adedapo (2006), who of the opinion that high levels of rainfall and relative humidity created ideal conditions for the growth of parasites that lead to the outbreak of diseases that kill birds. Similar to high temperatures, prolonged sunshine is known to reduce egg production, feed intake, and chicken mortality (Akande, 2016).

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The results of the mean analysis reveal the mean value ($\bar{x} = 2.71$) indicating that the poultry agreed that variation in climate has many negative effects on water consumption. The result implies that as the ambient temperature rises, chickens spend more time drinking water rather than consuming nutrients that would promote healthy chicken growth. However, chickens may spend less time drinking water and more time eating meals when there is a lot of rain and a colder climate. This fluctuating temperature causes many behavioural and physiological changes in poultry, which could have an impact on the effectiveness and quality of poultry production and products (Irivboje et al., 2021).

Table 3: Extent of climate change effect on poultry production

Statement	Mean	SD	Remark
Breeding (cycle)	1.09	.50253	Disagree
Feed consumption	2.56	.47123	Agree
The restlessness of the BIRD	2.46	.47123	Disagree
The growth rate of livestock	2.47	.67508	Disagree
Pest infestation and spread of diseases	2.58	.47811	Agree
Death of young ones	2.72	.50253	Agree
Water consumption	2.71	.47123	Agree
Quality of meat	1.05	.67508	Disagree
Decision rule: >2.5 for agree and <2.5 for disagree			

Source: Field survey**,** 2021 and Authors' computation

As shown in *Table 4*, the mean score ($\bar{x}$ =2.72) depicts that the respondents concurred with the fact that one of the greatest adaptation strategies to deal with the effects of climate change on poultry production was changing to intensive management. Fans, cooling pads, static pressure regulators, feed restrictions that lower endogenic heat production in chickens and decrease mortality, water added to chicken feeds increases the consumption of water during the hottest part of the year, and the addition of water to poultry feeds all help mitigate the effects of the rise in climate on the animals (Sinha et al., 2018). The results imply that the respondents would adapt to laws intended to decrease the negative effects of variation in climate on poultry enterprise in the study area. As a result, the extension agents could use their knowledge to plan training on intensive management for the study's responders as a method of coping with climate change. More so, data in Table 4 shows that respondents indicated that one additional adaptation strategy was to collect runoff water in ditches during dry spells because the water was discovered to be an essential nutrient that must be taken into account at all times to achieve high productivity in chicken (Abioja and Abiona, 2020). This result implies that chicken farmers in the study area were had awareness about the value of gathering and storing runoff water to provide a consistent supply of water for chicken cages during dry season for efficiency for poultry birds.

As an incentive to reduce losses, financial assistance is provided to farmers who are impacted by climate change; it encourages farmers to more production. However, the mean value ($\bar{x}$=1.71) in *Table 4* shows that the respondents did not agree that providing financial support to farmers who have been impacted by climate change is one of the adaptation strategies to its effects. The finding contradicts the report of Wollenberg et al., (2012) that financial support improves farm production, efficiency, and adaptability to climate change. When farmers lack the necessary expertise to apply the optimal adaptation strategy to minimise the negative impacts of climate change on their poultry production, financial assistance to farmers may not be able to decrease or cushion the effects of climate change. The claim explains why sufficient training must be provided to poultry producers so they can use the most effective methods to prevent the effects of the changing climate. Similarly, Table 4 displays the mean value of

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poultry farmers' agreement that moving communities away from unsafe locations is another strategy for coping with the effects of climate variation. Another adaptation strategy to the consequences of climate change in the study is the study of communities out of risky areas. Because some of the fields were being used for producing crops like cassava and vegetables, among others, it was discovered during the study that some of the poultry farms were located on flood-prone lands. Hence, moving poultry farms from such locations to an upland area could provide safe, consistent, and high-quality production of birds and their products, which will consequently increase the income of the farmers.

More so, the mean value ($\bar{x}$ =2.65), as shown in *Table 4*, indicates the respondents agreed that vaccinating birds against diseases is a very important adaptation strategy. The implication is that poultry farmers knew that vaccination of birds plays a vital role in preventing diseases that might break out due to climate variation in the study area. The knowledge might be associated with the successes in the use of previous vaccines. This is incongruent with the assertion of Lindahl *et al.* (2018) that the success rates of the earlier provided vaccines were related to the use of vaccines in Kenya and Tanzania. Therefore, it is important to continue educating farmers on the best vaccines and administration techniques for disease prevention and health management of poultry flocks because doing so will help decrease bird mortality, raise farmers' revenue (Msoffe et al., 2010).

Table 4: Poultry farmers' climate change adaptation strategies

Statement	Mean	SD	Remark
Using crop and animal breeds with improved yields	1.50	.47123	Disagreed
adjusting planting and stocking times	1.46	.47123	Disagreed
Using mulch on crops and coverings for animals from exposing animals	1.47	.67508	Disagreed
Using early maturing plants/animals	1.58	.47811	Disagreed
Switching to intensive management of livestock	2.72	.50253	Agreed
Skipping storage but processing and marketing immediately affect full maturity	1.56	.47123	Disagreed
Changing from the production of agriculture to marketing	1.56	.47123	Disagreed
Storing runoff water in ditches during periods of drought	2.56	.47123	Agreed
Construction walls using blocks and/or sandbags to direct floodwater	1.42	.47123	Disagreed
Building a dam or drainage system for a farm or household	1.47	.67508	Disagreed
Subsidising of agricultural inputs by relevant authorities	1.58	.47811	Disagreed
Setting up housing programmes for displaced farmers	1.72	.50253	Disagreed
Resettlement of communities from hazard zones	2.47	.47123	Disagreed
Giving the affected farmers financial support	1.71	.47123	Disagreed
Vaccinating against diseases	2.65	.67508	Agreed
Change profession entirely	1.02	62500	Disagreed

Decision rule: >2.5 for agree and <2.5 for disagree

Source: Field survey, 2021 and Authors' computation**,** 2.5≥ Agreed and <2.5 Disagreed

Entries in *Table 5* reveal the mean value ($\bar{x}$ =2.82) indicating that a lack of support from the government was encountered by poultry farmers. This finding depicts the absence of government support institutions such as extension services that could provide necessary information and education to the farmers on the best climate change adaptation strategies. The finding implies that many of the study's poultry farmers may stop raising chicken dues to the effects of climate change on their operations. Therefore, it is vital for government representatives tasked with educating farmers about climate change to also spread their knowledge to the study area. Table 5

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shows that responders were equally in agreement that disease outbreaks increased farmers' revenue, increased food security, and mothers' and children's egg consumption ($\bar{x}$ =2.76) due to climate change being a constraint to poultry production in the study area. The respondent reported during the study that their birds experienced respiratory diseases, sudden death, and pest attacks that few weeks before the survey. The experience shows that it is challenging the achievement of the food security target of Nigeria and consequently compromising the sustainability of the poultry business. The assertion is line with the finding of Shapiro et al. (2015) which reported that the higher disease occurrence in Ethiopia clearly indicated that it is a big challenge to achieve the country's poultry value chain master plan, which compromises the sustainability of poultry ventures.

Furthermore, in *Table 5*, the mean rating ($\bar{x}$ =2.56) reveals that the poultry farmers indicated the high start-up capital as another constraint to the poultry business. This might be because starting and sustaining a poultry business requires enough capital. However, it was found during the survey that the majority of the respondents were smallholder poultry farmers and did not have enough capital to sustain their businesses as well as coping with the effects of climate change. The finding implies that Governments, NGOs, humanitarian donors, and extension organisations should provide financial support and extension services for poultry farmers in the study area in order to ensure the sustainability of poultry business among the respondents. Similarly, entries in *Table 5* show the mean score ($\bar{x} = 2.88$), demonstrating that respondents agreed that the non-availability and affordability of vaccines constituted a big challenge. This implies that the respondents either did not have enough capital to purchase vaccines or did have access to improved vaccines for their poultry. Vaccines provide adequate prevention against diseases and ensure the health management of poultry flocks for optimum poultry productivity and sustainability of the business. This assertion is congruent with the view of Ravikumar et al. (2022) that controlling the spread of new infections and regulating viruses through vaccination on chicken farms will reduce the danger of zoonotic infection.

Table 5: Respondents' constraints/challenges encountered by the poultry

Constraints	Mean	SD	Remark
Lack of support from the government	2.82	.47123	Agree
Outbreak of diseases	2.76	.47123	Agree
High start-up capital	2.56	.67508	Agree
Lack of accessibility and high cost of vaccines	2.88	.47811	Agree
Adulteration and high cost of poultry food	2.72	.50253	Agree
Decision rule: >2.5 for agree and <2.5 for disagree			

Source: Field survey, 2021 and Authors' computation

Figure 1 shows the respondents' degree of knowledge regarding climate change, with 44% of poultry producers having poor knowledge, 36% having high knowledge, and 20% having average knowledge. According to this conclusion, the majority of respondents lacked the information necessary to implement mitigation measures for the preventing the negative impact of climate change on poultry production.

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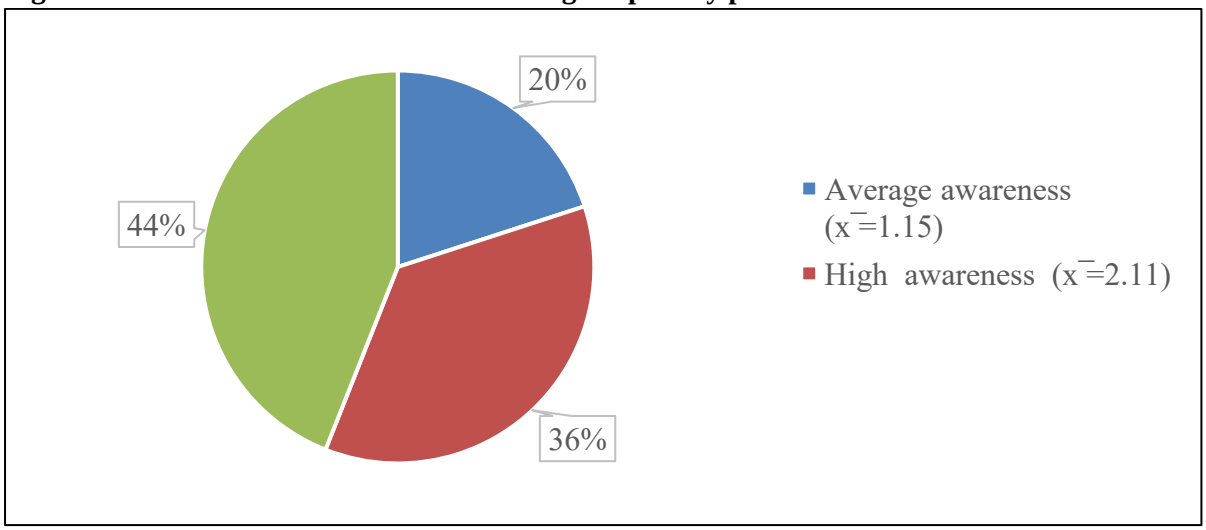
Figure 1: Level of awareness of climate change of poultry producers



The Pearson product-moment correlation ($p<0.05$) reveals that climate change significantly influences production in the study area. A rise in ambient temperature as a result of changes in climate will greatly affect the productivity of birds. The results also show that climate change adaptation strategies influence poultry production. This implies that when farmers apply the appropriate adaptation strategies to poultry production, there will be an increase in productivity. Hence, the need for relevant authorities to invest heavily in training and educating poultry farmers the climate issues order to ensure the sustainability of poultry business in the study area.

Table 6: Pearson Product Moment Correlation (PPMC) on climate change significantly affect poultry production

Variables	N	Mean	SD	Df	Corrindex r	Critr	P
Climate change	100	82.56	7.649	99	.676**	0.235	0.000
Poultry production	100	28.94	2.145				
Climate change adaptation strategies	100	84.61	7.526	99	.822**	0.235	0.000
Poultry production	100	28.94	2.145				

***Correlation is significant at 0.05 significant level*

Source: Field survey, 2021 and Authors' computation

CONCLUSION

Climate change has a negative effect on the egg and meat production of birds and, consequently, death. Pest infestation and disease, death of young ones, and reduced quality of feeds, among others, were due to climate change. The increase in temperature has made the birds spend more time drinking water than feeding on the feeds provided that could ensure their healthy growth. In order to reduce the effect of climate change, the respondents engaged in climate change adaptation strategies in the intensive management of poultry, such as the use of fans, cooling pads, static pressure controllers, and feed restriction that lowers the endogenic heat production of poultry and water addition to chicken feeds that would help increases water intake. In the research area, poultry farmers also experienced a lack of government assistance, a disease epidemic, high start-up costs, lack of accessibility and affordability of adulterated feeds, and the high price of poultry feeds.

Recommendation

Nigeria's federal, state, and local governments should provide financial support to the poultry producers that will serve as a catalyst for

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expanding and sustaining their business, as well as making use of improved chicks.

Agricultural Development Programme (ADP), Federal and State Ministries of Agriculture and other agricultural-related government agencies and department should organise climate adaptation training programmes for poultry producers that will equip them with the necessary knowledge to prevent or minimise the effect of climate change among poultry farmers.

Federal and State governments should work in collaboration with other donor agencies in order to provide poultry producers with necessary inputs such as vaccines, feeds, cooling pads, fans, lanterns, pressure controllers, hatchery technology, drugs and other inputs in the study area. The provision of the aforementioned inputs will greatly ensure the expansion and productivity of the birds in order to increase farmers' income.

The Nigerian government through the Ministry of Energy lowers the cost of electricity to an affordable rate which helps to provide power to tackle temperature. If this is done, the poultry business will create many jobs thereby reducing the unemployment rate in the country.

The government should exert pressure on the commercial banks to cut their lending rates and place less of a focus on the pricey collateral that poultry farmers must deposit with them in order to be eligible for loans that they have requested for. This pressure should come from the central bank. If these two ideas are put into practice, poultry farmers may be more inclined to seek out loans from financial organizations so they can combat climate change. Instead of relying on conventional work options, which are rare relative to demand, young, educated, imaginative, and energetic persons should be encouraged to engage into chicken production and take seriously as a company and as an alternative source of employment creation instead of banking on formal employment opportunities, which are scarce relative to the demand.

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