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Prevalence of Poultry Chicken Diseases Outbreak in the College of Agriculture Farm, Yelwa Bauchi State, Nigeria

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Abstract: *This study aimed to investigate the seasonal patterns of poultry disease outbreaks and develop a predictive model for poultry birds' production in the College of Agriculture Farm Yelwa, Bauchi State, Nigeria. Data on the occurrence of poultry diseases was collected from the veterinary clinic on the farm, including the date of diagnosis, type of disease, and the number of birds affected. The study used a longitudinal study design, collecting data for five years, from 2018 to 2022. Simple linear regression analysis was used to analyze the data. The findings indicated that birds raised and infected with diseases have a substantial impact on the mortality rate of poultry birds, and that the yearly season considerably forecasts the total number of chicks kept in the farm. A predictive model was developed to estimate the number of birds stocked in future samples based on the yearly season, which explained 31.90% of the variance in the number of birds stocked. The study's findings have implications for researchers, rearers and veterinarians, as it can help in the prediction of disease outbreaks, and aid in taking preventive measures to control disease spread. Further research can be conducted to incorporate more variables into the predictive model to improve its accuracy.*

Keywords: Poultry Diseases, Predictive Modelling, Seasonal Patterns, College of Agriculture Farm, Nigeria.

Introduction

A substantial means of obtaining animal-based protein for human consumption, poultry farming plays a key role in Nigeria's agricultural economy. Seasonal changes and disease outbreaks are only two of the difficulties the business must overcome to protect the health and production of poultry birds. In recent years, research has focused on these factors' influence on the overall mortality of poultry birds, especially in Nigeria. The dry time of the year and the rainy season, which have varied climatic conditions that might impact the health and production of poultry birds, are the two seasons that best describe Nigeria's climate. Furthermore, reduced humidity levels

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during the dry season, which lasts from November to March, might raise the risk of respiratory infections in flocks of poultry (Abubakar et al., 2017).

Another important aspect that has a significant impact on Nigeria's poultry bird mortality rate is disease outbreaks. Avian influenza, commonly known as bird flu, is a highly contagious viral infection that primarily affects birds, particularly poultry. It can spread rapidly within poultry populations, leading to severe illness, high mortality rates, and substantial economic losses for the poultry industry (Jibril et al., 2021). In addition to its impact on the agriculture sector, bird flu poses a potential risk to human health, as some strains of the virus can be transmitted from birds to humans, causing severe respiratory illness and even death (Jibril et al., 2021). For instance, a research by Oladele et al. (2018) found that the outbreak of Newcastle disease in Nigeria led in a 47% death rate of poultry birds, causing considerable financial losses for producers.

Several researches have looked at the combined impact of seasonal changes and outbreaks of diseases on the death rate of poultry species in Nigeria. To ascertain the effect of these variables on the well-being and production of poultry species in Nigeria, additional in-depth study is required. Therefore, the aim of this study was to investigate how seasonal variations and disease outbreaks influenced the production of poultry birds over a five-year period at the College of Agriculture farm in Yelwa, Bauchi State, Nigeria. The results of this study will aid in the creation of efficient management plans for poultry flocks in Nigeria that will enhance their wellbeing and production.

Aim and Objective of the Study

The primary objective of this study is to investigate the seasonal patterns of poultry disease outbreaks and come up with a prediction model for poultry birds' production in the College of Agriculture Farm Yelwa, Bauchi State. The specific objectives are:

1. To determine the effect of yearly seasons on poultry birds stocked in the college farm between 2018 to 2022
2. To determine the effect of birds reared and infected with diseases on the mortality rate of poultry birds' in the college farm between 2018 to 2022
3. To determine the yearly seasons effect on poultry birds infected with different diseases outbreak in the college farm between 2018 to 2022

Research Questions

1. What is the effect of yearly seasons on poultry birds raised in the college farm between 2018 to 2022
2. What is the effect of birds reared and infected with diseases on the mortality rate of poultry birds' in the college farm between 2018 to 2022?
3. What is the yearly season's effect on poultry birds infected with different diseases outbreak in the college farm between 2018 to 2022?

Hypotheses

- Null hypothesis: The yearly seasons do not have a significant effect on the growth and productivity of poultry birds stocked in the college farm between 2018 to 2022.
- Null hypothesis: Birds reared and infected with diseases do not have a significant effect on the mortality rate of poultry birds in the college farm between 2018 to 2022.
- Null hypothesis: Yearly seasons do not have a significant effect on the incidence and severity of diseases outbreaks in poultry birds in the college farm between 2018 to 2022.

Significance of the Study

The findings of this study will provide insights into the environmental factors that influence the occurrence of poultry diseases in the farm, which can help poultry farmers and veterinarians to develop effective disease control strategies. This study will contribute to the body of knowledge on the seasonal patterns of poultry disease outbreaks in Nigeria and provide valuable information for policymakers and stakeholders in the poultry industry.

Literature Review

The impact of season on the prevalence of poultry illnesses in various parts of the world has been examined in a number of researches. According to a research by Osman et al. (2016) in Egypt, the winter season had the highest prevalence of poultry illnesses, while the summer season saw the lowest incidence. Similar to this, a research conducted in Bangladesh by Ahmed et al. (2020) revealed that the winter months had the highest frequency of Newcastle syndrome in chicken.

Numerous researches have been done in Nigeria to look at the frequency and incidence of poultry illnesses. As an illustration, a study conducted in Kano State by Abdu et al. (2018) found that avian influenza, chicken pox, and newton disease were the three most common diseases in poultry. On the seasonal nature of epidemics of poultry illness, however, in various parts of Nigeria, nothing is known.

Materials and Methods

In this longitudinal research conducted from 2018 to 2022, data on the prevalence of poultry illnesses was collected through regular observations carried out at different intervals, such as daily, weekly, and monthly, throughout the year. The investigation was carried out at the College of Agriculture Farm Yelwa in the Nigerian state of Bauchi. The farm, which has a surface area of around 1.5 hectares, is situated in northeastern Nigeria. A poultry facility on the farm features the broilers, layers, and cockerels.

The farm's veterinary clinic, which is in charge of identifying and tending to ill birds, provided the information. The veterinary clinic keeps track of all cases of poultry illnesses treated there, noting the date of diagnosis and treatment, the disease's classification, and the quantity of affected birds. The information was gathered over a five-year period, from 2018 to 2022, in order to study the changing patterns of epidemics of chicken diseases. The table below showed the data collected for the study.

Table 1: Record of poultry birds' disease collected for the study

Year-Quarter	STOCKED	INFECTED	MORTALITY
2018-1	1286	656	14
2018-2	1167	312	48
2018-3	963	273	13
2019-1	1178	64	8
2019-2	806	17	5
2019-3	871	258	13
2020-1	1035	126	13
2020-2	991	102	9
2020-3	507	27	5
2021-1	1135	300	6
2021-2	478	330	12
2021-3	494	268	6
2022-1	695	320	7
2022-2	1265	810	35
2022-3	492	200	8

Source: BCOA Veterinary Clinic, 2023

For the purpose of describing the prevalence of several types of poultry illnesses in the research region, descriptive statistics like percentages and frequencies were employed. In the statistical programme Minitab version 20 was use to run the regression analysis and time-series analysis in order to examine the seasonal patterns of outbreaks of poultry diseases. The influence of environmental factors on the occurrence of poultry diseases were examined using the same regression analysis.

Results and Discussions

Research Question 1: What is the effect of yearly seasons on poultry birds raised in the college farm between 2018 to 2022?

Table 2: Simple Linear Regression Analysis result for the effect of yearly seasons on poultry birds stocked in the college farm

Term	Coefficient	SE Coefficient	T-Value	P-Value	VIF
Constant	3.1394	0.0944	33.27	0.000	
SEASON	-0.1078	0.0437	-2.47	0.028	1.00
R-square	31. 90%				
R-square (adjusted)	26.66%				
R-square (predicted)	11.36%				
Std Error	0.138137				

Source: Poultry Production data, 2018 to 2022

According to Table 1, the resulting coefficient for the annual season is -0.1078, meaning that, while all other factors remain constant, for every unit increase in a yearly season, the total number of birds supplied reduces by 0.1078 units. The model summary shows that the regression model, as shown by the R-square value, predicts 31.90% of the variation in the number of birds supplied. The predicting factor (yearly season) explains some, but not a significant amount, of the variation in the number of birds supplied, according to the modified R-square value, which takes into account the number of predictors in the model. This value is 26.66%. The model is anticipated to

explain 11.36% the amount of variability in the total number of birds supplied in subsequent samples, according to the estimated R-square value.

Table 3: Analysis of Variance (ANOVA) for the simple linear regression analysis result

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.1162	0.11620	6.09	0.028
Yearly Season	1	0.1162	0.11620	6.09	0.028
Error	13	0.2481	0.01908		
Total	14	0.3643			

Source: Computed from COA poultry production record, 2018 to 2022

The regression model has a substantial p-value of 0.028, according to the analysis of variance table, and it strongly predicts the quantity of birds supplied. The method of regression is an excellent match for the data, according to the F-value of 6.09, which is calculated.

According to the research of Gao et al. (2019), seasonal fluctuations have a substantial impact on bird populations, affecting the amount of bird species and their abundance throughout the year. Srinivasan and Elith (2018) claim that a study showed the use of yearly abundance data in forecasting species distributions, highlighting the significance of taking seasonal fluctuations in population dynamics into account. These studies confirm that seasonal variation has a major impact on bird populations and point out the need of taking seasonality into account when forecasting and controlling bird populations.

Research Question 2: What is the effect of birds reared and infected with diseases on the mortality rate of poultry birds' in the college farm?

Regression Equation

Mortality rate = -1.061 + 0.505birds reared + 0.250 birds infected……...…Eq. 1

According to the equation, the total number of birds raised and the amount of sick birds both predict the death rate. When there are no birds being raised or infected, the death rate is represented by the constant (-1.061). According to these coefficients, the death rate is predicted to rise by 0.505 units for every additional unit of birds raised, while all other variables remain the same. Similar to this, while keeping all other variables constant, it is predicted that the death rate would rise by 0.250 units for every additional unit in the number of sick birds.

Table 4: Simple Linear Regression Analysis result for the effect of yearly seasons on poultry birds stocked in the college farm

Term	Coefficient	SE Coefficient	T-Value	P-Value	VIF
Constant	-1.061	0.796	-1.33	0.207	
Birds reared	0.505	0.282	1.79	0.099	1.08
Birds infected	0.250	0.116	2.15	0.053	1.08
R-square	0.472				
R-square (adjusted)	0.384				
R-square (predicted)	0.249				
Std Error (SE)	0.164				

Source: Poultry Production data, 2018 to 2022

Information about the model is summarized in Table 3. The model accounts for 47.20 percent of the variance in the mortality rate, according to the R-squared value of 0.4720. The model's explanatory power did not significantly increase with the addition of more independent variables, as shown by the adjusting R-squared value of 0.3841, which is somewhat lower than the R-squared value. The model can predict approximately 24.92% of the variability in mortality rates for fresh data, according to the projected R-squared value of 0.2492.

Table 5: Analysis of Variance (ANOVA) for the simple linear regression analysis result

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	2	0.28795	0.14398	5.36	0.022
Birds reared	1	0.08595	0.08595	3.20	0.099
Birds infected	1	0.12350	0.12350	4.60	0.053
Error	12	0.32206	0.02684		
Total	14	0.61001			

Source: Computed from COA poultry production record, 2018 to 2022

An estimation of the variance of the estimated coefficient is provided by calculating the SE of the coefficients. The coefficient is tested to see if it differs substantially from zero using the P-value. The P-value in this instance is 0.099 for birds that were raised and 0.053 for infected birds. There is no substantial evidence to imply that the value of the coefficients differ from zero, according to both of these P-values, which are both bigger than the statistical significance level of 0.05.

The relevance of the predictive equation and the independent variables are shown by the analysis of variance (ANOVA). The model's P-value is 0.022, which is below the threshold of 0.05 for significance, suggesting that it is statistically significant. The F-values, degrees of freedom (DF), and P-values for all of the independent variables are also included in the ANOVA table. The P-value for birds that have been raised is 0.099, whereas the P-value for infected birds is 0.053. These factors are not significant determinants of the mortality rate, as shown by the fact that both of these P-values are higher than the significance threshold of 0.05.

In general, the regression analysis indicates that there may be some correlation between the death rate and the number of birds raised and infected. The P-values for each of these variables are higher than 0.05, hence the association is not statistically significant. Vazquez et al. (2020) conducted a review on the influence of outbreaks of diseases on avian death rates. The intensity of infectious disease epidemics and their effect on bird populations may be influenced by a number of variables, including pathogen infectiousness, host receptivity, and environmental circumstances, the scientists discovered. While Pimm et al. (2018) conducted a meta-analysis to investigate the effects of fragmentation of habitat on bird death rates. Because of variables including decreased habitat quality, greater contact with predators, and decreased genetic diversity, the scientists discovered that habitat fragmentation can raise the death rates of birds. Loss et al. (2019) conducted a thorough study of the literature to determine what factors affect the fatality rates of birds due to collision with structures. The scientists discovered that factors including height of buildings, location, and illumination may have a big impact on bird fatality rates and they provide a number of mitigation tactics to lessen these effects.

Research Question 3: What is the effect of yearly seasons on poultry birds infected with different diseases outbreak?

Regression Equation……. 2

Birds Infected = 2.582 + 0.0year_1 - 0.766year_2 - 0.736year_3 - 0.108year_4 - 0.011year_5

Table 6: Simple Linear Regression Analysis result for the effect of yearly seasons on poultry birds' diseases outbreak

Term	Coefficient	SE Coefficient	T-Value	P-Value	VIF
Constant	2.582	0.203	12.70	0.000	
YEAR					
2	-0.766	0.288	-2.67	0.024	1.60
3	-0.736	0.288	-2.56	0.028	1.60
4	-0.108	0.288	-0.37	0.716	1.60
5	-0.011	0.288	-0.04	0.971	1.60
R-square	59.80%				
R-square (adjusted)	43.72%				
R-square (predicted)	9.54%				
Std Error (SE)	0.352				

Source: Poultry Production data, 2018 to 2022

The influence of each independent variable on the dependent variable is shown by the coefficients associated with the independent variables. For instance, with regard to YEAR_1, the anticipated value of Birds Infectious drops by 0.766 units for every unit rise in Year 2 season. As all VIF values are below the cutoff of 5.0, the VIF values show that that there is no linear relationship among the independent variables.

According to the model summary, the multiple R-squared value is 0.598, which indicates that the independent variables can account for around 59.8% of the variance in the dependent variable. The overall number of factors that are independent in the model has been taken into account while calculating the adjusted R-squared value, which is 0.437. The model's predictions were accurate, as evidenced by the expected R-squared value of 0.095. The (SE) was just 0.352, though.

Table 7: Analysis of Variance (ANOVA) for the simple linear regression result

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	4	1.845	0.4611	3.72	0.042
YEAR	4	1.845	0.4611	3.72	0.042
Error	10	1.240	0.1240		
Total	14	3.085			

Source: Computed from COA poultry production record, 2018 to 2022

The regression model is significant according to the analysis of variance (ANOVA) table (p-value = 0.042), indicating that at least any of the independent variables significantly affects the dependent variable. The model has a better fit than an equation with no independent variables, according to the F-value of 3.72 and the corresponding p-value.

In southwestern Nigeria, Adesokan and Akinbobola (2017) looked at how the seasons affected the prevalence of the avian influenza virus in chicken. When Muzaffar, Haider, and Khan (2018) used a time-series regression model to examine the seasonality and patterns of Newcastle outbreaks of diseases in chicken in the Punjab region of Pakistan, they discovered that the virus was more prevalent during the dry season than the wet season. They discovered that March and April were the months when the sickness was most common. Shahid et al. (2020) investigated the cyclical nature of the illness and the spread of an infectious bursal infection in poultry birds. They discovered that June and July were the months when the sickness was most common. Using a regression model, Hassan et al. (2021) examined the seasonal trend of several poultry disease outbreaks in Bangladesh. They discovered that the winter months were when avian influenza,

Newcastle disease, and infectious bursal disease outbreaks were most common. These studies indicate that there are seasonal variations in the onset of many chicken illnesses, which may be studied using regression models. Implementing proper control measures to stop or lessen the prevalence of disease outbreaks can be made easier through knowledge of the seasonal patterns of these illnesses.

Conclusions

Finally, the study shows a few noteworthy facts. For starters, the annual season clearly has a statistically significant negative influence on the quantity of birds supplied. This suggests that some seasons provide difficulties in the stocking process. Secondly, neither the number of birds raised nor the number of diseased birds had a statistically significant influence on mortality. While these indicators may have a role, their impact is insufficient to confidently predict death rates. Overall, while the regression analysis showed some insight into the connections between the variables, their explanatory strength is limited. As a result, further study is needed to acquire a more complete knowledge of the components which contribute to these results. A fuller picture of the factors influencing the outcomes may be gained by diving deeply into the underlying components.

Recommendations

There are several recommendations for future research based on the conclusions of this study. Firstly, it is worth considering the inclusion of additional variables that may have a significant impact on the number of birds stocked. These include; environmental conditions, nutritional deficiencies or imbalances, management practices, genetic factors, parasite infestations, predators, pests, vaccination and biosecurity practices. By incorporating these variables into the analysis, a greater portion of the variance in the stocking numbers can be explained, leading to a more comprehensive understanding of the factors influencing this outcome. The variables include temperature ratings, drugs administered, and other routine health practices in the farm. Secondly, in order to gain a more comprehensive understanding of mortality rates, it is essential to explore additional variables that may be related to this outcome. By examining factors beyond the scope of this study, a more nuanced understanding of the drivers of mortality rates among birds can be achieved. Furthermore, it is advisable to expand the exploration of predictors for the number of birds infected beyond the timeframe of the 2018 to 2022 yearly seasons. By considering additional potential predictors, a more comprehensive picture of the factors contributing to bird infections can be obtained.

Suggestions for Further Studies

1. Investigating the effectiveness of different disease management strategies in reducing mortality rates and improving the health and welfare of broiler chickens in the college farm such as vaccination, biosecurity measures, and antibiotic treatment.
2. Comparing the growth performance and meat quality of broiler chickens reared in conventional and alternative production systems in the college farm such as free-range, organic, or pasture-based systems, and analyzing the effects of seasonal variations on these outcomes.

Conflict of Interest

Before commencing the research, the researchers obtained approval from the college authority to collect data from the college farm for research purpose ensuring that the provided information will be solely used for research purposes. Moreover, the authors took measures to maintain the confidentiality of the collected data, refraining from sharing it with unauthorized individuals or

organizations. Notably, the division of tasks among Umar, Altine, and Muhammad prevented any potential conflict of interest. Umar conducted the statistical analysis, Altine handled secretariat duties, and Muhammad gathered the data from the farm clinic. The authors were personally responsible for the publication fee.

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