**A STUDY TO INVESTIGATE THE FACTORS AFFECTING EGG PRODUCTION IN DEEP LITTER SYSTEM OF POULTRY FARMING IN LIMURU, KIAMBU COUNTY.**

**BY**

**JOSEPH BAYA KARISA**

**SMSI/00815/2020**

**A RESEARCH PROJECT REPORT, SUBMITTED TO THE TECHNICAL UNIVERSITY OF KENYA, SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A DEGREE IN TECHNOLOGY IN APPLIED STATISTICS.**

**MARCH 2024**

DECLARATION

I Joseph Baya Karisa declare that this research project report is my original work and has not been presented for the award of a degree in any other university.

Joseph Baya Karisa

SMSI/00815/2020

Signature ………………………. Date ……………………………..

# APPROVAL

This proposal has been submitted for examination with my approval as the university supervisor.

Madam Catherine Mwangi

Lecturer,

School of Mathematics and Actuarial Science

Sign ……………………………..Date ………………………………………..

# DEDICATION

This study is dedicated to my parents, Mr. and Mrs. Karisa. Your encouragement and love have fueled my journey and I'm truly grateful for your unwavering belief in me.

# ACKNOWLEDGMENT

I extend my heartfelt appreciation to everyone who contributed to the completion of my research. Your support, encouragement, and guidance have been of great importance throughout this journey.

First, I would like to thank the Almighty for guiding me through all the hardships and difficulties.

I am deeply grateful to my supervisor Madam Catherine Mwangi for her valuable guidance and constant supervision till the completion of my research. Your mentorship and dedication have been truly invaluable.

To my family and friends, most especially my parents, I am profoundly grateful for your unwavering support and encouragement. Your understanding and patience were the pillars that sustained me during this challenging journey.

To Limuru Fertilizer Agrovet, I appreciate your openness and confidence in allowing me to access and use the data.

This research would not have been complete without the collective support of these individuals. Thank you for being a crucial part of this school project.

# ABSTRACT

This study aimed to investigate the factors that affect efficient egg production in deep litter systems. The data used in this study was secondary data obtained from Limuru fertilizer agrovet in Limuru. The research objectives were based on the following variables: mortality and amount of feeds. The health management practice that was put in consideration was mortality. Other health management practices that were not looked at intensively include vaccination programs, parasite control, biosecurity measures, etc. The method used for data analysis was multiple linear regression with one dependent variable egg production and two independent variables (mortality, amount of feeds). The statistical software used for the analysis was R programming. The results were that mortality was statistically significant with a p-value < 0.05. However, reevaluation of the other variables could provide insights that might have been overlooked in this study.

Contents

[DECLARATION 2](#_Toc161297171)

[APPROVAL 2](#_Toc161297172)

[DEDICATION 3](#_Toc161297173)

[ACKNOWLEDGMENT 4](#_Toc161297174)

[ABSTRACT 5](#_Toc161297175)

[CHAPTER 1 9](#_Toc161297176)

[INTRODUCTION 9](#_Toc161297177)

[PROBLEM STATEMENT 10](#_Toc161297178)

[OBJECTIVES OF THE STUDY 11](#_Toc161297179)

[RESEARCH QUESTIONS 11](#_Toc161297180)

[HYPOTHESIS 11](#_Toc161297181)

[JUSTIFICATION OF THE STUDY 11](#_Toc161297182)

[SIGNIFICANCE OF THE STUDY 12](#_Toc161297183)

[ASSUMPTIONS OF THE STUDY 12](#_Toc161297184)

[RESEARCH DESIGN AND APPROACH 12](#_Toc161297185)

[INDEPENDENT VARIABLE 12](#_Toc161297186)

[DATA COLLECTION 12](#_Toc161297187)

[DATA ANALYSIS 12](#_Toc161297188)

[DEFINITION OF TERMS 12](#_Toc161297189)

[ORGANISATION OF THE STUDY 13](#_Toc161297190)

[CHAPTER 2 14](#_Toc161297191)

[Introduction 14](#_Toc161297192)

[CONCEPT OF POULTRY PRODUCTION 14](#_Toc161297193)

[RESOURCE UTILIZATION 14](#_Toc161297194)

[DISEASE INCIDENCE 15](#_Toc161297195)

[MORTALITY 15](#_Toc161297196)

[TYPE OF FEEDS 16](#_Toc161297197)

[EGG PRODUCTION 16](#_Toc161297198)

[LIMITATIONS OF THE STUDY 17](#_Toc161297199)

[Conclusion 17](#_Toc161297200)

[CHAPTER 3 18](#_Toc161297201)

[RESEARCH METHODOLOGY 18](#_Toc161297202)

[INTRODUCTION METHODOLOGY 18](#_Toc161297203)

[DATA COLECTION 18](#_Toc161297204)

[VARIABLES: 18](#_Toc161297205)

[SAMPLE SIZE 18](#_Toc161297206)

[DATA ANALYSIS 19](#_Toc161297207)

[ANOVA 19](#_Toc161297208)

[THE LEAST-SQUARE ESTIMATION 20](#_Toc161297209)

[ASSUMPTIONS OF THE MODEL 20](#_Toc161297210)

[CHAPTER 4 22](#_Toc161297211)

[INTRODUCTION 22](#_Toc161297212)

[CHECK FOR ASSUMPTIONS 23](#_Toc161297213)

[CORRELATION MATRIX 29](#_Toc161297214)

[**MULTIPLE REGRESSION EQUATION** 29](#_Toc161297215)

[CHAPTER 5 31](#_Toc161297216)

[CONCLUSIONS AND RECOMMENDATIONS 31](#_Toc161297217)

[CONCLUSION 31](#_Toc161297218)

[REFERENCES 34](#_Toc161297219)

[APPENDIX 35](#_Toc161297220)

# CHAPTER 1

## INTRODUCTION

**BACKGROUND TO THE STUDY**

Poultry breeding is generally acceptable to people all over the world and provides an excellent source of protein, especially for poor rural communities, because it requires little capital, labor and land. Poultry birds are good converters of feed into usable protein in meat and eggs (Abanikannda et al., 2007). In commercial egg-laying farming enterprises, success depends on the total number and size of eggs produced. Commercial layer strains produce eggs for the food and egg processing industries (Olawumi and Adeoti, 2009). Egg consumption regularly can effectively correct nutritional imbalance among vulnerable groups, particularly nursing mothers and children (Olawumi et al., 2006).

“The success of poultry production dedicated to egg production is based on the productive performance of the poultry. Many factors of non-infectious and infectious origin can impact laying hens. Egg production in hens lasts approximately 23 hours. At this stage, multiple factors can increase this time or even prevent egg formation. Therefore, it is of great importance in poultry farming to know these causes and prevent them in time. These factors must be considered in both laying hens and breeding poultry.”(veterania digital)

Globally, the demand for animal-source food has grown exponentially, particularly in developing countries due to urbanization, income, and population growth (FAO, 2002, FAO, 2010). However, despite the growing demand for poultry products, poultry farmers worldwide face numerous problems. In Nigeria and Ghana, for example, poultry farmers have suffered setbacks in poultry production due to rising costs of farm inputs and some mysterious diseases that have wiped out the farmer’s birds. The high costs of inputs and the mysterious diseases have significantly reduced the returns of poultry farmers' businesses (Oyesola & Olujide, 2000: Okoli, 2003, Aihonsu, 1999).

Agriculture contributes 25-26% of GDP in Kenya with poultry playing a major role, representing 30% of the agricultural contribution to GDP. Most rural families in Kenya (an estimated 75%) keep chicken. Indigenous chickens contribute 71% of the total egg and poultry meat produced in Kenya and therefore impact significantly the rural trade, welfare, and food security of smallholder farmers. The average household is reported to keep 13 birds per flock. Commercial poultry is concentrated in the urban centers of Nairobi, Mombasa, Nakuru, Kisumu, and Nyeri where ready markets are available. This has led to the growth of commercial hatcheries located in the peri-urban areas, which sell hybrid broilers and layer chicks to commercial farmers, (Njenga, 2005). The Kenya Poultry Farmers’ Association Baseline Survey (2008), established about 3.8 million farmers in Kenya are engaged in poultry farming both for commercial and subsistence purposes. The Ministry of Livestock Development in Kenya's annual estimates on poultry meat production record 18,600 tonnes per annum valued at kshs.3.5 billion while the annual egg production is 1.2 billion valued at kshs.9.7 billion (2008). Based on the statistics given poultry farming in Kenya has a growth potential. However, this growth has been hindered by several challenges, largely because the necessary backward and forward market linkages are rarely in place i.e. rural farmers and small-scale entrepreneurs lack both reliable and cost-efficient inputs. Other challenges include poor disease management and lack of quality inputs such as chicks, feeds, and vaccines. The Kenya Poultry Farmers’ Association (KEPOFA) has been at the forefront of voicing these issues to stakeholders in the poultry sector. The association believes that some of these challenges could be addressed through the adoption by the government of a policy to guide the regulation of the poultry sector more effectively, (Getambu, 2009).

A recent review by ILRI in May 2023 stated that the livestock sector is a major benefactor to the Kenyan economy as it contributes about 12% to the national gross domestic product and 42% to agricultural GDP. However, the report stated that there has been a recent decline in poultry productivity. This was associated with health management practices, feed and access to quality and reliable services and inputs such as vaccines and improved breeds and inadequate knowledge and skills in flock management. Knowledge of how to counter these problems is therefore required to boost production and income of smallholder poultry farmers.

Intensification of poultry production requires large amounts of inputs thus many farmers shy away from adopting the management interventions package. However, efficient use of management interventions with limited wastage of resources would lead to higher productivity of the birds. Poultry chickens would be profitable if managed well and common diseases are controlled to improve the survival rate of chicks by at least 30 percent while improved feeding, housing, and disease control increase survival rate by up to 80 percent. (KARI 2006, Nduthu 2013)

Problems facing poultry farming in other parts of the world are not unique to them only. Some of the problems facing poultry farmers that are of non-infectious origin include age, nutrition and water supply, lighting, and stress among others. Those of infectious origin include parasites (both internal and external), diseases, etc.

The conflicting problems that the poultry farmers in Limuru have been facing include low-quality feeds from manufacturers and disease incidences that may be fatal resulting in high levels of mortality among the birds. Among the various poultry farming systems, the deep litter system has gained the most popularity, and therefore understanding the factors influencing egg production in this system is important to ensure maximum egg production from the bird

## PROBLEM STATEMENT

For many Kenyan families, especially in rural areas, raising chickens through free-range poultry farming is not just an agricultural activity but a way of life. In particular, eggs play an important role in their livelihood, providing a valuable source of protein and nutrients for family consumption, as well as being a source of income. However, maintaining stable and optimal levels of egg production in deep litter systems can be a significant challenge for small-scale farmers, who often face various challenges. Many factors, from chicken diet and nutrition to housing conditions, disease prevention measures, and environmental influences such as weather, can have a significant impact on the laying performance of hens. When egg production rates are not at optimal levels, this can have far-reaching consequences on the financial well-being of these farming households.

This research project aims to conduct an in-depth investigation of the key factors influencing egg production in deep litter poultry production systems. By developing a deep understanding of these influences, the research seeks to provide practical insights and recommendations that can help small-scale farmers overcome these challenges and maximize production. The main aim is to contribute to improving rural livelihoods by improving the productivity and profitability of deep litter poultry farming, a sector that plays an important role in the lives of many families, especially in rural areas. Through this research, I hope to shed light on the main challenges faced by deep litter poultry farmers and provide tailored solutions that can help them overcome obstacles and thrive. Ultimately, this research project aims to equip smallholder farmers with the knowledge and tools they need to exploit the full potential of deep litter poultry farming, thereby ensuring nutritious food and sustainable income for future generations. Prioritizing the needs and well-being of these farming communities can contribute to the broader goal of achieving food security, poverty reduction, and economic development in rural areas.

## OBJECTIVES OF THE STUDY

General objective;

To determine the factors that influence egg production.

Specific objectives;

To determine how mortality influences egg production.

To determine how the amount of feeds influences egg production.

## RESEARCH QUESTIONS

To what extent does mortality influence egg production?

To what extent does the amount of feeds influence egg production?

## HYPOTHESIS

Ho: Mortality does not affect egg production

H1: Mortality affects egg production.

Ho: The amount of feeds does not affect egg production.

H1: The amount of feed affects egg production.

## JUSTIFICATION OF THE STUDY

The study was to determine the factors affecting egg production in free-range poultry farming systems and give recommendations. Implementation of these recommendations will contribute to the optimization of practices supporting both the economic viability of the farmer and meeting the growing demand for eggs produced in Kenya.

## SSIGNIFICANCE OF THE STUDY

The study recommendations were to assist in addressing the factors affecting egg production and to also add more knowledge on poultry productivity.

## RESEARCH DESIGN AND APPROACH

This study employed a quantitative research design as the data available was secondary data and not much information was provided.

**DEPENDENT VARIABLE**

The dependent variable was egg production.

## INDEPENDENT VARIABLE

The independent variables were:

- Mortality,

- Amount of feeds consumed

## DATA COLLECTION

The data used was secondary data from Limuru fertilizers agro vet. The method that was used to collect the data and the criteria used was however not known.

## DATA ANALYSIS

Multiple linear regression analysis was used to check the significance of each independent variable on egg production impact. The regression model was evaluated for assumptions such as linearity, homoscedasticity & heteroscedasticity, independence, etc.

## DEFINITION OF TERMS

Deep litter system- A system in which several hens are housed in one covered enclosure, within which they can move about freely, on a layer of straw or wood shavings.

Poultry farming – A form of animal husbandry that raises domesticated birds such as chickens, ducks, turkeys, and geese to produce meat or eggs for feed.

Health management practices – A comprehensive approach to prevent, identify, and manage health issues can affect the flock. (mortality)

# 

# CHAPTER 2

## Introduction

The literature review is in line with the specified variables and objectives. It was based on previous studies relevant to the said objectives. It starts by discussing the concept of poultry production and then proceeds to provide information on the other specified variables. At the end of the review, the limitations of the study have been stated as well.

## CONCEPT OF POULTRY PRODUCTION

Poultry production as an aspect of livestock production is important to the economic and social development and biological needs of the people of any nation because it assists in alleviating food security, creates employment opportunities for the people engaged, and generates income for them as well. It is a process that involves the rearing of chicks from day to the time they mature. (Oladeebo & Ambe-Lamidi 2007).

## RESOURCE UTILIZATION

Efficient use of resources is important in optimizing egg production in deep litter systems of poultry farming. This variable encompasses many different aspects, including water consumption, feed intake, vaccination, space availability, ventilation, lighting, and litter management.

Water consumption is an important factor in resource utilization as it is essential for the overall health, growth and productivity of poultry. Not drinking enough water can lead to dehydration, reduced food intake, and ultimately reduced egg production (Abudabos et al., 2013). Studies have shown that providing clean, accessible water can significantly improve egg production and overall flock productivity (Mugnai et al., 2009).

Feed consumption is another important component of resource utilization as it has a direct impact on the nutritional status of birds and their energy requirements for egg production. Ensuring birds have access to high-quality feed and maintaining appropriate feed consumption is essential to support optimal egg production (Roberts, 2004). Factors such as food composition, palatability, and environmental conditions can influence food consumption and thus egg production (Huchuan et al., 2015).

Vaccination plays an essential role in resource utilization by promoting disease prevention and maintaining poultry health. Implementing effective vaccination programs can protect poultry from various diseases, such as avian influenza, Newcastle disease and infectious bronchitis, which can have a significant impact on egg production (Ssematimba et al., 2021). Regular vaccination, combined with appropriate biosecurity measures, can help minimize disease outbreaks and associated production losses (Comin et al., 2022). Ventilation is essential to maintain optimal air quality in deep litter systems. Proper ventilation helps remove harmful gases, such as ammonia and regulates temperature and humidity (Luo et al., 2022). Inadequate ventilation can lead to respiratory problems, increased stress, and reduced egg production (Dunlop et al., 2015).

## MORTALITY

Mortality in deep litter systems can significantly affect egg production in poultry production.High mortality can lead to reduced flock size, leading to lower overall egg production (Zhuang et al.,2020). Additionally, increased mortality may be an indication of underlying health or management problems that may also be affecting the performance of the remaining birds. Many different factors can contribute to high mortality rates in deep litter systems, including disease outbreaks, poor biosecurity measures, inadequate nutrition, and other factors causing environmental stress (Mostert et al., 2019; Luo et al., 2022). Diseases such as avian influenza, Newcastle disease, and coccidiosis can cause severe mortality in poultry flocks, leading to significant production losses (Comin et al., 2022; Ssematimba et al., 2021; Awaad et al., 2021).

Poor biosecurity measures and inadequate hygiene practices may increase the risk of disease transmission and mortality in deep litter systems (“Luo et al., 2022”). Poor waste management, lack of vaccination programs, and poor hygiene can contribute to the spread of pathogens and increased mortality rates (Mostert et al., 2019; Ssematimba et al., 2021). Nutritional deficiencies or imbalances can also contribute to increased mortality in poultry flocks. Inadequate intake of protein, energy or vitamins and minerals can weaken the immune system of poultry, making them more susceptible to disease and increasing mortality (Enting et al., 2007; Hossain et al., 2021; Banerjee et al., 2022). Environmental stress factors, such as extreme temperatures, poor air quality, or inadequate lighting, can also lead to increased mortality in deep litter systems (Mostert' et al., 2019; Luo et al., 2022). For example, high ammonia concentrations can cause respiratory problems and increased mortality, especially in chicks (Luo et al., 2022). Implement appropriate management measures, such as maintaining optimal environmental conditions, providing a balanced diet, implementing effective biosecurity measures, monitoring, and timely treatment of sick birds, which can help minimize mortality and support optimal egg production in deep litter systems.(Mostert et al., 2019; Luo et al., 2022; Comin et al., 2022).

## EGG PRODUCTION

Egg production was the dependent variable in this study and was influenced by a variety of factors including resource use, morbidity, mortality, and food type. Optimal egg production is critical to the profitability and sustainability of poultry farms. Egg production can be measured in a variety of ways, including the number of eggs per chicken, egg mass (weight), and egg quality parameters (e.g., shell quality, egg color , yellowness and albumen quality) (Dikmen et al., 2016; Hossain et al., 2021). These measurements provide insight into the productivity and efficiency of the flock as well as the quality of eggs produced.

Many different factors can influence egg production in deep litter systems, including environmental conditions, bird age and breed, management methods, use of resources, morbidity, mortality, and food type) (Nonga et al., 2021; Mostert et al., 2019; Panda et al., 2020).

Environmental conditions such as temperature, humidity, and light can significantly influence egg production (Lewis and Morris, 2006; Gewehr and de Freitas Zara, 2017; Farghly et al., 2019). Excessive heat or humidity can cause stress and discomfort in poultry, leading to reduced egg production (Mostert et al., 2019). Good light management is also important because it regulates the bird's reproductive cycle and affects egg production (Lewis and Morris, 2006). The age and breed of the bird can also affect egg production, as chicks typically have a lower egg production rate than adult hens during their production cycle (Zita et al., 2009). Additionally, some breeds may be better suited to egg production or to deep litter systems than others (Nonga et al., 2021).

## Conclusion

The key findings that emerged from the past studies were, high quality feed formulations designed to meet the nutritional needs of laying hens are associated with improved egg yield, enhanced egg quality, overall flock performance. Understanding and addressing factors contributing to mortality such as disease outbreaks, environmental stressors and flock management are critical for flock production and health. Optimization of resources minimizes environmental stressors and supports optimal egg-laying behavior. Effective disease control measures such as vaccination programs and biosecurity are essential for minimizing the impact of diseases on flock productivity and health.

# CHAPTER 3

## RESEARCH METHODOLOGY

## INTRODUCTION METHODOLOGY

This chapter focuses on the variables the research focused on, the source of data, the sample size of the research variables, the method used for analysis and its assumptions, and the software used which was R programming.

## DATA COLECTION

Type of data: Secondary data

Source of data: Limuru Fertiliser Agrovet

My sample had 3 variables with 92 observations.

## VARIABLES:

INDEPENDENT VARIABLES:

1. Amount of feeds consumed.

Aimed at evaluating whether resources such as feeds, water and supplements were well administered. A certain proportion of water and feeds is supposed to be administered as per the number of birds being reared. A record of the daily water and feed intake should be kept to check whether average daily intakes are met to ensure optimum egg production rates.

1. Mortality rates

Focused on death rates among poultry, both natural and those caused by diseases and other factors. Measure for this is given by calculating the mortality rate. The impact on production would then be determined by comparing the quantity produced before and after mortality.

DEPENDENT VARIABLE:

Egg production rates

The variable the study aimed at understanding and explaining. This is the variable influenced by other independent variables.

## 

## DATA ANALYSIS

## ANOVA

The ANOVA table was used to check the overall significance of the model for the data. A large F –value, basically above the critical value or with a corresponding small p- value leads to the rejection of the null hypothesis, indicating that at least one independent variable has a significant effect on the dependent variable.

**MULTIPLE LINEAR REGRESSION MODEL**

A statistical technique used to model the relationship between a dependent variable and two or more independent variables.

GENERAL EQUATION:

**y = β0 + β1x1 + ... + β2x2 + βpxp + ε**

Where:

**y –** Is the dependent variable

**β0 –** intercept (value of y when all independent variables are zero)

**β1, β2, βp –** (regression coefficients representing change in y relative to a unit change in the x’s)

**x1, x2, xp –** independent variables

**ε –** error/residual term

SPECIFIC EQUATION:

**y = β0 + β1x1 + β2x2 + ε**

Where:

**y** – Egg production

**β0 –** value of egg production when all independent variables are zero

**β1, β2 – (**regression coefficients representing a change in egg production relative to a unit change in the independent variables)

**x1, x2 –**  the independent variables

## THE LEAST-SQUARE ESTIMATION

The regression coefficients are estimated using the method of ordinary least squares (OLS) by minimizing the sum of squared residuals:

The least-square estimation was done in R.

To fit a linear regression model using the least squares method in R, the lm () function was used, which stands for "linear model."

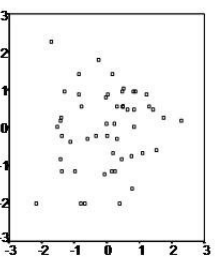
## ASSUMPTIONS OF THE MODEL

1. Linearity

The relationship between the dependent variable and the independent variable is assumed to be linear.

-Test for linearity

Scatterplots of observed values against predicted values are used and should show a random pattern with no visible trend.



Linear relationship

1. Independence

The residuals should be independent of each other.

-Test for independence

Durbin-Watson test – checks for autocorrelation between the residuals.

1. Homoscedasticity

The variance of the residuals should have no clear pattern across all levels of the independent variables.

-Test for homoscedasticity

Tested by plotting scatterplot of the residuals against the predicted values.

If the data exhibits heteroscedasticity, a non-linear transformation should be done.

1. Normality

The residuals should be normally distributed.

-Test for normality

Q-Q plots – quantiles of the standardized residuals against the quantiles of a normal distribution. Shifting from a straight line indicates a lack of normality.

1. No multicollinearity in the data

-Test for no multicollinearity

Variance inflation factor (VIF) – the variance inflation factor indicates the degree to which the variances in the regression estimates are increased due to multicollinearity. VIF values higher than 10 indicate multicollinearity.

Solved by centering the data i.e. subtracting the mean from each independent variable or by identifying the variables causing multicollinearity (in VIF)

The tests for these assumptions and the modeling of the multiple regression were done in R and the relevant R codes are provided in the appendix section.

# 

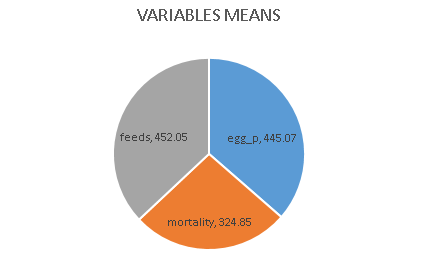
# CHAPTER 4

## INTRODUCTION

This chapter presents the detailed analysis and findings of the study investigating factors affecting egg production in deep litter system. The analysis aims to quantify the relationships between egg production and each of the independent variables. This chapter begins with a descriptive statistic providing an overview of the mean, the ranges and median. This initial understanding lays foundation to deeper understanding of the data and guides the inferential statistics. The chapter then proceeds to examine the assumptions of the model. It evaluates normality of residuals, homoscedasticity & heteroscedasticity, independence of the error terms. Then the linear regression model is employed to analyze the egg production and independent variables relationship. Correlation analysis and analysis of variance is also carried out.

**DESCRIPTIVE STATISTICS**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | Min | 1ST Quartile | Median | Mean | 3rd Quartile | Max. | | Egg prod. | 371.0 | 430.0 | 450.0 | 445.1 | 460.0 | 493.0 | | Mortality | 180.0 | 300.0 | 335.0 | 324.8 | 360.0 | 408.0 | | Feeds cons. | 365.0 | 439.5 | 455.0 | 452.1 | 469.2 | 489.0 |   These descriptive statistics gives summary of the data in the form of the minimum and maximum values, the 1st and 3rd quartile, the mean and the median. The information provides a foundation for understanding the data and patterns that may be within the data. |
|  |
| |  | | --- | |  | |

****

## 

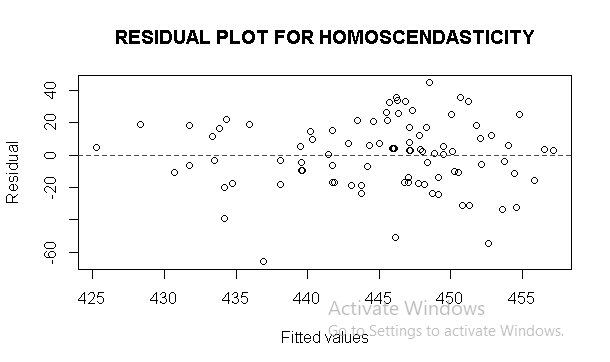
## CHECK FOR ASSUMPTIONS

1. **HOMOSCEDASTICITY**

Studentized Breusch-Pagan test

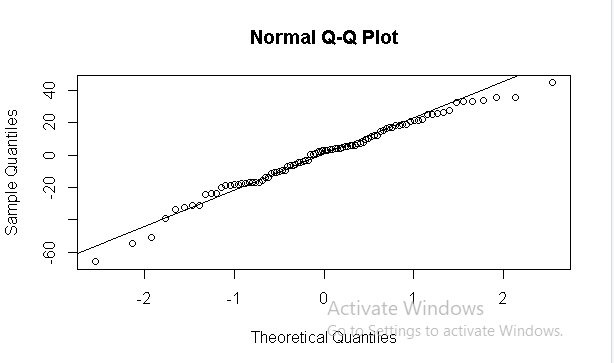
|  |  |  |  |
| --- | --- | --- | --- |
| Data | BP | DF | P-value |
| Model2 | 2.097 | 2 | 0.351 |

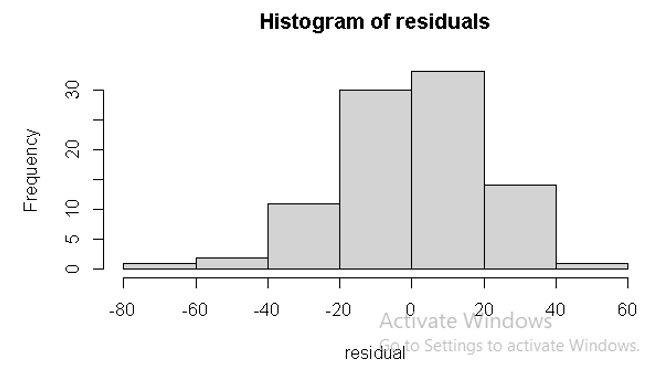
The Breusch pagan test is used to test for homoscedasticity. A p-value that is significantly small leads to the rejection of the null hypothesis suggesting that heteroscedasticity is prevalent. Since p-value =0.351 > 0.05, we fail to reject the null hypothesis and conclude that the assumption of homoscedasticity is met.



The plot illustrates the relationship between the fitted values on the x axis and the residuals on the y axis. Examining the plot and the spread of residuals, no clear pattern is depicted from the plot. This suggests that homoscedasticity is present therefore meeting the assumption for constant error term.

1. **NORMALITY**



The Q-Q plot assess visually the assumption for normality. In the plot, almost all data point align with the reference line, indicating adherence to normality. The histogram of residuals almost gives a clear representation of a normal distribution therefore solidifying the assumption for normality.

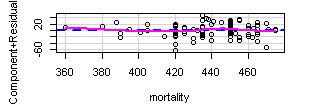
SHAPIRO WILK NORMALITY TEST

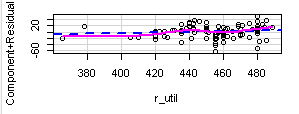
|  |  |  |
| --- | --- | --- |
| Data | W | P-value |
| Residual | 0.98 | 0.19 |

P-value is greater than 0.05 therefore there isn’t enough evidence to reject the null hypothesis and there the assumptions for normality are true.

1. **LINEARITY**

PARTIAL REGRESSION PLOTS





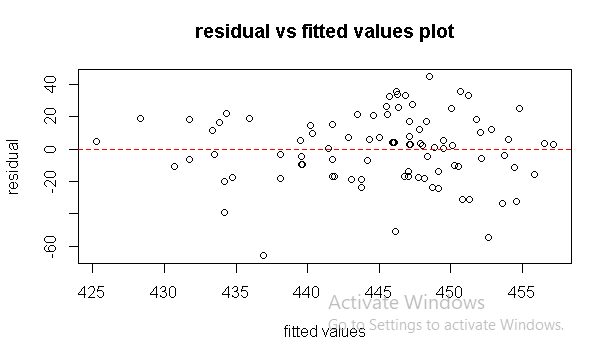
The roughly straight lines indicate that the assumption of linearity is met.

1. **MUTICOLLINEARITY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Mortality | Feeds cons. | | 1.006 | 1.006 |   Values are less than 10 indicating no multicollinearity |
|  |
| |  | | --- | |  | |

1. **INDEPENDENCE**

No patterns detected therefore independence assumption is met.

****

## CORRELATION MATRIX

|  |  |  |  |
| --- | --- | --- | --- |
|  | Egg production | Mortality | Feeds cons. |
| Egg production | 1.00 | 0.31 | 0.05 |
| Mortality | 0.31 | 1.00 | 0.08 |
| Feeds cons. | 0.05 | 0.08 | 1.00 |

The diagonal elements are 1 representing the perfect correlation of the variable to itself. The off-diagonal elements represent correlation coefficients between -1 to 1. Correlation close to 1 represents a strong positive linear relationship while that close to -1 suggest a strong negative linear relationship. A correlation close to 0 indicates little no linear relationship between the variables. In the correlation matrix, all the values are positive meaning that as one of the variables increases, the other tends to increase. Egg production and mortality have a weak positive correlation. Feed consumption and egg production have a moderate positive correlation.

## **MULTIPLE REGRESSION MODEL**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Std. error | T value | P-value |
| Intercept | 389.42 | 45.670 | 8.53 | 3.58e-13 |
| Mortality | 0.137 | 0.046 | 3.01 | 0.003 |
| Feeds cons. | 0.024 | 0.098 | 0.25 | 0.804 |

The level of significance used was 5%. Mortality had a significant effect on feeds since the p-value was less than 5%. Amount of feeds consumed had no effect on egg production since the p-value was relatively large.

Equation;

Egg production = 389.42 + 0.137 mortality + 0.02 feeds consumption

## LIMITATIONS OF THE STUDY

Since I was using secondary data, finding specific data on poultry farming specifically egg production, that was well broken down into parts explaining why, on some days production was high and other days low was quite challenging.

Consistency of the data. Some data was incomplete and some outdated which could potentially interfere with the data analysis and data accuracy.

The data that was available had just a few predictor variables therefore analyzing it was quite challenging. Some of the data analysis results may be incorrect as a result of the minimum number of predictor variables.

The person collecting the data may not have been experienced and did not know how to handle the missing values thus resulting to inaccuracy of the data and therefore affecting the data quality. This could have contributed to the insignificance of some variables.

The data that I was working with may have been collected for a different purpose and I had limited information on the methodology used and that could be reason as to why some of my independent variables were insignificant.

# CHAPTER 5

## CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSION

REGRESSION MODEL VALUES:

The regression model coefficients represent the estimated effect of each predictor variable on the dependent variable holding other variables constant. P-value coefficients indicate the significance of the effect of each predictor variable on the dependent variable.

HYPOTHESIS TESTING FOR THE REGRESSION MODEL

H0: Each independent variable = 0 (no effect)

H1: At least one independent variable not equal to zero (there is an effect)

(Reject H0 if P – value < 0.05%)

Amount of feeds consumed – P-value = 0.804 > 0.05%. We fail to reject H0 at 0.05% significant level and conclude that there is insufficient evidence to support the claim that amount of feeds consumed significantly affects egg production.

Mortality – P-value = 0.003 < 0.05% we reject H0 at 0.05% significance level and conclude that there is sufficient evidence to support the claim that mortality significantly affects egg production.

RECOMMENDATION

To anyone who would like to continue with this research, I would recommend they add more independent variables that could significantly affect egg production so as to improve the results of this study.

To deal with mortality, proper biosecurity measures need to be put in place. Biosecurity measures that the farmer should incorporate or should update in the already existing ones are as follows:

* Restricting access to the poultry farm by implementing a strict visitor policy. If any visitors are allowed into the poultry farm, then they are expected to wear clean protective clothing, disinfect footwear at the farm entry or the poultry house entry, wash hands thoroughly before and after the visit.
* Provide separate isolation facilities to house sick birds or potentially infected birds to prevent further infections
* Regular thorough cleaning and disinfection for poultry houses, equipment and vehicles.
* Ensure feed and water sources well protected from contamination by pests, wild birds, and other animals.
* Use clean and secure storage facilities for feed and water.
* Implement proper manure and litter management practices to prevent the spread of diseases.

## REFERENCES

Abudabos, A., Samara, E. M., Hussein, E. O., Al-Ghadi, M. Q., & Al-Atiyat, R. M. (2013). Impacts of stocking density on the performance and welfare of broiler chickens. Italian Journal of Animal Science, 12(1), e11.

Awaad, M. H. H., Elmenawey, M., & Ahmed, K. A. (2021). The potential role of natural feed supplements in poultry production. World's Poultry Science Journal, 77(1), 21-34.

Bande, F., Arshad, S. S., Hair Bejo, M., Moeini, H., & Omar, A. R. (2016). Progress and challenges toward the development of vaccines against avian infectious bronchitis. Journal of Immunology Research, 2016, 4621659.

Banerjee, S., Mohammadpanah, H., & Schlegel, V. L. (2022). Dietary amino acid requirements for laying hens: A comprehensive review. Poultry Science, 101(5), 101889.

Blake, D. P., & Tomley, F. M. (2014). Securing poultry production from the ever-present Eimeria challenge. Trends in Parasitology, 30(1), 12-19.

Comin, E. F., Faccin, J. L., Kuhn, B. O., Cardoso, R. L., & Falcheur, A. P. (2022). Biosecurity and pathogen control strategies for sustainable poultry production: A systematic review. Frontiers in Veterinary Science, 9, 906283.

Dikmen, B. Y., İpek, A., Şahan, Ü., Petek, M., & Sözcü, A. (2016). Egg production and welfare traits of laying hens in different housing systems. Çukurova Üniversitesi Ziraat Fakültesi Dergisi, 31(2), 49-58.

Dimitrov, K. M., Ramey, A. M., Qiu, X., Bahl, J., & Afonso, C. L. (2019). Temporal and geographic patterns of Newcastle disease virus evolution. Infection, Genetics and Evolution, 76, 103952.

Dunlop, M. W., Moss, A. F., Groves, P. J., Wilkinson, S. J., Stuetz, R. M., & Selle, P. H. (2015). Sustainable use of inputs in the production of concentrated animal feeding operations. The Science of the Total Environment, 530-531, 395-442.

Enting, H., Boersma, W. J., Cornelissen, J. B., Van Winden, S. C., Awati, M. F. W., & Van Winden, J. C. (2007). Maternal energy and protein deficiency during various periods of the reproductive cycle of broilers and effects on offspring performance. Poultry Science, 86(8), 1672-1677.

Farghly, M. F., Mahmoud, U. T., & Mahrose, K. M. (2019). Impact of light intensity and duration in monochromatic and combination LED light on productive performance and egg quality of Japanese quail. Livestock Science, 228, 77-86.

Gewehr, C. E., & de Freitas Zara, R. (2017). Lighting environment for layers and its effects on poultry production. World's Poultry Science Journal, 73(3), 503-514.

Hossain, M. E., Islam, A. F., Akter, S., & Hoque, M. A. (2021). Dietary energy requirement and energy-protein ratio for optimum egg production and nutrient utilization in laying hens. Animals, 11(12), 3397.

MA Ogolla (2016). Factors influencing poultry production among poultry farmers in Eldoret town, Uasin Gishu County, Kenya.

Nduthu Wanjugu (2013). Factors influencing indigenous poultry production in Kathiani District, Machakos County.

Veterania digital (2022). Factors decreasing egg production.

# APPENDIX

library(tidyverse)

library(car)

library(lmtest)

library(MASS)

library(ggplot2)

library(broom)

library(readxl)

egg2d<-read.csv("C:\\Users\\kelvin kahiga\\Documents\\VM PROJECT SLIDES\\egg2data.csv")

egg2d

summary(egg2d)

#linear model equation

model2<-lm(egg\_p ~ mortality + feeds, data = egg2d)

model2

summary(model2)

#test for homoscendasticity

bptest(model2)

residual<-residuals(model2)

plot(fitted(model2),residual,

xlab = "Fitted values",

ylab = "Residual",

main = "RESIDUAL PLOT FOR HOMOSCENDASTICITY")

abline(h=0, col="red", lty=2)

#test for normality

residual<- residuals(model2)

hist(residual, main = "HISTOGRAM OF RESIDUALS", xlab = "Residual")

qqnorm(residual)

qqline(residual)

shapiro.test(residual)

#test for linearity

crPlots(model2, data = egg2d)

#test for independence

residual<- residuals(model2)

plot(fitted(model2), residual,

xlab = "fitted values",

ylab = "residual",

main = "residual vs fitted values plot")

abline(h=0, col="red", lty=2)

#test for multicollinearty

vif\_values<-car::vif(model2)

vif\_values

#correlation matrix

corr\_matrix<- cor(egg2d)

corr\_matrix