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Statistical Analysis on the Effect of Feeds on Chicken Weight and Egg Production

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Abstract

This study evaluated the effects of three commercial poultry feed brands—Metrovet, Topfeed, and Chikun—on the body weight and egg weight of laying chickens. A total of nine (9) layer chickens were used for the experiment, which was conducted over a five-month period. The birds were randomly assigned to three treatment groups, with each group receiving one of the three feed types throughout the study duration. Data on chicken body weight and egg weight were collected and analyzed to determine the influence of the different feeds on growth and egg production performance. A Completely Randomized Design (CRD) was adopted, and Analysis of Variance (ANOVA) was employed to assess differences among the feed treatments. The ANOVA results revealed no statistically significant differences ($p > 0.05$) in the mean body weight of chickens or the mean egg weight among the three feed types. To further investigate pairwise differences, Independent Sample t-tests were conducted. The results showed significant differences in mean chicken body weight between Metrovet and Topfeed, as well as between Metrovet and Chikun, whereas no significant difference was observed between Topfeed and Chikun. Similarly, pairwise comparisons of mean egg weight indicated statistically significant differences among all feed combinations. Despite the significant differences detected in some pairwise comparisons, the overall ANOVA results suggest that the three feed types did not exert a statistically significant effect on the average body weight and egg weight of the laying chickens. It is therefore concluded that Metrovet, Topfeed, and Chikun feeds produce comparable performance in terms of chicken growth and egg weight under the conditions of this study.

Keywords

Poultry Feed,
Layer Chickens,
Body Weight,
Egg Weight,
Analysis of Variance,
Independent Sample t-Test.

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1.0 Introduction

The poultry industry plays a vital role in global food security by providing high-quality animal protein through the production of meat and eggs. In recent years, the increasing demand for poultry products has necessitated the development of more efficient and sustainable production systems. One of the most critical factors influencing poultry productivity is feed management, which directly affects the growth, health, reproductive performance, and overall productivity of chickens. According to Abdelqader (2020), effective feed management is essential for maximizing poultry production efficiency and ensuring optimal bird performance.

Adequate nutrition is fundamental to the successful growth and development of poultry birds. Moghaddam (2020) reported that balanced diets containing appropriate levels of protein, vitamins, minerals, and energy significantly enhance growth performance, disease resistance, and productivity in chickens. In addition to nutrient composition, the physical form of feed has been shown to influence feed intake, feed conversion efficiency, and overall performance. González-Rivas (2021) observed that pelletized and crumble feeds often improve feed utilization and growth rates compared to conventional mash feeds.

Poultry feeds are specifically formulated to meet the nutritional requirements of birds at different stages of growth and production. According to Arotopin et al. (2007), feeds are manufactured based on the age and physiological condition of the birds. Starter feeds are formulated for newly hatched chicks and are typically provided from hatching until approximately six weeks of age. These feeds contain about 18–20% crude protein to support rapid growth and development. Feeds designed specifically for broiler chicks may contain up to 22% protein to maximize growth, although such high protein levels are generally unnecessary and uneconomical for layer chickens.

At approximately six weeks of age, chickens are transitioned to grower feeds, which contain about 15–16% protein and are designed to sustain steady growth until maturity. Beyond fourteen weeks of age, developer feeds may be introduced where available. These feeds typically contain 14–15% protein and are formulated to prepare pullets for the onset of egg production. Although the ingredients used in starter, grower, developer, layer, and breeder feeds are generally similar, their proportions vary to meet the specific nutritional demands of birds at different production stages.

The influence of feeding strategies and feed forms on laying performance has received considerable research attention. González-Rivas (2021) investigated the effects of various feeding strategies and feed forms on production traits and egg quality in laying hens and reported that birds fed crumble feed during the rearing phase exhibited superior egg production and egg quality compared to those fed mash feed.

Several researchers have employed statistical techniques to evaluate the effects of feed composition, feed forms, and feeding strategies on poultry growth and egg production. Afolayan (2008) emphasized that efforts aimed at improving poultry productivity should focus largely on enhancing feed quality. However, in developing countries such as Nigeria, feed formulation remains a challenge due to competition between humans and livestock for conventional feed ingredients (Fetuga, 1997; Larmorde et al., 1981; Igboeli, 2000). Consequently, identifying cost-effective and nutritionally adequate feed options remains a priority for poultry producers.

Poultry feed generally consists of grains and other nutrient-rich ingredients formulated to provide balanced nutrition for chickens, ducks, geese, and other domestic birds. The selection of appropriate feed types can significantly influence growth

performance, feed efficiency, and egg production, thereby impacting the profitability of poultry enterprises.

1.1 Scope of the Study

This study involved nine (9) layer chickens that were randomly assigned into three treatment groups (strata), with each group comprising three birds. Three commercially available poultry feeds—Metrovet, Topfeed, and Chikun—were evaluated. Each group received one of the feed types exclusively throughout the experimental period.

The chickens were weighed at regular intervals over a five-month period to monitor growth performance. At the onset of egg production, egg characteristics were assessed by measuring egg weight using a kitchen scale and egg diameter using a measuring tape. The study focused on evaluating the influence of the three feed types on chicken growth and egg production.

1.2 Statement of the Problem

Despite advances in poultry nutrition and management, poultry producers continue to face challenges in identifying feed formulations and feeding strategies that maximize growth performance and egg production. Variations in feed quality, nutrient composition, and feed utilization efficiency can significantly affect productivity and profitability. Therefore, there is a need to scientifically evaluate the performance of commonly used commercial feeds to provide evidence-based recommendations for poultry farmers.

This study was designed to assess the effects of different feed types on chicken growth and egg production, with particular emphasis on Metrovet, Topfeed, and Chikun feeds.

1.3 Aim and Objectives

Aim

The primary aim of this study is to investigate the effects of different poultry feeds on the growth performance and egg production of layer chickens.

Specific Objectives

The specific objectives are to:

1. Evaluate the effects of different feed types on the growth of layer chickens.
2. Determine the effects of various feed types on egg production and egg weight.
3. Compare the mean growth performance of chickens fed different feed types.
4. Compare the mean egg production characteristics among chickens fed different feed types.

2.0 Materials and Methods

2.1 Experimental Design

The study employed a Completely Randomized Design (CRD), a widely used experimental design in agricultural and biological research where homogeneous experimental units are randomly assigned to treatments. The CRD minimizes systematic bias and provides a reliable framework for assessing treatment effects.

The statistical model for the design is expressed as:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

- Y_{ij} = Observation from the jth chicken receiving the ith feed type.
- μ = Overall population mean.
- T_i = Effect of the ith feed treatment.
- e_{ij} = Random experimental error associated with the observation.

2.2 Data Collection and Analysis

Three commercial feed types—Metrovet, Topfeed, and Chikun—were randomly allocated to nine homogeneous layer chickens. Each feed treatment was administered to three birds throughout the experimental period. Body weight measurements were taken periodically over a five-month duration to monitor growth performance. At the commencement of laying, egg weights were measured using a kitchen scale, while egg diameter measurements were obtained using a measuring tape. The collected data were analyzed using Analysis of Variance (ANOVA) under the framework of a Completely Randomized Design to determine whether significant differences existed among the feed treatments. Where necessary, Independent Sample t-tests were conducted to compare treatment means and identify specific differences between feed types. Statistical significance was assessed at the 5% probability level.

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Table 1: Average Weight of Chicken from First Month to Fifth Month

Unit (Chicken)	Treatment	1st Month Value	2nd Month Value	3rd Month Value	4th Month Value	5th Month Value
1	Metrovet	0.7067	0.75	1.4225	1.8375	2.6175
2	Topfeed	0.5133	0.9275	1.665	1.9875	2.665
3	Chickun	0.82	1.225	1.635	2.7825	3.1425
4	Metrovet	0.5	0.6075	1.495	1.8675	2.53
5	Topfeed	1.1	1.54	1.6975	2.3025	3.5075
6	Chickun	0.7333	1.25	1.78	2.6025	3.165
7	Metrovet	0.6067	0.6925	1.515	1.875	2.5975
8	Topfeed	0.8667	1.415	1.7425	2.2725	3.1425
9	Chickun	1.2	1.275	1.8125	2.685	3.905

Hypothesis statement:

H_o: There is no significant difference on the effect of different feeds on the average weight of chickens in the first/second/third/fourth/fifth month.

H_1: There is significant difference on the effect of different feeds on the average weight of chickens in the first/second/third/fourth/fifth month.

Level of significance: $\alpha = 0.05$
Decision Rule: Reject H_o if p value is less than ($\leq$) α value. Otherwise, do not reject.

Table 2: Analysis of Variance for Chicken Weight

Source of variation	Degree of Freedom	Sum of Square	Mean Square	F value	Pr(>F)
Treatment 1st Month	2	0.066988	0.033494	0.492597	0.63375
Treatment 2nd Month	2	0.05285	0.026425	0.183435	0.836904
Treatment 3rd Month	2	0.021418	0.010709	0.508524	0.625159
Treatment 4th Month	2	0.00905	0.004525	0.024304	0.976084
Treatment 5th Month	2	0.254301	0.127151	0.500822	0.629294

Table 3: Decision on Measurement of Chicken Weight at 5% Level of Significance

Months	P-value	Decision
First Month	0.63375	No Significant
Second Month	0.836904	No Significant
Third Month	0.625159	No Significant
Fourth Month	0.976084	No Significant
Fifth Month	0.629294	No Significant

Table 4: Average Chicken's Egg Weights

Unit (Chicken)	Treatment	Average Weight
1	Metrovet	0.201
2	Topfeed	0.328
3	Chikun	0.413
4	Metrovet	0.203
5	Topfeed	0.315
6	Chikun	0.4
7	Metrovet	0.2
8	Topfeed	0.302
9	Chikun	0.4

Hypothesis statements:

H_o: There is no significant difference on the effect of different feeds on the average weight of

Chicken's egg

H_1: There is significant difference on the effect of different feeds on the average weight of

Chicken's egg

Level of significance: $\alpha = 0.05$
Decision Rule: Reject H_o if p value is less than ($\leq$) α value. Otherwise, do not reject.

Table 5: Analysis of Variance for Chicken"egg Weight

Source of variation	SS	DF	MS	F	P-value
Treatment	0.00352	2	0.00176	0.22488	0.80505
Error	0.046961	6	0.007827		
Total	0.050482	8			

Since p value (0.80505) > α value (0.05), there is no reason to reject H_o and conclude that there is no significant difference on the effect of feed on the average weight of chicken eggs.

Comparison of Two Means T-test for Average Chicken Weight

Table 6 : Average Chicken Weight using Metrovet, Top feed and Chikun for all the Five Months

Metrovet	Top feed	CHIKUN
1.5068	1.6063	2.0579
1.4474	1.9772	1.9679
1.5021	1.9416	2.2753

Hypothesis statement

H_0: There is no significant difference in the population mean weight of chicken with two poultry feeds

H_1: There is significant difference in the population mean weight of chicken with two poultry feeds

Level of significance $\alpha = 0.05$

Decision rule: Reject H_0 if P-value ≤ α-value

Table 7: Output of T-Test for Comparison of Two Means for Average Chicken Weight for Five Months

	Metrovet	Top feed	Metrovet	Chikun	Top feed	Chikun
Mean	1.485433	1.841706	1.485433	2.100363	1.841706	
Df	4		4		2.100363	
T Stat	-2.75557		-6.59688		4	
P(T<=t)	0.025541		0.002735		-1.73274	
					0.158176	

Table 8 : Decision for Comparison of Two Means for Average Chicken Weight for Five Months

Comparison of Two Means	P-value	Decision
Metrovet and Top feed	0.025541	Significant difference in the population mean weight
Metrovet and Chikun	0.002735	Significant difference in the population mean weight
Top feed and Chikun	0.158176	No Significant difference in the population mean weight

Comparison of Two Means for Average Chickens" Egg Weight

Table 9: Average Chicken Egg weight for Metrovet, Top feed and Chikun

Metrovet	Top feed	Chikun
0.201	0.328	0.413
0.203	0.315	0.4
0.2	0.302	0.4

Hypothesis statement

H_0: There is no significant difference in the population mean of chickens" egg weight with two poultry feeds

H_1: There is significant difference in the population mean of chickens" egg weight with two poultry feeds .

Table 10: Output of T-test for Comparison of Two Means for Average Chicken Egg Weight

	Metrovet	Top feed	Metrovet	Chikun	Top feed	Chikun
Mean	0.201333	0.315	0.201333	0.404167	0.315	0.404167
Df	4		4		4	
T Stat	-15.0409		-47.6249		-10.1868	
P(T<=t)	0.0000569		0.00000116		0.000523	

Table 11: Decision for Comparison of Two Means for Average Chicken Egg Weight

Comparison of Two Means	P-value	Decision
Metrovet and Top feed	0.0000569	Significant difference in the population mean of chickens" egg weight
Metrovet and Chikun	0.00000116	Significant difference in the population mean of chickens" egg weight
Top feed and Chikun	0.000523	Significant difference in the population mean of chickens" egg weight

4.0 Results and Discussion

The results obtained from the statistical analyses provide insight into the effects of three commercial poultry feeds—Metrovet, Topfeed, and Chikun—on the growth performance of layer chickens and the weight of eggs produced during the study period.

The Analysis of Variance (ANOVA) results presented in Table 3 revealed that there were no statistically significant differences ($p > 0.05$) in the average body weight of chickens fed the three different feed types throughout the five-month experimental period. Specifically, comparisons of mean body weights from the first month through the fifth month showed that the observed variations among the feed treatments were insufficient to establish significant differences in growth performance. This finding suggests that all three feed brands were capable of supporting comparable growth rates and body weight development in layer chickens under the conditions of this study.

Similarly, the ANOVA results presented in Table 5 indicated that there were no statistically significant differences ($p > 0.05$) in the average egg weights produced by chickens fed Metrovet, Topfeed, and Chikun feeds. Although minor variations in egg weights were observed among the treatment groups, these differences were not large enough to be considered statistically meaningful. This result implies that the three feed types provided similar nutritional support for egg formation and development.

To further examine the differences between specific feed brands, Independent Sample t-tests were conducted for pairwise comparisons of mean chicken weights. The results presented in Tables 7 and 8 showed statistically significant differences ($p < 0.05$) between Metrovet and Topfeed, as well as between Metrovet and Chikun. However, no statistically significant difference was observed between Topfeed and Chikun. These findings suggest that although the overall ANOVA detected no significant treatment

effect, Metrovet differed from the other two feeds when specific pairwise comparisons were considered.

Furthermore, the pairwise comparison of mean egg weights revealed statistically significant differences between all combinations of feed types. This indicates that individual feed brands may influence egg weight differently when directly compared, despite the absence of significant differences in the overall analysis of variance. Such variations may be attributed to differences in nutrient composition, feed digestibility, ingredient quality, or feed utilization efficiency among the feed brands.

The findings of this study generally suggest that the three feed types are capable of supporting similar growth performance and egg production in layer chickens. The absence of significant differences in the overall ANOVA analysis indicates that none of the feeds demonstrated a clear superiority over the others in terms of average body weight gain and average egg weight. This observation is consistent with previous studies that reported comparable poultry performance when feeds with similar nutritional compositions are used.

5.0 Conclusion

This study evaluated the effects of three commercial poultry feeds—Metrovet, Topfeed, and Chikun—on the growth performance and egg production of layer chickens over a five-month period. Based on the results obtained, it can be concluded that the type of feed administered did not significantly influence the overall body weight of the chickens or the average weight of eggs produced, as evidenced by the Analysis of Variance results.

The findings indicate that the use of any of the three feed brands is likely to produce comparable results in terms of chicken growth and egg production. Consequently, poultry farmers may select any of these feeds based on factors such as availability, cost, and management preferences without expecting substantial differences in overall performance.

However, the pairwise comparison of means revealed significant differences in chicken body weight between Metrovet and Topfeed and between Metrovet and Chikun, whereas no significant difference was observed between Topfeed and Chikun. This suggests that Metrovet may influence growth performance differently when compared directly with the other feed brands.

In addition, pairwise comparisons of egg weights showed statistically significant differences between all feed combinations, indicating that individual feed types may have varying influences on egg weight characteristics. Nevertheless, these differences were not sufficiently large to produce significant variation in the overall ANOVA analysis.

Overall, the study demonstrates that Metrovet, Topfeed, and Chikun feeds are all suitable for raising layer chickens and supporting egg production. Therefore, the general impact of the three feeds on chicken growth and egg production can be regarded as broadly similar, with no statistically significant differences observed in the overall treatment effects.

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