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AN ANALYSIS ON THE EFFECTIVENESS OF TWO BRANDS OF FEEDS ON THE WEIGHT OF BROILER CHICKENS: A CASE STUDY OF WISDOM POULTRY FARM, BESIDE NAZE CLUSTER MARKET OWERRI

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ABSTRACT: *This study compared two diffferent types of poultry feeds namely, Vital feed and Top feed commonly used in rearing birds in order to determine which of them is preferred over the other . The data used are the weigths (in kg) of 100 randomly selected 6-weeks broilers that were fed on the two poultry feeds. A crossover design was used to conduct the experiment. Analysis of variance and direct assay methods were used to analyze the research data. The study revealed through the analysis of variance method that there is no siginficant difference between the effects of the two feeds under study on the weight of the poultry birds. Moreover, the bioassay analysis revealed that even though the effects of the feeds on the weights of the poultry birds were insignificant, it is clear that Vital feed is more effective than Top feed in improving the weight of the poultry birds. Futhermore, it was recommened that Vital feed should be used over Top feed in rearing 6-weeks broilers since it's effect on the weights of the birds is more significant.*

KEYWORDS: Cross Over Design, Analysis of Variance, Bioassay Analysis, Poultry Feeds

INTRODUCTION

Poultry farms are farms that raise domesticated birds such as chickens, ducks, turkeys and geese for the purpose of farming meats and eggs for food. Poultry are farmed in great numbers with chicken being the most numerous. Chickens raised for eggs are usually called layers while chicken rose for meat are often called broilers (Egemonye, 2014).

The high demand for chicken meat and eggs has really proven that poultry farming in Nigeria is indeed a very lucrative business. The business of rearing of chickens and producing of eggs for sale has created an opportunity for some young graduates, retired civil servants and others to earn regular income and also to provide employment for countless number of Nigerians. The major buyers of chicken meat and eggs in the country are fast-food companies like, Mr. Biggs, Tantalizer, tasty-fried chicken, UAC, Crunches, Hotels, restaurants and various households nationwide. Chickens are also used in traditional caring rituals, means of knowing the time, offered as gifts and in cementing marriages and friendship. In communities where food shortages are uncommon, chickens are kept to supplement the meals or to honour a guest (Nwagu, 2002).

Most importantly, chickens support humans with high quality protein. In order to improve the production of poultry birds, especially chickens, there is need to feed them on highly nutritious livestock feeds. Poultry feeds are food for farm poultry including chickens, ducks, geese, and other domestic birds. Poultry feeds are referred to as "complete" feeds, because they are designed to contain all the protein, energy, vitamins, minerals, and other nutrients necessary for proper growth, egg production, and health of the birds (Firo, 2016). Modern feeds for poultry consist largely of grain protein supplements such as Soya bean oil meal, mineral supplement and Vitamin supplements. The quality of feed depends on the weight and age of the poultry, their rate of egg production, the weather condition, and the amount of nutrition the poultry obtain from foraging which results in a wide variety of feed formulations. The substitution of less expensive local ingredients introduces additional variations. Healthy poultry require a sufficient amount of protein and carbohydrates, along with the necessary vitamins, dietary minerals and an adequate supply of water. The feed must be clean and dry, contaminated feed can infect poultry.

There are many species of chickens; however, this study covers only 6–weeks broilers. Also, there are several competing poultry feeds in the market but this study focuses on only two: Vital feed and Top feed. Lastly, there were a large number of broilers in the poultry farm but this study randomly selected only 100 of them.

In order to address this problem of feed-selection amongst poultry farmers, this study was initiated. The objective is to determine the significance of the feed effects on the weight of broilers, to use bioassay to determine between top feed and vital feed, which is more effective in improving the weight of the poultry birds and to guide small scale poultry farmers on the appropriate feed for chicken production through the findings of this work.

LITERATURE REVIEW

Ojedapo (2013) evaluated the body weight and other linear parameters of Marshall Broiler for repeatability estimates. A total of one hundred (100) broiler chickens (Marshall) was used in estimating the repeatability of body weight and linear parameters of day old from 2 to 8 weeks of age. Body weight (BW) and other linear body parameters such as body length (BL), shank length (SL), thigh length (TL), breast girth (BG) and keel length (KL) were taken every two weeks. The mean values for body weight and other linear variables revealed increase for BW. Therefore, selection for improvement using any of the traits (body weight, breast girth and keel length) will result in good performance and a significant genetic gain throughout the lifetime of Marshall Broiler chickens.

Kperegbeyi (2009) in his paper stated that egg and meat production of local chicken (Gallus domesticus) is an indispensable component of household poultry development. The rapid production of local chicken has become a commercial trend in coastal regions of Niger Delta. Consumers prefer local chicken equally to that of cockerel and they consider it tastier than the broiler meat. Local chicken production management is easier than the broiler production particularly in the coastal regions where modern facilities including electric supply are not available.

Nworgu (2007) conducted an 8-week experiment to assess the weight gain and the economic importance of broiler chickens served fluted pumpkin leaf extract (FPLE) during the late dry season in Ibadan, Nigeria. One hundred and twenty-day-old Anak 2000 broiler chicks were randomly distributed to 5 treatments which contained 0, 30, 60, 90 and 120 ml of FPLE per litre of water for A, B, C, D and E, respectively, in a completely randomized design. Each treatment was replicated three times. The birds were fed with the same starter and finisher diets. The feed and water were served at the same time. The experiment lasted for 8 weeks. The FPLE is rich in protein (21.31%), ash (10.92%) and low in crude fibre, oxalate and tannin. Results of average body weight gain was significantly (P<0.05) different, which was least in control (1676.19 g/bird) compared to the birds served 30-120 ml of FPLE (1833.09-2089.70 g/bird). The cost of feed out of the total cost of production was least on the birds served 30- 120 ml of FPLE (61.79%) unlike control (66.21%). Benefit cost ratio (BCR) was best on the birds served 30-120 ml FPLE/l of water (1.91:1-2.06:1) compared to control (1.76:1). The net profit (NP) and cost of feed per kilogramme live weight gain were N307.13 and N87.50 /kg for the birds served 120 ml FPLE/litre of water compared to control (N208.17 and N96.52/kg), respectively. An average NP of N273.56 was made for the broiler chickens served 30-120 ml FPLE/l of water with reference to control (N208.17), which was a difference of N64.39 per bird. For improved growth rate and higher profit margin, it is advisable to serve broiler chickens 120 ml FPLE/litre of water during the late dry season. This is a simple, affordable and available technology for poultry farmers most especially during the harsh climatic period of the year.

Chehraghi et al (2013) determined the effects of different feed forms on performance in broiler chickens. Ninety-six broiler chickens of 1-day old divided in to 3 different feed treatment groups, namely: mash group, crumble group and pellet group. Each group was divided into 4 replications, consisted of 8 chickens each. The chickens were raised for 6 weeks. All chickens were weekly weight and feed consumption weekly measured in each group. The results showed that dietary treatment was significantly increase weight gain in crumble group and were significantly increase weekly feed intake in pellet group but not significantly increase FCR in mash group (p<0.05).

Sanusi (2015) conducted a study to evaluate growth performance, carcass characteristics, haematological parameters and cost effectiveness in broilers fed self-formulated and four commercial diets as coded T1 (Control diet), T2, T3, T4 and T5. A total of 220 Anak 2000 broiler chicks were allotted to five dietary treatments with 44 birds per diet and 11 birds per replicate in a completely randomized design. Feed and water were supplied *ad libitum* and the experiment lasted for 49 days. Most of the haematological parameters studied were within the normal range and were similar except white blood cell (2.18-3.28%) which was significantly affected (P < 0.01) by the dietary treatment. The feed cost per kilogram gained ranged between N124.67 – N190.29 ($0.86 – 1.31) with the lowest value obtained for the self-formulated diet which proved to be most economical.

Oyediji (2001) reported that feed accounts for not less than 70% of the cost of production in livestock enterprises. Therefore, there is the need to focus on efficient feed utilization, in order to maximize profits and avoid losses. Given the increasing number of people venturing into poultry business, there is no doubt, that there is a high demand for commercial feeds.

There is now the tendency for feed manufacturers to produce substandard feeds, especially as the quality control agencies in Nigeria are non-existent or non-functional (Okoli *et al.,* 2007; Omede, 2008., Okoli, et al., 2009). It appears that the farmer, consumer and the public at large are left at the mercy of commercial feed millers and feed raw materials producers and processors. Ordinarily, it appears that most poultry feeds are similar in composition and as such will meet the nutrient requirements of the birds to which they are fed. However, the feeds offered to birds are varied mixtures of ingredients, and considering the tendency of feed producers to maximize profit, there might be differences in the quality of the manufactured feeds sold in the market. It is important therefore, to ensure that quality compound feeds with appropriate nutritional values capable of achieving efficient production performance are patronized by the farmers.

Mohamed and Talha (2013), Desalew, *et. al.* (2013), Sogunle, *et. al.* (2014), Martin *et. el.* (2009), Aganga *et. al.* (2003), Ayorinde, *et. al.* (2012) and Chehraghi (2013) also conducted research in the area of the effect of feeds on the growth of poultry birds.

METHOD OF DATA ANALYSIS

Analysis of variance model for crossover designs and direct assay method were used for data analysis.

Analysis of Variance for Crossover Designs

A crossover design is a design in which each of the n subjects involved in the experiment receives each of the treatments, t in succession. This implies that the first randomly selected subjects, S_1, receives the first treatment, t_1, then t_2, then t_3, and so on in that order. The second subjects S_2, might receive the second treatment, t_2, first, t_1, then t_3, and so on, and other subjects equally receiving the treatments respectively in a similar succession.

The statistical model for the crossover design is given by;

$$X_{ijk} = \mu + r_i + c_j + t_k + e_{ijk} \qquad \left.\begin{array}{l} i = 1, 2, ..., n \\ j = 1, 2, ..., p \\ k = 1, 2, ..., p \end{array}\right\} \tag{3.1}$$

Assumptions of Anova

In order to employ Analysis of variance in this study, we make the following assumptions;

(i) Constant Variance: Bartletts test will be used to justify this assumption.

(ii) Normality: Normal probability plot will be used to justify this assumption.

The Least Squares Estimates of the parameters of the ANOVA Model for Crossover Design are given as follows;

$$\hat{\mu} = \overline{X}... = \frac{\sum_{i=1}^{n}\sum_{j=1}^{p}\sum_{k=1}^{p} X_{ijk}}{np} = \frac{X^2...}{np} \qquad (3.2)$$

$$\hat{r}_i = \overline{X}_i.. - \overline{X}... \qquad (3.3)$$

$$\hat{c}_j = \overline{X}._J. - \overline{X}... \qquad (3.4)$$

$$\hat{t}_k = \overline{X}.._K - \overline{X}... \qquad (3.5)$$

$$\hat{e}_{ijk} = X_{ijk} - \overline{X}... - \overline{X}_i.. - \overline{X}._j. - \overline{X}.._k + 2\overline{X}... \qquad (3.6)$$

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Where, $\bar{X}_{i\cdot\cdot} = \frac{\sum_{j=1}^{p} X_{ijk}}{n} = \frac{X_{i\cdot\cdot}}{n}$. (3.7)

$$\bar{X}_{\cdot j\cdot} = \frac{\sum_{j=1}^{n} X_{ijk}}{p} = \frac{X_{\cdot j\cdot}}{p} \quad (3.8)$$

$$\bar{X}_{\cdot\cdot k} = \frac{\sum_{j=1}^{p} X_{ijk}}{p} = \frac{X_{\cdot\cdot k}}{p} \quad (3.9)$$

The sums of squares for the ANOVA model for cross over design are computed by the following formulae; $SS_{Total} = \sum_{i=1}^{p}\sum_{j=1}^{n}\sum_{k=1}^{p} X^2_{ijk} - \frac{X^2\ldots}{np}$ (3.10)

$$SS_{Row}(Period) = \frac{\sum_{i=1}^{p} X^2_{i\cdot\cdot}}{n} - \frac{X^2\ldots}{np} \quad (3.11)$$

$$SS_{Coloumn}(Subject) == \frac{\sum_{j=1}^{n} X^2_{\cdot j\cdot}}{p} - \frac{X^2\ldots}{np} \quad (3.12)$$

$$SS_{Treatment}(Letters) = \sum_{k=1}^{p}\left(\bar{X}_{\cdot\cdot k} - \bar{X}\ldots\right)^2 \quad (3.13)$$

$$SS_{Error} = SS_{Total} - SS_{Period} - SS_{Birds} - SS_{Feeds} \quad (3.14)$$

The summary of the ANOVA for crossover design is presented in Table 3.1

Table 3.1: Anova Table for Crossover Designs

Source of Variation	**Degree of freedom**	**Sum of Squares**	**Mean sum of Squares**	**F-calculated**
Treatments (letters)	$p-1$	SSTreatments	$MS_{Trt} = \frac{SS_{Trt}}{P-1}$	$F_{Ratio} = \frac{MS_{Trt}}{MS_E}$
Periods (Rows)	$p-1$	SSPeriods	$MS_{Period} = \frac{SS_{Row}}{P-1}$	
Subjects (Columns)	$n-1$	SSSubjects	$MS_{Column} = \frac{SS_{Column}}{n-1}$	
Error	$(n-2)(P-1)$	SSError	$MS_E = \frac{SS_{Error}}{(n-2)(P-1)}$	
Total	np - 1	SSTotal		

H_O : The two feeds (A and B) have the same effect on the weight of broilers.

H_1 : There is a significant difference in the average impact of the two feeds (A and B) on the weight of broilers.

Decision Rule: The null hypotheses of equality of treatment (feed) effect on the weight of chicken is rejected if $F > F_{\alpha, P-1,(n-2)(p-1)}$ otherwise do not reject.

Direct Assay Method

In bioassay, an experiment is conducted with the aim of estimating the potency of a substance or to compare the efficacy of two or more substances by examining the reaction that follows when the substances are applied to living matter. In direct assays, however, the doses of standard and test preparations (i.e. poultry feeds) are administered to randomly select identical subjects (i.e. poultry birds). The administration of the stimuli is stopped as soon as the pre-assigned response has occurred. Relating this concept to the variables under study we will estimate the following means:

$$\bar{X}_A = \frac{\sum_i^{n_A} X_A}{n_A} \tag{3.15}$$

$$\bar{X}_B = \frac{\sum_i^{n_B} X_B}{n_B} \tag{3.16}$$

where; $\bar{X}_A$ is the average weight of six weeks broilers where feed A was administered to them $\bar{X}_B$ is the average weight of six weeks broilers when feed B was administered to them; consequently, the estimate of the relative potency is given by (Rangaswammy, 2010) as

$$R = \frac{\bar{X}_A}{\bar{X}_B} \tag{3.17}$$

If $R = 1$, the two feeds are equipotent, meaning that they have the same effects on the weight of six weeks broilers. If $R > 1$, the potency of feed B is greater than that of feed A, and If $R < 1$ the potency of feed B is smaller than that of feed A.

The confidence limits for R are calculated using Fiellers' theorem as

$$R_L < R < R_U \tag{3.18}$$

$$R_L = R - t_{\frac{\alpha}{2}, n_A+n_B-2} SE(R) \tag{3.19}$$

$$R_U = R + t_{\frac{\alpha}{2}, n_A+n_B-2} SE(R) \tag{3.20}$$

$$SE(R)=\sqrt{\frac{s^2}{b^2}\left[v_{11}+R^2v_{22}\right]} \tag{3.21}$$

$$s^2=\frac{(n_A-1)S_A^2+(n_B-1)S_B^2}{n_A+n_B-2} \tag{3.22}$$

$$S_A^2=\frac{\sum_{i}^{n_A}\left(X_A-\bar{X}_A\right)^2}{n_A-1} \tag{3.23}$$

$$S_B^2=\frac{\sum_{i}^{n_B}\left(X_B-\bar{X}_B\right)^2}{n_B-1} \tag{3.24}$$

$$v_{11}=\frac{1}{n_A} \tag{3.25}$$

$$v_{22}=\frac{1}{n_B} \tag{3.26}$$

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF REULTS

Table 4.1: Weight Gain (in kg) of 6-week Broiler after administering two types of feed on them

Poultry Birds	Periods for which feeds were administered	
	Period 1	Period 2
1	3.0	2.5
2	2.6	2.1
3	3.0	3.2
4	3.1	2.3
5	2.3	3.2
6	2.8	2.8
7	2.0	2.6
8	2.8	3.6
9	2.7	2.7
10	2.8	2.0
11	3.0	2.5
12	3.2	2.0
13	3.8	2.5
14	2.8	2.3
15	2.3	3.0
16	2.0	4.2
17	3.2	2.8

18	2.8	2.6
19	2.6	3.4
20	3.5	2.0
21	2.8	2.8
22	4.2	2.2
23	3.0	2.7
24	2.5	2.7
25	3.2	3.0
26	2.6	2.8
27	2.0	2.6
28	2.8	2.4
29	2.7	2.8
30	3.3	2.9
31	2.8	3.0
32	2.9	2.7
33	3.4	2.7
34	2.7	2.9
35	2.8	2.8
36	2.6	3.6
37	2.5	3.4
38	2.9	2.7
39	3.3	2.4
40	2.1	2.9
41	4.0	2.7
42	3.0	2.5
43	2.8	2.5
44	2.8	2.8
45	2.8	2.3
46	3.2	3.2
47	2.7	3.2
48	3.5	2.5
49	3.0	2.5
50	2.8	2.7
51	2.6	2.1
52	2.8	2.6
53	3.0	3.2
54	2.8	2.8
55	3.1	2.3
56	2.0	2.8
57	2.3	3.2
58	2.7	3.2
59	2.8	2.8
60	2.7	2.6
61	2.0	2.6
62	3.5	2.8
63	2.8	3.6

64	2.7	3.5
65	2.7	2.7
66	2.6	3.2
67	2.8	2.0
68	2.8	2.8
69	3.0	2.5
70	2.4	2.8
71	3.2	2.0
72	2.6	2.7
73	3.8	2.5
74	2.4	2.5
75	2.8	2.3
76	2.8	2.5
77	2.3	3.0
78	2.0	4.2
79	2.8	2.7
80	3.2	2.8
81	3.0	2.8
82	2.8	2.6
83	2.8	2.6
84	2.8	3.5
85	3.8	2.7
86	2.6	3.4
87	3.5	2.0
88	3.8	2.5
89	2.8	2.8
90	4.2	2.2
91	2.5	3
92	2.3	2.6
93	4.0	2.6
94	3.0	2.7
95	3.6	2.7
96	2.5	2.7
97	3.2	2.6
98	3.2	3.0
99	2.6	2.8
100	4.2	2.3

Source: WISDOM Poultry Farms, 2019.

Analysis of Variance on the Crossover Design

Table 4.2: Necessary totals for analysis of variance

Poultry Birds	Periods for which feeds were administered		Total
	Period 1	Period 2	
1	3	2.5	5.5
2	2.6	2.1	4.7
3	3	3.2	6.2
4	3.1	2.3	5.4
5	2.3	3.2	5.5
6	2.8	2.8	5.6
7	2	2.6	4.6
8	2.8	3.6	6.4
9	2.7	2.7	5.4
10	2.8	2	4.8
11	3	2.5	5.5
12	3.2	2	5.2
13	3.8	2.5	6.3
14	2.8	2.3	5.1
15	2.3	3	5.3
16	2	4.2	6.2
17	3.2	2.8	6
18	2.8	2.6	5.4
19	2.6	3.4	6
20	3.5	2	5.5
21	2.8	2.8	5.6
22	4.2	2.2	6.4
23	3	2.7	5.7
24	2.5	2.7	5.2
25	3.2	3	6.2
26	2.6	2.8	5.4
27	2	2.6	4.6
28	2.8	2.4	5.2
29	2.7	2.8	5.5
30	3.3	2.9	6.2
31	2.8	3	5.8
32	2.9	2.7	5.6
33	3.4	2.7	6.1
34	2.7	2.9	5.6
35	2.8	2.8	5.6
36	2.6	3.6	6.2
37	2.5	3.4	5.9
38	2.9	2.7	5.6
39	3.3	2.4	5.7
40	2.1	2.9	5
41	4	2.7	6.7

42	3	2.5	5.5
43	2.8	2.5	5.3
44	2.8	2.8	5.6
45	2.8	2.3	5.1
46	3.2	3.2	6.4
47	2.7	3.2	5.9
48	3.5	2.5	6
49	3	2.5	5.5
50	2.8	2.7	5.5
51	2.6	2.1	4.7
52	2.8	2.6	5.4
53	3	3.2	6.2
54	2.8	2.8	5.6
55	3.1	2.3	5.4
56	2	2.8	4.8
57	2.3	3.2	5.5
58	2.7	3.2	5.9
59	2.8	2.8	5.6
60	2.7	2.6	5.3
61	2	2.6	4.6
62	3.5	2.8	6.3
63	2.8	3.6	6.4
64	2.7	3.5	6.2
65	2.7	2.7	5.4
66	2.6	3.2	5.8
67	2.8	2	4.8
68	2.8	2.8	5.6
69	3	2.5	5.5
70	2.4	2.8	5.2
71	3.2	2	5.2
72	2.6	2.7	5.3
73	3.8	2.5	6.3
74	2.4	2.5	4.9
75	2.8	2.3	5.1
76	2.8	2.5	5.3
77	2.3	3	5.3
78	2	4.2	6.2
79	2.8	2.7	5.5
80	3.2	2.8	6
81	3	2.8	5.8
82	2.8	2.6	5.4
83	2.8	2.6	5.4
84	2.8	3.5	6.3
85	3.8	2.7	6.5
86	2.6	3.4	6
87	3.5	2	5.5

88	3.8	2.5	6.3
89	2.8	2.8	5.6
90	4.2	2.2	6.4
91	2.5	3	5.5
92	2.3	2.6	4.9
93	4	2.6	6.6
94	3	2.7	5.7
95	3.6	2.7	6.3
96	2.5	2.7	5.2
97	3.2	2.6	5.8
98	3.2	3	6.2
99	2.6	2.8	5.4
100	4.2	2.3	6.5
Total	289.2	274.6	563.8

Table: 4.3 Treatment Totals Computed from Table 4.2

S/No	**Treatment A**	**Treatment B**
1	3	2.6
2	3	3.1
3	2.3	2
4	2.8	2.7
5	2.8	3
6	2.8	2.8
7	3.2	2
8	3.8	2.6
9	2.3	2.8
10	3.2	3
11	2.8	3.2
12	3.5	2
13	4.2	3.3
14	2.5	2.5
15	2.6	3.2
16	2.8	3.2
17	2.7	2.8
18	2.8	3.6
19	2.9	2
20	2.1	2
21	2.3	2.5
22	2.6	3
23	2.7	2.8
24	2.5	2.6
25	2.3	2
26	4.2	2.2

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27	3.4	2.7
28	2.8	2.8
29	2.7	2.4
30	3	2.8
31	2.6	3
32	2.9	2.7
33	2.8	3.4
34	2.6	2.7
35	2.1	2.5
36	4	2.9
37	2.8	3.3
38	3.2	3
39	2.7	2.8
40	3	2.8
41	2.8	3.5
42	3	2.8
43	3.1	2.6
44	2.3	2.8
45	2.8	2
46	3.5	2.7
47	2.8	2.7
48	2.7	2
49	2.9	2.7
50	3.4	2.7
51	2.7	2.8
52	2.4	3.6
53	2.5	2.9
54	2.5	2.7
55	2.3	2.8
56	2.5	3.2
57	2.7	3.2
58	2.1	2.5
59	2.8	2.6
60	2.8	3.2
61	3.2	2.3
62	2.6	3.2
63	2.6	2.8
64	3.5	2.8
65	2.6	3.6
66	2.8	2.7
67	2.4	2.8
68	2.6	3
69	3.8	3.2
70	2.8	2.4
71	2.3	2.8
72	3.2	2

73	3	2.8
74	2.8	2.8
75	3.8	2.8
76	3.5	2.6
77	3.8	2.8
78	4.2	2.5
79	2.3	3
80	4	3.6
81	2.5	3.2
82	3.2	4.2
83	2.6	3.2
84	2.8	2
85	2.5	2.8
86	2	2.7
87	2.5	2.5
88	2.3	2.5
89	4.2	3
90	2.7	2.8
91	2.6	2.8
92	3.5	2.6
93	3.4	2.7
94	2.8	2
95	3	2.5
96	2.7	2.2
97	2.7	2.6
98	3	2.6
99	2.3	2.7
100	2.8	2.6
Total	**287.8**	**276.0**

Applying Equation (3.10) to data of Table 4.1, we obtain the sum of squares total as

$$SS_{Total} = 1632.56 - \frac{(563.8)^2}{100(2)} = 43.2078$$

Applying Equation (3.11) to data of Table 4.1, we obtain the sum of squares Period as

$$SS_{Row}(Period) = \frac{(289.2)^2}{100} + \frac{(274.6)^2}{100} - \frac{(563.8)^2}{100(2)} = 1.0658$$

Applying Equation (3.12) to data of Table 4.1, we obtain the sum of squares Subjects as

$$SS_{Coloumn}(Subject) = \frac{(3203.94)}{2} - \frac{(563.8)^2}{100(2)} = 12.6178$$

Applying Equation (3.13) to data of Table 4.1, we obtain the sum of squares Treatments as

$$SS_{Treatment}(Letters) = \frac{(287.8)^2}{100} + \frac{(276.0)^2}{100} - \frac{(563.8)^2}{100(2)} = 0.6962$$

Applying Equation (3.14) to data of Table 4.1, we obtain the sum of squares total as

$$SS_{Error} = 43.2078 - 1.0658 - 12.6178 - 0.6962 = 31.828$$

Table 4.4: Anova Table for weight of 6-weeks broiler fed on two different feeds

Source of variation	**Degree of freedom**	**Sum of Squares**	**Mean sum of Squares**	**F_{-cal}**
Treatments(letters)	1	0.6962	0.6962	2.1435
Periods (Rows)	1	1.0658	1.0658	
Subjects (Columns)	99	12.6178	0.1275	
Error	98	31.8280	0.3248	
Total	199	43.2078		

REMARKS: At $\alpha = 0.05$, $F_{0.05,1,98} = 3.96$, hence we conclude that the two feeds under investigation are not significantly different in their effects on the weight of the 6 weeks old broilers.

Estimation of the Relative Potency of the effects of the Feeds on weights of the Poultry Birds

Table 4.5: Necessary totals for estimation of relative potency and fiducial limits

S/No	X_A	X_B	$(X_A - \bar{X}_A)$	$(X_B - \bar{X}_B)$	$(X_A - \bar{X}_A)^2$	$(X_B - \bar{X}_B)$
1	3	2.6	0.122	-0.16	0.014884	0.0256
2	3	3.1	0.122	0.34	0.014884	0.1156
3	2.3	2	-0.578	-0.76	0.334084	0.5776
4	2.8	2.7	-0.078	-0.06	0.006084	0.0036
5	2.8	3	-0.078	0.24	0.006084	0.0576
6	2.8	2.8	-0.078	0.04	0.006084	0.0016
7	3.2	2	0.322	-0.76	0.103684	0.5776
8	3.8	2.6	0.922	-0.16	0.850084	0.0256
9	2.3	2.8	-0.578	0.04	0.334084	0.0016
10	3.2	3	0.322	0.24	0.103684	0.0576
11	2.8	3.2	-0.078	0.44	0.006084	0.1936
12	3.5	2	0.622	-0.76	0.386884	0.5776
13	4.2	3.3	1.322	0.54	1.747684	0.2916
14	2.5	2.5	-0.378	-0.26	0.142884	0.0676
15	2.6	3.2	-0.278	0.44	0.077284	0.1936
16	2.8	3.2	-0.078	0.44	0.006084	0.1936

17	2.7	2.8	-0.178	0.04	0.031684	0.0016
18	2.8	3.6	-0.078	0.84	0.006084	0.7056
19	2.9	2	0.022	-0.76	0.000484	0.5776
20	2.1	2	-0.778	-0.76	0.605284	0.5776
21	2.3	2.5	-0.578	-0.26	0.334084	0.0676
22	2.6	3	-0.278	0.24	0.077284	0.0576
23	2.7	2.8	-0.178	0.04	0.031684	0.0016
24	2.5	2.6	-0.378	-0.16	0.142884	0.0256
25	2.3	2	-0.578	-0.76	0.334084	0.5776
26	4.2	2.2	1.322	-0.56	1.747684	0.3136
27	3.4	2.7	0.522	-0.06	0.272484	0.0036
28	2.8	2.8	-0.078	0.04	0.006084	0.0016
29	2.7	2.4	-0.178	-0.36	0.031684	0.1296
30	3	2.8	0.122	0.04	0.014884	0.0016
31	2.6	3	-0.278	0.24	0.077284	0.0576
32	2.9	2.7	0.022	-0.06	0.000484	0.0036
33	2.8	3.4	-0.078	0.64	0.006084	0.4096
34	2.6	2.7	-0.278	-0.06	0.077284	0.0036
35	2.1	2.5	-0.778	-0.26	0.605284	0.0676
36	4	2.9	1.122	0.14	1.258884	0.0196
37	2.8	3.3	-0.078	0.54	0.006084	0.2916
38	3.2	3	0.322	0.24	0.103684	0.0576
39	2.7	2.8	-0.178	0.04	0.031684	0.0016
40	3	2.8	0.122	0.04	0.014884	0.0016
41	2.8	3.5	-0.078	0.74	0.006084	0.5476
42	3	2.8	0.122	0.04	0.014884	0.0016
43	3.1	2.6	0.222	-0.16	0.049284	0.0256
44	2.3	2.8	-0.578	0.04	0.334084	0.0016
45	2.8	2	-0.078	-0.76	0.006084	0.5776
46	3.5	2.7	0.622	-0.06	0.386884	0.0036
47	2.8	2.7	-0.078	-0.06	0.006084	0.0036
48	2.7	2	-0.178	-0.76	0.031684	0.5776
49	2.9	2.7	0.022	-0.06	0.000484	0.0036
50	3.4	2.7	0.522	-0.06	0.272484	0.0036
51	2.7	2.8	-0.178	0.04	0.031684	0.0016
52	2.4	3.6	-0.478	0.84	0.228484	0.7056
53	2.5	2.9	-0.378	0.14	0.142884	0.0196
54	2.5	2.7	-0.378	-0.06	0.142884	0.0036
55	2.3	2.8	-0.578	0.04	0.334084	0.0016
56	2.5	3.2	-0.378	0.44	0.142884	0.1936
57	2.7	3.2	-0.178	0.44	0.031684	0.1936
58	2.1	2.5	-0.778	-0.26	0.605284	0.0676
59	2.8	2.6	-0.078	-0.16	0.006084	0.0256
60	2.8	3.2	-0.078	0.44	0.006084	0.1936
61	3.2	2.3	0.322	-0.46	0.103684	0.2116
62	2.6	3.2	-0.278	0.44	0.077284	0.1936

63	2.6	2.8	-0.278	0.04	0.077284	0.0016
64	3.5	2.8	0.622	0.04	0.386884	0.0016
65	2.6	3.6	-0.278	0.84	0.077284	0.7056
66	2.8	2.7	-0.078	-0.06	0.006084	0.0036
67	2.4	2.8	-0.478	0.04	0.228484	0.0016
68	2.6	3	-0.278	0.24	0.077284	0.0576
69	3.8	3.2	0.922	0.44	0.850084	0.1936
70	2.8	2.4	-0.078	-0.36	0.006084	0.1296
71	2.3	2.8	-0.578	0.04	0.334084	0.0016
72	3.2	2	0.322	-0.76	0.103684	0.5776
73	3	2.8	0.122	0.04	0.014884	0.0016
74	2.8	2.8	-0.078	0.04	0.006084	0.0016
75	3.8	2.8	0.922	0.04	0.850084	0.0016
76	3.5	2.6	0.622	-0.16	0.386884	0.0256
77	3.8	2.8	0.922	0.04	0.850084	0.0016
78	4.2	2.5	1.322	-0.26	1.747684	0.0676
79	2.3	3	-0.578	0.24	0.334084	0.0576
80	4	3.6	1.122	0.84	1.258884	0.7056
81	2.5	3.2	-0.378	0.44	0.142884	0.1936
82	3.2	4.2	0.322	1.44	0.103684	2.0736
83	2.6	3.2	-0.278	0.44	0.077284	0.1936
84	2.8	2	-0.078	-0.76	0.006084	0.5776
85	2.5	2.8	-0.378	0.04	0.142884	0.0016
86	2	2.7	-0.878	-0.06	0.770884	0.0036
87	2.5	2.5	-0.378	-0.26	0.142884	0.0676
88	2.3	2.5	-0.578	-0.26	0.334084	0.0676
89	4.2	3	1.322	0.24	1.747684	0.0576
90	2.7	2.8	-0.178	0.04	0.031684	0.0016
91	2.6	2.8	-0.278	0.04	0.077284	0.0016
92	3.5	2.6	0.622	-0.16	0.386884	0.0256
93	3.4	2.7	0.522	-0.06	0.272484	0.0036
94	2.8	2	-0.078	-0.76	0.006084	0.5776
95	3	2.5	0.122	-0.26	0.014884	0.0676
96	2.7	2.2	-0.178	-0.56	0.031684	0.3136
97	2.7	2.6	-0.178	-0.16	0.031684	0.0256
98	3	2.6	0.122	-0.16	0.014884	0.0256
99	2.3	2.7	-0.578	-0.06	0.334084	0.0036
100	2.8	2.6	-0.078	-0.16	0.006084	0.0256
Total	287.8	276	0.00	0.00	25.1916	17.32

Applying Equations (3.15) and (3.16), we obtain the average effects of feeds A and B respectively on the weights of 6 weeks old as follows;

$$\overline{X}_A = \frac{287.8}{100} = 2.878 \quad while \quad \overline{X}_B = \frac{276.0}{100} = 2.760$$

Suppose feed A is to be regarded as the standard preparation, and feed B is to be compared with it as a test preparation, then the mean of feed A effect obtained using Equation (3.17).

$$R = \frac{2.878}{2.760} = 1.0428$$

REMARKS: Since**,** $R = 1.0428 > 1$ then it means that one kg of feed B is equivalent to 1.0428 kg of feed A. this is an indication that feed A is more effective in improving the weight of 6 weeks broilers than feed B.

Applying Equation (3.25), (3.26), (3.23), (3.24), (3.22), (3.21), (3.19), (3.20), (3.18) on data of Table 4.2, we obtain $v_{11} = \frac{1}{100} = 0.01 \quad and \quad v_{22} = \frac{1}{100} = 0.01$

$$S_A^2 = \frac{25.1916}{100-1} = 0.2545 \quad and \quad S_B^2 = \frac{17.32}{100-1} = 0.1750$$

$$S^2 = \frac{(100-1)(0.2545) + (100-1)(0.1750)}{100+100-2} = 0.2148$$

$$SE(R) = \sqrt{\frac{0.2148}{(2.760)^2}\left[0.01 + (1.0428)^2(0.01)\right]} = 0.0243$$

$$R_L = 1.0428 - 1.96(0.0243) = 0.9952$$

$$R_U = 1.0428 + 1.96(0.0243) = 1.0904$$

Using Equation (3.18), the fiducial limits are obtained as $R_L = 0.9952 < R < R_U = 1.0904$

REMARKS: We are 95% confident that one kg of feed B is not less potent than 0.9952 kg of A, and not more than 1.0904 kg of A.

FINDINGS

The analysis of variance results of the crossover design shows that the effect of vital feed and Top feed on the weight of chickens are not significantly different. Also, the result of the bioassay shows that vital feed is more effective in improving the weight of Chickens as compared to the Top feed.

CONCLUSION

This study compared two selected poultry feeds in order to determine their effects on the weight of poultry birds. Random samples of 100, 6-weeks broilers were used to perform the experiment in which a crossover design was utilized. Analysis of variance was used to analyze the responses from the experiment and at the end of the analysis it was observed that the effect of the feeds on the weights of the 6-weeks broilers were not the same. A further analysis was then carried out using direct bioassay method to determine which of the feed is more effective in improving the weight of the broilers. The findings show that vital feed is more effective than Top feed.

RECOMMENDATIONS

Consequent upon findings and conclusion of this study, it is recommended that mostly farmers who rear broilers up to 6-weeks should use the vital feed on their chickens as this would improve the weights of the chicken and consequently improve the prices of the chickens.

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