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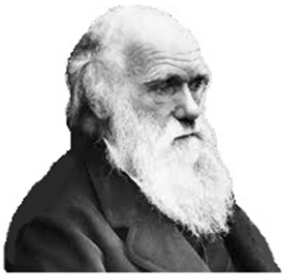

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Growth Performance and Developmental Response of Broiler Chickens to Compounded versus Commercial Feeds

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ABSTRACT

The rising expense of commercial feed in Nigeria has driven the quest for effective alternatives. A promising suitable option is the formulation of compounded feed and its usefulness is investigated in this study. Conducted in the Animal House Unit in the Department of Genetics and Biotechnology for nine weeks, this research was performed to compare the growth metrics and development of birds by analyzing parameters such as feed intake, feed conversion ratio, body weight, and mortality rate for those fed commercial versus compounded feed. This experiment included a total of 20 broiler chicks. They were fed commercial feed from week 0 to week 5. Within the finishing phase (weeks 5-9), they were randomly assigned into two categories: the reference group continued feeding on the commercial feed and the other group was fed with the formulated feed. Results showed that weight gain between birds fed commercial feed and those fed formulated feed did not differ significantly as shown in Table 7. Although there was a Least Significant Difference (LSD) in feed intake and feed conversion ratios between broilers fed commercial feed versus those fed formulated feed, the overall weight gain showed no significant difference. However, birds fed commercial feed had the highest mean body weight but this did not differ significantly ($p<0.05$) as indicated by Analysis of Variance (ANOVA). Given that compound feed is considerably more affordable than commercial feed, this research finds that poultry producers can benefit from utilizing compounded feeds based on their cost-effectiveness and potential for higher profitability. Nonetheless, extension specialists, poultry owners and researchers must carefully consider the potential risks. It is highly recommended that regulatory bodies develop and implement measures to ensure some quality control for compounded feeds.

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***Keywords*:** Development, Growth Performance, Poultry feeds, Broiler

1. INTRODUCTION

The development of the broiler industry as a means of bridging the food and nutrition gap in most countries has been attracting great attention (Dieye *et al*., 2010; Marcu *et al*., 2013). Globally, growing demand for poultry products cannot be over-emphasized (Ekpo *et al*., 2019; Ushie, *et al*., 2025). Unfortunately, the growth of the broiler sector in most developing countries are constrained by the spiraling feed cost due to rising prices of feed ingredients particularly protein supplements (Abbas, 2013).

Feed is a key component influencing net returns in poultry industry as feed cost accounts for about 60 to 80% of broiler production and it is a major factor that affects the production cost (Larry, 1993; Dozier *et al*., 2010; Chen *et al*., 2013). Food grains for human consumption are in high demand and they compete with poultry for feed production; as a result, the cost of commercial feed is high and mostly erodes profit for small-scale poultry farmers (Helena, 2021).

According to Ibrahim and Balarabe (2023), various administrations have primarily focused on establishing local poultry production and its products within the livestock sector in Nigeria. The objective is to improve protein availability for the population while also increasing the earnings of small-scale farmers. A vital factor in achieving this aim is decreasing feed costs that account for more than 70 percent of production expenses as well as significantly impacting farmers' profits.

In many developing nations including Nigeria, the consumption of animal protein is relatively minimal, this is often attributed to the high costs of animal products which are largely a result of the steep costs associated with production inputs, especially feed. Feed is widely considered a significant portion of the overall expense in poultry production.

There has been a significant disparity between the production and availability of animal protein to support Nigeria's growing population of over 140 million (NPC, 2006), which has led to low per capita consumption of these products. Additionally, the prices of traditional feed ingredients like maize, fish meal, soybeans and food processing by-products have been rising annually, contributing to increased costs for animal products, particularly animal protein (Adejinmi *et al.*, 2007).

The high costs and competition for certain feed ingredients between humans and livestock have led to a search for alternative options. While the exact number of operational feed mills is unclear, only a few are committed to ensuring the quality of their products. Farmers who lack the necessary tools to test and oversee the quality of commercial feeds frequently turn to unconventional feed ingredients to help lower production costs. Numerous commercial poultry farms have gone out of business while many others are facing sluggish growth due to a sudden rise in the price of poultry feed (Ogundipe, 2002; Bregendahl *et al*., 2002).

Nevertheless, the incorporation of unconventional ingredients can lead to poor nutrition due to anti-nutrient effect, low nutrient quality and imbalances in nutrient composition. Doma *et al.* (2001) and Uchegbu *et al.* (2007) highlighted deficiencies in certain commercial feeds which correlated with unsatisfactory output in birds fed these diets. Assessing how feed influences bird performance is regarded as the most accurate method for determining feed

quality. A variety of research efforts have been carried out on feed formulation to help decrease the expenses associated with commercial feed in poultry production. In Nigeria, Sanusi *et al.* (2015) studied the effect of a compounded diet on the growth metrics of broiler birds relative to the commercial diet. The research found that using self-formulated feed can be a cost-effective option for broilers during the finishing phase, enhance profitability for farmers while maintaining the bird's growth, internal organ health and haematological parameters. Samuel *et al.* (2018) found that processed millet waste could substitute for maize in broiler diets by as much as 80% without negatively affecting growth performance and characteristics. They also noted that incorporating millet waste meal into the diet enhanced revenue, resulting in greater financial benefits for farmers.

In 2015, Samuel *et al.* conducted research on how self-formulated diets could lower poultry feed expenses which resulted in about a 78% decrease. They concluded that effective planning can lead to significant reductions in feed cost without negatively impacting the broiler's health.

After studying the preferences of poultry producers regarding commercial and compounded feeds in Oyo State, Apantaku *et al.* (2020) discovered a correlation between farmers' feed choices as well as factors such as feed cost, quality and accessibility of feed ingredients. However, poultry farmers prefer compounded diets based on cost and quality (Rahimi *et al*., 2011). The cost of feed along with its quality plays a significant role in shaping farmers' preferences for commercial versus self-compounded feed (Adebayo *et al*. 2002; Umeh and Odo (2002).

Given this context, this research was undertaken to compare the effectiveness of commercial and compounded feed based on the growth performance of broiler birds. The study aims to determine the development of broilers when fed with compounded and commercial feeds, analyzing their performance metrics and comparing the feeds based on growth metrics such as body weight, size, and feed conversion ratio, along with the overall development of birds.

2. MATERIALS AND METHODS

The study took place at the Animal House Unit within the Department of Genetics and Biotechnology at the University of Calabar, Calabar, Nigeria. Twenty-day-old commercial birds were sourced from a well-known farm located on Murtala Mohammed Highway in Calabar, Cross River State, Nigeria. Experimental materials used for the study include; Feeders, drinkers, kerosene lamps, clean water which constitutes about 65% of the total body weight of eggs (Scott and Kenneth 2000), wood shavings, compounded feed ingredients, electronic weighing balance, and commercial feed. The commercial super starter feed was purchased from a reputable commercial feed vendor at Gabty Agric Services, Calabar, Nigeria. On arrival of the birds, they were weighed individually and housed together in a large cage constructed in the animal house, well equipped with facilities to deliver feed and water including ventilation systems that would prevent ammonia build-up. Anyanwu *et al.* (2002) advise against overcrowding in poultry housing, as it can lead to issues like cannibalism and pecking among the birds. Feed, vaccinations, and medications were administered daily to the birds to prevent diseases. During the initial phase, all birds were given similar commercial feed while being maintained under identical conditions for five weeks, water was also made available.

After week five, the completely randomized design was applied in dividing birds into two treatment groups with ten birds each, the birds were then provided feed in accordance with their assigned treatment level. The treatment levels consist of one low-cost compounded feed and one commercial diet serving as a control. According to Aviagu (2005), achieving sufficient feed intake is crucial for promoting healthy chicken growth and maximizing nutrient efficiency, he further elucidated that a poor feed form will inhibit feed intake and have a negative impact on growth rate. The compounded feed was made using local ingredients and was formulated to meet the various nutrient requirements of birds (Oluyemi and Roberts 2002) using the freehand method in the animal house. Table 1 shows the dietary percentage formulation at the finisher phase (5-9 weeks).

3. RESULTS AND DISCUSSION

Table 1. Dietary percentage formulation for broilers during the finisher phase (5-9 weeks).

Ingredients	**Percentage Formulation**
Maize	44.00
Soya bean	34.00
Groundnut	2.00
Crayfish	12.00
Fish	4.00
Salt	0.25
Bone	3.00
Premix	0.25
Methionine	0.25
Lysine	0.25
Total	**100**
Calculated analysis	
Crude protein	21.05
Crude fibre	3.60
Calcium	1.19

Phosphorus	ND
Methionine	ND
Lysine	ND
ME (Ken/kg)	ND

ND – not determined

The evaluated development and growth variables included Body Weight, Feed Intake, Mortality Rate, and Feed Conversion Ratio. To assess the average body weight gain, broilers were weighed weekly, daily records were maintained for mortality rate and Feed Intake for each group while Feed Conversion Ratio was calculated every week. This ratio was obtained by dividing the total feed consumed in kilograms by the weight gain.

This research utilized the completely randomized design (CRD), all information gathered was analyzed through one-way ANOVA and to separate the difference significantly between treatment means at $P<0.05$, least significant differences (LSD) technique was employed.

The outcome of the overall performance of two groups of birds fed with commercial and compounded feed. Table 2 displays the mean body weight, feed intake, and feed conversion ratio.

Table 2. Overall Performance of birds fed commercial feed versus compounded feed.

Variables/Duration	Week One		Week Two		Week Three		Week Four	
	Commercial Feed	Formulated Feed	Commercial Feed	Formulated Feed	Commercial Feed	Formulated Feed	Commercial Feed	Formulated Feed
Weight Gain (kg)	1.30^{a} ± 0.13	1.23^{a} ± 0.42	1.45^{c} ± 0.15	1.39^{c} ± 0.49	1.79^{e} ± 0.22	1.63^{f} ± 0.64	2.00^{k} ± 0.18	1.63^{k} ± 1.03
Feed Intake (kg)	1.24^{a} ± 0.11	0.97^{a} ± 0.14	1.38^{b} ± 0.18	1.32^{b} ± 0.02	1.42^{c} ± 0.09	1.38^{c} ± 0.08	1.30^{d} ± 0.12	1.36^{e} ± 0.11
Feed Conversion Ratio	0.70^{a} ± 0.03	0.52^{b} ± 0.01	0.67^{c} ± 0.06	0.66^{c} ± 0.04	0.55^{d} ± 0.03	0.56^{d} ± 0.03	0.57^{e} ± 0.01	0.56^{e} ± 0.03
Mortality	0	0	0	0	1		0	1N

* The outcome is expressed as mean ± standard error
* Means with distinct superscript within every horizontal column differ significantly ($p>0.05$)

By the conclusion of the study, it was recorded that birds receiving commercial feed achieved the greatest body weight feed intake and feed conversion. Analysis of variance

(ANOVA) showed no difference significantly ($p<0.05$) in the gained body weight, feed intake, and feed conversion ratio between birds fed commercial feed and those fed compounded feed. The feed intake result shows no difference significantly ($p<0.05$) in feed intake between birds fed with commercial feed and those fed with formulated. Though those fed with commercial feed had the highest feed intake (1.33 ± 0.14), it was not significant ($p<0.05$) (Table 3). ANOVA also showed no difference significantly ($p<0.05$) between those fed with commercial feed and formulated (Table 4 and Figure 1).

Table 3. Age Effect (weeks) on Feed intake (kg) Within Treatment Clusters.

TREATMENT	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR
Commercial Feed	$1.24^{a} \pm 0.11$	$1.38^{c} \pm 0.5$	$1.42^{n} \pm 0.22$	$1.30^{b} \pm 0.18$
Formulated Feed	$0.97^{a} \pm 0.14$	$1.32^{c} \pm 0.02$	$1.38^{j} \pm 0.04$	$1.36^{b} \pm 1.03$

* The outcome is expressed as mean ± standard error
* Means with different superscript differ significantly ($p>0.05$)

Feed Conversion Ratio result shows there were no significant differences ($p<0.05$) between broiler birds although, those fed formulated feed had the greatest mean feed utilization ratio (0.62 ± 0.07), which still does not differ significantly ($p<0.05$) (Table 5). The ANOVA results also indicated no difference significantly ($p<0.05$) between those fed with commercial and compounded feed (As shown in Figure 1).

A low mortality rate was recorded as the control group (birds fed with commercial feed) had just one mortality at week three while the treatment group (birds fed with compounded feed) had one mortality at week 4 (Table 6).

The outcome of body weight did not differ significantly ($p<0.05$) in the body weight between birds fed commercial feed and those fed formulated feed. Though those fed with commercial feed had the highest mean body weight (1.58 ± 0.32) (Table 7), it was not statistically significant ($p<0.05$) (See Table 8). ANOVA also showed no significant difference ($p<0.05$) between those fed with commercial feed and formulated (Table 8 and Figure 2). This study aligns with the work of Samuel *et al.* (2015) who investigated the effect of a compounded diet on the growth metrics of broiler birds relative to the commercial diet.

Given the rising costs of livestock feed and the observed shortages as well as the unaffordability of conventional proteins and animal concentrates, poultry farmers have to explore the use of alternative sources that can provide a more economical production cost. This necessity drives the exploration of non-conventional feed materials that may serve as viable ingredients in poultry diets. However, the research on the impact of commercial feed and compounded feed on growth parameters in broiler birds showed that weight gain between the birds did not differ significantly (Table 8 and Figure 2). Although there was minimal significant variation in feed intake and feed conversion, overall weight gain did not reflect any significant difference. Results from the study show that local ingredients can be sourced to formulate feed, which will not only cut costs in poultry farming but also result in good growth indices.

Table 4. Statistical Analysis
Anova for Feed Intake

SOV	SS	DF	MS	F	Sig.
Intercept	94.614	1	94.614	6794.252	4.01
Treatment	0.087	1	0.087	6.263	4.01
Duration	0.724	3	0.241	17.322	2.77
Treatment* Duration	0.197	3	0.066	4.72	0.277
Error	0.668	56	0.014		
Total	96.289	55			

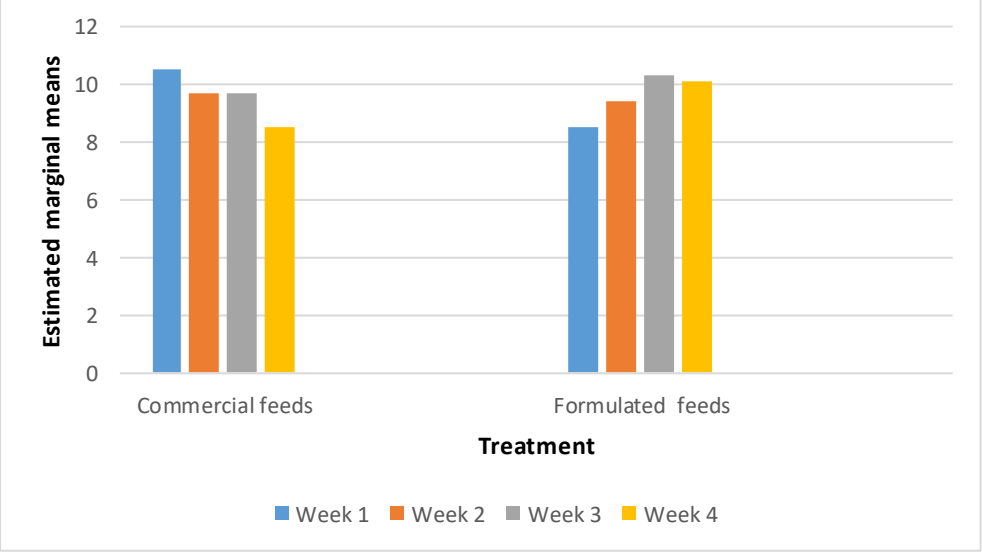

Figure 1. Estimated marginal mean of feed intake

Table 5. Effect of Age (weeks) on Feed Conversion Ratio (kg) Within Treatment Clusters

TREATMENT	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR
Commercial Feed	$0.70^{a} \pm 0.03$	$0.67^{c} \pm 0.06$	$0.55^{n} \pm 0.03$	$0.57^{b} \pm 0.01$
Formulated Feed	$0.52^{k} \pm 0.01$	$0.66^{c} \pm 0.04$	$0.56^{n} \pm 0.03$	$0.56^{b} \pm 0.02$

* The outcome is expressed as mean ± standard error
* Means with different superscript show significant difference (p>0.05)

Table 6. Birds Mortality at Different Weeks Across Various Clusters

TREATMENT	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR
Commercial Feed	0	0	1	0
Formulated Feed	0	0	0	1

Table 7. Age Effect (weeks) on Weekly Body Weight (BW) in Kg Within the Treatment Clusters

TREATMENT	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR
Commercial Feed	$1.30^{a} \pm 0.13$	$1.45^{c} \pm 0.5$	$1.71^{n} \pm 0.22$	$2.00^{b} \pm 0.18$
Formulated Feed	$1.23^{a} \pm 0.42$	$1.39^{c} \pm 0.49$	$1.63^{j} \pm 0.04$	$1.63^{b} \pm 1.03$

* The outcome is expressed as mean ± standard error
* Means with different superscript differ significantly (p>0.05)

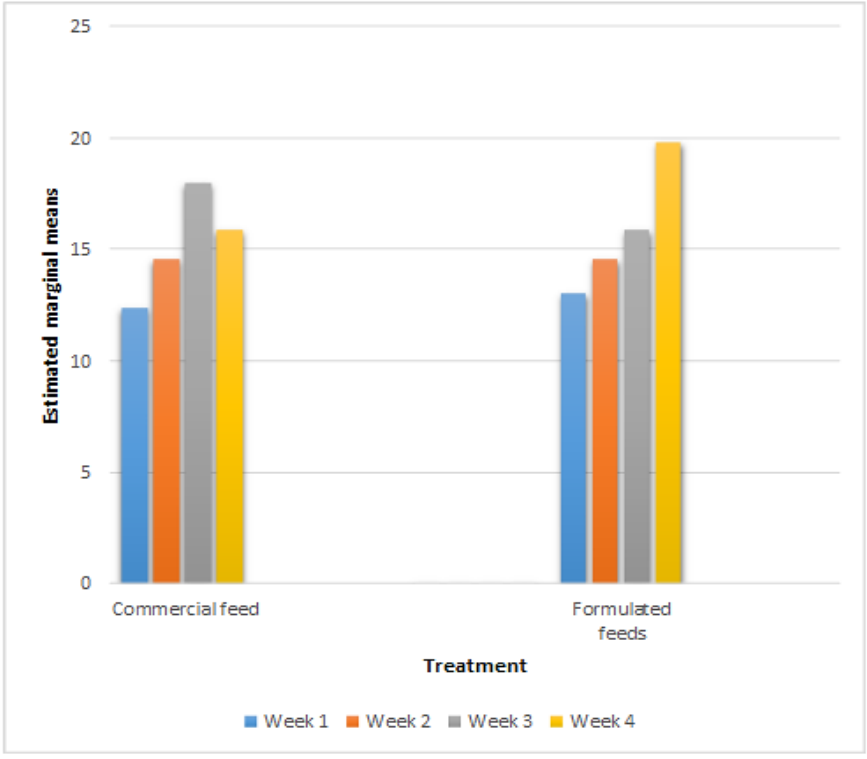

Figure 2. Estimated marginal means of weight gain

Table 8. Statistical Analysis
Anova Table for Mean Body Weight Gain

SOV	SS	DF	MS	F	Sig.
Intercept	193.847	1	193.847	760.186	1.324
Treatment	0.059	1	0.059	0.231	0.632
Duration	3.857	3	1.286	5.041	0.003
Treatment* Duration	0.801	6	0.267	1.047	0.377
Error	18.360	72	0.255		
Total	216.923	80			

4. CONCLUSION

The impact of poultry feeds on the development and growth performance of broilers cannot be overemphasized. However, the high cost of commercial feeds in Nigeria has elucidated the need for farmers to formulate their feeds and maintain profit.

The central goal of this research was to find affordable yet high-quality local products that can be utilized to formulate poultry feed and assess the growth and development performance of broilers. To achieve this, broiler birds aged twenty days were procured and provided with commercial feed at the starter phase (0-5 weeks). Afterwards, they were divided into two groups using the completely randomized design, broilers in the control group were fed commercial feeds while the other group were fed compounded feeds, and water was given ad libitum. Based on this premise, the findings from the study indicate that formulated feed can also result in great growth parameters outcome. Formulated feed tends to be more cost-effective than commercial feed. Incorporating formulated feed into poultry farming can significantly cut costs while improving the birds overall performance. This study recommends that poultry farmers should explore the use of formulated feed as it helps reduce costs.

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