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Evaluation of varying feeds quality on the performance of arbor acre breed of broiler chickens reared in Niger delta, Nigeria

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***Abstract*---**The quest for balanced and affordable protein makes broiler rearing increasing monotonic economically. It is highly nutritious and it creates employment opportunities as a result of its quick returns on investment and readiness to the market within a short period. The experiment was conducted at the Animal Production Departmental Demonstration Farm (APDDF), Faculty of Agriculture, DSUST, Ozoro, to evaluate BWT and morphometrics of Arbor Acre (AA) broiler chickens. BWT and morphometrics were recorded from one hundred (100) AA broiler chickens. Day-old chicks were purchased at Amo farm in Enugu State. The experimental design was RCBD. There were four (4) replications which consist of 25 birds per treatment. The experiment lasted for six (6) weeks. The findings were based on the feeds quality among feed products on an average of six (6) weeks old. Result showed that there was a significant (P>0.05) difference among the experimental feeds. The Jake starter mash had superiority in BWT of birds over other feed products. The BWT and morphometric traits were superior in all the birds fed starter mash. Therefore, it can be concluded that Jake starter mash is a good quality feed product that can be recommended to broiler farmers used for high productive performance.

***Keywords*---**Arbor Acre, body weight, rations formulation, feed quality, broiler chick and feed mill.

Introduction

AA broiler chicken breeds are raised popularly for their meat, which has a higher nutritional value. The quest for balanced and affordable protein makes broiler production to nationally improve the economy of a nation. Apart from the highly nutritious meat obtained from broiler chickens, it also creates employment opportunities and swift returns on investment and readiness to the market within a short period for consumption Leeson [1]

Intensive broiler farming is based on hybrid genotypes reared in tightly controlled environments under high stocking density with limited space from physical activities Leeson [2,3]. Genetic progress in broiler breeding has lead to the selection of heavier animals with rapid growth rate (GR) than before Tallectire [4,3]. Indeed Haven stein [5] established that genetics contributed 85 to 90 % to the 6-fold increase in broiler carcass yield during the last 50 years. Every poultry producers strive for the best breed of chickens for good productivity; hence, rearing the best breed of chickens becomes their priority.

Over the years constant improvement in nutrition and genetic selection has led to a fast GR in modern broiler strains. Study shows that broilers must be provided proper nutrition for optimum performance and result. Commercial feeds must contain adequate nutrition to provide optimal growth. Broilers should be fed a high protein diet to stimulate growth Baker [6,7].

Monitoring key production indication such as BWT, GR, Morphometrics and FCR is fundamental in poultry farming to improve the efficiency and profitability Mollah [8,9,10].

Apart from BWT, a number of conformation traits are known to be good indicators of body growth and market value of broiler chicken. Such conformation traits includes, CL (cm), BKL (cm), HL (cm), BRL (cm), NL (cm), WL (cm), WS (cm), THL (cm), SL (cm), GL (cm), TOL (cm), amongst others. The relationship between BWT and conformation traits has been found to have important implications in the production of broiler chicken.

The amount of feed that broiler chickens eat will depend upon the types of feed provided. The feed should be a high energy and protein ration formulation and hence promoted rapid growth. Chickens provided with a diet of lower nutrient density will require more feed to reach a desired weight. Feed mill industries are responsible for the production of feed in Nigeria a great majority of feed mill fail to produce good quality feed due to feed constraints facing industry such as irregular and inadequate supply of feed ingredients, high and unstable prices, poor quality, of feed ingredient, cost of maintaining high quality in the feed ingredient and the headache involved in looking for the ingredient necessitated the feed mill industries to adulterate and produce very poor quality feed for livestock farmers.

Therefore, given the central importance that feeds play an intensive broiler feeding management system and the imperative to identifying of feeds, it becomes feed options for the farmers.

The objective of this study was to evaluate the different feeds quality on the BWT and morphometrics of AA breed of broiler chickens.

2. Materials And Methods

2.1 Experimental site

The experiment was conducted at the ATDDF, Faculty of Agriculture, DSUST, Ozoro. The centre falls within the rain forest vegetation zone of mid-western Nigeria on Latitude 5^0 32^I N and Longitude 6^0 15^I E of the Greenwich meridian. The climatic condition is humid with a mean annual rainfall of between 2500-3000mm. the mean temperature and RH are 27.4^0C and 85% respectively DSUST [11].

2.2 Housing and Equipment

The deep litter house was made of dwarf block wall, wire mesh, corrugated aluminum zinc and floored with wood shavings for ease cleaning. It has a total of four (4) pens. The entire size of the deep litter was 6ft x 4ft. each pen accommodates twenty five (25) broiler chicks of Acre breed of broilers, Partition were made with wire mesh to ensure adequate ventilation and to protect the broiler chicks from predators. Four (4) feeders and four (4) drinkers were used.

2.3 Experimental Birds

A total of 100 broiler chicks (Acre breeds) were used for the project. Day-old chicks were purchased at Amo farm in Enugu State.

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2.4 Experimental Design

At the commencement of the study, AA broilers were weighed and allocated to four (4) pens. The four (4) pens were classified as self compounded starter mash (PEN 1), Vital starter mash (PEN 2), Chikun starter mash (PEN 3), and Jake starter mash (PEN 4). The experimental design was RCBD. There were four (4) replications which consist of 25 birds per treatment. The experiment lasted for six (6) weeks.

2.5 Feed, and Feeding Management

The broiler chicks were fed with broiler super starter pellet feed for Pen 2, Pen 3, Pen 4, and Pen 1 were fed self compounded starter mash and water at *ad-libitum*. Throughout the study, the broiler chicks were fed twice per day (morning 8.00am and evening 4.00pm).

Percentage Composition of Broiler Starter for AA Breed

2.5.1 Self Compounded Starter Mash: Maize (61.70 %), Groundnut meal (27.50 %), Fish meal (7.50 %), Bone meal (2.00 %), Limestone (0.75 %), Common salt (0.35 %), and Premix (0.20 %).

The calculated compositions are as follows: CP (24.00 %), ME (3000 kcal/kg), Meth+cysteine (0.70 %), Lysine (1.26 %),

Calcium (1.25 %), Phosphorus (0.85 %), and Available phosphorus (0.64 %)

2.5.2 Vital Feeds (Broiler super starter)

Proximate Analysis: DM (90.25 %), CP (22.23 %), CF (3.04 %), Calcium (1.49 %), Methionine (1.40 %), ME (2795 kcal/kg), and Total phosphorus (0.62 %).

2.5.3 Chikun Feeds (Broiler Super Starter Pellet)

Proximat e Analysis: CP (22.0 %), Crude fat (4.0 %), Calcium (1.0 %), CF (5.0%), Available phosphorus (0.47 %), Lysine (1.15 %), Methionine (0.5 %), and ME (2900 kcal/kg)

2.5.4 Jake Feeds (Broiler starter)

Proximate Analysis: CP (21.68 %) ME (2551kcal/kg), Calcium (1.00 %), Phosphorus (0.50 %), CF (4.00 %), Lysine (1.44 %), Methionine (0.51 %), and Crude Fat (3.43 %)

2.6 Cleaning

The operation was carried out daily. The surrounding was kept clean, the grasses around the house were cleared and debris and cobwebs were removed and litters were burnt. The droppings were collected and taken outside the experimental site before the disinfection takes place. The feeders and drinkers were also disinfected against microorganisms. The foot bath was filled with disinfected water.

2.7 Health Management and Disease Prevention

On the arrival of AA broiler chicks in the APDDF, birds were given multivitamin drugs (pantex, multivitamin, glucose) to serve as an Anti-stress and during the period of their transportation to stabilize the condition. All the birds were vaccinated and medicated similarly throughout the experimental period under the same managerial condition. Routine preventive hygiene were encourage by provision of clean water, provision of dry feed, regular cleaning of the pan, prevention of proliferation of flies and insects by regular use of disinfectant, a careful physical examination of the birds detect abnormal behavior, signs of symptoms of any disease condition, sick birds were isolated and dead birds were removed and buried. Visitors were highly restricted.

2.8 Data Collection

Data used for this study were obtained from BWT and morphometrics. This was done once a week, the broiler chick was properly identified with tag on their wing labeled from DSUST 1, DSUST 2,...DSUST 25 for each pen. All birds were weighted individually with a digital electronic balance scale calibrated in grams to obtain BWT. The morphometrics were measured by the use of tape calibrated in

centimeters (cm). The descriptions of how body linear measurements were taken are as follows:

CL: Total length of part of the head, comb covered.

BL: Measured from the tip of the head to base.

HL: Measured as the distance between the base of the beak and the Axis *vertebrae*.

NL: This is the length of axia skeleton from the first to the last cervical *vertebrae.*

WL: The length between the scapular and the tip of the wing.

WS: The length between the two scapulas and the tip of the wing.

BRL: Taken as the length of sternum or breast plate.

GL: Measured from the top of sternum to the lower abdomen.

BDL: Length taken from the beak tip down to the cloaca of the bird.

THL: Measurement as the distance between the hock joint and pelvic joint.

SL: Measured as the distance between the mid-region of distance between the mid-region of the genus and that of the *Regio Tasalis*.

TOL: The length between the tip of the toe to the base.

2.9 Statistical Analysis

The data generated from the experiment were entered in Microsoft excel worksheet, organized and processed for further analysis. Mean and SD were estimated with the help of SAS [12].

Results

The mean and SD values of different feeds quality on the BWT of broiler chicks ranging from 0 - 6 weeks of age are presented in Table 3.1. Different feed products had significant ($P<0.05$) effect on the broiler chicks. The broiler chicks fed Chikun starter mash and Jake starter mash had higher mean value than the birds fed vital starter mash and compounded starter mash at 6 weeks of age. There was a significant different among the birds fed different feed products. Within the Chikun starter mash and Jake starter mash, the birds had higher values. The Jake starter mash had superior over other feed products.

The mean value of CL, BL, HL and NL as influenced by different feed products are presented in Table 3.2. Different feed products had significant ($P<0.05$) effect on all variables. The CL of broiler chicks fed Jake starter mash had higher mean

value at 6th week than their counterpart. There was a significant different of the birds fed Jake starter mash and generally had higher mean values for all traits.

Mean values for WL and WS of AA broiler chicks fed on different feed products are presented in Table 3.3. Birds fed Jake starter mash and Chikun starter mash had significantly ($P<0.01$) longer WL and WS than other birds fed vital and compounded starter mash at 6th week. The higher mean value of 18.05 cm was observed in both Jake starter mash and Chikun.

Chikun starter mash for WL, while 40.05 cm and 39.11 cm was respectively obtained for WL and WS which was also significant ($P<0.05$). These values was significantly ($P<0.05$) higher than those obtain in vital starter mash and self-compounded starter mash.

The mean values for BDL, BRL and GL of AA broiler chicks fed on different feed products are presented in Table 3.4. BDL were significantly ($P<0.05$) longer in the birds fed vital starter mash (32.06 cm) compared to those of Chikun starter mash and self-compounded starter mash (30.10 cm and 30.31 cm) respectively. The Chikun starter mash and self-compounded starter mash values were also higher than those of Jake starter mash. The mean BRL and GL value of Chikun starter mash and Jake starter mash (27.04 cm and 25.06 cm) were higher than values reported in vital and self-compounded starter mash.

The mean THL, SL and TOL of AA broiler chicks fed on different feed products are presented in Table 3.5. THL and SL were also significantly ($P<0.05$) longer in the Chikun starter mash compared to Vital and compounded starter mash at 6th week. The birds fed Jake starter mash were also longer in TOL than other feed products. While birds fed Vital and Chikun starter mash were higher than the self-compounded starter mash value (4.04 cm).

Discussion

The birds fed Jake starter mash are superior compared to birds fed Chikun starter mash in terms of BWT. But birds from Chikun starter mash looks bigger due to much feathered but less in BWT. The superiority mean value (633.90 g at 6th week) of BWT may have arises because of reduced feathering, reduction of pteriae and reduction of secondary feather, the energy used for the production of feathers may have been converted into the production of muscles and other viscera hence better live weight. Ojedapo [13] recorded an average BWT of 1525.08 g at 6 weeks of age for Marshall Broiler chickens. The mean value obtained in this study is less than compared to Ojedapo [13]. This implies that the study birds were inadequate fed.

In the head dimensions, the result revealed that CL, BL, HL and NL had higher mean value than their counterpart. This is as a result of high nutritive value in Jake starter mash. This greater increase in traits is genetic potential for rapid growth and development of the birds (Uzeje and Mgbere [14].

In wing dimensions, the result revealed that birds fed Jake starter mash and Chikun starter mash had significantly ($P<0.05$) longer WL and WS than other

birds fed vital and self-compounded starter mash. This may be attributed as high quality feed that possess. The result also revealed that BDL were significantly ($P<0.05$) longer among the birds fed vital starter mash (32.06 cm) compared to other counterparts. This result revealed that the little nutrients found in the feed were concentrated on the body dimension of the birds. This may be due to the body cell division that builds up the body conformation. While the concentration of protein was build in the breast plate of birds fed Chikun starter mash and Jake starter mash. This result showed that there is more meat found in the birds. In the limb dimensions, THL, SL and TOL were significantly ($P<0.05$) longer in birds fed Jake starter mash compared to other counterparts. The longer length of the traits above may contribute to the higher weight obtained in birds fed Jake starter mash.

The better live weight obtained in this study were influenced as a result of good quality feed produced by Jake feedmill industry. This is in line with NRC [15] that opined good quality feed influence body weight of an animal. Jake starter mash had adequate and proper nutrient requirement were considered for their optimum performance as expected. Result shows that the birds fed Jake starter mash did not record any mortality while birds fed Vital starter mash recorded highest mortality throughout the period. This is due to the nutritive value of the Jake feed that build up their immune system.

Result also revealed that the bird's gene traits were superior in morphometrics compared to other birds fed Chikun, Vital and Self-compounded starter mash. ANOVA showed significant difference between genotypes ($P<0.05$) for all morphometrics. The study had shown that birds fed Jake Starter mash had better BWT.

Therefore, it can be concluded that Jake starter mash is a good quality feed product that can be recommended to broiler producers for high productive performance.

Table 3.1.
Mean and SD of Different Feeds Quality on the BWT of AA Broiler Chicks (0 - 6 weeks of age)

	Weeks of age					
Type of feed	**1**	**2**	**3**	**4**	**5**	**6**
Compounded feed	63.08 ± 8.2^{b}	113.10 ± 12.6^{c}	192.37 ± 11.2^{b}	269.87 ± 10.1^{b}	480.05 ± 32.3^{b}	488.71 ± 30.1^{c}
Vital feed	82.23 ± 10.4^{a}	158.80 ± 14.2^{b}	198.89 ± 10.1^{b}	210.14 ± 12.3^{c}	341.87 ± 14.2^{c}	366.84 ± 17.4^{d}
Chikun feed	96.89 ± 12.1^{a}	239.60 ± 16.3^{a}	367.10 ± 21.1^{a}	369.69 ± 20.2^{a}	555.84 ± 42.1^{a}	576.67 ± 41.2^{b}
Jakes feed	94.04 ± 11.3^{a}	222.96 ± 13.2^{a}	332.23 ± 18.1^{a}	368.51 ± 19.2^{a}	524.00 ± 34.3^{a}	633.90 ± 53.2^{a}

Means with different superscript on a row are significantly different ($p< 0.05$)

Table 3.2.
Mean and SD of Head Morphometrics of AA Broiler Chicks (0 – 6 weeks of age)

Variables (cm)	Type of feeds	Weeks of age 1	2	3	4	5	6
CL	Compounded feed	1.03 ± 0.1[a]	1.06 ± 0.1[b]	1.76 ± 0.5[b]	1.75 ± 0.3[c]	1.85 ± 0.2[c]	1.87 ± 0.4[d]
	Vital feed	1.04 ± 0.2[a]	1.75 ± 0.1[a]	2.01 ± 0.3[a]	2.05 ± 0.4[b]	2.09 ± 0.2[b]	2.16 ± 0.1[c]
	Chikun feed	1.12 ± 0.2[a]	1.65 ± 0.1[a]	2.05 ± 0.1[a]	2.18 ± 0.2[b]	2.21 ± 0.2[b]	3.03 ± 0.1[b]
	Jakes feed	1.06 ± 0.2[a]	1.18 ± 0.1[b]	2.04 ± 0.2[a]	2.92 ± 0.3[a]	3.18 ± 0.2[a]	3.45 ± 0.1[a]
BL	Compounded feed	1.03 ± 0.5[a]	1.04 ± 0.2[a]	1.15 ± 0.3[b]	1.17 ± 0.1[b]	1.20 ± 0.4[b]	1.43 ± 0.2[b]
	Vital feed	1.05 ± 0.4[a]	1.08 ± 0.1[a]	1.13 ± 0.3[b]	1.23 ± 0.1[b]	1.36 ± 0.2[b]	1.64 ± 0.1[b]
	Chikun feed	1.04 ± 0.2[a]	1.05 ± 0.2[a]	1.23 ± 0.4[b]	1.30 ± 0.1[b]	1.45 ± 0.3[b]	1.55 ± 0.1[b]
	Jakes feed	1.03 ± 0.2[a]	1.03 ± 0.1[a]	1.43 ± 0.3[a]	1.63 ± 0.2[a]	1.75 ± 0.2[a]	1.77 ± 0.1[a]
HL	Compounded feed	3.90 ± 0.1[a]	4.75 ± 0.3[a]	4.75 ± 0.2[b]	4.80 ± 0.1[c]	5.03 ± 0.6[b]	5.39 ± 0.2[b]
	Vital feed	3.60 ± 0.2[b]	3.40 ± 0.1[c]	4.04 ± 0.2[c]	5.07 ± 0.1[b]	5.19 ± 0.3[b]	5.06 ± 0.2[b]
	Chikun feed	3.64 ± 0.2[b]	4.05 ± 0.1[b]	5.41 ± 0.3[a]	5.66 ± 0.1[a]	5.74 ± 0.2[a]	6.06 ± 0.4[a]
	Jakes feed	3.43 ± 0.1[b]	4.04 ± 0.3[b]	4.71 ± 0.1[b]	5.04 ± 0.3[b]	5.05 ± 0.4[b]	7.05 ± 0.2[b]
NL	Compounded feed	4.15 ± 0.3[a]	4.19 ± 0.1[a]	5.45 ± 0.4[a]	5.05 ± 0.2[c]	5.96 ± 0.1[b]	7.48 ± 0.4[c]
	Vital feed	3.08 ± 0.1[b]	4.12 ± 0.1[a]	4.17 ± 0.3[b]	5.04 ± 0.1[c]	6.07 ± 0.1[b]	7.97 ± 0.4[c]
	Chikun feed	4.32 ± 0.3[a]	4.44 ± 0.2[a]	4.05 ± 0.1[b]	6.50 ± 0.2[b]	6.53 ± 0.1[b]	8.05 ± 0.4[b]
	Jakes feed	3.07 ± 0.3[b]	4.42 ± 0.1[a]	4.05 ± 0.3[b]	7.05 ± 0.2[a]	8.03 ± 0.1[a]	9.04 ± 0.3[a]

Means with different superscript on the row are significantly different ($p < 0.05$)

Table 3.3.
Mean and SD of Wing Morphometrics of AA Broiler Chicks (0 – 6 weeks of age)

Variables (cm)	Type of feeds	Weeks of age 1	2	3	4	5	6
WL	Compounded feed	3.98 ± 0.4[c]	6.15 ± 0.3[c]	11.53 ± 0.2[a]	12.05 ± 0.1[c]	12.98 ± 0.2[c]	14.05 ± 0.5[b]
	Vital feed	4.70 ± 0.1[b]	5.45 ± 0.3[d]	10.15 ± 0.4[b]	12.04 ± 0.1[c]	13.94 ± 0.3[b]	14.15 ± 0.2[b]
	Chikun feed	3.97 ± 0.1[c]	10.17 ± 0.3[a]	10.63 ± 0.2[b]	16.44 ± 0.2[a]	17.02 ± 0.1[a]	18.05 ± 0.2[a]
	Jakes feed	5.35 ± 0.1[a]	9.05 ± 0.4[b]	9.49 ± 0.2[c]	14.05 ± 0.1[b]	16.10 ± 0.3[b]	18.05 ± 0.2[a]
WS	Compounded feed	12.01 ± 0.3[a]	14.92 ± 0.1[b]	23.83 ± 0.5[b]	25.51 ± 0.2[d]	26.73 ± 0.1[d]	29.01 ± 0.3[d]
	Vital feed	10.02 ± 0.3[b]	13.48 ± 0.1[c]	22.69 ± 0.2[b]	26.51 ± 0.1[c]	28.66 ± 0.5[c]	31.02 ± 0.2[c]
	Chikun feed	10.00 ± 0.2[b]	21.37 ± 0.1[a]	22.31 ± 0.1[b]	35.32 ± 0.4[a]	37.01 ± 0.2[a]	39.11 ± 0.1[b]
	Jakes feed	12.32 ± 0.1[a]	21.45 ± 0.3[a]	24.41 ± 0.2[a]	31.05 ± 0.1[b]	34.05 ± 0.2[b]	40.05 ± 0.1[a]

Means with different superscript on the row are significantly different ($p < 0.05$)

Table 3.4.
Mean and SD of Morphometrics of AA Broiler Chicks (0 – 6 weeks of age)

Variables (cm)	Type of feeds	Weeks of age 1	2	3	4	5	6
BDL	Compounded feed	12.11 ± 0.2^{c}	16.32 ± 0.4^{b}	19.47 ± 0.3^{b}	30.05 ± 0.2^{a}	30.15 ± 0.1^{a}	30.31 ± 0.4^{b}
	Vital feed	14.75 ± 0.3^{b}	15.03 ± 0.2^{c}	18.65 ± 0.3^{c}	20.06 ± 0.1^{d}	20.53 ± 0.3^{d}	32.06 ± 0.1^{a}
	Chikun feed	14.93 ± 0.2^{b}	17.05 ± 0.3^{a}	23.27 ± 0.1^{a}	28.04 ± 0.3^{b}	28.34 ± 0.2^{b}	30.10 ± 0.1^{b}
	Jakes feed	15.01 ± 0.3^{a}	17.04 ± 0.1^{a}	19.04 ± 0.3^{b}	25.51 ± 0.2^{c}	27.05 ± 0.1^{c}	28.30 ± 0.3^{c}
BRL	Compounded feed	9.98 ± 0.2^{c}	11.70 ± 0.1^{c}	14.04 ± 0.1^{c}	14.03 ± 0.2^{d}	19.91 ± 0.4^{b}	25.06 ± 0.3^{b}
	Vital feed	10.56 ± 0.3^{c}	11.48 ± 0.2^{c}	15.04 ± 0.2^{c}	16.05 ± 0.1^{c}	18.78 ± 0.5^{b}	25.05 ± 0.2^{b}
	Chikun feed	12.03 ± 0.3^{a}	15.04 ± 0.2^{b}	22.03 ± 0.1^{a}	23.04 ± 0.2^{a}	25.03 ± 0.3^{a}	27.04 ± 0.2^{a}
	Jakes feed	11.20 ± 0.2^{b}	18.04 ± 0.1^{a}	19.04 ± 0.2^{b}	21.06 ± 0.1^{b}	24.93 ± 0.4^{a}	26.05 ± 0.3^{a}
GL	Compounded feed	5.98 ± 0.3^{c}	6.01 ± 0.5^{b}	6.23 ± 0.2^{c}	6.46 ± 0.3^{d}	9.98 ± 0.2^{c}	13.01 ± 0.1^{c}
	Vital feed	5.82 ± 0.4^{c}	6.07 ± 0.2^{b}	7.47 ± 0.2^{c}	9.04 ± 0.1^{c}	10.03 ± 0.2^{c}	13.12 ± 0.1^{c}
	Chikun feed	6.01 ± 0.1^{b}	6.05 ± 0.2^{b}	9.03 ± 0.4^{b}	11.18 ± 0.2^{b}	12.03 ± 0.1^{b}	14.04 ± 0.3^{b}
	Jakes feed	9.98 ± 0.2^{a}	11.70 ± 0.1^{a}	14.04 ± 0.1^{a}	14.03 ± 0.2^{a}	19.91 ± 0.4^{a}	25.06 ± 0.3^{a}

Means with different superscript on the row are significantly different ($p < 0.05$

Table 3.5.
Mean and SD of Limb Morphometrics of AA Broiler Chicks (0 – 6 weeks of age)

Variables (cm)	Type of feeds	Weeks of age 1	2	3	4	5	6
THL	Compounded feed	5.07 ± 0.1^{a}	6.06 ± 0.2^{b}	7.02 ± 0.5^{c}	8.06 ± 0.3^{c}	9.04 ± 0.2^{b}	11.09 ± 0.3^{b}
	Vital feed	4.91 ± 0.1^{a}	5.83 ± 0.3^{b}	7.03 ± 0.2^{c}	8.07 ± 0.1^{c}	8.70 ± 0.1^{b}	11.12 ± 0.3^{b}
	Chikun feed	5.41 ± 0.3^{a}	7.05 ± 0.2^{a}	8.43 ± 0.3^{a}	11.03 ± 0.2^{a}	11.04 ± 0.2^{a}	11.08 ± 0.1^{b}
	Jakes feed	5.35 ± 0.1^{a}	6.00 ± 0.3^{b}	7.70 ± 0.2^{b}	10.05 ± 0.1^{b}	11.00 ± 0.1^{a}	12.05 ± 0.2^{a}
SL	Compounded feed	2.92 ± 0.3^{b}	2.94 ± 0.2^{b}	3.35 ± 0.1^{c}	4.04 ± 0.2^{c}	5.01 ± 0.4^{b}	6.07 ± 0.2^{b}
	Vital feed	3.05 ± 0.1^{b}	3.05 ± 0.4^{b}	4.05 ± 0.2^{b}	4.12 ± 0.1^{c}	4.99 ± 0.3^{c}	6.07 ± 0.1^{b}
	Chikun feed	3.52 ± 0.1^{a}	5.05 ± 0.5^{a}	5.55 ± 0.1^{a}	6.05 ± 0.1^{a}	6.08 ± 0.1^{a}	5.47 ± 0.4^{c}
	Jakes feed	3.20 ± 0.4^{b}	3.35 ± 0.1^{b}	4.57 ± 0.2^{b}	5.14 ± 0.2^{b}	5.29 ± 0.4^{b}	7.11 ± 0.3^{a}
TOL	Compounded feed	2.19 ± 0.3^{c}	3.12 ± 0.2^{a}	3.45 ± 0.1^{b}	4.00 ± 0.4^{a}	4.01 ± 0.2^{b}	4.04 ± 0.1^{c}
	Vital feed	3.05 ± 0.2^{b}	3.05 ± 0.1^{a}	3.43 ± 0.3^{b}	4.05 ± 0.1^{a}	4.08 ± 0.4^{b}	5.00 ± 0.2^{b}
	Chikun feed	2.42 ± 0.1^{c}	3.85 ± 0.2^{a}	4.75 ± 0.3^{a}	4.82 ± 0.4^{a}	5.30 ± 0.4^{a}	5.45 ± 0.1^{b}
	Jakes feed	3.03 ± 0.3^{b}	3.14 ± 0.3^{a}	3.34 ± 0.1^{b}	4.85 ± 0.3^{a}	5.41 ± 0.3^{a}	6.13 ± 0.3^{a}

8

Means with different superscript on the row are significantly different ($p < 0.05$)

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