COMPARATIVE ASSESSMENT OF SEMINAL ATTRIBUTES IN THE FULANI AND YORUBA ROOSTERS SUBJECTED TO VARYING LEVELS AND DURATION OF QUANTITATIVE FEEDING

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ABSTRACT
Maintaining superior seminal traits with prudent feeding is significant for sustainable food supply from indigenous poultry; hence, this study assessed the effects of duration and levels of quantitative feeding on seminal attributes of Fulani and Yoruba roosters. The study randomly assigned 36 roosters (18 each of Fulani and Yoruba ecotypes) to three equal groups labelled ad-libitum feeding, 85% ad-libitum, and 70% ad-libitum, receiving 125.00, 106.25, and 87.50 g of feed per bird, respectively. Each group was duplicated thrice to host two roosters per replicate in a completely randomized design. Roosters were fed ad-libitum for 14 days prior to test feeding for 56 days. Semen collections and analysis were performed per replicate in every two fortnights of test feeding. One-way analysis of variance of the experimental data indicated that seminal volumes and concentration, alongside motility and liveability of the constituent spermatozoa were significantly affected ($p < 0.05$) by test feeding, though Yoruba roosters on ad-libitum feeding for 56 days had best values that differed significantly ($p < 0.05$) among the experimental groups. The study concluded that restricting Yoruba roosters to 85% ad-libitum (106.25 g of feed per bird) for 28 days, or to ad-libitum feeding (125.00 g of feed per bird) for 56 days promote seminal attributes in the birds for efficient breeding.
Keywords: Genetics, Nutrition, Poultry, Seminogram, Sustainability, Tropics

INTRODUCTION

Improving indigenous poultry birds for large scale commercialization is a significant option to augment the exotic broiler chickens in meeting the demand for animal protein food by the fast-growing human population in developing countries. This feat was attributed to the birds' innate biological characteristics which sponsored their adaptation and tolerance to the harsh environmental and rearing conditions typical of these developing regions of the globe (Afolabi, 2013). In addition, the under-explored genetic potentials of these tropical chickens hold significant prospects for improved and sustainable food and nutrition security in the tropics. Despite their hardy and thrifty nature, the performance of these local birds can be significantly affected by nutrition and feeding (Okpeku *et al.,* 2019). As such, the high cost of poultry feeds in Nigeria which led to scarcity and inadequate supply of poultry feeds has been challenging poultry production in the country and in turn limits the improvement of these local chickens due to high cost of feeding. Consequently, poultry farmers are much interested in strategies that will aid optimize feed efficiency in their production systems considering the wastage associated with poultry feeding. In view of the foregoing, quantitative feeding, which is the circumspect reduction in quantity of feeding without compromising nutritional requirements for full genetic expression of a particular animal, has demonstrated to be cost effective protocol for enhancing feed efficiency in indigenous chicken lines (Ebeid *et al.,* 2022).

The Yoruba and Fulani birds are Nigerian indigenous dual-purpose chickens classified as heavy and light ecotypes, respectively based on their biological body weight. Several strategies of quantitative feeding that were carried out in these birds produced positive outcomes, yet there are still areas of significant prospects to be explored (Ogbu, 2021). For instance, quantitative feeding has shown to influence sperm modelling and male fertility in rooster chickens (Liang *et al*., 2024); yet, the effect of duration and levels of quantitative feeding on the seminal attributes of Yoruba and Fulani roosters has not been studied, thereby necessitating the current study to bridge this research gap by evaluating the impact of different levels and duration of quantitative feeding on the seminal attributes of these Nigerian rooster chickens as determined by the seminogram. Utilizing this strategy to maximize feed efficiency in the Yoruba and Fulani roosters by promoting the seminal attributes for breeding purposes, particularly in the context of artificial insemination for large scale production, is a significant contribution to improved production of these indigenous poultry for food security in Nigeria.

MATERIALS AND METHODS

The 10-week study was carried out at the Poultry Unit, Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. The study area is in the tropical high forest zone of Nigeria, between latitudes 5° 50′ and 7° 00′ north and longitude 6° 52′ and 7° 54′ east on a land elevation of 500 m above sea level (Alahira, 2022). The conduct of the research and handling of experimental birds were in-line with ethical guidelines for use and care of

animals in research; hence, was approved by the Institutional Committee on Animal Use and Care in Research, University of Nigeria (approval number—UNN/ICAUC/FVM/AS002003A). The study randomly assigned 36 Fulani and Yoruba ecotype roosters to three equal groups, labelled *ad-libitum* feeding, 85% *ad-libitum* feeding, and 70% *adlibitum* feeding. Each group was replicated thrice, having two roosters per replicate using the completely randomized design (CRD). The birds were fed basal grower feed (Chikun, Olam and Ultra Feedmill) at 125.00 g, 106.25 g, and 87.50 g per bird, accordingly to the labelled groups. The test roosters were fed the basal feed for seven days prior to the experimental feeding, which lasted for 56 days. Table 1 shows the proximate composition of the basal grower feed as determined by standard methods (White, 1946).

Table 1: Proximate composition of the experimental feed

Nutrients	(%)
Moisture	14.52
Crude protein	15.02
Crude fiber	5.57
Ether extract	8.50
Nitrogen free extract	47.70
Ash	8.69
Metabolizable energy (kcal/kg feed)	2450.00

The ecotype roosters were trained for semen collection by gentle massage (Lake, 1957), for two weeks before collection of test samples on the 28th and 56th day of experimental feeding. The semen samples were subjected to standard laboratory analysis to determine the seminal volumes, and the concentration, liveability, and progressive motility of the constituent spermatozoa (Cecil and Bakst, 1984). Data generated were analyzed in one-way analysis of variance (ANOVA) for numeric variables in completely randomized experiments using the IBM SPSS statistics for Windows, version 24.0 (IBM Corporation, Armonk-New York, USA). The Duncan's new multiple range tests separated significantly different means at 5% level of probability.

RESULTS AND DISCUSSION

The effect of restricting Fulani and Yoruba roosters to levels of quantitative feeding for 28 days (Table 2). There were significant differences ($p < 0.05$) in semen volume and spermatozoa concentration among the test roosters, while the progressive motility and liveability of spermatozoa were not significantly ($p > 0.05$) influenced by the experimental feeding.

Table 2: Seminal attributes of Fulani and Yoruba roosters on levels of quantitative feeding for 28 days

	ad-libitum		**85% *ad-libitum***		**70% *ad-libitum***	
	Fulani	**Yoruba**	**Fulani**	**Yoruba**	**Fulani**	**Yoruba**
SV (ml)	0.57^{a}	0.33^{c}	0.48^{b}	0.68^{a}	0.46^{b}	0.42^{b}
SC ($\times 10^{9}$/ml)	3.79^{a}	3.23^{b}	2.97^{b}	3.79^{a}	3.22^{b}	2.84^{b}
PM (%)	95.42	95.45	94.58	95.83	92.08	92.92
LS (%)	94.58	94.08	94.58	94.67	94.04	93.88
DS (%)	5.42	5.92	5.42	5.33	5.96	6.12

SV = Semen volume, SC = Spermatozoa concentration, PM = Progressive motility of spermatozoa, LS = Live spermatozoa, DS = Dead spermatozoa, ad-libitum feeding = 125.00 g of feed per bird, 85% ad-libitum feeding = 106.25 g of feed per bird, 70% ad-libitum feeding = 87.50 g of feed per bird. Means on the same row but with different superscripts are significantly different at p < 0.05.

The highest ($p < 0.05$) semen volumes and spermatozoa concentrations were recorded by the Fulani and Yoruba roosters on *ad-libitum* and 85% *ad-libitum* feeding, respectively. Table 3 presented the seminal attributes of Fulani and Yoruba roosters on varying levels of quantitative feed restriction for 56 days. The Yoruba roosters fed *ad-libitum* had the highest ($p < 0.05$) semen volume, spermatozoa concentration, live spermatozoa and the progressive motility among the experimental groups. The Yoruba roosters on 85% *ad-libitum* feeding had similar ($p > 0.05$) semen volumes with those of Fulani and Yoruba roosters on 70% *ad-libitum* feeding, which were significantly ($p < 0.05$) higher than the lowest volumes observed in the Fulani roosters on *ad-libitum* feeding and 85% *ad-libitum*. Fulani roosters on 85% *ad-libitum* feeding had least spermatozoa concentrations among the bird-groups Physical traits of poultry semen were explained to be reliable bio-indicators for predicting fertility in breeding males; nonetheless, no single trait could adequately predict fertility of a semen sample (Fouad *et al.,* 2020). The seminal traits recorded in this study are within range of optimal quality for local roosters reared in the humid tropical environment (Ajayi *et al.,* 2014). Semen volume has a unique relationship with spermatozoa concentration in that increased semen volume presents increased concentration of spermatozoa (Mussa *et al.,* 2023). But this was not the

case with present study, as both seminal traits were individually affected by different levels of restricted feeding. This could be due to sperm tendency to agglutinate leading to reduced concentration of spermatozoa in the ejaculate volumes. Sayed *et al.* (2022) observed a tendency of spermatozoa to agglutinate in motile bundles in relation to sperm competition and fertility duration in chickens.

Table 3: Seminal attributes of Fulani and Yoruba roosters on levels of quantitative feeding for 56 days

	ad-libitum		**85% *ad-libitum***		**70% *ad-libitum***	
	Fulani	**Yoruba**	**Fulani**	**Yoruba**	**Fulani**	**Yoruba**
SV (ml)	0.29^{c}	0.71^{a}	0.23^{c}	0.44^{b}	0.39^{b}	0.40^{b}
SC ($\times 10^{9}$/ml)	3.30^{b}	4.15^{a}	2.40^{c}	3.05^{b}	2.85^{b}	3.08^{b}
PM (%)	92.91^{b}	98.45^{a}	90.41^{b}	92.35^{b}	92.15^{b}	89.50^{b}
LS (%)	93.95^{b}	95.25^{a}	93.45^{b}	92.95^{b}	93.59^{b}	93.53^{b}
DS (%)	6.05^{a}	4.75^{b}	6.55^{a}	7.05^{a}	6.41^{a}	6.42^{a}

SV = Semen volume, SC = Spermatozoa concentration, PM = Progressive motility of spermatozoa, LS = Live spermatozoa, DS = Dead spermatozoa, ad-libitum feeding = 125.00 g of feed per bird, 85% ad-libitum feeding = 106.25 g of feed per bird, 70% ad-libitum feeding = 87.50 g of feed per bird. Means on the same row but with different superscripts are significantly different at $p < 0.05$.

The test feeding might have modulated nutrient supply from sertoli cells to influence sperm maturation that enhanced this agglutinating tendency. Howbeit, similar semen volume and spermatozoa concentration of Fulani roosters on *ad-libitum* feeding along with the Yoruba on 85% *ad-libitum*, which were higher than other groups implicated these feeding levels in increased supply of nutrients for enhanced spermatogenesis in both chicken ecotypes during the first 28 days of feeding. Moreover, aging compromises semen quality of poultry species by declining their fertility potential (Dim *et al.,* 2022). The non-significant improvements mostly observed in semen quality traits of roosters were attributed to aging. Nevertheless, nutrition has shown to proficiently ameliorate this detrimental effect of aging on semen quality traits in rooster birds (Fouad *et al.,* 2020). According to Liang *et al.* (2024), restricted feeding promotes sperm remodelling in aged roosters. Asides the beneficial effects in poultry production, Moyle *et al.* (2012) reported feed restriction to augment sperm production and seminal characteristics in male roosters. Furthermore, the 56-day feeding regime showcased the genetic superiority of Yoruba roosters over the Fulani birds in efficient use of available nutrients (at *ad-libitum* feeding) for improved seminal attributes that were better than other groups. This innate proficiency of the Yoruba chickens was attributed to their their inimitable adaptation to the harsh rearing conditions of the tropical environment (Lasagna *et al.,* 2020). The variable seminal attributes observed in the experimental roosters could be attributed to the level of quantitative feeding the birds were subjected to during the fortnightly sampling periods (i.e., at 28th and 56th day of study). In agreement with the current study, Ajayi *et al.* (2014) and Mussa *et al.* (2023) had reported similar findings in Nigerian indigenous chicken lines reared under tropical conditions. However, there is proof of unaffected semen quality traits in breeder poultry on restricted feeding regimes (Rakphongphairoj, 1987).

CONCLUSION

The study concluded that restricting Yoruba roosters to 106.25 g of feed per bird (i.e., 85% *ad-libitum*) for 28 days, or to 125.00 g of feed per bird (*ad-libitum*) for 56 days promote seminal attributes in the birds for efficient breeding purposes.

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