ENHANCIED SUSTAINABLE CATTLE PRODUCTION: A COMPREHENSIVE STUDY ON THE IMPACT OF FEEDING REGIMENS ON WHITE FULANI CALVES IN NIGERIA

Akinlade, J. A., Aderinola, O. A., Ojoawo, O. T.# and Adekanmbi, A. D.
Ladoke Akintola University of Technology, Ogbomoso.
#Corresponding author, Email: otojoawo47@lautech.edu.ng

ABSTRACT
Eminent among challenges faced by the Nigerian beef industry, is the inconsistent availability of feed affecting livestock feeding practices. Recognizing the need for year-round production of quality meat to meet population demands, the study focuses on the use of supplemental feeding regimens to optimize the growth potential of grazing the white Fulani breed calves in Ogbomoso, Nigeria. The study explored the impact of three feeding regimens (morning concentrate supplement (G1), evening concentrate supplement (G2), and without supplementation (G3)) on body measurements and haematological indices. The experiment, conducted over three months, employs a completely randomized design with three replicates. Proximate analysis of the supplemental diet and forages reveals nutritional compositions within the recommended ranges for calf growth crude protein of 8.90 % and 22.59 % and dry matter of 88.66 %-90.80 %. Body measurements showed significant improvements, with evening supplementation leading to notable changes in body length (6cm), weight, circumference, and tail length. Red blood cell count (8.46 x 106uL, haemoglobin (6.90 g/dL), and mean corpuscular haemoglobin concentration (24.50 g/dL), exhibited significant variations (P>0.05) among the feeding regimens, suggesting a nuanced impact on animal health. In conclusion, supplemental feeding in the evening emerges as a promising strategy to enhance the performance of white Fulani calves, not only in terms of growth but also in maintaining favourable blood profiles.
Keywords: Feeding regimen, supplement, grazing, white Fulani calves, semi-intensively

INTRODUCTION

Beef industry in Nigeria has suffered a major setback due to the unavailability of feed which has made feeding of livestock inconsistent. There is a need to ensure the availability of quality meat all year round to meet up with the daily requirements of the population. Available forages could not support and optimize the inherent growth potential of the grazing animals (Orskov, 1999). They are generally characterized by high energy content and low protein savaging the great benefit of the nutrient needed to optimize the animal's growth potential (Orskov, 1999). Hence, there is a need for supplementation. It is expedient to consider the growth rate and the blood profile as output based on all forms of treatment the animal is being exposed to. This may include the change in the feeding plan/regimen and provision of feed supplements. In addition to these, the blood profiles are a great advantage in monitoring the effect of the feed supplement on animal health (Wongnhor *et al*., 2023). This is because animals may have good growth performance and satisfy the desired body size proposed by the farmer in due time. Still, there may be a damaging factor on the quality of animal health, as animals may have lower white blood cell value, at instant.These predispose the animals to diseases and inhibit productivity. Hence, it is expedient to consider not only the growth performance but also the blood parameters when considering sustainable cattle production. This study assessed the effect of the different feeding regimens on the performance and haematological indices of the white Fulani breed calves in Ogbomoso, a derived savannah zone in Nigeria.

MATERIALS AND METHODS

Experimental site, design, duration and animal management

This experiment was carried out at the Teaching and Research farm of Ladoke Akintola University of Technology Ogbomoso. The experimental design was a completely randomized design with three replicates in each of the three regimens. The experimental duration was 3 months. Nine weaned white Fulani breed of cattle were purchased from a reputable farm in Ogbomoso. They were quarantined for two weeks and allowed to acclimatize for another 2 weeks before the experimental period. The sick ones were identified and treated with necessary drugs such as antibiotics, dewormers etc. The animals

were randomly divided into three experimental groups. G1 calves were fed concentrate supplement in the morning before grazing, G2 calves were fed the supplement in the evening after grazing while G3 calves were not given supplement (control). All the calves had 8 hours of grazing daily. Feed supplement in the form of a concentrate diet given to the animals at the different feeding regimens was formulated and milled at a reputable feed mill in Ogbomoso. Feed ingredients included wheat offal (29.9%), corn bran (29.9%), maize (7.9%), palm kernel cake (14.9%), groundnut cake (14.9%) and oyster shell (2.9%) while water was provided *ad libitum*.

Body Measurements: Body length, height at whither, tail length and body circumference were taken with measuring tape very early in the morning and forth-nightly before feeding either the supplement or grazing to avoid inaccuracy. The animals' body weight was measured using a hanging scale.

Blood sampling and analysis: Approximately 10 mL of the blood was collected via the jugular vein on arrival of the animals at the site and the end of the experiment. The jugular vein was punctured and the blood sample was collected with a syringe, 5mL was put into an EDTA bottle to prevent coagulation for haematology. The blood samples were subjected to analysis using an auto-analyzer machine of model BS 110. Parameters measured in the blood included Mean cell volume (MCV), Red blood cell (RBC), white blood cell (WBC), Mean platelet volume (MPV), Mean cell haemoglobin (MCH), Mean cell haemoglobin concentration (MCHC), hematocrit (HCT), haemoglobin (HGB).

Chemical analysis: The sample of the forages eaten by the animals during grazing were collected, oven-dried at 60 ^{0}C, milled and kept for analysis. The supplemental feed sample and the forage samples were analyzed in the laboratory using the AOAC (2005) procedure for proximate analysis.

Statistical analysis: all the data were subjected to a one-way analysis of variance (ANOVA) using the general linear model of SAS (2003). Means were separated using Duncan of the same package at a 5% significance level.

RESULTS AND DISCUSSION

Proximate Composition of Supplemental Diet and Forages in the Grazing Area

The proximate composition of the concentrate diet and forages fed to the animal during the period of the experiment is presented in Table 1. The crude protein values of the feeds offered to the animals during the experimental period within the range of 8.50- 22.59 % are similar to the range of 6-34 % reported by Lee (2018). The crude fibre content of the forages with the value of 5.84 % and 13.12 % as reported by Eyoh *et al.* (2018) also falls within the range of the value of 3.61 % to 37.50 % obtained in this study. The dry matter content of the supplemental diet and the forage (88.66 %-90.80 %) is similar to the value of 85.06 % reported by Yusuf *et al*, (2012). All these are within the recommended range required for calves (NRC, 2016).

Table 1: Proximate Composition of Supplemental Diet and Forages in the Grazing Area

Feed	Crude Protein %	Crude Fibre %	Dry Matter %	ASH %	Nitrogen Free Extract %
Concentrate diet	13.50	3.61	90.54	9.53	61.30
Panicum maximum	10.47	23.62	90.80	8.54	42.23
Stylosanthes humilis	13.70	29.10	89.60	10.20	54.50
Brachiaria decumbens	8.90	31.40	90.60	11.20	68.10
Cybopogon spp	22.59	37.50	88.66	7.15	47.23
Cynodon dactylon	9.80	31.30	89.77	9.50	24.38

Body Measurements of the calves as affected by supplemental feeding regimens

Changes in the body measurements as affected by supplemental feeding regimens are shown in Table 2. Among all the treatment means the changes in body weight (BW), body circumference (BC), tail length (TL) and height at withers (HW) were not significantly different from one another except for the change in body length (BL) with calves offered supplemental diet in the evening. The highest values for change in BL, BW, BC and TL after the experiment were recorded among animals that had supplemental feeding in the evening after grazing (G2) with 6.00 cm, 30 kg, 6.00 cm and 4 cm respectively.

It was observed from this study that the supplemental feeding led to increased significant changes in the body measurements of the calves. The significant changes were observed among calves that had supplemental feeding in the evening. This could be attributed to the optimum use of the diet by the animals. Since the movement is restricted in the evening, the calves were able to conserve and maximize the nutrients for body maintenance and growth. This buttresses the reduced performance observed among calves in G1 and G3 diets (Muller *et al*., 2012).

Table 2: Change in body measurements as affected by supplemental feeding regimens

Body Measurement	Morning Supplementation	Evening supplementation	No supplementation	SEM
Body length (cm)	3.00[b]	6.00[a]	2.65[b]	0.65
Body weight (kg)	26.00	30.00	13.00	5.01
Body circumference (cm)	4.75	6.00	3.50	0.74
Height at whither (cm)	0.75	4.00	1.90	0.70
Tail length (cm)	2.75	4.00	2.25	0.41

Means within the same row with different superscripts are significantly different (P>0.05).

Haematological Parameters of the Experimental Animals as Affected by Supplemental Feeding Regimens

The haematological indices of the experimental animals are shown in Table 3. All the treatment means showed no significant difference at the initial stage. At the end of the experiment, and among all the treatment means, only RBC, HGB, and MCHC were significantly different while others were not. For RBC, cattle with concentrate supplement in the morning before grazing (G1) is significantly different from cattle with concentrate supplement in the evening after grazing (G2) and cattle that grazed only (G3) with values 8.46 $x10^6$/µL, 6.82 $x10^6$/µL, 6.43 $x10^6$/µL, respectively.

Table 3: Haematological parameters of the Experimental Animals as affected by Supplemental Feeding Regimens

Blood parameters		Morning Supplementation	Evening supplementation	No supplementation	SEM
WBC (x103/µL)	Initial	6.45	5.35	5.90	0.30
	Final	14.45	10.20	10.20	1.68
RBC (x106/µL)	Initial	6.66	5.55	5.43	0.67
	Final	8.46[a]	6.82[b]	6.42[c]	0.47
Hb (g/dL)	Initial	6.90	5.65	8.20	0.68
	Final	8.10[a]	6.90[b]	6.15[b]	0.44
Haematocrit (%)	Initial	33.70	27.70	28.50	3.19
	Final	36.20	28.20	32.86	119.22
MCV(*fl*)	Initial	51.10	49.85	53.40	1.04
	Final	42.80	41.30	40.76	0.49
MCH (*pg*)	Initial	10.60	10.15	9.76	0.31
	Final	9.55	10.10	9.01	0.22
MCHC (g/dL)	Initial	20.75	20.40	17.50	0.66
	Final	22.40[ab]	24.50[a]	21.15[b]	0.64
Platelets($x10^3$/µL)	Initial	97.50	99.00	85.00	3.98
	Final	681.50	581.50	723.00	31.49

Means within the same row with different superscripts are significantly different (P>0.05). MCHC-mean corpuscular haemoglobin concentration, SEM- standard error of mean.

This study indicated a significant change at P>0.05 as a result of the supplemental feeding regimens. The red blood cell count (RBC), hematocrit (HCT), mean corpuscular volume (MCV), and platelets (PLT) fall within the range as reported by Merck (2012) and RAR (2009). Although the white blood cell count (WBC) value of 14.45 $x10^3$/µL for calves with concentrate supplement in the morning before grazing (G1), exceeded the range of value of 4–12 $x10^3$/µL recorded by RAR (2009). This high

value recorded can be a result of an underlying disease or stress. The MCH values (mean corpuscular haemoglobin) were 9.55pg (G1), 10.10pg (G2) and 9.01pg (G3) are low when compared to the value of 13–17 pg recorded by Merck (2012) and 13.90-15 pg by Wuanor *et al.* (2015). However, the value for G2 (10.10 *pg*) is still close to (11-17*pg*) the value range reported by RAR (2009). This is an indication of the possibility that they do not have enough oxygen carried by the RBC as MCH indicates the oxygen carrying capacity of the RBC. This can be a result of low or deficiency in iron or other micronutrients in the body.

CONCLUSION

The effect of supplemental feeding of white Fulani calves in the evening after grazing improved body measurements, and haematological and serum parameters. I hereby recommend this for herders. This will ensure the optimum performance of the animals in the face of scarcity, alleviate meat scarcity and improve the cattle fattening programme.

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