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Impact of Dry Season Supplementary Feeding on Biological and Economic Performance of Bull Calves in a Fulani Herd in Derived Savanna Zone of Nigeria

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Abstract: Inadequate nutrition remains a major constraint to improved cattle production in the traditional agropastoral system of derived savanna in Nigeria. Consequently, a trial to study effect of supplementary feeding of dried brewers spent grain to grazing cattle in the dry season was carried out in four selected Fulani herds located in the four axis of the derived savanna zone. In the trial, studies were carried out on eight N'dama and eight Bunaji bull calves in a 2×2 factorial arrangement of complete randomized block design. The supplement DBSG (24% CP) was fed at the rate of 1 kg/calf /day for the period of 3 months. The calves on supplementation consumed an average of 0.80 kg day^{-1} of the supplement. The average daily weight gains were higher for bull-calves on supplementary feeding (85/day for N'dama versus 56 g day^{-1} for Bunaji) than those without the supplement (17 g day^{-1} for N'dama versus 11 g day^{-1} for Bunaji). Ndama cattle gained more weight than Bunaji. Financial analysis showed that the net benefit for the two breeds fed with or without supplementation was higher for N'dama than for Bunaji. Supplementation had a significant ($p<0.05$) effect on animal PCV, RBC and Hb values. There were significant interaction between hematological parameters and protein intake except for leukocyte count. The study showed that dietary protein supplementation had asignificant influence on haemotogical parameters; body weight gains and the net

economic returns. Thus, dry season feed supplementation with dried brewers spent grain had a positive effect on Bunaji and N'dama bull calves being raised in a traditional Fulani herd and could be encouraged as a strategy to boost cattle productivity during the critical dry season.

INTRODUCTION

The importance of ruminant livestock such as cattle, sheep and goat as source of income and animal protein supply cannot be overemphasized. Cattle and to a lesser extent sheep and goat production are generally associated with the pastoral Fulani who are reported to own approximately 90% of the national herd. Pastoralism is an age-old system of livestock husbandry which entails global grazing of ruminant's livestock as practiced in the ecological stratification of West Africa. Despite its dominance in the region, the system has begun to breakdown in the recent decades as a result of population explosion, draught, low rainfall and reduced fertile land[1, 2]. Bunaji, a trypanosusceptible Bos indicus is still the dominant type of cattle breed being kept by agropastoralist in this zone[3] and has increased rapidly as a result of large movement of Bunaji cattle into the region by Fulbe pastoralists who are in search for feed and water for animals[4]. However, with increasing duration of settlements a trend towards keeping more trypanotolerant breed (N'dama, Keteku) has been observed[5]. N'dama, a trypanotolerant Bos Taurus was introduced into the zone through the National Breed improvement programme. N'dama were imported from Gambia to Nigeria as a breeding stock which were multiplied and disseminated in five government ranches in southern Nigeria to the farmers[1].

Ruminant livestock in most of sub-Saharan Africa countries depend on forage from natural pasture as a major feed resource. Inadequate quantity and quality nutrition for cattle from rangeland especially during the dry season is considered one of the major limitations to cattle productivity. Protein is usually the limiting factor but energy and mineral deficiency can be critical in certain period. Full diet concentrate feeding is rarely practiced due to its non-availability and exorbitant cost. However, there is the need to supplement the usually coarse, lignified feeds from range natural pasture and farm crop residues with cheaply and readily available feed that is rich in protein in the dry season in order to improve the performance of cattle on natural pastures to ensure a year round livestock production to satisfy the growing demand for meat and milk in Nigeria.

This study was therefore undertaken to evaluate the influence of dry season natural pasture grazing with or without Dried Brewers Spent Grain (DBSG) (24% CP) supplementation on Bunaji and Ndama bull calves; haematologic and body weight changes and economic returns.

MATERIALS AND METHODS

Production environment and animal management: The study was carried out during the critical dry season in four Fulani herds located within the derived savannah zone of Nigeria. The area is characterized by an annual rainfall of 1500-2000 mm and followed a bimodal distribution. The major rainfall begins in April and ends in middle of August with a peak in July. The minor wet season is in September and ends in December. The two wet seasons together support an annual plant growth period of 270 days.

Cattle in the traditional husbandry systems are tethered to individual stick on ground near the homestead, called "Ruga" usually sited in the outskirts or the few kilometers from town. The herdsman, usually a member of the family herded the cattle, for a period of 7-10 h a day (between 7.00-19 h) in search of feed on communal lands. The animals were returned to the holding grounds by 7.00 h and the lactating cows were milked. In the following morning, before being released for herding, calves that were previously kept separately from their dams are brought to the dams at milking time and remained with dam until milking is completed. Calves may have access to pastures and browses near the holding grounds. Supplementary feeding with agro-industrial by-products or concentrate mixtures was not a common practice in the area. Calves whose dam has died may have their feeding supplemented with cereal brans (e.g, maize brans). Cattle herd size averages 35 of which 17-20 are adult females.

Approximately, 10-13 of the cows will be lactating at any particular time. Milk is usually manually extracted once daily in the morning. The family consumes part of the milk while the remainder is processed into local cheese (wara). The local cheese is mostly sold at the farm gate to women traders who in turn sell them in local markets. Sale of fresh milk is not common in the area.

A total of 4 herds were randomly selected around the four axes of the derived savanna, South Western Nigeria. The herds consisted of Bunaji and N'Dama cattle. The 4 herds were allotted to 2 experimental treatments in a 2×2 factorial arrangement of complete randomized block design. The 16 calves with a pre-experimental weight (80 kg) and age (9 months) were selected for the treatments group. The allocation process resulted in the structure below:

Treatment 1: Farmer's practice; grazing of animal on natural pastures without DBSG supplementary feeding (control):

- Total number of calves in the herds = 26 calves
- Number of calves involved in the experiment = 8 calves (4 N'dama+4 Bunaji calves)

Treatment 2: Farmer's practice of grazing on natural pastures plus protein supplementary feeding with dried brewer's spent (DBSG; 24% crude protein) fed prior to daily grazing at 1 kg/calf/day:

- Total No of calves in the herds = 25 calves
- Number of calves involved in experiment = 8 calves (4 N'dama+4 Bunaji calves)

Bases and justification of timing of feeds and feeding strategies: The timing of feeding strategy was based on the availability of feeds (grazing on natural pasture and crop residues) and on the quality of the feed. The period from December to mid-March represents a period when quantity and quality of grasses and crop residues were poor. Although, some fresh grasses may become available in the late April to mid-May when it rains. These consideration favoured December to February as months when there was the need for supplementation. The level and type of supplements were based on average dry matter intake, average live weight of cattle and general knowledge on the performance of cattle.

Experimental unit: The experimental unit in this study was the herd but calves in the herds receiving feed supplements (Dried Brewers spent grain) were fed individually. Monitoring of all parameters included in the study was on individual animal basis. The parameters and frequency of measurements were:

- Live weight of calves; at the start of the experiment 1st December, 2003 and at every month
- Blood sample from calves; at the starts of the experiment and end of experiment

Blood sample collection: Blood samples were collected at the start and end of the experiment though the calve's jugular vein using vacutainer needles and monoject tube (sterilized with EDTA). The point of collection was cleaned with cotton wool soaked in 75% alcohol in order to sterilize the skin.

Sample tubes with blood were stored in the box laced with block for preservation for about 20 min before getting to the laboratory for analysis. Haematology indices.

Packed Cell Volum (PCV): Capillary tubes were filled with blood to ¾ of the length and one end sealed with crista seal. The tubes were spun in a Hawlsley microhaematocrit for 2 min at 1200 g and the PCV value were read on the Hawksley haematocrit reader[6].

Red Blood Cell (Erythrocyte) ($RBC\times10^6$ cm^{-3}) and White Blood Cell (WBC) ($leukocyte\times10^3$ cm^{-3}) counts: The RBC and total WBC counts were estimated by the haemocytometer method[6, 7] using the improved Hawksley heamocytometer. For RBC counts whole blood was diluted in 1:200 with Dacies fluid (99 mL of 3% aqueous solution of sodium citrate and 1 mL of 40% formaldehyde) which kept and preserved the morphology of the RBC. For WBC counts the dilution was 1:20 using 3% aqueous solution of acetic acid to which gentian violet had been added.

Haemoglobin concentration (g dL^{-1}) using Cyanmethaemoglobin method: According to Schalm *et al*.[6], 4 mL of Drabkin's solution as a diluent was placed in a test tube and 0.02 mL of the blood was added rinsing the pipette at least three times. The solution was mixed well and allowed to stand for 10 min. The values were read in a colorimeter at 540 nm wavelength using a tube of Drabkin's solution and the standard solution of cyanomethaemmoglobin.

Feed intake and weight response

Measurements

Weight gain: This was determined in terms of weigh change for all animals. The weights of all animals were taken at the beginning of the experiment and monthly throughout the period before feeding for the day.

Supplement intake: Intake was estimated for individual animals by feeding them on a known quantity (1 kg) of brewer's spent grain daily. The difference between the quantity offered and the leftover stood for the intake. The feed intake was calculated on dry matter basis by multiplying total intake (as fed) of individual animals by dry matter percentage of the Supplement. The dry matter was calculated by putting a known quantity of DBSG in an oven at a temperature of 1000°C to a constant weight. This was expressed as follows:

(Oven dried weight of feed/fresh weight of the feed×100)

Chemical analysis: Feed (DBSG) sample was analyzed for Dry Matter (DM) Crude Protein (CP), Crude Fibre (CF) and Ether Extract (EE) according to AOAC.[8].

Statistical analysis: Data were analyzed as a 2×2 factorial arrangement in a completely randomized block

design using statistical package SAS in 1996. The model included breed, ration. Differences between breed means were significant at ($p<0.5$).

RESULTS AND DISCUSSION

The chemical composition of feed supplement is presented in Table 1. The result showed that the feed was rich in crude protein, although, the fibre content was slightly high. The crude protein content (24%) was far above the 7-8% minimum CP requirement as reported by Minson (1967) below the level of which the feed intake and digestibility becomes poor.

The result of haemotological parameters is presented in Table 2. The hematological parameter values obtained in the study were within the normal range as reported for tropical breeds[9, 10]. The result in this study showed that a reduction in protein intake in dry season reduced packed cell volume, haemoglobin concentration and red blood cell counts (Table 2). These observations were in agreement with some findings which have shown that haemoglobin and packed cell volume were influenced by feeding level and by protein contents in zebu cattle[11-13]. Nomani and Evans[14] reported that packed cell volume was increased in growing steers by increasing protein intake from the feed while Bedrack, etc., observed no consistent association between level of protein intake and variation in leukocyte count for Zebu heifers. A report in Zebu heifers by Oyedipe *et al*.[13] had also induced that the level of protein intake had no significant effect on leukocyte counts which was in disagreement with results of the present study (Table 2).

The mean daily weight gains were higher in calves supplemented with dried brewer's spent grain than those that were grazed on natural pasture alone. The supplemented N'dama calves gained 85 g day^{-1}; Bunaji gained 56 g day^{-1} while Ndama calve without supplementation gained 17 g day^{-1} Bunaji calves 11 g day^{-1} (Fig. 1). The two breeds performed better than their controls and N'dama performed better than Bunaji (Fig. 1).

This confirmed earlier reports that there is significant association between plane of nutrition and body condition scored in cattle[15].

The economic net benefit was enormous for calf supplemented than non-supplemented group. This was consistently higher for N'dama calves than Bunaji calves. For supplemented N'dama calves N140 was realized as net benefit for 3 months per animal and N140 for Bunaji calves for the same period while their controls had a net benefit of N150 and N100, respectively (Table 3). This was in line with the observation of Little *et al*.[16, 17] who reported a net value of >20-fold the cost of supplementation for N'dama cattle in Gambia.

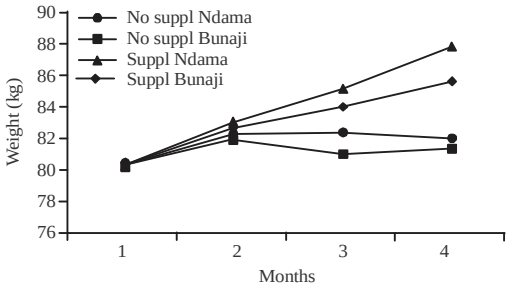

Fig. 1: Effect of dry season protein supplementation on weight profile of grazing N'dama and Bunaji calves; $I_{SE} = 0.87$

Table 1: Chemical composition of the supplement feed (%)

Components	Percentage
Dry matter	90.400
Crude protein	24.440
Ether extracts	7.250
Fiber extracts	20.510
Ash	3.320

Table 2: Least square means of N'dama and Bunaji calves haematological responses to dry season protein supplementary feeding

	Breed of cattle		
Parameters	N'dama	Bunaji	SEM
Packed cell volume (%)	29.50	26.50	0.92
Haemoglobin (g dL^{-1})	7.89	7.63	0.21
Red blood cell ($\times 10^6$ cm^{-1})	4.43	4.20	0.17
White blood cell ($\times 10^3$ cm^{-1})	8.27	7.96	0.19

Table 3: Cost benefit analysis of the dry season protein supplementary feeding

Treatments	Breed	No. of calves	Cost of feeding (N) (90 days)	Calf growth N (90 days)	Net benefit N (90 days)
No supplement	Drama	4	-	600	600
	Bunaji	4	-	400	400
Supplement	N'dama	4	1440	3040	1600
	Bunaji	4	1440	2000	560

1 kg dried brewer's spent grain = N5.00; 1 kg live weight of cattle = N100.00

CONCLUSION

This study demonstrated that dry season supplementary feeding improved animal body weight gain and heamatological parameters. Farmers will benefit from extension package that includes dry season supplementary feeding with natural pasture. Thus, any limitation in protein content of diet would easily be expressed by loss of weight and poor haematologic profile. Thus, of haematolgic parameters and growth rate may provide a useful tool in setting material for evaluating the production potentials of indigenous cattle.

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