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Performance, Haematology And Serum Biochemistry Of Grazing Bunaji Bulls Supplemented Varying Levels An Agro Industrial By- Product Based Diet.

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Abstract: *The performance, haematology and serum biochemistry of grazing Bunaji bulls fed an agro industrial by products based diet at varying levels for 90 days were evaluated in this study. Twelve, two year old bulls, weighing 117.83 kg on the average were allotted to four treatments of three bulls each and fed 1.5, 1.0 and 0.5 kg of the supplement daily before grazing (treatments 1, 2 and 3 coded T1, T2 and T3) while the last group (T4) was grazed without being fed the supplement. The supplemental diet was formulated using palm kernel cake, brewers dried grain, maize offal, bone ash and table salt. Performance, haematological and serum biochemistry parameters measured were: body weight change; packed cell volume, haemoglobin, red blood cells, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, red cells distribution width, platelets, white blood cells, granulocytes, lymphocytes and monocytes; total protein , albumin, aspartate aminotransferase, alanine aminotransferase, alkaline Phosphatase, total bilirubin, glucose and creatinine. The parameters measured did not vary significantly (P>0.01). It was concluded that feeding the supplement had no positive effect on the body weight, haematology and serum biochemistry of the Bunaji bulls.*

Keywords*: Bunaji bulls, Haematology, Performance, Serum Biochemistry.*

I. Introduction

Ruminant production in the tropical region is hampered to a great extent by nutritional limitation. This limitation manifests in forages growing very fast and lignifying early leading to loss in nutritional value and also a clearly defined dry season spanning over many months when the forages dry up and become unavailable [1]. One of the measures suggested for improving ruminant production, and used over the years in the tropics is feed supplementation coupled with grazing the animals. It is reasoned that supplemental feeding provides the ideal environment needed by rumen micro organisms to process the mostly scabrous feeds eaten by the ruminants and provide enough nutrients for the animals' body processes as well as fulfilling the production expectation for which they are kept [2]. It is thus theoretically expected that supplemental feeding should elicit responses that differ from those of non supplemented animals. This is predicated on availability of nutrients which may otherwise not be available for the non supplemented animals. Measurable performances of animals are indicated in growth performance and the blood picture. Reports by [3] Showed that performance of supplemented cattle was better than those not supplemented when they worked with Ankole cattle and its Boran and Friesian crossbreds while [4] and [5]reported no significant differences when performance of supplemented beef cattle was compared to those not fed supplement. Processing of agricultural products arising from cropping activities (main occupation of people in Nigeria) yield many agro industrial by products. Agro industrial by products have been used globally with reasonable success in feed supplementation of grazing animals [6]. This study was carried out to evaluate the performance, haematology and serum biochemistry of grazing Bunaji bulls supplemented an agro industrial by products (Palm kernel cake, maize offal, and brewers dried grain) based diet at varying levels.

II. Methodology

2.1 Experimental diet formulation/preparation

The feed inputs used in feed formulation were sourced from local livestock stores and the feed prepared using the formula in table 1 while the chemical composition of the feed inputs is shown in table 2.

2.2 Proximate analysis

The agro industrial by-products used in formulating the supplementary diet were analyzed for their chemical composition using [7] procedure and the gross energy by use of a bomb calorimeter.

2.3 Study environment

The study was conducted at the Cattle Unit of the Livestock Teaching and Research Farm of the University of Agriculture, Makurdi. Makurdi is located on latitude 7^0 14 N^1 and longitude 8^031^1 and a height of 90 meters above sea level in the Southern Guinea Savannah ecological zone of Nigeria. The rainy season spans from May to October, while dry season spans from November to April. Mean annual rainfall ranges from 1270 to 1397 mm. Mean temperature ranges from 22.3°C to 33.41^{0}C; the mean relative humidity is 64.58% [8]. The University of Agriculture is located on a land mass of 7,986.22 hectares [9] out of which less than half is occupied by buildings and crop farm, the rest is natural grassland on which cattle are grazed.

2.4 Experimental Animals

Twelve White Fulani (Bunaji) bulls, with an average age two years and mean weight of 117.8 kg were purchased from the Makurdi International Cattle Market, taken to the experimental site. The bulls were treated for internal and external parasites using Tridox, ivermectin and pour on. The animals were quarantined for a period of 30 days after which they were weighed and randomly allotted to the four treatments. During supplement feeding each of the bulls was restricted in a pen measuring 3.6 m X 2.5 m constructed of wood and roofed using corrugated iron sheets. The supplement was served in troughs made from metal drums that had been cut into two along the length and fitted with metal rods to enable them remain in standing position.

2.5 Data collection

During the experimental period, the bulls were offered daily the experimental ration between 8:00am and 10:00 am (two hour) after which they were taken out for grazing on the natural grassland around the University environment from 10:00am to 4:00pm local time. Daily supplement quantity intake was determined by subtracting weight of leftover from the weight fed. On the first day of each of the experimental weeks, live weight was recorded prior to morning feeding and was used by subtracting weight of previous week from it to know the weight change. On the last day of the experimental period, blood samples were collected from all the animals at 09:00 am via jugular puncture into 10 mL tubes and haematology and serum biochemistry parameters evaluated using 3200 model auto hemo analyzer at the laboratory of the University of Agriculture, Makurdi Veterinary Teaching Hospital.

2.6 Experimental design/procedure

The study was conducted using the Completely Randomized design. The twelve bulls were allotted into four groups of three animals each and each animal served as a replicate.

2.7 Data analysis

Collected data were analyzed using Analysis of Variance (ANOVA) package of Minitab statistical software and significant differences in means were separated using Duncan's Multiple Range Test as outlined by [10]

2.8 Parameters measured

The parameters measured were body weight change, packed cell volume (PCV), haemoglobin (HGB), red blood cells (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cells distribution width (RDW), platelets (PLT), white blood cells (WBC), granulocytes (GRAN), lymphocytes (LYMPH), monocytes, total protein, albumin, Aspartate amino transferase (AST) alanine aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin and glucose.

Table 1. Experimental Feed Formula

Ingredient	percent inclusion
Brewer dried grain	30
Palm kernel cake	30
Maize offal	35
Bone ash	3
Table salt	2
Total	100
Nutrient composition	
Dry matter (%)	86.25
Crude protein (%)	16.22
Crude fibre (%)	12.38
Ether extract (%)	3.86

Nitrogen free extract (%)	57.85
Ash (%)	4.68
Gross Energy (Kcal/kg)	3.56

Treatments
The four dietary treatments were:
T1: Grazing + 1.5 kg supplement fed daily
T2: Grazing + 1.0 kg supplement fed daily
T3: Grazing + 0.5 kg supplement fed daily
T4: Grazing only without supplement

Table 2. Chemical Composition of feed inputs used in supplementary feed formulation

Chemical component	Input		
	Brewers dried grain	palm kernel cake	maize offal
Dry matter (%)	90.26	91.38	90.70
Crude protein (%)	21.63	18.23	12.19
Ether extract (%)	3.84	6.58	2.10
Crude fibre (%)	14.90	13.70	10.87
Ash (%)	6.27	4.78	3.89
Nitrogen free extract (%)	53.36	56.71	70.95
Gross Energy (Kcal/ Kg)	3.22	4.49	3.57

III. Result

The daily body weight gain and final body weight were highest for bulls offered 1.5 kg supplement daily and lowest for bulls grazed without supplement, and did not differ significantly (P>0.01). PCV and HGB values were highest for bulls offered 0.5 kg supplement daily and lowest for bulls offered 1.5 kg supplement daily, though there were no significant difference (P>0.01). The RBC of bulls fed 0.5 kg supplement daily was the highest and that of those offered 1.0 kg supplement daily was the lowest, though the HGB values did not differ significantly (P>0.01). The bulls assigned to 1.0 kg supplement daily had the highest MCV and MCH while the lowest values were recorded for bulls that were fed 0.5 kg supplement daily, there were no significant difference (P>0.01) in MCV and MCH values. The MCHC values also showed no significant difference (P>0.01) and were highest for the bulls fed 1.5 kg supplement daily and lowest for the group grazed without supplement. The RDW of bulls fed 0.5 kg supplement daily was the highest while that of bulls grazed without supplement was the lowest, there was no significant difference (P>0.01) in RDW values. The PLT values were not significantly different (P>0.01), were highest for the bulls offered 1.0 kg supplement daily and lowest for the bulls offered 0.5 kg supplement daily. The bulls given 1.5 kg supplement daily had the highest WBC while those grazed without supplement had the lowest WBC, there was no significant difference (P>0.01) in WBC of all the bulls. The highest granulocytes percent was recorded for bulls offered 1.5 kg supplement daily while the lowest value was recorded for bulls offered 1.0 kg supplement daily, the values not differing significantly (P>0.01). There was no significant difference (P>0.01) in lymphocytes percent of the bulls; the bulls offered 1.0 kg supplement daily had the highest value while those grazed without supplement had the lowest value. No significant difference (P>0.01) occurred in monocytes percent of the bulls even as the highest value was recorded for the bulls offered 0.5 kg supplement daily and the lowest for bulls offered 1.5 kg supplement daily.
The bulls offered 0.5 kg supplement daily had the highest total protein while those offered 1.5 kg supplement daily had the lowest, there was no significant difference (P>0.01) in total protein values, a trend which was repeated for albumin values. The highest AST values were recorded for the bulls offered 0.5 kg supplement daily, while bulls grazed without supplement recorded the lowest values but there was no significant difference (P>0.01) in AST values. The ALT of bulls offered 1.0 kg supplement daily was the highest and that of bulls offered 0.5 kg supplement daily was the lowest, though all ALT values were similar (P>0.01) to each other. The bulls grazed without supplement had the highest ALP value and those offered 1.5 kg supplement daily had the lowest value even as all the ALP values were similar to each other (P>0.01). There was no significant difference (P>0.01) in total bilirubin values, the highest value was recorded for bulls offered 1.0 kg supplement and the lowest for bulls grazed without supplement. The glucose of bulls grazed without supplement was the highest and that of those offered 1.5 kg supplement daily was the lowest though there was no significant difference (P>0.01) in glucose values. Bulls offered 1.5 kg supplement daily had the highest creatinine values while those of bulls offered 0.5 kg supplement daily and those grazed without supplement were the lowest; there was no significant difference (P>0.01) in creatinine values of all the bulls.

IV. Discussion

The pattern of daily body weight gain showed that the increasing supplement quantity offered the animals proportionately increased the body weight, though there was no significant difference (P>0.05). This range of body weight gain (0.34-0.58 kg/day) compares with results of [3] when Ankole cattle and it's Boran and Friesian crossbreds were either grazed alone or fed supplements additional to grazing and also that of [11] when steers were stall fed. The increasing body weights as supplement fed increased is thought to be caused by availability of more nutrients and especially protein which would have caused grater deposition of the nutrients in the growing animals [12]. It is reasoned that the non significance of the body weight may be due to the availability of abundant forages for the non supplemented group. According to [9], the experimental area covers a land mass spanning over 7,986.52 hectares much of which is covered by natural grass land on which the animals grazed freely. In event of surplus forages, rumen micro organisms are able to digest the forages eaten and provide enough nutrients for the animals to live well. The final body weight is a cumulative of daily body weight gain; it is normal that it followed the pattern of daily body weight gain.

All the haematological and serum biochemistry parameters values fell within reference ranges [13]; [14]). The PCV values fell within reference range values and indicated that the feeds available to the bulls enabled provision of quality protein to them as PCV is useful in assessing protein status of the feed fed. The non significance is also attributed to the fact that the animals were of same breed [15] and rumen metabolism may have provided similar quality nutrients to them despite quality of feed earlier fed. According to [16], rumen micro organisms usually break down the ingested feed, incorporating them to microbial cells which are later digested in the gastrointestinal tract. The high haemoglobin values imply the availability of oxygen carrying capacity of the blood and the animals not suffering from anaemia. The RBC values show the blood of the bulls had enough oxygen carrying ability necessary for normal metabolism in the bulls' systems [17]. Similarity in MCV values of the animals imply that the animals may not stand the risk of haemoconcentration nor anaemia [18]. The animals MCH values showed that they had enough oxygen carried by the RBC because MCH is an indicator of the oxygen carrying capacity of the RBC [18]. The range of RDW of the experimental animals showed that they possessed proportionate variation in cell volume within the red cell population because according to [18], RDW is an index of variation in cell volume within the red cell population. It also showed that the variability in red blood cells volume was not abnormal [19]. The similar platelets values signify that the animals had equal abilities for arresting excess blood loss if there were a broken vessel. According to [20], platelets are small cells in the blood, are designed for a single purpose – to begin the process of coagulation or forming a clot, whenever a blood vessel is broken. Similarity in WBC implies conferment with similar immunity since WBC are known to fight diseases [21]; [18]; [22]. Feeding the experimental ration and grazing was able to provide the nutrients necessary for the animals' body to generate enough disease fighting ability.

The granulocytes values imply that the animals had sufficient potential to ward off attacks that could cause them health challenge. Granulocyte is a type of WBC or leukocyte that ignites and destroys foreign substances in the blood, such as those that cause poisoning, infections and allergies [23]. The values of lymphocytes reported for the animals imply that the animals had a fair potential to ward off invading disease causing organisms. According to [23], lymphocytes are a variety of WBC that directly attack disease causing bacteria, viruses and toxins and regulate the other part of the immune system as well as produce antibodies, which neutralize invaders or mark them for destruction by other agents of the immune system. That the animals had normal monocytes values meant they were equally equipped to identify harmful bacteria, viruses and toxins and attack foreign substances all that are needed for the health, survival and enhanced performance of the animals. Total protein high values are suggestive of high quality protein of the diet and also that the feed contains vital nutrients for the animals [24]. In this instance the nutrients made available to the animals were not protected from rumen

Table 3. Performance, Haematology and Serum Biochemistry of Grazing Bunaji Bulls Fed an Agro Industrial By Products Based Supplement at Varying Levels

Parameter	T1	T2	T3	T4	LOS
Initial body weight (Kg)	118.00±28.00	117.33±14.22	118.00±10.39	118.00±12.00	NS
Daily body weight gain (kg)	0.58±0.30	0.46±0.19	0.39±0.05	0.34±0.05	NS
Final body weight (kg)	170.00±46.29	159.67±9.07	149.33±19.01	148.00±17.09	NS
PCV (%)	26.97±1.34	27.67±0.83	29.23±3.50	28.87±6.48	NS
Hgb (g/L)	88.33±2.52	89.33±3.06	94.67±8.74	91.33±20.65	NS
RBC ($x10^{12}$/L)	6.37±0.57	5.92±0.13	6.91±0.45	6.45±1.79	NS
MCV (fl)	42.73±5.67	47.40±4.81	42.50±6.07	45.27±2.75	NS
MCH (pg)	13.90±1.47	15.00±0.20	13.67±1.42	14.23±0.67	NS
MCHC (g/L)	327.33±11.02	317.00±4.00	324.00±12.29	316.00±6.56	NS
RDW (%)	16.20±0.85	16.00±0.95	17.23±1.07	15.60±0.40	NS
PLT (x 10^9/L)	518.7±34.6	799.0±7.00	442.3±138.5	711.0±281.5	NS
WBC (x 10^9/L)	12.47±1.99	11.90±2.88	11.23±3.91	10.30±1.55	NS
GRAN (%)	51.23±11.60	39.30±0.90	39.77±14.34	47.80±3.46	NS
GRAN (x 10^9/L)	6.33±1.46	4.70±0.10	4.37±2.04	4.93±0.72	NS
LYMPH (%)	39.37±15.65	45.80±2.50	45.13±17.04	38.63±4.71	NS
LYMPH (x 10^9/L)	5.00±2.17	5.43±0.25	5.17±3.24	4.03±1.01	NS
MONOCYTES (%)	9.40±4.50	14.90±1.60	15.10±2.87	13.57±1.93	NS
MONOCYTES (x 10^9/L)	1.13±0.42	1.77±0.15	1.70±0.62	1.33±0.06	NS
TOTAL PROTEIN (g/L)	57.77±2.75	60.60±2.62	62.03±8.34	59.77±3.13	NS
ALBUMIN (g/L)	27.63±1.10	28.90±0.96	30.40±1.44	28.17±2.15	NS
AST (u/L)	37.00±1.00	41.33±22.23	45.67±44.41	34.67±8.62	NS
ALT (u/L)	4.67±4.04	6.67±3.51	1.17±1.61	2.00±2.65	NS
ALP (u/L)	20.37±13.58	23.20±3.51	20.87±11.87	30.10±11.19	NS
TOTAL BIL. (mg/L)	0.33±0.19	0.35±0.17	0.32±0.03	0.25±0.07	NS
GLUCOSE (mg/L)	308.67±26.58	317.33±33.29	331.67±65.96	351.67±20.40	NS
CREATININE (mg/L)	2.13±1.01	2.03±0.21	1.93±0.60	1.93±0.25	NS

T1 = fed 1.5 kg supplement; T2 = fed 1.0 kg supplement; T3 = fed 0.5 kg supplement; T4 = grazing without supplement; LOS = level of significance; NS = Not significantly different;
* = significantly different ($P<0.01$)

Microbial breakdown and so may have resulted in being broken down by the rumen micro flora and thus the quality of protein ultimately available to the bulls fed the supplement may have been same as that of the bulls grazed without supplement. More so since all the animals were healthy, their blood total protein were also expected to be similar because total protein is a reflection of dietary protein and health status of the animals. According to [25], reports on zebu heifers indicate that level of protein fed had no significant effect on the total plasma protein. Plasma proteins partake in nutrition by functioning as a pool for amino acids and other tissue protein. The normal values of the bulls' albumin is beneficial because albumin is involved in blood clotting, so animals with high values may face less risk of haemorrhage [26]. It has the physiological function of maintaining colloidal osmotic pressure required to maintain blood volume [25].

The similarity in AST and ALT means there was no heath challenge that affected the heart and livers of the experimental animals because these enzymes are usually found in high quantities in the blood whenever there are injuries to the heart and liver [27]. ALP being in reference range means there were no disorders in the experimental animals. According to [23], ALP is an enzyme released into the blood in various disorders including obtrusive jaundice and some bone diseases; it also controls hydrolysis. The bilirubin values implied that there was no problem with metabolism because bilirubin is a reddish yellow bile pigment and an intermediate product of the breakdown of haemoglobin in the liver. Too much bilirubin in the blood indicates jaundice [28]. The glucose levels of the bulls implied absence of a challenge in carbohydrate metabolism. The normal glucose levels also indicated that the animals were not suffering from glycaemia and glycusoria [29]. In ruminants, glucose is not the main source of energy but is nevertheless needed as energy for the brain and for lactose and milk production and other uses [30]. Similar creatinine values imply the animals have similar efficiency of handling waste products of metabolism since it is a waste in the blood. According to [31], creatinine is a derivative of creatine found in muscle, blood and urine.

V. Conclusion

It is concluded that the feeding regime used in feeding the experimental bulls did not enhance their performance and blood picture

It was recommended that:

i. the tested levels of the experimental diet could be used in supplementing grazing Bunaji bulls
ii. the effect of these tested levels be investigated in feedlot fattening of Bunaji bulls.

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