The Haematological and Serum Biochemistry of four Breeds of Cattle fed Palm Kernel Cake based diet

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Abstract— *The objective was to investigate haematological and serum biochemical parameters of four Nigerian breeds of cattle grazed and supplemented with palm kernel cake. Twenty four yearlings were used for this study. Experiment was a 2×4 factorial laid in a completely randomized design. Animals were divided into two groups, one group fed experimental diet and also grazed while the other only grazed. At the end of eight weeks feeding trial, four animals of different breeds were from each group making a total of eight animals selected. Blood samples were collected from these animals via jugular vein puncture using sterilized disposable syringe. Parameters determined were red blood cell, white blood cell, pack cell volume, haemoglobulin, mean corpuscular haemoglobulin, mean corpuscular haemoglobulin concentration, mean corpuscular valve, total protein, globulin, creatinine, albumin, cholesterol, urea, amino transferase and alanine transferase. The data collected were analyzed using IBM SPSS (2011). Results revealed that concentrate and grazing and grazing alone had effect ($p<0.05$) with the following values respectively on Hb (9.29,7.05), WBC (9.29,5.20), RBC (6.40,5.03), PCV (25.91,18.01), MCH (13.81,14.15), MCHC (35.00,34.84) and PLT (590.25,501.25) of breeds but had no effect on MCV (40.10,22.56) of breeds ($p>0.05$) though parameters were within normal range for cattle. Similarly, concentrate and grazing, and grazing alone had effect ($p<0.05$) on serum biochemical profile with the following values respectively total protein (7.85,7.43), albumin (4.54,2.81) total cholesterol (145.00,145.38), urea (38.75,3919) and alanine transferase (69.55,61.83) but had no effect ($p>0.05$) on creatinine (0.96,1.04), globulin (2.91,3.62) and aspartate aminotransferase (68.43,75.88) although all values were still within normal range for cattle. It is therefore concluded that blood biochemical parameters and haematology were within range in all treatments indicating that diet did not exert any deleterious effect. Animals that fed on concentrate however recorded higher values for most parameters. Therefore, the supplementation of Cattle diet with PKC is advisable*.

Keywords— Haematological, Serum biochemical parameters, Palm kernel cake, Nigerian breeds of cattle, Concentrate supplementation.

I. INTRODUCTION

Cattle are the most common type of large domesticated animals *(www.agriculturwnigeria.com)*. They command a prominent position in our meat and livestock industry. Cattle are also utilized for milk, hides and skin which is processed into leather, it's by products such as dung is utilized as manure and fuel.

Rangelands for animals to graze only blossom in the rainy season while in the dry season, they become standing hay (*Bamigboye et al.,2013*).Feed accounts for about two- third of the cost of meat production (*Vecchiettin and Giardini, 2000*) which is about 70-90% of total cost of fattening cattle (*Lamidi, 2005*).High cost of conventional feedstuffs have made research efforts to be directed towards harnessing and enhancing the utilization of agricultural by products and crop residues for livestock feeding.

Palm kernel cake is highly fibrous and has a medium grade protein content which is more suitable in feeding of ruminants and rabbits (*Pichard, 2005*). Protein content of palm kernel cake is between 18-25% (*Onwuka et al.,2014*). Palm kernel cake is deficient in lysine, methionine, histidine and threonine. Palm kernel is gritty and high in fibre content.

The health status of animals maintained under different feeding conditions is one of the criteria for welfare assessment. The assessment is through the haematology and serum biochemistry of the animal. The need to observe the changes taking place in the animal's body in response to external factors such as nutrition as it affects haematological and biochemical parameters cannot be over emphasized (*Scamell, 2006*). When haematological and serum biochemical values fall within the normal range established for the animal, it is an indication that the diet does not show adverse effect on the animal. Haematological and serum biochemical components are valuable in monitoring feed toxicity especially with feed constituents that affect the blood as well as health status of farm animal. Haematology and serum biochemistry assay of livestock determine the physiological disposition of the animals to their nutrition (*Menon et al, 2013*). Haematological traits especially PCV and Hb are correlated with the nutritional status of animals PCV and other haematological parameters are useful aids to prognosis and may reveal adverse condition even when the animal does not display obvious clinical signs of ill health. Thus biochemical determination of serum constituents and blood examination can provide valuable information regarding nutrition, and other environmental factors that influence the performance and wellbeing of animals (*Ate et al., 2009; Al-Fartosiet al., 2010; Diostanzo and Gill, 2012*). Serum vitamin, protein and lipid concentrations are affected by diet/nutrition (*Swanson et al, 2004*). Diet is therefore an important factor influencing rumen environment and blood metabolite. This study was carried out to evaluate the effect of palm kernel cake on haematology and serum biochemistry of four breeds of cattle.

II. MATERIALS AND METHODS

2.1 Experimental Site

This experiment was carried out at the ruminant section of the department of animal science and technology research farm, Nnamdi Azikiwe University Awka, Anambra state. The location is situated on lat 6.24◦N, 6.28◦N and a longitude of 7.00◦E, 7.04◦E of the equator on the southern part of Nigeria. The climate is the tropical wet and dry with clear season. The mean daily temperature is usually about 27◦c-34◦c in March and lowest during harmattan month of December and January (*Ezenwaj 2013*). The annual temperature and rainfall are 26.8◦c and 1589mm respectively.

2.2 Experimental Animal and Management

A total of twenty four yearlings of four different breeds of cattle was used for this experiment. The breeds include; White Fulani, Red bororo, Adamawa gudali and Sokoto gudali. They were purchased from cattle markets in Adamawa state.

2.3 Experimental Diet

Palm kernel cake used for experiment was purchased from a known palm kernel cake processing factory at Amansea Awka.

2.4 Management of Experimental Animals

On arrival, the animals were weighed, tagged and kept in pens for proper routine maintenance. All animals were given antibiotics injection (oxytetracycline) while Ivomec injection was administered to control both endo and ecto-parasites. Animals were acclimatized for two weeks before commencement of feeding trial. The feed given was a PKC and salt was provided free choice for the animals. The diet was given to the animals in the morning before they go to graze. Water was also supplied ad-libitium. Feeding trial lasted for eight weeks excluding two weeks of adjustment period.

2.5 Experimental Treatment

Yearlings were divided into two groups, twelve animals per breed. A group was fed experimental diet while the other did not. Each animal in each group constituted a replicate.

2.6 Data Collection

At the end of eight weeks feeding phase, blood samples were collected from four animals from each group making a total of eight animals. 5ml of blood was collected from each animal via jugular vein puncture using sterilized disposal syringe and needle. Blood samples were drawn into vials containing Ethylene-Diamine-Tetra-Acetic acid (EDTA) as anticoagulant. This was used to determine the following haematological and serum parameters Red blood count (RBC), pack cell volume (PCV), white blood cell (WBC), platelets, haemoglobin concentration (HC), mean corpuscular valve (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC), total protein globulin, glucose, albumin, cholesterol, creatinine, urea, amino transferase and alaninetransferase. Haematological parameters were analysed using rinse, diluents and M-30Cfl lyse reagents in a haematology auto analyser. Serum was analysed using a serum auto analyzer.

2.7 Experimental Design and Statistical Analysis

The experiment was a 2 by 4 factorial arrangement involving two treatments which are the patterns of feeding (concentrate/ grazing and only grazing) and four breeds (white Fulani, red bororo, sokoto gudali, adamawa gudali) were shared into two groups in a completely randomized design. Statistical package used was IBM (2011).

III. RESULTS AND DISCUSSION

TABLE 1
HAEMATOLOGICAL INDICES OF INDIGENOUS CATTLE GRAZED AND SUPPLEMENTED WITH PALM KERNEL CAKE

Factors		**Parameter**							
Breed	Feeding Pattern	Hb	PCV	RBC	WBC	MCV	MCH	MCHC	PLT
AG	Concentrate feeding combined with grazing	8.25	22.30	5.61	9.45	37.70	13.80	36.10	623.50
	Grazing	6.90	17.25	5.13	4.40	22.10	14.20	35.35	472.50
WF	Concentrate feeding combined with grazing	9.15	26.65	6.59	9.85	38.90	13.25	34.50	731.50
	Grazing	7.45	22.10	5.02	7.55	25.90	14.60	33.70	603.50
SG	Concentrate feeding combined with grazing	10.15	31.10	7.08	9.60	44.40	14.40	32.50	403.00
	Grazing	6.75	17.20	4.78	3.85	21.10	14.10	35.95	504.00
RB	Concentrate feeding combined with grazing	9.60	23.60	6.30	8.25	39.40	13.80	36.90	603.00
	Grazing	7.10	15.50	5.21	5.02	21.15	13.70	34.35	425.00
	SEM	0.16	0.48	0.15	0.22	12.44	0.14	0.15	2.35
	p-value	0.001	0	0.001	0	0.978	0.001	0	0

Where: AG = Adamawa gudali

WF = White fulani

SG = Sokoto gudali

RB = Red bororo

PCV=Packed cell volume

RBC= Red blood cell

WBC= White blood cell

MCV= Mean corpuscular haemoglobin

MCH= Mean corpuscular haemoglobin

MCHC= Mean corpuscular haemoglobinconcentration

PLT= Platelets

TABLE 2
SERUM BIOCHEMICAL INDICES OF INDIGENOUS CATTLE GRAZED AND SUPPLEMENTED WITH PALM KERNEL CAKE

Factors		Parameter							
Breed	Feeding Pattern	TP	Globulin	Albumin	TC	Creatinine	AST	ALT	Urea
AG	Concentrate feeding with grazing	8.06	2.53	5.53	151.5	0.95	65.4	73.3	40.00 40.00
	Grazing	7.07	3.65	2.52	149	1.03	73.25	62.2	39.04 39.04
WF	Concentrate feeding with grazing	6.53	3.03	3.53	153	0.9	67.4	70.4	37.04 37.04
	Grazing	7.04	4.06	2.98	138	1.04	80.4	60.25	38.06 38.06
SG	Concentrate feeding with grazing	8.52	3.04	5.48	136	1.25	71.5	66.2	39.07 39.76
	Grazing	8.29	3.55	3.02	148	1.03	75.45	63.25	40.65 40.65
RB	Concentrate feeding with grazing	8.27	3.03	3.63	139.5	0.75	69.4	68.3	38.20 38.20
	Grazing	7.32	3.23	2.73	146.5	1.06	74.4	61.6	39.02 39.02
	SEM	0.1	0.17	0.02	1.49	0.05	1.61	0.2	0.13 0.13
	P-value	0	0.077	0	0	0.003	0.087	0	0.0

3.1 Haematological profile of four breeds of cattle (Adamawa gudali, White Fulani, sokoto gudali and Red bororo)

The hematological status of cattle grazed and also fed supplement (pkc) and those grazed alone were similar but significantly different ($p<0.05$) as shown in all tables.

The Hb for the animals grazed and also supplemented with concentrate fell within the range of (8.25-10.15 g/dl) and those that grazed alone ranged between (6.75-7.45g/dl). Though the values for supplemented animals were higher, they all fell with the normal range for healthy cattle as reported by (RAR, 2009).

PCV for animals grazed and fed supplement were within the ranges of 22.30-31,10g/dl while animals that only grazed were between 15.50-22.10 g/dl. Theses' values obtained all fell within the range for healthy cattle as reported by (RAR, 2009). This suggests that PKC in cattle ration does not induce reduction in PCV.

RBC for grazed and supplemented cattle and those grazed alone were similar but significantly different. The RBC values obtained for grazed and supplemented cattle were between the ranges of ($5.61\text{-}7.08\times10^6\times\mu/l$) and ($5.02\text{-}5.21\times10^6\mu/l$) respectively but still fell within the range for cattle as reported by (MVM, 2012).

WBC count were similar among breeds and agrees with the normal value of WBC that ranged between $4\text{-}12\times10^3\mu/l$ as stated by (RAR,2009) but higher WBC values was observed in breeds grazed and fed supplement. This indicates that animals were capable of generating antibodies in the process of phagocytosis and have high resistance to diseases (Soetan et al, 2013).

MCV however was not significantly different ($p>0.05$). Breeds grazed and fed supplement ranged between (37.7-44.40 fl) which fell within range for healthy cattle according to (RAR, 2009) but animals that only grazed had values between (21.15-25.90fl) these values were below the established range for healthy animals. This could be as a result of anemic condition and on deficiency in diet.

MCHC were similar but significantly different among breeds of grazed and supplemented and only grazed cattle. The range however was normal for healthy cattle reported by (RAR, 2009). This shows that blood level condition of animals was stable and was not affected by feeding pattern.

Platelet count of animals both grazed alone and supplemented with concentrate (pkc) were all similar and within range for healthy cattle as reported by (RAR, 2009). Platelets were unaffected by feeding pattern

3.2 Serum biochemistry of four breeds of cattle (Adamawa gudali, Sokoto gudali, White fulani and Red bororo) grazed and supplemented with palm kernel cake.

The results showed that there was significant difference ($p<0.05$) among parameters measured for different breeds except globulin and AST which were not significantly different ($p>0.05$).

The total protein of experimental animals fell within range normal range of 6.7- 8.8 g/dl (Gleghorn et.al, 2004). Although SG, AG, WF and RB grazed and also supplemented with pkc had highest values of 8.25, 8.06, 6.53 and 8.27g/dl respectively compared to animals grazed alone but were within range for healthy cattle as reported (msdvet manual.com). This could mean that those animals received adequate levels of protein from the diet and this translated into adequate production of microbial protein by the microbes to the animal.

Total cholesterol and albumin values for different breeds were significant ($p>0.05$) and fell within range for healthy cattle as reported by (msdvet manual.com) though values carried with some breeds fed supplement with AG having highest values (15.50mg/dl) for cholesterol and (5.53g/dl) and albumin. WF also recorded 153.00 for cholesterol and 3.53 for albumin, SG and RB also recorded highest for cholesterol (5.48mg/dl) and (3.63g/dl) for albumin compared to the animals grazed alone. Total cholesterol however, were high in some breeds only grazed this included SG which recorded (148.00mg/dl) and RB (146.50 mg/dl). All values gotten did not exceed the range for healthy cattle. Thus, PKC has no adverse effect on cholesterol and albumin of animals. Values of grazed animals which recorded high vales for total cholesterol could be due to influence of selectivity preference of forage by animals when they go on grazing.

It was observed that AST was not significantly different ($p>0.05$) among breeds but fell within normal range for healthy cattle as reported by (msdvetmanual.com). Result showed that AST values were highest in breeds grazed and supplemented with pkc. AST activities increased above normal range in pathological situations that cause cell necrosis such as liver damage to liver cells (Klinkon and Jezek, 2012) but AST in this study was within range.

Creatinine and urea were significant ($p<0.05$) among breeds. Klinkon and Jezek stated that increased urea concentration in serum of values is indicative of increased protein catabolism. On the other hand, creatinine is synthesized during endogenous metabolism in muscles and do not depend on nutrition (Klinkon and Jezek, 2012) the values reported for the various variables fell within ranges reported for apparently healthy subjects by other studies. For instance, Mahima et al. (2013) reported reference values for urea as 34.26 ± 0.90g/dl, creatinine (0.93 ± 0.03g/dl), total protein (5.34 ± 0.10g/dl), globulin (1.94 ± 0.31g/dl), ALT (29.58 ± 1.08iu/l), and AST (66.63 ± 2.38 iu/l) in healthy Hariana cattle. Omer *et al.* (2009) reported values of 26.78 ± 1.77mg/100ml, 1.33 ± 0.20mg/100ml, 7.24 ± 0.20g/100ml, 9.74 ± 1.98iu/l, and 25.24 ± 2.27iu/l for urea, creatinine, total protein, ALT and AST, respectively in suckling and yearling Sudanese carmels (Camelusdromedarius). In cattle breeds of Saudi Arabia, Al-Shami (2003) reported values of serum urea as 24.1 ± 2.1mg/dl, 1.3 ± 0.01mg/dl for creatinine, 7.4 ± 0.62g/dl for total serum protein, 270 ± 20.1iu/l for AST and 0.1 ± 1.4 for ALT. These values substantially agree with the values reported in the present study and this showed that both natural forages and the formulated rations were well tolerated by the animals and that supplementation of diet with palm kernel cake has no adverse effect on pathology of animals.

IV. CONCLUSION AND RECOMMENDATION

From the results obtained in this study, it is concluded that the use of palm kernel cake as supplement to cattle did not have any adverse effect on haematology and serum biochemistry of the different breeds of cattle rather all parameters were within the normal range for healthy cattle.

I recommend that farmers use palm kernel cake in fattening their cattle as it no negative effects on health of animals but rather promotes growth and meet up the dietary requirements of the animals.

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