Nigerian Journal of Basic and Applied Sciences Vol. 16 No. 2 December 2008 235 - 242

Effects of Feeding High Level of Cowpea Husk on the Haematological and Blood Urea Nitrogen of *Uda* Lambs

[1]A.A. Kwaido, [1]S.A. Maigandi, [1]B.S. Malami and [2]A.I. Daneji
[1]Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto.
[2]Department of Medicine, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto.

ABSTRACT: This study was conducted at Usmanu Danfodiyo University, Sokoto, to find out the effect of feeding high levels of cowpea husk on the haematological parameters and Blood urea nitrogen of Uda lambs. Fifteen (15) weeks feeding trial (including three (3) weeks digestibility trial) was conducted using sixteen (16) growing Uda lambs. Four diets with varying levels of cowpea husk were formulated. The diets were diet 1 control, 0% cowpea husk, diet 2, 20%, diet 3, 40% and diet 4, 60% cowpea husk. Blood samples were collected prior to and at the end of the feeding trial for haematological (blood glucose, blood urea nitrogen and bilirubin) studies. Results showed that incorporation of cowpea husk in the diet of growing Uda lambs up to 60% level gave an encouraging effect. Haematological parameters, blood glucose and blood urea nitrogen and bilirubin obtained at the end of feeding trial were within the normal ranges reported in the literature. It could be concluded that cowpea husk has no detrimental effect on the haematological characteristics of growing Uda lambs.

INTRODUCTION

Over 70% of Nigeria's national herd is located within the Sudan and Sahel zones; Most of the livestock in these derived their annual dry matter intake from crop residues, for instance, Olayiwole and Olorunju, (1987) reported that ruminants alone derive about 18% annual dry matter intake from crop residues.

Cowpea husks and haulms are among the most important crop residues obtained from cowpea plants and are used as fodder. Some farmers grow the crop for only this purpose. Large quantities of cowpea husks are produced in the country. Adebowale (1981) reported that about 82,000 metric tonnes of cowpea husks and straws are produced in Nigeria annually.

Haematological components of animals could provide useful information on their health status. It has also been reported that the metabolic systems involved in the physiology of growth and reproduction are dependent on some blood components. One factor that affects these components is plane of nutrition There is very scanty information on how this deficiency in nutrition affects the haematological components of sheep in Nigeria (Abdullahi *et al.*, 1986). This study therefore was conducted to determine the haematological characteristics and Blood Urea Nitrogen (BUN) of the uda lambs.

MATERIALS AND METHODS

The study was conducted at the Usmanu Danfodiyo University, Sokoto, Livestock Teaching and Research Farm. The farm is situated within the main campus of the University at about 10km north of Sokoto Metropolis in Wamakko Local Government Area of Sokoto State.

Sokoto State is located in the Sudano – Sahelian zone in the extreme north western part of Nigeria. It falls between longitudes 4°8'E and 6° 54'E and latitudes 12° 0' N and 13° 58'N (Mamman *et al*., 2000) and at an altitude of 350m above the sea level.

The State has a semi-arid climate, which is characterized by low rainfall. Diurnal and seasonal temperature fluctuations are very wide, where minimum temperature has been recorded to be 13°C in January and maximum temperature of 42°C has been recorded in April (SEPP, 1996).

Humidity is low during most parts of the year with a relatively high solar radiation and clear skies. In the extreme northern part of the state, the humidity in January is less than 20% and in the southern area, it varies between 20 - 40%. Also the potential evapo-transpiration rate has been reported to be 162cm (SEPP, 1996). The State is also blessed with abundant livestock species.

Experimental Animals and their Management

Sixteen, intact male Uda lambs with an average age and weight of 6.5 months and 22.63kg, respectively, were purchased locally for the experiment. The lambs were quarantined for two weeks, dewormed with Sambizole 11® (3mls/10kg liveweight of the animal) and sprayed against ectoparasites with Triatic® and treated with Oxytetracycline HCl (1ml/10kg liveweight) administered intra-muscularly.

The Uda lambs were managed intensively and fed in groups with groundnut hay and wheat bran prior to the commencement of the experiment.

Preparation of Experimental Feed Ingredients

Cowpea Husk

The principal ingredient (tested feed) was cowpea husk, which was purchased from a local market. The dried cowpea husk was packed in sacks and used during the experiment.

Formulation of Experimental Diets

Four (4) complete experimental diets were formulated using varying levels of cowpea husks 0%, 20%, 40% and 60% levels of inclusion. The composition of the experimental diets is shown in Table 1. Variations in composition of the feed ingredients (as observed from Table 1) were made in order to balance up the crude protein and energy levels.

Experimental Design and Feeding Procedure

A Randomized Complete Block Design CRBD (Steel and Torries, 1980) was used in this experiment. Four (4) animals were allocated to each treatment and were blocked for weight with each animal representing a replicate. Each animal was individually housed in a pen, which had been previously disinfected. Each group of four animals was assigned to one of the experimental diets and fed *ad libitum* in the morning and evening for 90 days. Water was also measured.

Sample Collection and Analysis

Blood samples were collected from each animal before the commencement of the feeding trial and at the last week of the experiment. The samples were collected from the jugular vein (Coles, 1986). Bleeding was done early morning before feeding and an average of 7 ml of blood was collected from each animal. About 3 ml of each sample was placed in an ethylenediaminetetraacetate EDTA (anti–coagulant) bottle for haematological studies. The remaining 4ml were placed in a universal bottle and allowed to stand for about 2 hours at room temperature; this allowed the coagulation to take place and subsequent collection of serum which was used for the analysis.

Table 1: Composition of the experimental diets

Ingredients	Experimental diets			
	0% C.H	20% C.H	40% C.H	60% C.H
Cowpea husk	0.0	20.0	40.0	60.0
Maize	8.0	5.0	2.0	2.0
Rice milling waste	20.0	12.0	7.0	0.0
Groundnut hay	33.0	31.0	19.0	13.0
Cotton seed cake	14.0	11.0	15.0	17.0
Wheat offal	23.0	19.0	15.0	6.0
Bone meal	1.0	1.0	1.0	1.0
Salt	1.0	1.0	1.0	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**
Calculated Crude Protein	16.1	16.1	16.1	16.1
Calculated energy	3168.5	3144.3	3002.1	2996.5
Cost/kg Diet (₦)	46.1	40.1	36.9	35.7

C.H = Cowpea husk

Chemical Analysis
Whole blood samples in ethylene diamine tetraacetate (EDTA) bottles were analysed for haemoglobin (Hb) content using cyanomethemoglobin method (Coles, 1986). Packed cell volume (PCV), erythrocyte and leucocyte counts were also determined according to the methods described by Coles (1986).

Blood urea nitrogen was estimated by the method of Tanis and Naylor (1968). Total protein in the blood was also estimated by the method of Henry and Stobel (1957). Albumin was determined by Bromocresol green method, while globulin was calculated by sulphanilic difference between total protein and albumin. Blood glucose and bilirubin were also determined by glucose oxidase and sulphanylic acid methods respectively.

Statistical Analysis
The data generated from the experiments were subjected to analysis of variance (ANOVA) using completely randomized block design (CRBD) according to Steel and Torrie (1980). Where significant differences between the means were indicated, Duncan's Multiple Range Test (DMRT) was used to separate the means (Duncan, 1955).

RESULT
Haematological Parameters in Serum of the Experimental Animals
Table 2 indicates the values for the haematological parameters of the experimental animals. The initial packed cell volume (PCV) recorded before the commencement of the feeding trial was significantly ($P<0.05$). Similar for animals on treatments B and D which differed significantly with animals on other treatments. Likewise treatments A and C recorded the lowest PCV values which did not differ significantly ($p>0.05$). The final PVV values recorded at the end of the feeding trial was significantly higher ($P<0.05$) for animals on treatment D compared to other treatment means.

Both the initial and final haemoglobin concentrations (g/d) were not significantly ($P>0.05$) different between treatment means.

The initial red blood cell (RBC) value for treatments B and D were significantly higher ($P<0.05$) than those in treatments A and C. There were no significant differences ($P>0.05$) between treatments B and D, likewise between treatments A and C.

Final RBC concentration was higher in animals on treatment D compared to other treatments, though not significantly different ($P>0.05$). However, there were no significant increase ($P>0.05$) in the final RBC concentration in all the treatments, although more increase was recorded in treatments C and D.

The initial WBC concentration was higher for animals on treatments A and C, while the least was recorded for animals on treatment D. However, significant differences ($P<0.05$) were recorded in the final WBC values among all the treatments. The highest final WBC was recorded for treatment D while the least value of WBC at the end of the feeding trial was recorded for treatment C.

Differential Count Values of WBC (%) in Growing Uda Lambs Fed Varying Levels of Cowpea Husk
The differential counts of the WBC are shown in Table 3. From the table it could be observed that initial neutrophils (%) decreased ($P<0.05$) in animals from treatment A to D. The animals for treatment D recorded the highest final Neutrophils (%) value while those for treatment C recorded the least value.

The mean initial Eosinophils mean values differed significantly ($P<0.05$) between the treatments and there was an increase in the initial Eosinophils values from treatments A to D. The final Eosinophils did not differ significantly ($P>0.05$) between the treatments. Increased Eosinophils content was recorded for animals on treatment A at the end of the study. However, eosinophils content was constant throughout. Basophils were not detected both in the initial and final blood samples of the experimental animals.

The initial Lymphocytes mean value was significantly higher ($P<0.05$) for animals for treatment D, while animals for treatment A recorded the least. The final Lymphocytes counts differed significantly ($P<0.05$) between treatments with the highest value recorded for animals on treatment A while the least value was obtained by animals for treatment D.

The initial monocytes value was significantly higher (P<0.05) for treatment D. Final imoncytes recorded significantly higher (P<0.05) values for animals on treatments C and D, while the least moncyte level was recorded for treatment B at the end of the study.

Table 2: Haematological Changes of Uda Lambs fed varying levels of Cowpea Husk

Parameter	Treatments (Cowpea Husk Inclusion levels %)				
	0% C.H	20% C.H	40% C.H	60% C.H	SE
Packed cell volume (%)					
Initial	23.00b	26.50a	22.00b	26.33a	0.16
Final	27.50b	27.25b	28.00b	33.33a	0.17
Haemoglobin conc. (g/dl)					
Initial	7.68	8.90	7.65	8.80	0.39
Final	8.98	8.93	8.90	9.73	3.22
Red blood cell ($x10^{12}$/L)					
Initial	3.70b	4.28	3.38	4.27a	0.15
Final	5.60	5.48	6.03	7.23	0.3
White blood cell (x 10^{12}/L)					
Initial	5.18	3.88	5.25	3.70	1.21
Final	4.80c	5.80b	3.10d	7.60a	0.4

a.b.c.d means in the same row with different super scripts are significantly different (P<0.05)
C.H = Cowpea husk, SE = Standard Error, g/dl = grammes per decilitre.

Table 3: Differential Count of WBC (%) in Growing Uda Lambs fed varying Levels of Cowpea Husk

Parameter	Treatments (Cowpea Husk Inclusion levels %)				
	0%C.H	**20% C.H**	**40% C.H**	**60% C.H**	**SE**
Neutrophils (%)					
Initial	68.25a	64.00b	62.75c	58.33d	0.45
Final	23.50c	26.50b	21.75d	27.00a	0.13
Eosinophils (%)					
Initial	0.25b	0.50b	1.25a	1.33a	0.01
Final	0.50	0.00	0.00	0.00	0.26
Lymphocytes (%)					
Initial	26.50c	30.25b	29.50b	32.67a	0.11
Final	64.00a	63.00b	63.25b	59.33c	0.15
Monocytes					
Initial	5.00b	5.25b	5.25b	7.67a	0.11
Final	12.00b	10.50c	13.50a	13.67a	0.15

a.b.c.d means in the same row with different super scripts are significantly different (P<0.05)
C.H = Cowpea husk, WBC = White Blood Cells, SE = Standard Error.

Biochemical Changes in the Blood of Uda Lambs

Table 4 presents the biochemical changes in the blood serum of growing Uda lambs fed varying levels of cowpea husk. Initial urea concentrations were significantly higher (P<0.05) for animals on treatment D compared to other treatments. Final urea concentrations were lower than the initial values recorded in all the treatments, thus leading to a decrease in urea concentrations at the end of the trial, although the treatments did not differ significantly (P>0.05).

There were significant differences (P<0.05) between all the treatments in the initial total protein values. Final total protein significantly (P<0.05) increased in treatments B and D, but decreased in treatments A and C.

Initial albumin values differed significantly (P<0.05) between treatments. Final albumin

level was significantly higher (P<0.05) in treatments A and B whose values were similar, but differed significantly (P<0.05) from treatments C and D.

Initial globulin concentration (g/dl) was significantly higher (P<0.05) for animals on treatment D. Animals on treatment B recorded the least value. Final globulin concentration increased significantly (P<0.05) as the level of cowpea husk increased.

The initial total bilirubin (mmol/L) differed significantly (P<0.05) between treatments. The final total bilirubin followed the same pattern with that of the initial total bilirubin.

Animals for treatment A recorded the highest initial direct bilibrubin value. The mean values of treatments C and D were not significantly (P<0.05) different. Final direct bilirubin content of blood shows an increase in animals on treatments B, C and D. However, treatment A recorded a decrease in the final direct bilirubin.

Initial serum glucose values were not significantly different (P>0.05) between all the treatments. Final serum glucose values significantly increased (P<0.05) in all the treatments.

Table 4: Biochemical Changes in Serum of Growing Uda Lambs Fed Varying Levels of Cowpea Husk

Parameter	Treatments (Cowpea Husk Inclusion levels %)				
	0% C.H	**20% C.H**	**40%C.H**	**60% C.H**	**SE**
Urea conc. (mmol/L)					
Initial	29.13[b]	26.60[d]	28.45c	33.40[a]	0.12
Final	6.88	7.98	8.43	8.98	0.08
Total Protein (g/dl)					
Initial	72.00[c]	65.75d	74.25[b]	75.67[a]	0.43
Final	69.25[d]	70.25c	73.00[b]	82.00[a]	0.33
Albumin (g/dl)					
Initial	36.75[c]	36.00d	39.25[a]	38.67[b]	0.19
Final	40.75[a]	40.75[a]	39.25[b]	38.33[c]	0.17
Globulin (g/dl)					
Initial	35.25[b]	29.75[c]	35.00[b]	37.00[a]	0.59
Final	28.50[c]	29.50[c]	33.75[b]	43.67[a]	0.33
Total bilirubin (mmol/L)					
Initial	0.20[a]	0.14[b]	0.12[c]	0.12[c]	0.01
Final	0.23[a]	0.17[b]	0.14[c]	0.13[c]	0.02
Direct bilirubin (mmol/L)					
Initial	0.09[a]	0.05[c]	0.06[b]	0.06[b]	0.01
Final	0.08[a]	0.07[b]	0.07[b]	0.07[b]	0.01
Glucose (mmol/L)					
Initial	1.21	1.99	0.23	0.33	0.46
Final	2.68[b]	3.33[a]	2.95[b]	3.67[a]	0.04

a.b.c.d means in the same row with different super scripts are significantly different (P<0.05)
C.H = Cowpea husk, SE = Standard Error, g/dl = grammes per decilitre.

DISCUSSION

Characterization of the Experimental Diets

Incorporation of cowpea husk in the diets of Uda lambs led to a slight reduction in the crude protein (CP) content from treatment A (control) to treatment D (60%) level of inclusion). The CP levels in the experimental diets were within the recommended levels of 16-18% reported by Church (1978) and ARC (1990) for growing sheep in the tropics. The CP contents obtained in the present study were within those reported by Adu *et al*. (1985) who reported 15-18% CP level when the author replaced maize with brewers dried grains in the diets of growing sheep. Likewise Adeloye (1994) reported a range of 10.69-12.04% CP levels when he fed varying ratio of cowpea husk and maize milling

waste to goats. Usman (2005) used 15.63-16.42% CP for the growing of Sokoto red when she replaced cowpea husk with fore-stomach digesta in the diets of the goats. The crude fibre (CF) contents obtained in the present study were lower than the values reported by Adeloye (1994) and other previous studies (Maigandi *et al*., 2002; Usman, 2005) that replaced fore-stomach digesta for cowpea husk in the diet of growing sheep and goats.

Ether extract (EE) and Ash values obtained from the present experiment were comparable to the values reported by Maigandi *et al.* (2002). However, the nitrogen free extract (NFE) of the experimental diets were higher compared to those reported by Maigandi *et al.* (2002); Usman (2005) but similar to those of Adeloye (1994).

Haematological Parameters

The PCV and Hb concentrations reported in this experiment were within the normal range for sheep reported by Coles (1986). There were increases in the PCV of animals from the initial to final PCV in the treatment groups. For the animals on 60% level, the final PCV was higher than the other inclusion levels, although it had the lowest DM intake and ADG; this is an indication that 60% level of cowpea husk did not affect PCV. The increase in the final PCV in all the treatments may be associated with improved nutrition as reported by Jain (1993) and Swenson (1990). Also the increase in PCV may be due to the gradual increase in water intake by the animals towards the end of the trial, as water supply is essential for normal PCV (Aganga *et* al., 1988).

There were no significant differences between all the inclusion levels in both initial and final Hb concentrations. The slight increase in the final Hb concentration is an indication that cowpea husk increase Hb concentration as reported by Coles (1986) that nutrition affects Hb concentration.

The initial RBC values were lower than the values reported by Frandson (1981) and Heath and Olusanya (1988). However, at the final stage of the experiment there was an increase in the RBC values of all the treatments. This suggests inadequacy in the nutrition is reported to be essential for RBC production (Swenson, 1990; Coles, 1986).

Both initial and final WBC was lower than the values reported by the previous authors (Coles, 1986; Heath and Olusanya, 1988; Kerr, 2002). Nevertheless, it has been reported that maturity and health status of an animal could influence WBC counts (Coles, 1986; Swenson, 1990; Frandson and Spurgeon, 1992). This could account for the variation obtained in the present study.

The initial values of neutrophils and lymphocytes were not within the normal values reported by Coles (1986), though at the end of the trial both the final neutrophils and lymphocytes were within the normal values (Coles, 1986). It could be observed that neutrophils were higher prior to the feeding trial with age in animals neutrophils decrease while lymphocytes increase (Coles, 1986; Swenson, 1990).

At 40% and 60% inclusion levels initial eosinophils were within the ranges reported by Coles (1986), however, the control and 20% level the values were lower than the values reported by the same author. At the end of the feeding trial, final eosinophils in the control diet were lower than the normal values reported by Coles (1986), but eosinophils in the blood indicates parasitic infestation and therefore the lower and or absence of eosinophils obtained from the present study explains the health status of the animals (Coles, 1986; Frandson and Spurgeon, 1992).

Initial monocytes were within the ranges, but final monocytes were higher than what had been reported in the literature (Heath and Olusanya, 1988; Coles, 1986). The increase in the final moncytes may be due to age as reported by (Mathias, 1985; Coles, 1986), that maturity in animals is capable of producing variation in the monocytes counts.

Biochemical Study of the Blood

The higher urea concentrations obtained prior to the feeding trial could be due to the fact that lambs might have been in a poor state of nutrition and health when they were obtained (Maigandi *et al.,* 2003).The final urea values of 6.8 – 8.9 mmol/L are similar to those obtained by Maigandi *et al.* (2003) and Igbokwe (1993) who reported values ranging from 7.4 – 8.6 mmol/L for Yankasa sheep fed groundnut hay

and exposed to prolonged water deprivation. The normal final urea concentration obtained for all the treatments might be due to the better dietary protein as reported by Church (1978) that early-weaned lambs weighing 10-30kg require 16-17% crude proteins. This is an indication that the diets used in all the treatments were high in protein. Diets low in protein tends to produce lower blood urea concentrations in ruminants (Merck, 1998).

Total protein, albumin and globulin were higher in both the initial and final stages compared to what was reported by Maigandi *et al*. (2003) and Coles (1986).

Total bilirubin was lower prior to the feeding trial, but slightly increased at the end of the trial. Both at the initial and final stages the total bilirubin was within normal range. It has been reported by Churchill (1987) that bilirubin is a pigment largely derived from the breakdown of haemoglobin from red blood cells (RBC) destroyed in the spleen. Therefore the higher values of bilirubin in animals for treatments A and B indicates higher destruction of RBC.

The initial glucose level vary amongst animals irrespective of treatments. This may be due to the reason that the animals were obtained from different sources and raised on different plain of nutrition. This problem was however, taken care of before the commencement of the trial by first adapting the animals. At the end of the feeding trial glucose level (final) increased in all the treatments, with 20% and 60% levels having the highest values. This indicates that incorporation of cowpea husk in the diet of sheep could increase blood glucose level as earlier reported by Coles (1986).

CONCLUSION

The normal values of haematological parameters obtained at the end of the feeding trial indicated a positive effect of cowpea husk on the diets of Uda lambs. These observations indicate the suitability of cowpea husk inclusion at different levels in the diets of growing Uda lambs. It could therefore be concluded that up to 60% of cowpea husk could be included in the diet of growing sheep without any adverse effect on their health.

REFERENCES

Abdullahi, R. Akerejola, O.O. and Ezeokoli, C.D. (1986). Effect of dietary protein II: On some blood constituents in Yankasa ewes. *Bulletin Animal Health Production Africa* **34:** 119-121.

Abil, J.U., Iji, P.A., Umunna, N. N. and Dim N. I. (1992). The replacement value of wheat bran for cotton seed cake and maize in the diets of sheep. *Bulletin Animal Health Production Africa* 41: 65-69.

Adebowale, E. A. (1981). The feeding value of cowpea husks (*Vigna unguiculata Walp) in rations for goats.* Turrialba **31:** 141-145.

Adeloye, A. A. (1994). The influence of varying ratio of cowpea husk and maize milling waste on the feed intake, protein and energy utilization by the goat. *Nigeria Journal of Animal Production* **21:** 108-112.

Adu, I. F. and Osinowo, O. A. (1985). Effects of dietary protein concentration and feeding level on the performance of weaned lambs. *Nigeria Journal of Animal Production* **5(1):** 45-56.

Aganga, A. A. Umunna, N. N. Oyedipe, E. O. and Okoh, P. N. (1988). Influence of intermittent watering on some blood components of grazing Yankasa sheep. *Nigeria Journal Animal Production* **15:** 77-82.

A.R.C. (1990). Agricultural Research Council. The nutrient requirement of ruminant livestock. Technical review by an Agricultural Research Council Working Party. C. A. B. International, Wallingford, Oxon.

Church, D. C. (1978). *Livestock feeds and feeding*. Oxford Press, Portland, Oregon.

Coles, E. H. (1986). *Veterinary clinical pathology* (4th edition) W. B. Sanders Company, Harcourt Brace Jovanovich, Inc.

Duncan, D. B. (1955). Multiple range and multiple F-tests. *Biomet. II: 1-42*. 349.

Frandson, R. D. (1981). *Anatomy and Physiology of Farm Animals* (3rd ed). Lea and Febiger, Bailliere Tindal, London.

Frandson, R. D. and Spurgeon, T. L. (1992). *Anatomy and Physiology of Farm Animals* (4th ed). Lea and Febiger, London.

Heath, E. and Olusanya, S. (1988). (eds). *Anatomy and Physiology of Tropical Livestock* (ELBS edition) Longman, Limited. Singapore.

Henry, R. J. and Stobel, C. (1957). Determination of serum proteins by the biuret reaction. Analytical Chemistry **92:** 1491.

Igbokwe, I. O. (1993). Haemoconentration in Yankasa sheep exposed to prolonged water deprivation. *Small Ruminant Resource* **12:** 99-105.

Jain, N. C. (1993). Physiology of Blood with some comments on response to diseases. *International Journal Animal Science* **8:** 195-321.

Kerr, G. M. (2002). *Veterinary Laboratory Medicine* (2nd edition). Blackwell Scientific Company.

Maigandi, S. A. (2001). Quantification and Utilization of Fore-stomach Digesta in the diet of growing and fattening sheep. Ph.D. Thesis, Usmanu Danfodiyo University, Sokoto, Nigeria.

Maigandi, S. A., Tukur, H. M. and A. I. Daneji (2002). Fore-stomach Digesta in the diet of growing of sheep I. performance and economics of production. *Sokoto Journal Veterinary Sci*ence **4(2):** 16-21.

Maigandi, S. A., Tukur, H. M. and A. I. Daneji (2003). Fore-stomach Digesta in the diet of growing of sheep II. Haematological parameters and blood urea nitrogen. *Sokoto Journal Veterinary Sci*ence **5(1):** 12-17.

Mamman, A. B., Oyebanji, J. O. and Petters, S. W. (eds) (2000). *Nigeria A people United, A future Assured (Survey of States)*. Vol.2, Gabumo Publishing Co. Ltd., Calabar, Nigeria.

Mathias, E. (1985). Haematological and clinical chemistry studies in swamp buffalo calves from birth to the age of six month. Animal Resource Development 21: 101-111.

Merck, (1998). *The Merck Veterinary Manual* (8th ed) (Aiello, S. E. ed) Merck and Co. Inc. Whitehouse Station. Pp. 1433-1644.

Olayiwole, M. B. and Olorunji, S. A. (1987). Feedlot performance of yearling steers previously maintained on different crop residue/supplementation regimes. *Proceedings of the African Research Network for Agricultural By-products* (*ARNAB*), July 1987.

Oluokun, J. A. (2005). Intake, digestion and nitrogen balance of diets blended with area treated and untreated cowpea husk by growing rabbit. *African Journal of Biotechnology* **4 (10).**

Oyenuga, V. A. (1968). *Nigeria's foods and feeding stuffs: Their Chemistry and Nutrient value*. Ibadan University Press, Ibadan, Nigeria.

SEPP (1996). Sokoto Environmental Protection Programme. Meteorological Data (Unpublished).

Steel, R. G. D. and Torrie, J. H. (1980). *Principles and Procedures of Statistics*, McGraw Hill Book Co. Inc. N. Y.

Swenson, M. J. (1990). Physiological Properties, Cellular and Chemical Constituents of Blood; *Dukes Physiology of Domestic Animals* (10th ed). Cornell University Press, New York.

Tanis, R. J. and Naylor, A. W. (1968). Physical and Chemical Studies of a low Molecular weight form of Urease *Biochemistry Journal* **108:** 771.

Usman, H. B. (2005). Replacement Value of Fore-Stomach-Digesta for cowpea Husk in the diets of Sokoto Red Goats. M. Sc. Dissertation, Usmanu Danfodiyo University, Sokoto, Nigeria.