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Haematological Parameters and Serum Biochemistry of West African Dwarf Sheep Fed Ensiled Cassava Tops and Guinea Grass Mixture

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An experiment was conducted to evaluate the effect of ensiled cassava tops and guinea grass mixture on haematological and biochemical indices of West African Dwarf Sheep. A total of 20 growing West African dwarf rams were used for the study. The rams were divided into five groups of five animals and each group was randomly allotted to one of the five diets in a completely randomized design. Guinea Grass (GG) and Cassava tops(CT) with four energy additives were ensiled and combined in ratio 6:3:1 into five treatments: 1 (GG + CT + cassava chips), 2 (GG + CT + Sorghum), 3 (GG + CT + millet grains), 4 (GG + CT + sugar) and 5 (GG + CT + no additive). Results revealed significant($P<0.05$) variations occurred for the haematological parameters measured except for the insignificant differences ($P> 0.05$) in white blood cell (WBC), Red Blood Cells (RBC), mean cell volume (MCV) and mean cell haemoglobin (MCH). The packed cell volume (PCV) ranged between 27.00% and 33.67%. The serum biochemical indices showed significant difference ($P<0.05$) among treatments for Total proteins, Albumin, urea, and Aspartate amino transaminase (AST), Alanine transaminase and (ALT) and Alkaline phosphatase (ALP) and they ranged from 6.87-8.20g/dl; 3.42-4.56g/dl; 11.83-16.15mg/dl; 5.30-12.38 IU/l;11.49-27.40IU/l and 49.15-90.71 IU/l respectively. The study revealed that feeding ensiled Cassava tops and Guinea grass mixture to West African Dwarf ram had no deleterious effects on the haematological and serum biochemical parameters of WAD ram.

Keywords: Cassava tops, Haematology, Serum, Cassava leaves

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INTRODUCTION

Improved nutritional strategy is a key factor to improving the productive capacity of livestock animals. Adequate nutrition is one of the ways to enhance the productivity of WAD sheep *(*Yusuf *et al.,* 2010).Cassava foliage has been reported to be nutritious to ruminants when fed either fresh, dried or made into silage *(*Wanapat *et al.,* 2000a*;* Fasae *et al.,* 2009a, b). It is rich in crude fibre and protein which can be used to meet the nutrient requirement of livestock. Cassava foliage is a good source of protein and has been reported to increase livestock productivity including milk yield (IITA Annual report 2004, Kwamme*,* 2001*)* and body weight gain *(*Nhi *et al.,* 200l, Bunyeth and Preston 2006).

Guinea grass is one of the most nutritive grasses used as livestock feed. It is widely distributed across all ecological zones in Nigeria. The availability of this grass declines gradually as dry season approaches after the period of surplus in the wet season.

Blood plays an intensive role in the body of animals.it is an important index of physiological and pathological changes in animals and has been used in assessing the body's ability to respond to nutritional challenges (Aguihe *et al*., 2012). In order to achieve high productivity and good health more need to be known about haematological parameters of animals. Daramola *et al.,* (2005) reported that one of the primary functions of haematological studies is to apply the knowledge of blood characteristics to detect various blood diseases on the blood, that is haematological and serum biochemistry values could serve as baseline information for comparism in the physiological and health status of ram.

The effects of diets on blood and serum chemistry should be of paramount interest since blood transports gases, nutrients, hormones and excretory products within the body. Nutrition, breed, sex, age, reproductive status, environmental factors, stress and transportation are known to affect haematological and biochemical parameters and thought to play major roles in the differences in haematological and biochemical parameters observed between tropical and temperate animals (Opara and Fagbemi 2009).

The present study is therefore, designed to determine the effects of ensiled cassava tops and guinea grass mixture on haematological parameters and serum biochemistry of West African dwarf rams.

MATERIALS AND METHODS

Experimental Sites

The experiment was conducted at the Sheep and Goat unit of the Teaching and Research Farm Ladoke Akintola University of Technology, Ogbomoso, Oyo State,

Experimental animals and management

Twenty (20) male West African Dwarf sheep age 12-14 months were purchased from local markets around the University farm. The rams were weighed on arrival, rested, watered and tagged for easy identification. The animals were confined for one-month adaptation period. Rams were fed with the feedstuff (including maize bran, cassava peels, and wheat offal), which they consumed from where they were purchased during the acclimatization periods. The animals were placed on prophylactic treatment through the administration of antibiotics (long acting). Animal were also treated against endoparasites and ectoparasites using 10% of Levamisol and diazintol respectively. They were allowed to adapt for 1 month, which consists of 4 hr daily grazing and concentrate supplementation.

Feed, water and salt lick were provided *ad-libitum*.

After adaptation, the animals were randomly grouped into five treatments in a completely randomized design comprising five animals per diet. The animals were housed in individual pens made of low walls of 1 m x 1.5 m in size and each pen was about 220 cm long and 121 cm wide. The floor of the pen was made of concrete and the roof of the unit which housed the pens was made of corrugated iron sheets. The pens were cleaned and disinfected with Morigad The feeding and drinking troughs were washed and disinfected and the whole house was left to rest for two weeks before usage. Wood shaving was spread on the floor of the pen as bedding containers and changing of bedding was done fortnightly.

Feeders and drinking trough were placed in the pens for free access to feed and fresh water daily. Feed were offered at approximately 4% of their body weight. The trial lasted for one hundred and thirty five (135) day.

Experimental diets: In a completely randomized design with five replicate sheep were randomly distributed to treatment diet which is ensiled as follows.

Treatment 1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
Treatment 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
Treatment 3: 60% Guinea grass +30% cassava tops + 10% millet grain.
Treatment 4: 60% Guinea grass +30% cassava tops + 10% sugar
Treatment 5: 60% Guinea grass + 40% cassava tops + 0% additives.

Chemical analysis

The dried samples of silage were ground through a 1mm mesh screen for analysis. Crude protein determination was by kjeldahl technique which involved the digestion of the samples in concentrated sulphuric acid The percent CP was obtained by multiplying the percent nitrogen content obtained by 6.25 (AOAC, 1990).

Blood collection

Blood samples were taken before morning feeding via jugular vein puncture into two blood tubes. One containing an anticoagulant (Disodium salt of ethylene diamenetetracetic acid (EDTA)) and the other with no anticoagulant from which serum was harvested for biochemical analysis. Packed Cell Volume (PCV), Haemoglobin (Hb), red blood cell (RBC) and total white Blood Cells (WBC) were determined. Mean Corpuscular volume (MCV), Mean Corpuscular haemoglobin (MCH) and Mean Corpuscular haemoglobin concentration (MCHC) were calculated from PCV, Hb and RBC as established (Jain, 1986). The serum total protein (STP) was obtained by the biuret method.

Statistical analysis

Data generated were subjected to the analysis of variance procedure of SAS (1999). Significant means were separated using the Duncan Multiple range test of the same package.

RESULTS

Chemical composition of ensiled cassava tops and guinea grass mixture

Table 1 shows the chemical composition of ensiled cassava tops and guinea grass mixture with different additives and there were significant (p> 0.05) differences among the different silages. DM content ranged between 27.12g/100g DM in silage with sorghum additive to 28.80g /100g DM in silage with millet additive. CP varied from 21.88g/100g DM in silage with sugar additive to 25.60 g/100g DM in millet additive. The Crude fibre content of the silage was highest in silage with sorghum additive (32.49g/100g DM) but similar to the values obtained in silage with sugar additive (31.95g/100g DM), millet grain (31.91 g/100g DM) and cassava chips (31.89 g/100g DM) and differed significantly (P<0.05) from silage with no additive (31.12 g/100g DM). Ash was highest in silage with no additive (9.62 g/100g DM) and lowest in silage with sugar additive (7.56g/100g DM). The NDF content of the silage ranged between 68.81and 76.39g/ 100gDM while ADF ranged between 40.64 and 48.06g/ 100g DM.

Table 1: Chemical composition (g/100g DM) of ensiled cassava tops and Guinea grass mixture

Treat Parameter	Dry matter	Crude protein	Crude fiber	Ash	NDF	ADF	Ether extract
T1	28.80^{a}	23.74^{ab}	31.89^{a}	9.42^{a}	71.66^{b}	43.44^{c}	8.41^{b}
T2	27.12^{c}	23.85^{ab}	32.49^{a}	8.51^{b}	71.47^{b}	44.48^{b}	8.32^{b}
T3	28.80^{a}	25.60^{a}	31.91^{a}	9.41^{a}	76.39^{a}	40.64^{d}	10.13^{a}
T4	27.52^{bc}	21.88^{b}	31.95^{a}	7.56^{c}	69.39^{c}	44.81^{bc}	8.83^{b}
T5	28.06^{b}	24.94^{a}	31.12^{b}	9.62^{a}	68.81^{c}	48.06^{a}	8.39^{b}
SEM	0.18	0.75	0.20	0.14	0.39	0.31	0.16

Treatment 1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
Treatment 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
Treatment 3: 60% Guinea grass +30% cassava tops + 10% millet grain.
Treatment 4: 60% Guinea grass +30% cassava tops + 10% sugar
Treatment 5: 60% Guinea grass + 40% cassava tops + 0% additives.

Table 2 shows the haematological values of West African Dwarf (WAD) sheep fed ensiled 60% Guinea grass and cassava tops mixture. There were significant differences (p < 0.05) in the haematological parameters measured among the different additives used in ensiling the different silages fed to WAD sheep, except for the insignificant differences (P> 0.05) in WBC, RBC, MCV and MCH. There was significant difference between PCV, Hb, MCHC, lymphocytes and neutrophils. The PCV was higher (33.67%) in rams fed treatment 2 and lowest (27.00%) in rams fed treatment 1 and the control. Hb value ranges between 9.00 and 11.22. There was significant difference also in MCHC which ranged between 33.33% and 33.34%. There was no significant difference in MCV and MCH in all diets.

The RBC counts in the sheep ranged between 9.00 to11.22.g/dl; while the total WBS counts range was

7.40 -10.90 10^3/µl.The relative differential leucocyte counts (DLC) showed that Percentage distribution of leukocytes had significant differences. Lymphocyte and Neutrophils ranged between 60.33% - 67.50% and 29.50%-37.33% respectively. Eosinophil values were significantly higher ($p < 0.05$) in the WAD sheep fed silages ensiled with cassava chips (1.50%), millet grain, sugar and the control, than sorghum additive.

Table 2: Heamatology of WAD Sheep fed ensiled cassava tops and Guinea grass mixture

Parameter	T1	T2	T3	T4	T5	SEM
PCV, %	27.00^b	33.67^a	32.00^a	31.00^a	27.00^b	0.87
Hb, g/dl	9.00^b	11.22^a	10.67^a	10.33^a	9.00^b	0.29
WBCx10^3/µl	7.55	8.98	8.68	10.90	7.40	1.23
RBCs,x106/m	6.46	8.17	7.42	7.64	6.82	0.66
MCHC, %	33.33^b	33.34^a	33.33^b	33.33^b	33.33^b	0
MCV, fl	0.45	0.42	0.43	0.41	0.4	0.04
MCH, Pg	15.05	13.95	14.4	13.63	13.36	1.23
Percentage Distribution of leukocytes	T1	T2	T3	T4	T5	SEM
Lymphocytes,%	64.00^{ab}	60.33^b	62.50^{ab}	66.00^{ab}	67.50^a	1.73
Neutrophils,%	32.50^b	37.33^a	32.00^b	30.00^b	29.50^b	1.39
Eosinophils,%	1.50^a	0.00^b	1.50^a	1.00^a	1.50^a	0.43
Monocytes,%	2.00^b	2.33^b	4.00^a	3.00^b	1.50^b	0.49

ab means on the same row with different superscripts are significantly different ($P<0.05$)
Treatment 1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
Treatment 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
Treatment 3: 60% Guinea grass +30% cassava tops + 10% millet grain.
Treatment 4: 60% Guinea grass +30% cassava tops + 10% sugar
Treatment 5: 60% Guinea grass + 40% cassava tops + 0% additives.
; Packed Cell Volume (PCV), Haemoglobin (Hb), Red blood cell (RBC), white Blood Cells (WBC), Mean Corpuscular volume (MCV), Mean Corpuscular haemoglobin (MCH) and
Mean Corpuscular haemoglobin concentration (MCHC)

Table 3: Blood biochemistry of WAD Sheep fed ensiled cassava tops and Guinea grass mixture with different additives.

Parameters	T1	T2	T3	T4	T5	**SEM**
Glucose, mg/dl	73.74	85.86	74.75	69.19	45.08	13.38
Cholesterol,mg/dl	49.42	91.33	103.76	68.79	110.12	18.51
Total protein,g/dl	8.20^a	6.87^{ab}	7.68^a	7.63^a	6.08^b	0.45

Table 3: Continues

Albumin, g/dl	4.56^{a}	3.42^{b}	3.70^{b}	4.31^{a}	4.27^{a}	0.09
Urea, mg/dl	13.72^{ab}	11.83b	13.46^{ab}	16.15^{a}	13.17^{ab}	1.01
AST, IU/l	12.38^{a}	7.07^{bc}	8.84^{b}	5.30^{c}	6.19^{c}	0.69
ALT, IU/l	27.40	11.49	15.03	26.54	17.68	4.98
ALP, IU/l	90.71^{a}	81.06^{ab}	76.10^{b}	59.86^{c}	49.15^{c}	3.92

abc means on the same row with different superscripts are significantly different (P<0.05)
AST= Aspartate Amino Transferase; ALT= Alanine Amino Transferase; ALP= Alkaline phosphatase;
Treatment 1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
Treatment 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
Treatment 3: 60% Guinea grass +30% cassava tops + 10% millet grain.
Treatment 4: 60% Guinea grass +30% cassava tops + 10% sugar
Treatment 5: 60% Guinea grass + 40% cassava tops + 0% additives.

DISCUSSION

The CP exhibited within the range (21.88 and 25.60 g/100 g DM) reported was lower than those reported by Oluwadamilare (1997) who reported 31.9% CP for cassava/Guinea grass mixtures and Oduguwa *et al.* (2007) but similar to what Kavana *et al.* (2005) who reported 21.86% for cassava leave silage. The variations could be attributed to difference in varieties as well as the stage at which the crop was harvested, soil fertility, climate and sampling procedure. Variations in crude fiber level could be due to stage of maturity. The CP of the diet is high above the 7% CP requirement for optimum microbial growth in the rumen and the range of 10-12% CP requirement for growth of sheep and goats (Gatenby, 2002).The increase may be due to the cassava/guinea grass mixtures which give both energy and protein. NDF and ADF concentrations of the forage were much higher than recommended values of 25% for ruminants (NRC, 2001). However, their concentrations were not too high to hinder intake and animal production (Meissner *et al*., 1991; Buxton, 1996). The NDF content reported in this experiment was higher than results from Oduguwa *et al.* (2007), but ADF was in the range reported. Ensilage had average effect on the structural carbohydrate. Stage of Maturity is the major factor contributing to the variability in fibre content.

Blood parameters is a reflection of the effect of dietary treatment on the animals in terms of the type, quality and amount of the feed ingested and available for the animal to meet its physiological, biochemical and metabolic necessities (Ewuola *et al.,* 2004; Odetola, *et al.,* 2012**).** Haematology and blood biochemistry measurements may vary depending on factors such as sex, age, weather, stress, season, pregnancy status and physical exercise (Kaneko *et.al.,* 1997). Significant changes in these parameters are used to draw inference in clinical investigation. It may give some insight as to the animals" production performance potential. RBC, PCV, plasma protein and glucose are blood variable most consistently affected by the dietary influences

PCV and Hb levels indicate the nutritional status of the animal. Mean PCV values obtained in this study were within the range of 21 – 35 % reported by Daramola *et al*. (2005) and the range of 21-38% reported by Charks and Margi (2007). The packed cell volume (PCV) obtained in the present study (27.00 to 33.67%) was within the normal range (28.47 to 30.25% for adults) reported for sheep (Baneejee, 2007). Daramola *et al*. (2005) opined that PCV below the normal range for healthy goats is an indication that the animal is anaemic and is due to poor quality of protein of the diets. The observed PCV values in this study ranged from 21.00-33.67% were in line with the report of Olayemi *et. al*., (2000) for the intensively (24.9±1.95%) and extensively (20.15±2.59) reared West African Dwarf sheep.

Haemoglobin (Hb) concentration in this study fell within the range of high values obtained for Red Sokoto goats (Tambuwal *et al,* 2002). Daramola *et. al.* (2005). Reported that concentration of heamoglobin(Hb) in the cytoplasm of the red blood cells gives an indication of an oxygen carrying capacity of the blood of the individual. The Hb of the ram ranged from 9.00-11.22g/dl and compare favourably with Hb 8.00-14.00gm/dl(Mitruka and Raswnley, 1977),Recommended for healthy sheep indicating that the rams had sufficient blood pigment for proper transportation of oxygen, thus heathyn living. West African Dwarf sheep seem to possess relatively high Hb values, and this is an advantage in terms of the oxygen carrying capacity of the blood. This higher RBC values that were observed in the intensively managed rams in the present study may be due to higher plane of diet and veterinary care given to them.

This finding suggested that WAD sheep have the tendency for compensatory accelerated production (CAP) of PCV in case of infection and stress. Compensatory accelerated production has been shown to return PCV to normal level following infection (Dargie and Allonby, 1975). Comparative studies showed that PCV varies proportionately with serum protein; this suggested that PCV is beneficial in assessing the protein status and possibly forecasting the degree of protein supplementation in sheep at different physiological states.

The total WBC count was higher in this study than values obtained for Red Sokoto goats (Tambuwal *et al*., 2002), cattle in Nigeria (Oduye and Fasanmi 1971) and Nigerian buffaloes (Olusanya *et al*., 1976). It has been reported that the higher the value of WBC the better phagocytosis and hence the ability to fight disease (Roberts *et. al*., 2003). But abnormally high WBC could suggest the invasion of a 'foreign body' in the body. Which trigger off immune response by the production of more WBC (Ahmaefule, 2005). However the value reported for WBC in this study are within the normal range for sheep which depict absence of infection since elevation of WBC suggest infection by microorganism especially bacteria (Meyer and Harvey, 1998) and suggestive of well developed immune system of the WAD sheep to proffer good health.Total WBC counts were, however, lower than the 15.54 $x10^3$/µl and 15.39 $x10^3$/µl reported by Olayemi *et al* (2000) but fell within the range of normal values of $4x10^3$/µl to12x 10^3/µl reported for temperate breeds of sheep (Schalm *et al* 1986).

High WBC count is usually associated with microbial infection or the presence of foreign body or antigen in the circulating medium (Ahamefule *et al*., 2005). The normal values of WBC obtained in this study suggested well developed immune system of the goats in different dietary groups with the lowest and highest concentrations obtained in diets T1 and T4, respectively. Increase in WBC is normally due to immune response by animal as a result of the presence of an antigen(foreign body) in the body.

Red blood cells characterize anemia and other conditions affecting red blood cells in animals. The present result shows that the diets supported good health status of the rams, and hence the animals were not anemic. Rekwot *et al.* (1987) observed that White Fulani that were fed with high protein diet (14.45% crude protein) had higher erythrocyte values than those on low protein diet (8.51%).

WAD sheep seem to possess protective system, providing a rapid and potent defense against any infectious agent and this is probably the physiological basis for the adaptation of this species to this ecological zone characterized by high prevalence of diseases. The values of the PCV, HB, RBC, and WBC obtained for the Ram fed ensiled cassava tops and guinea grass with different additives were within the physiological normal range (PCV:19.00-38.00 %) (Hb 8.00-14.00gm/dl)(RBC 8.00-18.00*10-6ml)(WBC 4.00-13.00*103ml)(MCHC: 32-38%), (MCV: 10.2-11.0fl) and (MCH, 30-32pg) (Mitruka and Raswnley, 1977).

Wide variation in leucocytes number is a reflection of the leucocytes" response to infection. Lazzaro (2001) noted that depressed level of lymphocytes might indicate either an exhausted immune system or elevated neutrophil level in an active infection in sheep, like other ruminants there are more lymphocytes than neutrophils in circulation (Olusanya *et al*., 1976). Lymphocytes are the key elements in the production of immunity. .Osueni (2001) and Lazzaro (2001) observed an increase in neutrophils and this is associated with a decrease in lymphocyte and vice versa. Neutrophils and lymphocyte have been noted to fight pathogens once they have passed the barrier of the shin into the cell (Politis *et al.,* 2002) therefore increase number will increase immunity, thus suggestive of a well developed immune system in the WAD sheep with such number of immune cells to offer good health.

The relevance of MCHC,MCH and MCV measurement lies in their use in the diagnosis of anemia (Aletor and Egberongbe, 1992).From the findings of this study, the animals were free of anaemia infection. Also, the animals did not show signs of pallor and fatigue. However the blood profile/ component values of the rams seemed to be adequate as regulating factos of blood volume, good osmotic balance and immunity index. In this study only PCV,HB, MCHC were significantly affected by the silage fed

According to Otesile *et al*. (1991) serum biochemistry is a generalized medium of assessing the health status of animals. Differences in serum biochemical parameters may be caused by nutrition, environment and hormonal changes (Chineke *et.al*., 2002). Concentration of blood components of sheep were used to monitor nutrient status (e.g. serum glucose) and blood urea nitrogen (BUN) and associated muscle mass (e.g. creatinine).

Glucose is one of the metabolites measured as an indicator of the energy status of the animal. Normal glucose levels in the ram indicate adequate synthesis in the liver from propionate metabolism as the major glucose precursor (Houtert, 1993). Serum glucose is an indicator of cito metabolism, in high energy diets (Coles, 1986). When glucose is lower than the normal range is an indication of hypoglycemia while higher levels are indication of hyperglycemia (Olorunnisomo, 2012).

Fisher *et al*. (1974) reported that the concentrations of blood glucose and protein albumin are respectively the preferred indicators of adequacy of diets in terms of energy and protein. Based on the different dietary regimes it could be concluded that the efficiency of utilization of available dietary protein and energy were responsible for the variations in the concentration of blood glucose of the ram.Serum albumin is a strong predictor of health; a low albumin concentration is a sign of poor health and predictor of bad outcome (Kastow,2009)The higher the value of albumin, the higher the clotting ability of blood, hence , prevention f heamorrhages (Roberts et. al., 2003. Thus the obseverd albumin values in this study indicated that the rams are prevented against heamorhage.)

Concentration of specific blood components have been used to monitor nutrient status (e.g. serum glucose and blood urea nitrogen [BUN], Hammond *et al*., 1994) and have been associated with overall muscle mass (e.g. creatinine, Morgan *et al*., 1993; Myer *et al*., 1996) in ruminants.

Serum proteins are important in osmotic regulation, immunity and transport of several substances in the animal body (Jain, 1986). High value of serum total protein is indicator of quality protein of the experimental silage. True protein values were within the range of 5-9-7.8 g/dl reported by RAR (2009) and Merck (2012) for clinically healthy sheep, except for animal on silage with cassava chips. Kiran *et al* (2011) also reported similar total protein for clinically healthy sheep, indicating that the silage had adequate protein for ram performance.

Blood urea N is an indication of efficiency of utilization of dietary protein. Eggum (1989) reported that the blood urea N is highly inversely correlated with net protein utilization. Ruminants are not efficient utilizers of dietary protein (Beever, 1982). A positive correlation exists between level of protein (N) intake and BUN concentration (Pfander *et al*., 1975; Preston *et al*., 1965; Karnezos *et al*., 1994). In ruminants, BUN can be influenced by dietary N-to-energy ratio, level of forage intake, and protein degradability in the rumen (Hammond *et a*l., 1994). Feeding cattle on a low nutritional plane decreased metabolic body rate and the required maintenance energy (Hornick *et al.,* 2000). The BUN concentration in ruminants has been used as an indicator of excess N consumption relative to energy (Hammond *et al*., 1994). This explains why the urea N of the rams fed the different silages had high average daily gain because nearly all the ingested protein is used for protein synthesis (Kaneko, 1989). A high level of serum urea has been attributed to excessive tissues protein catabolism associated with protein deficiency (Oduye and Adadevoh, 1976, Opara *et. al.,* 2010)). The concentration of blood urea-N concentration (BUN) was higher in sheep on silage with sugar additive than others. BUN concentration of the rams was higher than values reported by Adegbola *et al*. (1987) and Aregheore and Oluokun (1989) for the West African Dwarf sheep. Diets may be implicated for the variations in BUN concentration of the West African Dwarf sheep used. The urea value obtained was within the range of 8 to 20 mg/dl (Banejee, 2007) in matured domestic animals.The values obtained in this study are above normal range which entails that the rams did not suffer from protein deficiency.

Belewu and Ogunsola (2010) asserted that serum creatinine helps in evaluating the liver function and diseases while serum urea evaluates renal function, and it may also indicate dehydration.

Enzymes are protein catalysts present mostly in living cells and are constantly and rapidly degraded although, renewed by new synthesis (Coles, 1986). According to Zilva and Pannall (1984), normal enzyme level in serum is a reflection of a balance between synthesis and their release, as a result of the different physiological processes in the body. Transaminase enzymes are those mostly responsible for the synthesis of non-essential amino acids through the process known as transamination according to Carola *et al*. (1990).

The measurement of the Aspartate aminotransferase (AST) level is helpful for the diagnosis and following the cases of myocardial infarction, hepatocellular disease and skeletal muscle disorders (kaneko.1989). The observed AST values indicated that the rams were healthy without any liver impairment. The values of Alkaline phosphate (ALP) gotten were reasonably low, indicating that the diets had enough protein as high value of ALP is an indicator of poor quality protein of the experimental diet. In this study, a wide range in the observed value for the transaminases could be an indication that the silage did not differ in their effects on enzyme secretion mechanism. According to Keele and Neil (1971), serum levels of AST are significantly high under disease and morbid conditions involving injuries to large numbers of metabolically active cells. However, the result of this study suggests a contrary situation in this regard thus indicating the potential of the silage in the feeding of rams. The ALP level can be influenced by Pregnancy, blood pH and disease (Kelly, 1974), the animal in this study were apparently healthy, non pregnant and these parameters could not have been influenced by these factors.it was reported that age have effect on ALP values (Opara *et .al.,*2010)

The values obtained for all the biochemical indices fall within the range quoted by Mitruka and Raswnley (1977). The values of the glucose, total protein, Serum albumin, Blood urea, AST, ALT and AlP obtained for the Ram fed ensiled cassava tops and guinea grass with different additives were within the physiological range (glucose: 55.0-131mg/dl), (total protein: 5.70 – 9.10g/dl), Albumin: 2.70-4.55g/dl), blood urea: 15.0-36.0mg/dl), (AST:40-123IU/l), (ALT:25-70IU/l) and (ALP:69.5-105IU/l) (Mitruka and Raswnley, 1977). AST were below the range of 82-

144(IU/dl) and ALP were within the range of 12-57 (IU/dl) for clinically healthy sheep (Kiran, *et. al*.,2002; RAR,2009 ; Merck, 2012) this result was in contrast with the report of Oni, *et.al* 2012 who reported that aspartate aminotransferase value were not significantly influenced by varying levels of cassava based concentrate diets for WAD Goat.

The different serum biochemical parameter may be caused by nutrition, environmental and hormonal factors (Chineke *et al*.,2002). Since these values are within normal range, it is inferred that the silage s were safe and did not contain compounds that are harmful to the liver which could prevent normal function of the liver. Thus it can be inferred that the experimental sheep were clinically healthy.

CONCLUSION

The study reveals that ensiled *Panicum mamximum* with cassava leaves and different additives had no significant effect on most of the haematological and biochemical component of the WAD ram and were within the normal range for healthy sheep. There was no adverse or deleterious effect on the blood parameters indicating good health status.

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