



Effects of *Sesbania Sesban* Fodder and Napier Grass Hay Mixture Diets on Blood Profile of West African Dwarf Growing Bucks

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Abstract

This study was conducted to evaluate the haematological and serum biochemical indices of West African dwarf growing bucks fed *Sesbania sesban* forage with Napier grass hay mixture diet for 90 days feeding trial carried out at the Teaching and Research Farm of Oyo State College of Agriculture and Technology Igbo-ora, Nigeria. A total of sixteen (16) growing WAD bucks between 6 - 9 months of age with an average body weight of 6.00-10.00kg were randomly allocated to four treatments with 4 bucks per treatment and 2 bucks per replicate in a completely randomized designed. The experimental diet was fed at 3% body weight of individual animal while air-dried *Sesbania sesban* and Napier grass hay mixture were fed at varied proportions with concentrate diet. The compared experimental diets (ED) were: T₁ (100%NG hay +500g concentrate), T₂ (NG25%SS75%hay+500gconcentrate), T₃ (NG50%SS50%hay+500gconcentrate) and T₄ (100%SS hay+500g concentrate) and fed for each individual animal per day. There were significant ($P<0.05$) differences in all parameters determined on haematological parameters across the dietary treatments except MCH that showed no significant ($P>0.05$) differences. Buck maintained on T₃ diet had the highest packed cell volume (33.00%), while the lowest value (27.00%) for PCV was recorded on buck fed diet T₁. Hence, buck fed diet T₃ that contained 50NG50SS hay recorded highest white blood cell (WBC) value of $9.00 \times 10^3/\mu\text{l}$ while the least WBC ($5.85 \times 10^3/\mu\text{l}$) was observed in diet T₁. Significant ($P<0.05$) differences was noted on serum biochemical constituents across the dietary treatments. The study revealed that feeding 50%NG50%SS hay diet has a good nutrient profile and enhanced the productivity of growing WAD bucks in terms of PCV, Hb and RBC and improved serum metabolites in terms of total protein without any deleterious effects on the animals.

Keywords: Tropical browse legume fodders, Napier grass, WAD bucks, Haematological parameters, Serum biochemical constituents.

Introduction

The importance of goat farming has recently gained momentum in Tropical regions because goats have a short growing period, low nutrient input requirements and fast economic returns, compared to large ruminants. Hozza *et al.* (2014) reported that goats produce more meat and milk per unit live weight per year compared to large ruminants. However, goat production in tropical developing countries is based on extensive feeding management, characterized by browsing and/or grazing poor quality natural pastures. In sub-Saharan Africa, recent years have been characterized by continued severe droughts. This has been linked to the effects of climatic change (Ondiek *et al.*, 2013) leading to an ever increasing animal feed shortage particularly in the arid and semi-arid areas. Ruminant animal production systems in these areas are predominantly of natural grass pastures.

The biochemical and haematological variables of blood can be used to monitor and/or evaluate health, nutritional and physiological status of ruminants (Al-Eissa *et al.*, 2012). Furthermore, Mohammed *et al.* (2016) reported that blood constituents are markers to determine the efficacy of feed nutrient content and its utilization. Al-Seaf and AlHarbi (2012) observed that biochemical and haematology profiles can also be used to assess the immunity status of goats while they can also be an index of transportation stress. Among other factors, nutrition, stress, reproductive status, age, sex, genetics, management, housing, and other environmental factors have been reported to have profound effects on the haematological and biochemical profiles of small ruminants (Mohammed *et al.*, 2016) Therefore, there is a need to establish the dietary effects of forage legumes fed to goats. Thus, the objective of this study was to evaluate the effects of



Sesbania sesban fodder and Napier grass hay mixture diets on haematological and biochemical parameters of West African dwarf growing bucks.

Materials and Methods

Experimental site and animals

The experiment was conducted at the Sheep and Goat Unit, Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igboora. Sixteen (16) growing West African dwarf bucks weighing between 6.00 – 10.00 kg and of 6 – 9 months of age were used. The bucks were dewormed with anthelmintics (Albendazole®) to control endoparasites; oxytetracycline and multivitamin preparations were administered at rate of 1ml per 10 kg body weight through intramuscular route for prophylactic treatment. Homologous *Pesti des petit* ruminant (PPR) vaccine was administered against PPR disease and acclimatized for 28 days before the commencement of the experiment. Guinea grass and cassava peels were offered to the animals during the adaptation period. Fresh and clean water was also made available throughout the experiment.

Harvesting and processing of experimental diets

Napier grass and *Sesbania sesban* forage were harvested around the College farm, chopped at 3 cm long and wilted for 2-3hours in the sun and air dried under shade for 4-5days to prevent bleaching and loss of nutrients, bailed and stored for the experiment.

Experimental layout, design and feeding method

The animals were allocated by weight into four treatments of four bucks per treatment and two bucks served as a replicate in a completely randomized design (CRD). The *Sesbania sesban* forage and Napier grass harvested and air-drying for 4 to 5 days were mixed in varying proportions as the experimental diets (ED) and fed to each individual buck per day at 3% body weight. The *Sesbania sesban* and Napier grass air dried fodders combinations were thoroughly mixed to eliminate/minimize selection by the animal. The bucks were offered their respective experimental feeds (Forage hay) at 8.00am. Each buck was offered 500g of concentrate per buck per day at 2.00pm, also 3 litres of fresh and clean water was also supplied daily. The compared experimental diets (ED) were: T1 (100%NG hay +500g concentrate), T2

(NG25%SS75%hay+500gconcentrate), T3 (NG50%SS50%hay+500gconcentrate) and T4 (100%SS hay+500g concentrate), and their proximate composition shown in Table 2. Each group of animals was assigned to an experimental diet.

Data Collection and Analysis

Blood sample collection, Haematological analysis, and evaluation of blood biochemical constituents

At the end of the completion of growth trial (on 91st day), a new hypodermic needle and syringe (for each animal to avoid cross-contamination) was used to collect 5mL of the blood sample via the jugular vein from three randomly selected rams from each treatment. Half of the blood sample was released into a sample bottle containing anticoagulant ethylene diamine tetra acetic acid (EDTA) and it was rocked gently to ensure easy mixing of the blood with the anticoagulant for estimation of haematology parameters. The remaining 2.5mL of blood samples was discharged into sterile plain bottle to allow blood to clot at room temperature within two hours of collection and serum obtained was used for serum.

Table 1: Composition of formulated low cost concentrate for experimental West African Dwarf growing bucks

INGREDIENTS	LEVEL (%)
Palm kernel cake	60.00
Wheat offal	20.00
Corn bran	9.75
Groundnut cake	8.00
Bone meal	2.00
Salt	0.25
TOTAL	100

Biochemical analysis. The bottles containing the blood samples were kept in an ice- park and taken to a laboratory for analysis. Plasma was separated by centrifugation at 3500 rpm for 15 minutes and serum frozen at -20°C for the determination of total protein, albumin, total cholesterol, glucose, creatinine, urea nitrogen using Elisa multiplex commercial kits (Pfizer Animal Health, New York, NY) following the steps as described by manufactures. Packed cell volume (PCV) and erythrocyte counts were determined as described by Ewuola and Egbunike (2008). Total leukocyte counts were



determined using Neubauer haemocytometer appropriate dilution. Blood constants (mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration MCHC) were calculated using appropriate formulae as described by Jain (1986). Serum total protein was determined using Biuret method as described by Reinhold (1953). Serum creatinine was determined as described by Scott (1965). The globulin values were obtained by subtracting values of albumin from the corresponding values of total protein (Coles, 1974).

Statistical Analysis

Data were subjected to one-way Analysis of Variance (ANOVA) procedure of SAS version 9.4 (SAS, 2002). Differences among treatment means were assessed using Duncan's Multiple Range Test (DMRT, Duncan 1955).

Results and Discussion

The analyzed proximate composition and fibre fractions of varied mixture of air dried *Sesbania sesban* legume forage and Napier grass hays and concentrate diets fed growing bucks is presented in Table 2. The dry matter (DM) contents observed in this study ranged from 71.59 to 87.63% was in consonance with the report of Oyewole and Aderinola (2022) for mixtures of *P. maximum* with either *Stylosanthes hamata* or *S. guianensis*. The higher dry matter values for grass-legume mixtures could be averred to higher dry matter percentage in Napier grass. Also, high DM of the diets in this study suggested good shelf-life of leaves during the drying process (Alalade *et al.*, 2019).

The percentage crude protein (CP) contents, ranging from 8.12 – 18.67%, were recorded for different inclusion levels of *Sesbania sesban* and Napier grass hay mixture. The observed values of CP in this current study was close to that of *Cajanus cajan* foliage (21.16%) recently reported by Adebisi *et al.* (2022). The CP contents of all treatments were high as they were well above the 8%CP requirement for ruminant animals which will provide ammonia requirement for the rumen microbial activity (Norton, 2003).

The crude fiber contents of the treatment feeds ranged from 19.01 to 29.57%. The values recorded for each sample showed that the higher the percentage of Napier grass in the

inclusion level, the higher the values recorded for crude fiber content. The higher crude fiber content values will aid digestion and absorption of water which is in favour of ruminant animal (Ayoola and Adeyeye, 2000).

The ash contents of the treatments at varied inclusion levels of *S. sesban* and Napier grass ranged from 7.06- 11.95%. The values obtained were in line with range values of 9.65- 9.87% reported for different cultivars of *L. purpureus* leaf by Alalade *et al.* (2017). The highest values of 11.95% ash content in the present study was above the 5.08% recorded for *Psophocarpus tetragonolobus* leaf (Alalade *et al.*, 2016) and also higher than the 3.70% reported for *Mucuna utilis* leaf (Ujowundu *et al.*, 2010). The proportion of ash content present is a reflection of mineral contents present in the feed material (Omotosho, 2006). This suggests that these feed samples could be a better source of essential valuable and useful minerals needed by ruminant, for good body development.

The ether extract value, which represented crude fat, was higher in forage samples. However, it showed that they contained adequate crude fat that will satisfy the energy requirement of ruminant animals for productive purpose. Feed stuffs having a crude fat value of 1-2% have been found sufficient to maintain good health in ruminant by reducing the risk of disease and ageing caused by its excess consumption (Sodamade *et al.*, 2013).

The NDF concentration of the treatment sample ranged from 41.65 and 51.50%. Increase inclusion level of Napier grass in the samples resulted higher values of NDF concentration. The NDF concentrations of the different varied mixtures of legume-grass were below 60% which has been reported as the threshold level of NDF in tropical plants beyond which feed intake of ruminants is affected (Meissner *et al.*, 1991). The NDF content is the best indicator to predict fodder quality as it is related to the intake potential of the fodder. Low energy value and the low NDF contents of all treatment samples, suggested it contained potential and important available fermentable carbohydrate in ruminant feeds. ADF concentrations ranged from 30.17 to 40.09% in this current study. These values agree with the values reported by Olajumoke (2003) that 30.6-40.20% was recorded for ADF on elephant grass at age of 4-8 weeks. Forage with high ADF value is



classified as low quality roughage (Rusdy, 2016). According to Kellems and Church (1998), roughage with less than 40% ADF is categorized as high quality and those with greater than 40% as poor quality. Based on this assertion, the varied mixtures of grass-legume hay and sole Napier grass samples used in this study can be classified as high quality forage because their ADF values were below 40%.

Haematological parameters of growing West African dwarf bucks fed with varying proportions of *Sesbania sesban*, and *Napier grass* foliage hay are shown in Table 3. The mean values (27.00 – 33.00%) of packed cell volume (PCV) recorded across the treatments at the end of the experiment fell within the

range of 24 – 48% reported for clinically healthy goats (Banerjee, 2004). The values of haemoglobin concentration which ranged from 8.80–10.70g/dl in the bucks suggested that the animals had sufficient blood pigment for proper transportation of oxygen, thus healthy living. Hemoglobin concentration (Hb) and red blood cell counts followed the same trend as in PCV and the values recorded across the treatments for Hb were higher than 5 – 6 g/dL reported by Belewu and Ogunsola (2010) fed Goat with fungi treated and untreated *Jatropha curcas* kernel cake in a mixed ration. In general, increase in Hb concentration is associated with greater ability to resist disease infection, and low level is an indication of disease infection and poor nutrition (Njidda *et al.* 2013).

Table 2: Proximate composition of air dried *Sesbania sesban* and Napier grass hay mixture and concentrate diets fed to bucks

Parameters (%)	T1 100NG	T2 NG25SS75	T3 NG50SS50	T4 100SS	Concentrate
DM	87.63	73.52	71.59	81.12	94.48
CP	8.12	15.28	15.61	18.67	17.57
CF	29.57	20.34	20.12	19.01	8.75
EE	1.15	2.28	2.33	2.37	10.39
Ash	11.95	7.06	9.67	10.69	5.85
NFE	36.84	28.64	23.86	30.38	50.21
NDF	51.50	45.18	48.16	41.65	30.34
ADF	40.09	30.17	31.78	32.07	16.05
ADL	14.03	10.60	11.03	10.27	5.65
*ME(Kcal/Kg)	1702.33	1676.15	1615.19	1963.15	3282.45

DM= Dry Matter, CP= Crude Protein, CF= Crude Fibre, EE= Ether Extract, NFE=Nitrogen Free Extract, NDF= Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin, *ME= Calculated Metabolizable energy, SS= *Sesbania sesban*, NG= *Napier grass*

As for RBC, Bello and Tsado (2013) reported values ranging from 6.4 – 9.9 x10⁶ /L when growing Yankassa rams were fed sorghum stover supplemented with graded level of dried poultry droppings, however, these values were lower than that obtained in this current study. The obtained values (12.53 – 13.42 x10⁶µl) in this study indicated that dietary protein of the Napier grass and *S. sesban* hay mixture were of high quality since Adeyemi (2008) observed that red blood cell and haemoglobin were positively correlated with protein quality and protein level in the diets. The red blood cell values (12.53 – 13.42 x10⁶µl) observed in this study were higher than reported values of 8.1–9.7x10⁶µl by Fayomi *et al.* (2014) on feeding trial using Moringa multi-nutrient blocks. The RBC indices aids in the characterization of anaemia and also low quality of RBC could be due to low quality of feed and protein deficiency (Merck's Veterinary Manual, 2012).

The obtained RBC, Hb and PCV values in this study were similar to their values obtained by Okoruwa and Ikhimiya. (2014) fed West African dwarf bucks with *Pennisetum purpureum* and unripe plantain peels. The observed values (5.85 – 9.00 x10³µl) of white blood cell in this current study were higher than the values (9.39 – 11.18 x10³µl) reported by Adebisi (2021) that fed West African Dwarf growing rams with varying proportions of *Panicum maximum* supplemented with *Cajanus Cajan* foliage hay. The leucocyte count (WBC) was lower than the values (8.20 – 14.40 x10³µl) reported by Njidda *et al.* (2013) for different breeds of goats of Northern Nigeria. Bucks fed diet T1 to T4 had their white blood cell (WBC) values (5.85–9.00 x10³µl) fell within the normal range (4 - 13x10³µl) reported by (Plumb, 1999). The lymphocytes constituted majority of the WBC counts and the cells



increased with age in early life (Egbe-Nwiyi *et al.*, 2000). The white blood cell differentials (lymphocytes and neutrophils) showed significant influence ($P < 0.05$) of diets on these parameters. Lymphocytes values (56.00 – 62.00%) obtained in this current study were generally higher compared to the values (32.00– 52.00%) reported by Njidda *et al.* (2013) when goats fed on natural grazing rangeland of Northern Nigeria. and Olafadehan *et al.* (2018) for red Sokoto goats. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) are important diagnosis of anaemia in most animals (Coles, 1986) and values obtained were within the normal ranges (16 – 25 fL, 5 – 8 fmol and

28 – 34% for MCV, MCH and MCHC, respectively) (Sirois, 1995). This indicated that all the experimental bucks used were not anaemic at the end of the experiment.

Serum biochemical indices of growing West African dwarf bucks fed varying proportions of Napier grass and *S. sesban* hay mixture with concentrate diet as shown in Table 4. The result revealed that biochemical indices were significantly ($p < 0.05$) influenced by the dietary treatment. Total blood protein is an indication of the quantity or quality of protein in the diet (Mohamed *et al.*, 2012). The synthesis of plasma protein is markedly reduced when the supply of amino acid for digestive process is not adequate.

Table 3: Haematological parameters of West African Dwarf growing bucks fed varying proportions of Napier grass and *S. sesban* hay mixture with concentrate diet.

Parameters (%)	T ₁ 100NG Hay	T ₂ NG25SS75 Hay	T ₃ NG50SS50 Hay	T ₄ 100SS Hay	SEM (±)
PCV (%)	27.00 ^d	28.00 ^c	33.00 ^a	30.00 ^b	1.08
Hb (g/dl)	8.80 ^{cd}	9.00 ^{bc}	10.70 ^a	9.60 ^b	0.05
RBC (x10 ⁶ /ul)	12.53 ^d	12.61 ^{bc}	13.42 ^a	13.28 ^b	1.01
WBC (x10 ³ /ul)	5.85 ^d	6.20 ^c	9.00 ^a	8.25 ^b	1.50
Platelets (ul)	113.00 ^b	94.00 ^d	109.00 ^c	122.00 ^a	2.28
Lymphocyte (%)	58.00 ^c	56.00 ^d	62.00 ^a	60.00 ^{ab}	1.62
Neutrophils (%)	37.00 ^b	41.00 ^a	34.00 ^d	36.00 ^{bc}	1.04
Monocyte (%)	2.00 ^a	1.00 ^b	1.00 ^b	1.00 ^b	0.06
Eosinophil (%)	3.00 ^a	2.00 ^b	3.00 ^a	2.00 ^b	0.08
MCV (fl)	21.55 ^c	22.20 ^{bc}	24.59 ^a	22.59 ^b	1.82
MCHC (%)	32.59 ^a	32.14 ^b	32.42 ^{ab}	32.00 ^c	1.50
MCH (pg)	7.02 ^a	7.14 ^a	7.97 ^a	7.23 ^a	0.24

^{a b c d} Means on the same row with different superscript are significantly different ($P < 0.05$). PCV= Packed cell volume, MCH= Mean Corpuscular Haemoglobin, RBC= Red blood cell, WBC= White blood cell, MCHC= Mean Corpuscular Hameoglobin Concentration, MCV = Mean Corpuscular Volume.

This could be the reason for the results observed in this study, as bucks fed solely 100%NG hay had the least total protein. This is because supply of amino acids which is usually from protein is not adequate. This finding is similar to what was recorded in animals fed solely napier grass hay (Kheir and Ahmed, 2008) which had low levels of total protein. Plasma protein helps to transport calcium and phosphorous and other substances in the blood (Njidda *et al.*, 2014). Result in this study is similar to reports by (Mohamed *et al.*, 2012) who stated that rams maintained on low level of feeding showed lower total protein. In a study by Bello and Tsado, (2013), total protein was high in rams fed 14% CP. This corroborated the findings in this present study as the required protein levels for rams is between 12-16%. The total protein observed for WAD bucks fed dietary treatment groups in this study was within the range of 6.1–7.5g/dl

reported by Merck, (2011) whereas significantly lower total protein of bucks fed T₁ diets is an indication of the relatively poor protein quality of the diet, the level and availability of the dietary protein (Olafadehan, 2011).

The serum total protein across the treatments ranged from 6.30 to 7.60g/dl and were significantly different ($p < 0.05$). In this current study, serum total protein values of 6.30 to 7.60g/dl was comparable to values of serum protein (5.81 to 6.36g/dl) reported for Nigerian breeds of sheep (Njidda *et al.*, 2014; Ayele *et al.*, 2017). Serum protein above the normal range (6.0–7.9g/dl) reported by Kaneko *et al.* (2008) among the sheep might be attributed to greater efficiency of dietary protein utilization. The albumin concentration recoded for West African dwarf bucks in this study ranged from 2.70–3.20g/dl was lower than 3.90–4.45μ/L reported by Yusuf *et al.* (2012) but similar to



that obtained by Oyebanji and Ayandiran, (2014). Serum albumin is a highly sensitive and nutritional indicator of protein status (Agenas *et al.*, 2006) and predisposition of animals to diseases. All the experimental rams were within the range of 2.7–4.4g/dl for globulin (Merck, 2012). Bucks fed diet T₃ had the highest globulin value (4.40g/dl), while bucks fed diet T₁ had the least (3.60g/dl) globulin. However, the concentrations were higher than 0.61–1.60g/dl reported by Daramola *et al.* (2005) for WAD goats.

The concentration of glucose determined in this study was decreased significantly in T₄ (59.33mg/dl) when compared with T₁ (63.37mg/dl) and T₃ (60.04mg/dl), respectively. The present serum glucose values (59.87 – 63.37mg/dl) observed in this current study was in agreement with that and the normal range (50–75mg/dl) of goats, which reported by Dhanotiya, (2004) and also agreed with the normal ranges of 55.00–131.00mg/dl and 50–80mg/dl reported by Radostits *et al.* (2007) and Latimer (2011), respectively. The range of blood cholesterol levels (65.00–82.00mg/dl) of the bucks in this study were within the values 56.80–103.90mg/dl reported by Yusuf *et al.* (2012). It was observed that the blood cholesterol level of the bucks fed dietary treatments were fell within the normal blood cholesterol values of 65–136mg/dl reported by Merck (2011). Hence, this indicated that air dried Napier grass and *S. sesban* hay as a potent hypo-cholesterolemic agent, which agreed with the submission of Esonu *et al.* (2001) that haematological constituents reflect the physiological responsiveness of the animal to its internal and external environments (including feed and feeding). The extremely low cholesterol levels observed among the treatments implies that experimental animals were healthy and not vulnerable to myocardial infarctions caused by the blockage of walls of blood vessels. Therefore, selected air-dried forage hay could serve as based diets for ruminants, being low in soluble carbohydrates and energy could reduce the deposition of fats in tissues.

The creatinine concentrations (1.20–1.60mg/dl) across the treatments were within the normal range (1.00–2.00mg/dl) reported by

Banerjee, (2006) but disagreed with the values of 1.61–1.89mg/dl reported for sheep by Jiwuba *et al.* (2017). The creatinine levels observed across the treatments are indicative of normal renal function, which could have resulted from efficient protein and amino acid metabolism (Abu El-Ella and Kommonna, 2013), absence of tissue protein catabolism (Prvulovic *et al.*, 2012) and anti-nutritional factors in the diets. 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, because of the different physiological processes in the body.

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 (163–174μl) indicated that the bucks were healthy without any liver impairment. In this study, a wide range in the observed value for the transaminases could be an indication that the selected air-dried legume forage hay did not differ in their effects on enzyme secretion mechanism. In this study, the observed levels of serum activity of the liver enzymes (AST and ALT) were within physiological ranges reported (Latimer, 2011) implies that no hepatocellular damaged occurred in the animals. This is an indication of no toxic effect of experimental diets upon ingestion by the animals on the liver or muscles due to optimal renal and hepatic functions. The normal Serum enzymes (ALT, AST and ALP) values among the diets imply no damage to the liver and kidney and no negative influence on the functions of organs associated with blood metabolism (Vakili *et al.* 2013). Serum enzyme activities above the normal ranges are abnormal and indicate that animals might have suffered liver and/or kidney damage (Olafadehan *et al.* 2014).



Table 4: Serum biochemical indices of West African Dwarf growing bucks fed varying proportions of Napier grass and *S. sesban* hay mixture with concentrate diet.

Parameters (%)	T ₁ 100NG Hay	T ₂ NG25SS75 Hay	T ₃ NG50SS50 Hay	T ₄ 100SS Hay	SEM (±)
Total protein (g/dl)	6.30 ^d	7.00 ^b	7.60 ^a	6.60 ^c	0.09
Albumin (g/dl)	2.70 ^{cd}	2.90 ^{ab}	3.20 ^a	2.80 ^c	0.06
Globulin (g/dl)	3.60 ^d	4.10 ^b	4.40 ^a	3.80 ^c	1.04
Glucose (mg/dl)	63.37 ^a	61.65 ^b	60.04 ^c	59.87 ^d	2.40
AST (I.µL)	165.00 ^c	174.00 ^a	172.00 ^b	163.00 ^d	3.08
ALT (I.µL)	15.00 ^b	15.00 ^b	16.00 ^a	15.00 ^b	0.52
Cholesterol(mg/dl)	65.00 ^d	75.00 ^b	82.00 ^a	70.00 ^c	1.97
Creatinine (mg/dl)	1.20 ^{cd}	1.40 ^{ab}	1.60 ^a	1.30 ^c	0.02

^{a b c d} Means on the same row with different superscript are significantly different (P< 0.05). AST= Aspartate aminotransferase, ALT= Alanine aminotransferase, SS= *Sesbania sesban*, NG=Napier grass

Conclusion

The results of the study indicated that the combination of grass based diet (Napier grass) with selected browse fodder had no significant effect on most of the hematological and biochemical components on growing West African Dwarf bucks. There was no adverse or deleterious effects on the blood parameters indicated good health status. The study revealed that feeding 50%NG50%SS hay diet has a good nutrient profile and enhanced the productivity of growing WAD bucks in terms of PCV, Hb and RBC and improved serum metabolites in terms of total protein without any deleterious effects on the animals. Hence, air dried Napier grass and *S. sesban* hay can be strategically utilized as dry season feed in smallholder goat production system.

Recommendation

Based on the obtained result, it is therefore, recommended that the tropical grass (Napier grass) be supplemented with browse fodder in diets of growing bucks to enhance the performance of the bucks and pose no health challenges to the animals. The combination ratio might, however, depend on the production status of the animal and the quality of both the basal grass diet and the browse plant species. It might be necessary, however, to further investigate the ratio of grass: browse fodder that will be best for different production statuses of bucks with different qualities of both basal grass diet and browse fodders.

References

Abu El-Ella, A. A. and Kommonna, O. F. 2013. Reproductive performance and blood constituents of Damascus goats as affected by yeast culture supplementation. *Egyptian Journal of Sheep Goat Science*, 8:171 – 187.

Adebisi, I.A. (2021). Performance and nutrient utilization by West African dwarf rams fed different proportions of *Cajanus cajan* hay and *Panicum maximum*. Ph. D thesis submitted to the Department of Animal Production and Health, Federal University of Agriculture, Abeokuta, Ogun State Nigeria. Pp133.

Adebisi, I.A., Okunlola, O.O., Aina, A.B.J., Sowande, O.S. and Aderinboye, A.Y. 2022. Nutritional potential of *Cajanus cajan* foliage hay on growth performance and nutrient digestibility of West African dwarf growing rams fed *Panicum maximum*. *Greener Journal of Agricultural Sciences*, 12 (3): 269 – 281.

Adeyemi, O. A., Eruvbetine, D., Oguntona, T., Dipeolu, M. A and Agunbiade, J. A. 2008. Feeding broiler chicken with diets containing whole cassava root meal fermented with rumen filtrate. *Archivos de Zootechnia*, 247- 258.

Agenas, S., Heath, M. F., Nixon, R. M., Wilkinson, J. M. and Phillips, C. J. C. (2006). Indicators of under nutrition in cattle. *Animal Welfare*. 15 (2): 149 – 160.

Akinmutimi, A. H., 2004. Evaluation of sword bean, *Canavalia gladiata*, as an alternative feed resource for broiler chickens. Ph.D. Thesis, Michael Okpara University of Agriculture Umudike, Nigeria.

Alalade, J.A., Akinlade, J.A., Aderinola, O.A., Fajemisin, A.N., Muraina, T.O. and Amoo, T.A. 2016. Proximate, mineral and anti-nutrient contents in *Psophocarpuste tragonolobus* (L) DC. (Winged Bean) leaves. *British Journal of Pharmaceutical Research*, 10(2):1-7.

Alalade, J.A., Akinlade, J.A., Fajemisin, A.N. and Adebisi, I.A. (2017). Three cultivars of *Lablab purpureus* foliage in Igbo-Ora, Oyo



- State, Nigeria are nutritive. *Nigerian Journal of Animal Production*, 44(5): 203-213.
- Alalade, J.A., Akinlade, J.A., Akingbade, A.A., Emiola, C.B. and Adebisi, I.A. (2019). Proximate composition and phytochemical screenings of *Crotalaria retusa* leaves and seeds. *Open Access Library Journal*, 6: e5058
- Al-Eissa, M. S., Alkahtani, S., Al-Farraj, S. A., Alarifi, S. A., Al-Dahmash, B., and AlYahya, H. (2012). Seasonal Variation Effects on the Composition of Blood in Nubian ibex (*Capra nubiana*) in Saudi Arabia. *African Journal Biotechnology*, 11(5), 1283–1286.
- Al-Seaf, A. M., and Al-Harbi, K. B. (2012). Variability of disease resistance, haematological parameters and lymphocyte proliferation in two goat breeds and their F1 and F2 crosses. *International Journal of Food Agriculture and Veterinary Science*, 2, 47–53.
- Arowora, K.A., Onilude, A.A., and Tewe, O.O. Seral, haematological and economics of production of weaner pigs fed graded levels of biodegraded cassava (*Manihot esculenta*) peels. *Trop. J. Anim. Sci.* 6: 7-16.
- Ayele, S., Urge, M., Animut, G. and Yusuf, M. 2017. Feed intake, digestibility, growth performance and blood profiles of three Ethiopian fat tail hair sheep fed hay supplemented with two levels of concentrate supplement. *Open Journal of Animal Sciences*. 7:149 – 167.
- Ayoola, P.B and Adeyeye, A. 2000. Proximate analysis and nutrient evaluation of some Nigerian pawpaw seeds varieties. *Science Focus*, 14(4):554-558.
- Babayemi, O. J. (2007). In-vitro fermentation characteristics and acceptability by West African Dwarf Goats of some dry season forages. *African Journal of Biotechnology*, 6, 1260-1265
- Banerjee, G. C. (2006). A Textbook on Animal Husbandry. 8th Edition. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi. Pp1079.
- Belewu, M. A. and Ogunsola, F. O. (2010). Haematological and serum indices of goat fed fungi treated *Jatropha curcas* kernel cake in a mixed ration. *Journal of Agricultural Biotechnology and Sustainable Development*, 2(3):035 – 038.
- Bello, A.A. and Tsado, D.N. (2013). Feed intake and Nutrient Digestibility of Growing Yankasa Rams fed Sorghum Stover Supplemented with Graded levels of Dried Poultry Droppings Based Diet. *Asian J. Anim. Sci.*, 2: 56-63.
- Buxton, D.R. (1996). Quality related characteristics of forages as influenced by plant environment and agronomic factors. *Animal Feed Science and Technology*, 59: 37-49.
- Chrenkova, M., Ceresnakova, Z., Sommer, A. and Flak, P. (2006). Content of structural saccharides and their influence on degradability of lucerne crude protein in different stage of maturity. pp. 137 139. Proceeding symposium on 12th international forage conservation, BRNO, Czech Republic, 3 - 5th April 2006.
- Coles, E.H. (1974). Liver function. In: Saunders, W.B. (Editor) Veterinary Clinical Pathology. Second Edition. Company Philadelphia. Pp. 202-215.
- Coles E. H. (1986). Veterinary Clinical Pathology, 4th ed. W.B. Saunders Co., Philadelphia.
- Daramola J. O, Adeloye A. A, Fatoba T. A and Soladoye A. O (2005). Haematological and Biochemical parameters of West African dwarf goats, *Livestock Research for Rural Development*. 17. (8).
- Dereje, W. (2015). Effect of substitution of concentrate mix with dried mulberry leaves on feed intake, digestibility, body weight gain and carcass characteristics of Arsi-Bale goats. MSc Thesis, Haramaya University, Haramaya, Ethiopia
- Dhanotiya, S. R. (2004). Text Book of Veterinary Biochemistry, College of Veterinary Science and Animal Husbandry; India, 448.
- Duncan, B. D. (1955). Multiple Range Test and Multiple Test *Biometrics* 1:1- 42.
- Egbe – Nwiyi, T. N; Nwaosu, S. C and Salami, H. A. (2000). Haematological Values of Apparently Healthy sheep and goats as influenced by age and sex in Arid Zone of Nigeria. *African Journal of Biomedical Research*. 3: 109-115.
- Esonu, B. O., Emenalom, O. O., Udedibie, A. B. I., Berbert, U., Ekpore, C. F., Okoli, E. C and Ibeukwumere, F. C. 2001. Performance and chemistry of weaner pigs fed raw mucuna bean (*Velvet bean*) meal. *Tropical Animal Production and Investment*. 4: 49-54.



- Ewuola, E.O and Egbunike, G.N. (2008). Haematological and serum biochemical response of growing rabbit bucks fed dietary fumonisin B1, *African Journal of Biotechnology*, 7(23): 59 - 65
- Farooq, A., Sajid, L., Muhammad, A., and Anwarul-Hassan, G. (2007). *Moringa oleifera*: A food plant with multiple medicinal uses. *Phytotherapy Research*, 21: 17–25.
- Fayomi, A., Ahmed, A., Musa, U., Salami-Shinaba, J.O., Ogedegbe, S.A., and Akanni, K. (2014). Moringa multi-nutrient blocks: formulation, production and feeding trial under a tropical environment. *International Journal of Science, Environment and Technology*, 3(1):67–72.
- Foster, R. and Smith, M. (2011). Blood cells and Complete Blood Counts (CBC) in animals. Foster and Smith Inc
- Ganong, W. F. (2005) Review of Medical Physiology 22nd edition McGraw Hill Medical Publication Asia Pp. 459- 532.
- Hozza, W. A., Mtenga, L. A., Kifaro, G. C., Shija, D. S. N., Mushi, D. E., Safari, J. G. and Shirima, E. J. M. (2014). Meat quality characteristics of Small East African goats and Norwegian Crosses finished under small scale farming conditions. *Asian Australian Journal of Animal Science*. 27, 1773-1782.
- Jain, N.C. 1986. *Schalms Veterinary Haematology*. 4th Ed., Lea and Febiger, Philadelphia, USA.
- Jiwuba, P. C., Jiwuba, L. C., and Onyekwere, M. U. 2017. Growth performance, haematology and serum biochemistry of West African dwarf sheep fed cassava peel-oil palm leaf meal based diets in hot humid tropics. *Agricultural*/ 14 (1-2): 37-44.
- Kaneko, J. J. (1989). Clinical Biochemistry of Domestic Animals. 4th ed. Academic Press., San Diego
- Kaneko, J. J., Harvey, W. J., and Bruss, M. L. (2008). *Clinical biochemistry of domestic animals*. 6th Edition. Academic Press. Pp928.
- Kellems, R.O. and Church, D.C. (1998). *Livestock Feeds and Feeding*. (4 Edition). Prentice Hall Inc. New Jersey, USA, 537p
- Kheir, M.I. and Ahmed, M.M.M. (2008). Effects of Water and Feed Restriction on Some Physiological and Haematological Parameters and Blood Constituents of Sudanese Desert Goats Fed High- and Low Quality Forage under Semi-Arid Conditions. *Ind. J. Anim. Res.*, 42(1): 93-43
- Latimer, K. S. 2011. *Duncan and Prasses Veterinary Laboratory Medicine: Clinical Pathology*, 5th Edition. Wiley-Blackwell. Pp528.
- Mako, A. A., Banjo, O. S. and Akinwande, V. O. (2012). Nutritive evaluation and acceptability of two aquatic weeds (*Eichhornia crassipes* and *Acroceras zizanioides*) by West African Dwarf goats. *African Journal of Agricultural Research*, 7, 3007-3013. Google scholar.
- Mbassa, G. K, Poulsen, J. S. (1991), Profiles of some clinical chemical parameters in growing dwarf and Landrace kids. *Comp Bio Chem Physiol B*. 100: 424-431.
- Meissner, H.H., Viljoen, M.D. and Van Nierkeki, W.A. (1991). Intake and digestibility by sheep of Anthephora, Panicum, Rhode and Smuts finger grass pastures: Proceeding of the 4th International Rangeland Congress, September 1991. Montpellier, France. pp. 648-649.
- Merck, 2011. Merck Sharp and Dohme Corp., a subsidiary of Merck & Co., Inc. Whitehouse Station, NJ, USA.
- Merck Manual 2012. Haematological reference ranges. Merck Veterinary Manual. Available at: <http://www.merckmanuals.com/>. Accessed on 23/04/2017.
- Mohamed, S., Hashim, S.N. and Abdul Rahman, H. (2012). Seaweeds: A sustainable functional food for complementary and alternative therapy. *Trends Food Sci Technol.*, 23:83–96.
- Mohammed, S. A., Razzaque, M. A., Omar, A. E., Albert, S., and Al-Gallaf, W. M. (2016). Biochemical and haematological profile of different breeds of goat maintained under intensive production system. *African Journal of Biotechnology*, 15, 1253–1257.
- Njidda, A.A., Hassan, I.T., and Olatunji, E. A. (2013). Haematological and Biochemical Parameters of Goats of Semi-Arid Environment Fed On Natural Grazing Rangeland of Northern Nigeria. *Journal of Agriculture and Veterinary Science* 3(2): 01-08
- Njidda, A. A., Shuai'bu, A. A. and Isidahomen C. E. (2014). Haematological and Serum Biochemical Indices of Sheep in Semi-Arid



- Environment of Northern Nigeria. *Global J. Sci. Fr. Res*, 14: 232-235.
- Norton, B.W. (2003). The nutritive value of tree legumes. In Gutteridge, R. C and Shelton, H.M. (Eds). *Forage Tree Legumes in Tropical Agriculture* pp.1-10
- Okoruwa, M.I and Ikhimioya, I. (2014). Haematological and serum biochemical indices of West African dwarf goats fed elephant grass and varying levels of combined plantain with mango peels. *Journal of Experimental Agriculture International*, 4(6):619-628.
- Olafadehan, O. A. (2011). Changes in haematological and biochemical diagnostic parameters of red sokoto goats fed tannin-rich *Pterocarpus erinaceus* forage diets. *Veterinarski Archives*, 81, 471-483.
- Olafadehan, O. A., Adewumi, M.K. and Okunade, S. A. (2014). Effects of feeding tannin containing forage in varying proportion with concentrate on the voluntary intake, haematological and biological indices of goats. *Trakia Journal of Sciences*, 1: 73 – 81.
- Olafadehan, O.A., Njidda, A.A., Okunade, S.A. Salihu, S.O., Balogun, D.O. and Salem, A.Z.M. (2018). Performance and haemtochemical parameters of buck-kids fed concentrate partially replaced with tropical *Piliostigma thonningii* foliage. *Animal Science Journal* 89, 340-347.
- Olajumoke, Z. 2003. Effect of age of regrowth on crude protein, acid detergent fibre and neutral detergent fibre contents of two types of *Pennisetum purpurenm*. Ph.D. Thesis, University of Agriculture, Abeokuta, Nigeria
- Ologhobo, A. D., Apata, D. F., Oyegide, A. and Akinpelu, R. O. (1992). Toxicity of raw lima beans (*Phaseolus lunatus*) and lima bean fractions for growing chicks. *Brit. Poultry. Sci.* 34: 505-522.
- Omotosho, O.T. 2006. Nutritional quality, functional properties and anti-nutrient compositions of the larva of *Cirinaforda* (Westwood) (Lepidoptera: Saturniidae). *Journal of Zhejiang University of Science B*, 7(1): 51-55.
- Ondiek, J. O., Ogore, P. B., Shakala, E. K. and Kaburu, G. M. (2013). Feed intake, digestibility and performance of growing small East African goats offered maize (*Zea mays*) stover supplemented with *Balanites aegyptiaca* and *Acacia tortilis* leaf forages. *Journal of Agricultural Science*, 2, 21-26.
- Oyebanji, B. O. and Ayandiran, S. K. 2014. Effect of feeding pineapple waste on haematological and biochemical parameters of West African Dwarf goats. *Journal of Agriculture and Rural Development*. 13: 28 - 38.
- Oyewole, A.T. and Aderinola, O.A. (2022). Effect of forage combinations, cutting age and season on biomass of *Panicum maximum* - intercropped with *Stylosanthes guianensis* and *Stylosanthes hamata* in the derived savanna of Nigeria. *Nigerian Journal of Animal Science*, 49(1):362-373.
- Plumb, D. C. (1999). *Veterinary Drug Handbook*. Iowa State University Press. Veterinary Clinical Pathology. Practice Publishing Co.
- Prvulovic, D., Slavica, K., Milan, P., Dimitrijevic, D. and Grubor-Lajsic, G. 2012. The influence of hydrated aluminosilicate on biochemical and haematological blood parameters, growth performance and carcass traits of pigs. *Journal of Animal and Veterinary Advances*. 11(1): 134- 140.
- Radostits, O. M., Gay, C. C., Hinchclif, K. W., and Constable, P. D. (2007). *Veterinary medicine: a textbook of the disease of cattle, sheep, goats, pigs and horses*. Saunders, Edinburgh, USA. 10th Edition. Pp.2065.
- Reinhold, J.G. 1953. Total protein, Albumin and Globulin. *Standard methods of clinical chemistry*, (1):8.
- Rusdy, M. 2016. Elephant grass as forage for ruminant animals. *Livestock Research for Rural Development*, 28(49). Retrieved from <http://www.Irrd.org/Irrd28/4/rusd28049.html> on 02/07/2023
- SAS/STAT (2002). *SAS User's guide: version 9.4*. Statistical Analysis System Institute Inc. Cary, NC.
- Scott, M.L. (1965). Plasma creatinine determination: A review specific reaction method Scandandin *Avian Journal of Laboratory Investigation* 13:381-388
- Sirosis M. (1995). *Veterinary Clinical Laboratory Procedure*, pp. 160. Mosby Year Book, Inc., St Louis, Missouri, USA.
- Sodamade, A., Bolaji, O.S. and Adeboye, O.O. (2013). Proximate analysis, mineral contents and functional properties of



Moringa oleifera leaf protein concentration.
Journal of Applied Chemistry, 4: 47-51.

Stella, A. V., Paratte, R., Valnegri, L., Cigalino, G., Soncini, G., and Chevaux, E. (2007). Effect of administration of live *saccharomyces cerevisiae* on milk production, milk composition, blood metabolites, and faecal flora in early lactating dairy goats. *Small Ruminant Research*, 67, 7-13.

Ujowundu, C.O., Okafor, O.E., Agha, N.C., Nwaogu, L.A., Igwe, K.O. and Igwe, C.U. (2010). Phytochemical and chemical composition of *Combretum zenkeri* leaves. *Journal of Medicinal Plant Research*, 4: 965- 968.

Vakili A.R, Khorrami B, Danesh Mesgaran M, Parand E. 2013. The effects of Thyme and Cinnamon essential oils on performance, rumen fermentation and blood metabolites in Holstein calves consuming high concentrate diet. *Asian Australasian Journal of Animal Science* 26, 935-944.

Yusuf, A. O., Oyebanji, O. A., Yusuf, D. A., Ekunseitan, K. A., Adeleye, O. S., Sowande, O. S., and Fasae, O. A. 2012. Blood profile of West African dwarf goats fed *Panicum maximum* supplemented with *New bouldia laevis* leaves. *Bull. Ani. Hlth and Prod.* 60 (4): 481-490.

Zilva, J. F. and Pannall, P. R. (1984). Clinical Chemistry in Diagnosis and Treatment. 4th Edition, Lloyd- Luke Medical Books Ltd, London, UK., ISBN13: 9780853242017, pp: 348002D352.