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Variation in haematological and serum biochemical indices of sheep fed *Ziziphus mucronata* and *Parkia biglobosa* (A comparative study)

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ABSTRACT

An experiment was conducted to evaluate the effect of *Ziziphus mucronata* and *Parkia biglobosa* on haematological and biochemical indices of sheep. The experiment was carried out in a complete randomized block design. A total of 32 animals were used for the study with 16 animals per experiment. The animals were allotted to four dietary treatments with four animals per treatment. The results of the chemical composition shows that all the parameters observed were significantly different (P<0.05) among treatments. Crude protein (CP), crude fibre (CF), acid detergent lignin (ADL), cellulose, and hemicellulose were significantly (P<0.05) higher in diets containing *Ziziphus mucronata* than diets containing *Parkia biglobosa*. The haematological values shows that all parameters observed are significantly different (P<0.05) among treatments for each diet. All values for all parameters are comparable between forages except for mean corpuscular volume (MCV), where values tend to be higher in diets containing *Parkia biglobosa* than diets containing *Ziziphus mucronata*. The serum biochemical indices showed significant difference (P<0.05) among treatments for all the parameters observed. The results obtained for the two browse forages are comparable. It can be concluded that inclusion of *Ziziphus mucronata* or *Parkia biglobosa* in the diet of sheep has no negative effect on haematological and biochemical indices.

Key words: hematology, blood chemistry, breeds, sheep, rams.

INTRODUCTION

Small ruminants such as sheep and goats play important role in the livestock subsector of the Nigerian agricultural economy (Lakpini *et al*., 2002). Nigeria hosts 21,230 million sheep (Adu *et al*., 1979) and over 70% of the sheep population in Nigeria is found in the sahelo savanna regions where three of the four breeds of sheep (Balami, Yankasa and Ouda) predominant (Adu and Ngere, 1979).

Ziziphus is grown in hot tropical region with less than 600m altitude and rainfall of 350 – 500mm. Jauhari (1960) Reported that *Ziziphus* is a drought resistant plant and adaptable to soil need. According to carter, (1994) stock eat the falling leaves of *Ziziphus mucronata* and the branches are sometime lopped and fed to cattle, the red berries are readily eaten from the ground by goat. Anti-nutritional factors in browses could manifest in hematological and biochemical components of blood. Haematological and biochemical indices are imperative in assessment of animal health status and are well documented in clinically healthy animal (Obi and Anosa, 1980). There is need to established appropriate physiological baseline values for various breed under different feeding regime which could aid in the evaluation of management practices nutrition, and healthy status. Research effort to identify suitable materials that can replace completely or partially expensive ingredients with less expensive, unconventional protein and energy sources could be timely (Kallah *et al.*, 2000)

The African locust bean tree, *Parkia bigloboso* is a perennial tree legume which belongs to the sub-family *Mimosoideae* and family *Leguminosae*. It grows in the savannah region of West Africa up to the southern edge of the Sahel zone 13^0N (Campbell-Platt, 1980). These trees are not normally cultivated but can be seen in population of two or more in the savannah region of Nigeria (Hopkins, 1983). The Parkia tree play vital ecological role in cycling of nutrients from deep solid, by holding the soil particles to prevent soil erosion with the aid of roots. The trees also provide shades for farmers (Campbell-Platt, 1980). The tree of parkia species are usually and carefully preserved by the inhabitants of the area where they grow because they are valuable source of reliable food, especially the seeds which serves as source of useful ingredients for consumption (Campbell-Platt, 1980). It has been reported that the husks and the pods are good feed for live livestock Obiozoba 1998).

Haematological tests have been widely used for the diagnosis of various diseases and nutritional status of animal. The information gained from the blood parameters would substantiate the physical examination and together with medical history provide excellent basis for medical judgment (Schalm *et al*., 1975). In addition, it would help determine the extent of tissue and organ damage, the response of defence mechanism of the patient and aid in the diagnosing the type of possible anemia (Schalm, 1975).

A quantifiable variation was reported in blood parameters due to altitude, management, feeding level, age, sex, breed, health status, method of blood collection, hematological techniques used, diurnal and seasonal variation, ambient temperature and physiological status (excrement, muscular exercise, pregnancy, estrus, parturition, time of sampling, water balance and transportation.(Schalm *et al*., 1975; Ewuola *et al*., 2004).

The present study was undertaken to evaluate the haematological and biochemical indices in sheep fed *Ziziphus mucronata* or *Parkia biglobosa*.

MATERIAL AND METHODS

Experimental Site

The experiment was conducted at the research and training farm, Bayero University, Kano. The area lies on longitude 9^o 30' and 12^o 30' North and Latitude 9^o 30' and 8^o 41' East. The state is characterized by tropical wet and dry climate (Olofin, 1987). Annual rainfall and temperature ranges between 787 to 969 mm and 21^oC to 39^oC, respectively (KNARDA, 2001). The climate is characterized by define wet season that normally begins in May and ends in September and dry season that last from October to April.

Experimental Animals

A total of 32 sheep weighed between 7 and 10 kg and between 8 – 10 months old were purchase from the livestock market in Kano metropolis.

Experimental Feeds

Experiment 1

Treatment diets was formulated using *Parkia biglobosan* Groundnut Cake, rice bran, maize offal, Sorghum Stover, wheat offal, sorghum offal, bone meal and salt. A basal diet of *pennisetum pedicellatum* was fed *ad- libitum* as source of roughages.

Experiment 2

Treatment diets was formulated using *Ziziphus mucronata*, groundnut Cake, rice bran, maize offal, Sorghum Stover, wheat offal, sorghum offal, bone meal and salt. A basal diet of *pennisetum pedicellatum* was fed *ad- libitum* as source of roughages.

Feed ingredients were purchase at Albarka poultry service, Sulhu Agro vet and logistics services and "Yan Awaki" ruminant market in Kano metropolis. While the browse plants were collected within the premises of Bayero University Kano (New Site). The chemical composition of major dietary ingredients is shown in Table 1.

Feeding and Management of experimental animals

All animal were treated against internal parasites using levamisole (Kepro B.V. Holland, 1ml per 20 kg body weight), sprayed with Triatix (cooper Ltd) and long acting oxytetracycline 200 LA (Invesa Spain 1ml per 10 kg body weight) was also administer before the commencement. All sheep were kept in a house and confined in individual, well ventilated raised slatted floor cages. Water and feed was supply *ad libitun* at 3% body weight for feed. The trail lasted for 90 days during which the animals were group in to treatments and fed with *Parkia biglobosa* forage inclusion at 4 different graded levels, 0, 5, 10, and 15% levels of inclusion. Daily feed intake, water and live weight changes were recorded; the haematological and biochemical values were also analyzed at the end of the experiment.

Experimental Design and Treatment

Sixteen (16) Yan kasa rams were allotted to four dietary treatments in a randomized complete block design, with four animals per treatment. The treatments compared were T_1=0%, T_2=5%, T_3= 10% and T_4= 15% levels of inclusion of *Parkia biglobosa* for experiment1 and T_1=0%, T_2=5%, T_3= 10% and T_4= 15% levels of inclusion of *Ziziphus mucronata* for experiment 2. Animal were subjected to 2 weeks adaptation period and 10 weeks to determine the level to which the browse plant has effect on and of the sheep.

Chemical analysis of the browse Samples

Proximate fraction (DM, CP, ADF, NDF and ash) in feed and faeces: and N in feeds, feces were determined according to standard methods of (AOAC) (1990). The Kjedahl nitrogen N content in feed and faeces was then converted into CP, calculated as (N x 6.25). Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) was determined according to Van soest (1991).

Haematological and Biochemical Studies

The Rams were bled through jugular vein and 10 ml of blood collected. 3ml of the blood samples was collected into plastic tube containing EDTA for haematological studies. The remaining 7ml of blood samples was deposited in anticoagulant free plastic tube and allowed to clot at room temperature within 3 hours of collection. The serum samples were stored at -20^0 c for biochemical studies Total erythrocytic count and total leukocytic counts were determined with the aid of Haemocytometer (Neubaur counting chamber) and Hb concentration wad determined by Sahl's (acid haematin) method (Bengamin 1978). Mean corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV) values were calculated (Jain, 1986) Serum Aspartate Aminotransferase, serum Alanine Aminotransferase and Alkaline Phospatase were analyzed spectrophotometric linked reaction method (Henry et al., 1960). Total protein by the Biuret method according to the procedure of Oser (1976), Albumin by Bromocresol green (BCG) method, serum glucose, creatinine and bilirubin by Peters *et al.*, 1982), Sodium ion and potassium ions by flame photometric method. Other biochemical analysis was done using the method describe by (Ogunsami *et al.*, 2002)

Statistical Analysis

The data generated were subjected to analysis of variance (ANOVA) in a Randomized Complete Block Deign (RCBD) using SAS package (2004) where significant difference between the means exist, Least Significant difference (LSD) was use to separate the means (Obi, 1990).

RESULTS

Chemical composition of experimental diets

The chemical composition of the browse forage leaves determine in this study is presented in Table 1. DM content ranged from 889.27gkg^{-1} DM in T_1 to 905.60gkg^{-1}DM in T_2 for *Ziziphus mucronata* while *Parkia biglobosa* DM content ranged from 871.80 to 896.30 g kg^{-1} DM. The ash content of the browse leaves (*Parkia biglobosa*) is generally higher in all treatments when compared to treatment groups receiving *Ziziphus mucronata*. The ash content ranged from 81.40 to 101.30 g kg^{-1} DM for *Parkia biglobosa* while 62.26 to 96.30 g kg^{-1} DM was observed for *Ziziphus mucronata*. The organic matter contents of the diets with *Ziziphus mucronata* inclusion ranged from 793.00 to 831.00 gkg^{-1}DM which diets with *Parkia biglobosa* inclusion, ranged from 777.5 to 809.96 gkg^{-1}DM. The crude protein content is generally high in all the dietary treatments but the values tend to be higher for diets with *Ziziphus mucronata* inclusion. The highest neural detergent fibre (NDF) content was observed in T_4 receiving *Ziziphus mucronata* or *Parkia biglobosa*. The values was observed to increases with increase in level of *Ziziphus mucronata* or *Parkia biglobosa*. The acid detergent fibre (ADF) follows a similar pattern with T4 both having the highest value. The acid detergent lignin levels was generally higher for both diets (*Ziziphus mucronata* and *Parkia biglobosa*). The cellulose content were also high in all diets. The values were comparable for both diets (*Ziziphus mucronata* and *Parkia biglobosa* inclusion). The hemicellulose content ranged from 90.30 to 94.40 gkg^{-1}DM for diets containing *Ziziphus mucronata* while diets containing *Parkia biglobosa* ranged from 61.60 to 90.40 gkg^{-1}DM.

Haematological parameters of sheep fed *Ziziphus mucronata* or *Parkia biglobosa*

The haematological values were comparable for both diets, the PCV for *Ziziplus mucronata* inclusion ranged from 36.00 to 42.00% while diets receiving *Parkia biglobosa* ranged in 37.00 to 40.00% T_2. The haemoglobin content were all with range in T_4 and are comparable between diets. The RBC values showed no variation between diets. The values ranged from 7.00 to 9.00 g/dl for diets containing *Ziziphus mucronata* inclusion while diet containing *Parkia biglobosa* had range of 6.3 to 8.03 g/dl. Mean corpuscular haemoglobin (MCH) are generally higher in diet containing *Parkia biglobosa* except in T_1 (0% inclusion of forages) where the values 17.05 (Pg) was higher than 14.2 (Pg). The mean corpuscular haemoglobin concentration (MCHC) for diets containing *Ziziphus mucronata* is higher compare to diets containing *Parkia biglobosa.* The mean corpuscular volume (MCV) was observed to be higher in diet containing *Parkia biglobosa* when compare with diets containing *Ziziphus mucronata*. White blood cell count (WBC) showed higher values for diets containing *Ziziphus mucronata* than diets containing *Parkia biglobosa* except for T_1 where WBC was observed to be higher in diet containing *Parkia biglobosa* than in diet containing *Ziziphus mucronata*. The WBC differentials are comparable between diets. Lymphocytes and neutrophils show higher values than eosinophils, monocytes and Basophils.

Serum biochemical indices of sheep fed *Ziziphus mucronata* or *Parkia biglobosa*

The result of serum biochemical indices is shown in table 5. Sodium ion are comparable between diets except in T_2 where the value in diet containing *Parkia biglobosa* was observed to be higher than in diet containing *Ziziplus mucronata.* Similar observation was made with chloride ion. The Urea value was higher in all diets containing *Ziziphus mucronata* except in T_4. The creatimine value was observed to be higher in all treatment receiving Parkia biglobosa than treatments receiving *Ziziplus mucronata*. The result for total protein follow similar partem with diets containing *Parkia biglobosa* having higher values. The albumin and Globulin showed differences between diets in T_4 (15% *Ziziphus mucronata* or 15% *Parkia biglobosa*). The values for all the enzymes observed are comparable between diets.

DISCUSSION

The result of chemical composition of experimental diets revealed that the treatment diet had relatively high dry matter content, this could probably be due to the fact that they were prepared from dried ingredients which were characteristically high in dry matter. The marked difference between the values reported in this study and that obtained in literature might have been coursed by difference in composition of the diets. The crude protein (CP) content are generally high for both diets. This might be due to the inclusion of the browse forage leaves in the diets since browses have been reported to contan high level of protein and minerals Machen (2012). The high CP content of browse species is well documented and is one of the main distinctive characteristic of browse compared to most grasses, Norton (1994) reported a range of CP contents from 12 to 30% for tropical tree legumes and Le Houerou (1980) gave a mean of 12.5 % in West African browse species with about 17% for leguminous species. Generally, the CP Content in browse has been shown to be above the minimum level required (7%) for microbial activities in the rumen (Norton 1994). This justifies the use of the browse forage in small quantities in order to supplement poor quality pasture and crop residue. The low total Ash content values obtained in diets (*Ziziphus* inclusion) is lower compared to diets (*Parkia biglobosa inclusion*), this confirm that the total mineral content in the treatment diets containing *Ziziphus mucronata* is low.

With regard to the fibre content, the values in the present study were moderatly higher compare to the values reported by Njidda *et al.* (2008) and this can limit feed intake (Meissner *et al.*,1991). This diets also had high lignin content. Lignin is a component of the cell wall, and deposited as part of the cell wall-thickening process (Boudet, 1998). Lignin is in general higher in browse than in herbaceous plants. The content varies according to species, age and the plant parts. The browse forages had moderate to high content of fibre. This is a positive attribute of the browse forages since the voluntary DM intake and digestibility are dependent on the cell wall constituents (fibre), especially the NDF and lignin (Bakshi and Wadhwa 2004). Cellulose is closely associated with lignin thus the observed relatively high lignin content in the examined plant leaves may have resulted in the high cellulose levels in this study. In other words, the concentration of cellulose provides an insight as to the level to which the forage has been lignified. The cell wall content of hemicellulose was observed to be fairly high compared to reported levels in the common browse forages. These hemicelluloses levels in the plants may be acceptable levels although rumen microbes are incapable of adequately degrading this fibre component of plants.The PCV value obtained in the present study range from 37 to 40% (*Parkia biglobosa*) and 36 to 42% (*Ziziphus mucronata*) the falls within the range reported by Benerjee (2007) and Njidda *et al.*

(2014). Biana (1995) and Patterson *et al.,* (1960) attributed increase in PCV value in cattle to increase in environmental temperature which was similar observation made in this study. No significant effect was observed between the browse forages. Reports by Aletor and Egberongbe (1992) indicated that the blood variables mostly consistently affected by dietary influences include RBC counts PCV, Plasma protein and glucose, the current study however observed significant difference ($P<0.05$) in plasma protein and glucose indicating that the diet offered significant effect on them. High PCV hematocrit values indicate either an increase in the number of circulating RBC or reduction in circulating plasma volume Kopp and Hetesa (2000). The Hb value obtain in this study did not differ significantly ($P>0.05$) among the treatments, the value obtain ranged from 9.7 to 11.4 g/dl, the value were comparable with those reported by (Benerjee, 2007 and Njidda *et al.,* 2014). 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 (Cheesbrough 2004). The result also showed no marked differences between the browse forages studied.

The result of RBC value obtain did not differ significantly ($P>0.05$) among the treatment. The values obtain in this study is within the range of 8% reported by Jain (1986) and Kaneko (1989). The high RBC values obtained in the study may among other things be due to excitements or strenuous exercise during handling (Gartner *et al.,* 1969), this lead to increase of adrenaline and hence spleen contractions and this causes the release of more RBC in to circulation, though the result is within the range reported by Njidda *et al.* (2014) for different breeds (Yankasa, Ouda and Balami) of sheep in semi arid. The reduction in PCV, Hb and RBC maybe attributed to hyperactivity of the bone marrow, leading to the production of red blood cells with impaired integrity which was easily destroyed in circulation by recticulo-endothelial system. Shakoor *et al.,* (1990) suggested that decrease in RBC counts is either an indication of excessive damage to erythrocyte or inhibition of erythrocytes formation. The MCH value did not significantly ($P>0.05$) differ among the treatment, the values recorded in this study are slightly higher than the values of 12.57 (Pg) reported by Masoni *et al.,*1985, Mbassa and Poulsen, (1993) and Sandabe and Yahi (2002). Comparison between the browse forages shows that the values for MCHC were higher for animals receiving *Ziziphus mucronata* than those receiving *Parkia biglobosa*. The result did not fall within the normal limit for all species of ruminants animal and is not comparable with those reported by (Anon 1980: Masoni *et al.,* 1985, Mbassa and Poulsen 1980; Sandabe and Yahi 2000), this is an indication that animal were undergoing abnormal physiological processes such as erythro poecesis, provision of anti bodies and bone development which were associated with blood characteristics (Oluremi and Sridhar 2004). Esonu (2001) reported that haematological constituents were always a reflection of animal's responsiveness to its internal and external environments. The values of MCV observed shows significant ($P<0.05$) difference among the treatments, the values recorded in this study fall within the range reported by Tambuwal *et al.,* (2002) and Jain, (1986). The values for animals receiving *Parkia biglobosa* show higher values than those receiving *Ziziphus mucronata.* Increased MCV may also be observed in regenerative anaemia due to heaolysis and haemorrhages (Awodi *et al.,* 2005) and Chineke *et al.* (2009). The differences observed in MCV and MCHC between diets may not pose any problem since MCH, MCV and MCHC are referred to as RBC indices and the values for RBC for both diets did not depict any pattern. The leucocyte in the present study show significant effect ($P>0.05$) among treatments with T_4 (6.35 $X10^9$/L) having the lowest value while T_2 (11.00 $X10^9$/L) has the highest value, these values range within (4 to 13 $x10^9$/L) reported by Latimer *et al.,* (2004). The white blood cells (WBC) are the soldiers of the body and their high counts may also be due to increase or complement the immune system of the aminal at the early stage of life which they may not obtain from the colestrum of the dam (Coles, 1980; Schalm *et al.,* 1975). It may also be attributed to physiological phenomenon. (coles 1980), the higher values of the WBC observed may also be attributed to the extensively managed sheep which makes them face challenges from microbes when on free range.

The white blood cell differentials (Lymphocytes and neutrophls) level is comparable among the treatments, in sheep like other ruminant there are more lymphocytes than neutrophiles in circulation (Olusanya *et al.,*1976). Lymmphocytes are the key elements in production of immunity. Low levels can be seen some bacterial infection, aplastic anaemia, and in some forms of leukemia, while the high values can be observed in viral infection and in some of leukemia (Ganong 2005). The result in the present study is similar to the value (64.8 to 70%) reported by Opera *et al.,* 2010) and also favoured by the findings of Milson *et al.,* (1960) and Wilkin and Hodges (1962) and it might be attributed to stress and immune response to the environment (Cole 1980) which harbors various detectable and undetectable parasitic and or bacterial organism. Neutrophils in the present study recorded significantly ($P<0.05$) different among the group of treatments which also falls within the range reported by Milson *et al*., (1960). Neutrophil was observed to be a very effective killing machine (Ganong 2005). The value for eosinophils in this study was observed to be higher in T_2 (4%) than the other treatments, this favoured the findings of Banerjee (2007) that reported the range of eosinophils fall between (1 to 8%). Like neutrophiles, they release protein cytokines and chemokines that produce inflammation but are capable of killing invading organism. However, the selectins and integrins have some selectivity in the way in which they respond and on the killing molecules they secrete. They are especially tract in the mucosa of respiratory and urinary tracts (Ganong 2005). Monocytes was observed in the study, which also recorded a significantly ($P<0.05$) effect across the treatment, the values ranges from (5.00 to 9.00%), this agreed with the findings of Latimer *et al.,* (2004), whose values falls with the ranged of (4 to 10%).

Serum biochemistry analysis is used to determine the level of heart attack, liver damage and to evaluate protein quality and amino acid requirements in animals as reported by Harper *et al*., (1979). The result of Na level obtained in this study is (130 to 173 mmol/L) higher, compared to the values (129.00 mmol/L) reported by Bhat *el al*., (2011), but falls within the ranges of (135 to 156 mmol/L) reported by Jackson and Cockcroft, (2002) for sheep and also favoured the finding of Freedeen and Van Kessel, (1990). The potassium (k) value did not significantly ($P>0.05$) differ, it ranges from (3.9 to 5.5 mmol/L), this values are comparable with (5.00 to 5.33 mmol/L) reported by (Bhat *el al.,* 2011) and (3.4 to 6.1 mmo/L) by Jackson and Cockroft, 2002. Chloride level from the present trial recorded significantly ($P<0.05$) difference among the treatments with T_2 having the highest value of 128 mmol/L and T_3 recorded the lowest value of 95 mmol/L these values were similar to those reported by Jackson and Cockcroft, (2002). Urea level in the present study showed significantly ($p<0.05$) effect among the groups of treatment, ranges from 7.65 to in T_2 to 11.7 mmol/L in T_3,

these values favoured the findings of (Okah and Ibeawuchi 2011). Lower blood urea indicate superior protein quality in T_3 this had earlier been reported by Eggun (1970), that high level of blood urea indicated poor protein quality, the high level of semen urea might be attributed to excessive tissue protein catabolism associated with protein deficiency (Odye and Adedevon 1976). Creatinine values in this study were significantly ($p<0.05$) amog the treatments, T_1 have the highst value of 95 mmol/L which is a slightly lower than (100 to 200 mmol/L) reported by SIROIS (1995). This observation suggested that there's no muscle waste and that the rams did not survive at the expense of their body reserves (Ologhobo, 1992). This is an indication that the dietary protein was well utilized by the animals in each treatmentgroup as earlier reported elsewhere (Eggum 1970, Ross *et al*., 1978). The amount of creatinine secreted daily is a function of the muscle mass and is not affected by diet, age, sex, or exercise, it amount to approximately 2% of the body stores of creatinine phosphate and is roughly 1-2 g/day for adult. Generally female excrete less creatinine than male because of their smaller muscle mass. The serum glucose in the study significantly ($p<0.05$) differ among the treatment with the highest value recorded in T_4 2.2 mmol/L thus, the result of this study were comparable to the reports of Mitruka and Rawwnssely (1977) who reported a range of 2.39 to 5.55 mmol/L and Jackson and Cockcroft (2002) (2.4 to 4.0 mmol). Serum glucose is an indication of carbohydrate metabolism in high energy diets (Coles 1976); lower glucose level is an indication of hypoglyceamia Olurunnisomo, (2012). Total protein was significantly ($p<0.05$) affected the dietary treatments. The values obtained in this study are higher than those reported by Frreedeen an Van Kessel (1990). The total protein concentration of serum is usually increased in patients with dehydration (Dinev *et al*., 2007). The Albumin and Globulin did not significantly ($p<0.05$) differ and the values are higher than the values reported by Bhat *et al.*, (2011). Low albumin (hypoalbuminemia) maybe caused by liver disease, nephritic syndrome, burns, protein losing enteropathy, malnutrition, late pregnancy, artifact genetic variation and magnancy. High albumin (hypoalbuminemia) is almost caused by dehydration. In some cases of retinol (vitamin A) deficiency, the albumin level can be raised to high normal values (ex: 4.9 g/dl) this is because retinol causes cell to swell with water. The AST, ALT and ALP in this trial did not significantly ($p>0.05$) effect the treatments; it was observed that T_1 has the highest AST value of (61.00 IU/L) and T_4 recorded the lowest value of (48.00 IU/L). ALT recorded the highest value in T_4 (12.00 IU/L) and lowest in T_1 (8.00 IU/L) while the highest value of ALP was observed in T_4 (35.00 IU/L) and the lowest in T2 (27.00 IU/L), the above value for AST, ALT and ALP agreed with the finding of Bhat *et al.*, (2011) who reported AST (43 to 123 IU/L), ALT (7 to 24 IU/L) and ALP (7 to 30 IU/L) respectively. Serum Aspartate Aminotranmsferase is found in practically every tissue of the body, inducing red blood cell and highly concentrated in candiac muscle and liver, intermediate in skeletal muscle and kidney in much lower concentrations in other tissue. The measurement of the AST levels helpful for the diagnosis and following case of myocardial infarction, hepatocellular disease and skeletal muscle disorders. Intrauma or in disease affecting skeletal muscle, after a renal infarct and in various hemolytic condition (Alex and Laverne, 1983). The concentration of serum Alanine Amino transferase in tissue is not nearly as great as for serum Aspartate Aminotransferase. If the serum Aspartate Aminotransferase is elevated while the serum Alamin Aminotransferase remains with normal limits in case of suspected myocardial infection, the result tare comparable with myocardial infarction (Alex and Laverne, 1983).

CONCLUSION

It can be concluded that, dietary inclusion of *Ziziphus mucronata* and *Parkia biglobosa* in the diet of Yankasa rams did not reveal any negative effect on the animals as regards blood parameters studied. The result obtained in this study indicated that dietary inclusion of *Ziziphus mucronata* and *Parkia biglobosa* up to 15% level of inclusion could be safely used as a component of sheep's diet.

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Table 1: **Composition of experimental diets (%) *Parkia biglobosa***

	Treatments			
Ingresients	T_1	T_2	T_3	T_4
Parkia biglobosa	0	5	10	15
Groundnut cake	30	25	20	15
Rice Bran	19	19	19	19
Maize Offal	10	10	10	10
Sorghum Stover	10	10	10	10
Wheat Offal	20	20	20	20
Sorghum Offal	10	10	10	10
Bone meal	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Metabolizable Energy (MJ)	10.50	10.16	9.72	9.36
Crude Protein (CP)	18.58	18.60	17.80	17.10

Table 2: **Composition of experimental diets (%) *Ziziphus mucronata***

	Treatments			
Ingresients	T_1	T_2	T_3	T_4
Ziziphus mucronata	0	5	10	15
Groundnut cake	30	25	20	15
Rice Bran	19	19	19	19
Maize Offal	10	10	10	10
Sorghum Stover	10	10	10	10
Wheat Offal	20	20	20	20
Sorghum Offal	10	10	10	10
Bone meal	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Metabolizable Energy (MJ)	10.50	9.88	9.75	9.50
Crude Protein (CP)	18.58	17.80	16.25	15.01

Table 3: Chemical composition of experimental diets (g kg^{-1} DM)

		Treatments				
Parameter		T_1	T_2	T_3	T_4	SEM
DM	Zm	889.27^{b}	905.60^{a}	898.30^{a}	889.30^{b}	9.25
	Pb	891.10^{b}	871.80^{d}	896.30^{a}	878.90^{c}	2.42
Ash	Zm	96.30^{a}	76.30^{b}	67.30^{c}	62.26^{c}	3.87
	Pb	101.30^{a}	94.30^{b}	86.40^{c}	81.40^{d}	1.65
OM	Zm	793.00^{c}	829.00^{a}	831.00^{a}	827.04^{ab}	2.06
	Pb	789.80^{c}	777.50^{d}	809.90^{a}	797.50^{b}	1.21
CP	Zm	184.90^{a}	168.30^{b}	136.10^{c}	132.40^{d}	2.08
	Pb	148.30^{a}	137.30^{b}	135.30^{b}	128.90^{c}	3.77
CF	Zm	168.00^{d}	191.40^{c}	201.07^{b}	222.30^{a}	5.14
	Pb	182.30^{d}	202.30^{c}	221.10^{b}	229.30^{a}	1.19
EE	Zm	98.40^{a}	87.30^{a}	68.30^{b}	67.30^{b}	5.19
	Pb	89.40^{a}	81.00^{b}	78.10^{c}	77.30^{c}	1.23
NDF	Zm	351.40^{d}	359.60^{c}	387.40^{b}	398.40^{a}	2.21
	Pb	361.40^{d}	372.30^{c}	384.40^{b}	394.00^{a}	4.60
ADF	Zm	264.43^{d}	281.20^{c}	293.40^{b}	305.27^{a}	2.41
	Pb	271.00^{d}	301.10^{c}	312.50^{b}	333.40^{a}	3.17
ADL	Zm	114.00^{c}	112.33^{c}	132.60^{a}	129.30^{b}	1.18
	Pb	102.90^{a}	113.40^{a}	131.10^{a}	122.40^{a}	16.42
Cell	Zm	256.80^{b}	264.30^{b}	334.90^{a}	293.40^{ab}	2.06
	Pb	246.20^{d}	257.40^{c}	266.10^{b}	284.30^{a}	2.87
Hcell	Zm	90.30^{a}	78.40^{b}	94.40^{a}	93.00^{a}	2.05
	Pb	90.40^{a}	71.20^{b}	69.90^{b}	61.60^{b}	5.50

ADF= Acid detergent fiber; ADL= Acid detergent lignin; CL= Cellulose; CF= Crude fiber; CP =Crude protein; DM=Dry matter; EE= Ether extract; HC= Hemi cellulose; NDF= Nutrient detergent fiber; Mean within the same row with different super are significantly different ($p<0.05$); NS=Not significant

Table 4: Haematological values of sheep fed *Ziziphus mucronata* and *Parkia biglobosa*

		Treatments			
Parameters		T_1	T_2	T_3	T_4
PCV (%)	Zm	42.00±1.15[a]	36.00±3.46[a]	39±5.19[a]	38 ±4.61[a]
	Pb	38.00 ± 4.61[a]	40.00 ± 2.88[a]	39.00 ± 5.19[a]	37.00 ± 4.04[a]
Hb (g/dl)	Zm	11±0.57[a]	10.1±0.05[a]	10.7±0.40[a]	11±1.15[a]
	Pb	11.4 ± 0.23[a]	10.25 ± 0.14[a]	9.7 ± 1.73[a]	10.35 ± 0.20[a]
RBC (g/dl)	Zm	7.00±1.15[a]	8.00±0.57[a]	9.00±1.73[a]	8.00±0.57[a]
	Pb	8.03 ± 0.01a	6.7 ± 0.57[c]	6.3 ± 0.17[d]	7.2 ± 1.15[b]
MCH (Pg)	Zm	17.05±0.22[a]	13±1.15[a]	15±2.88[a]	14±2.30[a]
	Pb	14.2 ± 2.30[a]	16 ± 2.30[a]	16 ± 3.46[a]	44.3 ± 6.35[a]
MCHC (%)	Zm	19.00±1.15[c]	32.00±1.15[ab]	38.00±4.61[a]	25.00±2.88[bc]
	Pb	15 .00± 2.88[c]	15.1 ± 2.88[ab]	16.4 ± 0.23[a]	17 ± 4.04[bc]
MCV (fl)	Zm	91.4±0.23[d]	40.35±0.20[c]	80±5.77[a]	67.4±0.23[b]
	Pb	96.2 ± 0.11[d]	103.5 ± 1.73[c]	95.4 ± 2.88[a]	88.3 ±6.35[a]
WBC ($x10^9$/l)	Zm	11.3±0.17[a]	9.8±0.57[a]	14±2.30[a]	10±2.88[a]
	Pb	7.3 ± 0.17[c]	11 ± 1.15[a]	10 ± 2.88[b]	6.35 ± 0.20[d]
Lymphocytes (%)	Zm	54.00±2.30[b]	74.00±1.73[a]	45.00±2.88[b]	48.00±4.61[b]
	Pb	58 ± 4.61[b]	51.00 ± 0.57[a]	53 ± 1.73[b]	66.00 ± 3.46[b]
Neutrophils (%)	Zm	42.00±5.77[a]	22.00±1.15[b]	44.00±2.30[a]	46.00±.3.46[a]
	Pb	38 ± 4.61[a]	41.00 ± 5.77[b]	60 ± 11.54[a]	29.00 ± 5.10[a]
Eosinophils (%)	Zm	0.5±0.00[bc]	0±0.00[c]	3.5±0.28[a]	1.0±0.28[b]
	Pb	0.00 ± 0.00[bc]	4.00 ± 1.15[c]	3 .00± 0.57[a]	0 .00± 0.00[b]
Monocytes (%)	Zm	5.00±0.57[b]	5.00±1.15[b]	8.00±0.57[a]	6.00±1.15[ab]
	Pb	5.00 ± 1.73[b]	9 ± 3.46[b]	8.00 ± 1.15[a]	6 ± 0.57[ab]
Basophils (%)	Zm	0.00	0.00	0.00	0.00
	Pb	0.00	0.00	0.00	0.00

PCV=Packed Cell Volume; Hb= Haemoglobin; RBC= Red Blood Cell; WBC= White Blood Cell; MCV= Mean corpuscular Volume; MCH= Mean corpuscular haemoglobin; MCHC= Mean corpuscular haemoglobin concentration; Mean within the same row with different super are significantly different ($p<0.05$); NS=Not significant

Table 5: Serum biochemical Indices of sheep fed (*Ziziphus mucronata* and *Parkia biglobosa*

		Treaments			
Parameter		T_1	T_2	T_3	T_4
Sodium (mmol/L)	Zm	132.00±18.47[a]	132.00±11.54[a]	135.00±20.20[a]	131.00±17.89[a]
	Pb	136±20.78[a]	173± 11.54[a]	130 ± 5.77[a]	130 ± 17.32[a]
Potassium (mmol/L)	Zm	4.1±0.05[b]	4.5±0.28[ab]	5.3±0.17[a]	4.1±0.57[b]
	Pb	4.05±0.02[a]	5.5± 0.28[a]	4.0 ± 1.15[a]	3.9 ± 0.05[a]
Chloride (mmol/L)	Zm	91.00±0.57[a]	95.00±1.73[a]	96.00±2.30[a]	95±2.88[a]
	Pb	98±1.15[b]	128.5±16.16[a]	95± 2.88[b]	96.5±1.15[b]
HCO^-_3 (mmol/L)	Zm	25.00±2.88[a]	21.00±1.73[a]	24.00±2.30[a]	23±1.73[a]
	Pb	20.5±5.77[ab]	32 ±1.15[a]	26.5 ± 3.46[ab]	18 ± 4.61[b]
Urea (mmol/L)	Zm	14.00±2.30[a]	9.00±1.15[bc]	12.00±1.15[ab]	5.1±0.05[c]
	Pb	8.2±0.11[c]	7.65±0.37[c]	11.7±0.40[a]	9.25±0.14[b]
Creatinine (mmol/L)	Zm	90.00±5.77[a]	43.00±1.73[b]	15.00±2.88[c]	23.00±1.73[c]
	Pb	95±2.88 [a]	87.5±0.28[a]	57±4.04[b]	78±11.54[a]
Cholesterol (mmol/L)	Zm	2.00±0.00[a]	2.00±0.57[a]	2.1±0.05[a]	2.00±0.00[a]
	Pb	1.2±0.11[b]	2.1±0.57[ab]	2.4±0.23[a]	2.2±0.23[ab]
Glucose (mmol/L)	Zm	2.00±0.00	2.00±0.00	2.00±0.00	2.00±0.00
	Pb	2.00±0.00[b]	2.00±0.00[b]	2.00±0.00[b]	2.2±0.11[a]
Total protein (g/L)	Zm	25.00±2.88[a]	50.00±5.77[a]	32.00±1.15[b]	47.00±4.04[a]
	Pb	74±2.30[a]	50±5.77[b]	79±5.19[a]	70±11.54[ab]
Albumin (mmol/L)	Zm	25.00±5.77[a]	25.00±2.88[a]	26.00±3.46[a]	30.00±1.72[a]
	Pb	26.00±3.46[a]	23.00±1.73[a]	24.00±2.30[a]	24±0.57[a]
Globulin (mmol/L)	Zm	28.00±2.30[a]	32.00±2.30[a]	30.00±2.88[a]	31.00±0.57[a]
	Pb	29.00±2.30[a]	32.00±1.15[a]	26.00±3.46[a]	33.00±1.73[a]
AST (IU/L)	Zm	61.00±0.57[ab]	67.00±0.04[a]	54±2.30[b]	55±2.88[b]
	Pb	61.00±17.32[a]	51.00±5.77[a]	52.00±1.15[a]	48.00±4.61[a]
ALT (IU/L)	Zm	15.00±2.88[a]	12.00±1.15[a]	11.00±1.15[a]	12.00±1.73[a]
	Pb	8.00±0.57[a]	11.00±1.73[a]	10.00±2.88[a]	12.00±1.15[a]
ALP (IU/L)	Zm	31.00±0.57[a]	28.00±2.30[a]	30.00±5.77[a]	34.00±2.30[a]
	Pb	32.00±1.15[a]	27.00±4.04[a]	28.00±4.61[a]	35.00±2.88[a]

AST= Aspartate Aminotransferase; ALT= Alanine Aminotransferase; ALP= Alkaline Phosphate; Means within different superscripts are significantly different ($p<0.05$); NS= Not significant