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Intake, growth performance and haematological parameters in West African dwarf sheep fed with or without Moringa and Gliricidia supplements in South Western Nigeria

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ABSTRACT

Sixteen (16) yearling West African Dwarf Sheep were used to assess body weight gain, feed intake and haematological indices as influenced by the four dietary treatments. The average weight gain of sheep fed supplemental diets were 2.70±0.09kg in *Gliricidia sepium*, 2.80±0.09kg in *Moringa oleifera* and 3.15±0.45kg in *Gliricidia sepium* + *Moringa oleifera* compared to 1.57±0.10kg for sheep fed basal diet only. The average weight gains in sheep fed supplemental diets were significantly (P<0.05) higher than sheep fed only the basal diets. The linear body measurement gain such as heart girth gain were 11.00±1.73cm in *Gliricidia sepium*, 8.67±2.08cm in *Moringa oleifera*, 13.34±1.04cm in *Gliricidia sepium* + *Moringa oleifera* compared to 8.33±0.58cm for sheep fed basal diet only. The heart girth gains of sheep fed supplemental diets were significantly (P<0.05) higher than sheep fed basal diets only. The height at whither gains were 8.55±4.04cm in *Gliricidia sepium*, 9.00±4.36cm in *Moringa oleifera*, 9.00±1.00cm in *Gliricidia sepium* + *Moringa oleifera* compared to 6.33±1.53cm for sheep fed Panicum+cassava peels only. The height whither gains of sheep fed supplemental diets were significantly (P<0.05) higher than sheep fed control diets. The body length gains were 8.00±1.73cm in *Gliricidia sepium*, 10.00±3.61cm in *Moringa oleifera*, 10.66±3.06cm in *Gliricidia sepium* + *Moringa oleifera* compared to 11.66±5.13cm for sheep fed basal diet only. The body length gains in sheep fed supplemental diets were significantly (P<0.05) higher than sheep fed basal diets. The haematological parameters such as packed cell volume (31.50 – 32.50 %), red blood cells (9.85 – 10.17 $X10^6mm^{-1}$), haemoglobin concentration (9.97 – 10.07g $100mm^{-1}$), Erythocyte sedimentation rate (0.62 – 0.34), mean Corpuscular haemoglobin (0.99 – 1.08 pg), mean corpuscular volume (3.15 – $3.29\mu m^3$), Eosinophils (3.00 – 4.25%), Basophils (0.50 – 1.00 %), Monocytes (6.50 – 8.75%), Lymphocyte (60.00 – 65.25%), Neutrophils (21.25 – 31.25%) of animals fed supplemental diets were significantly (P<0.05) higher than animals fed *Panicum*-cassava peels ration. From all indications, sheep fed supplemental diets had better growth performance and were haematological stable than sheep fed basal diet only.

Introduction

The insufficiency of year round grazeable forages for ruminants, owning to seasonal changes is a major constraint to ruminant production in Nigeria (Babayemi and Bamikole, 2006). The seasonal forage supply stems from uneven distribution of annual rainfall in the tropics, which explains the alternating abundance and scarcity of grazeable forage (Abdulrazak *et al*., 1997). This poses serious forage management and animal feeding difficulties during the dry season in Nigeria, when available forage materials could no longer provide the minimum protein and energy requirements to grazing ruminants (Aye, 2007; Aye and Adegun, 2010). This poor feeding regime has affected the growth rate and performance of WAD sheep. With perpetual increase in population of livestock in Nigeria, there has been serious competition for feed between man and animals, thereby hampering the productivity of small ruminants, hence shortage of animal proteins. Further, poor management, poor genetic make-up of indigenous animals, prevalence of pests and diseases and non availability of feed ingredients are other problems plagued sheep productivity in Nigeria.

The potentials of fodder trees such as *Moringa oleifera*, *Gliricidia sepium* and *Leucaena leucocephala* as browses are increasingly being recognized as very important components of food and feeds, as source of protein, fibre and a balance of other nutrients needed for maintenance, growth and reproduction (Aregheore, 2004). *Moringa oleifera* is a well known tree in West Africa especially in semi-arid areas where it is often cultivated as a living fence around people's gardens and consumed in various forms as food (Anjorin *et al*.,2010 ; Fadiyimu *et al*., 2011). Leaves of the tree are noted for high content of crude protein, vitamins, minerals and essential amino acids (Makkar and Becker , 1997; Gidamis *et al*., 2003). However, the value of the tree and its benefits as a high-quality supplement to low-quality roughages in ruminant feeding systems have been grossly under exploited in Nigeria (Akinbamijo *et al*., 2006; Asaolu *et al*., 2010).

The nutritive value of *Gliricidia sepium* has been studied extensively. It has been fed experimentally to all types and classes of livestock including poultry (Mishra *et al*., 1997). Studies with ruminants such as those conducted by Carew

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(1983), Odeyinka and Ademosun (1993), and Odeyinka *et al*. (2003) showed that *Gliricidia sepium* is a suitable feed for ruminants as it can be consumed in large amount without deleterious effects on animal performance.

In Nigeria, a less developed country, malnutrition has been identified as the single most important public health problem. Consequently, the indices of nutritional diseases are on the increase (FAO 1999). The recommended total protein intake for normal growth and development in human is 85.9g per person per day, out of which approximately 39g should be of animal origin but an average Nigerian consumes about 33g (Adegbola and Asaolu, 1986). This therefore calls for increase in livestock production in order to improve the nutritional status of Nigerians through provision of high quality animal protein such as meat, milk and eggs. This observed low level of animal protein intake has its root cause in the high cost of feeding farm animals for optimum growth and production. The costs of feeding farm animals are estimated to be between 60% and 80% of total cost of production (Bawala and Akinsoyinu, 2002). To reduce this trend, there has been a worldwide interest in the use of unconventional feed ingredients which are usually less expensive for the feeding of livestock (Akinfala and Tewe, 2002; Broin, 2006).

Sheep are numerically and economically important livestock animal in West Africa. Sheep from West Africa constitute about 21% of continental total and contribute about 6% of world meat supply (Ademosun, 1992). In addition, the 35% contribution to Nigeria's total meat supply makes this species very important to Nigeria economy. Their small size, early maturity, short gestation interval and ability to convert feeds not required by humans to meat make them unique (Aye, 2013)

Materials and methods

Study Area: The experiment was carried out at the Small Ruminant Unit of Teaching and Research Farm of Ekiti State University, Ado Ekiti, Nigeria.

The experiment lasted for a period of 12 weeks. Individual pens were cleaned and disinfected with izal disinfectant, cleaning of the surroundings, cleaning of feed and water troughs and renovation were carried out before the arrival of the animals.

Procurement of West African Dwarf Sheep (WAD): Sixteen yearlings WAD sheep weighing on average 13±0.03kg were purchased from the open markets in Ekiti state of Nigeria. They were quarantined for thirty days during which routine treatment developed at NAPRI (1984) and modified by Aye (1998) was applied.

Experimental layout and animal management: The sheep pen was partitioned into sixteen equi-dimensional units with planks. The sheep were weighed into their experimental units, efforts were made to ensure that all the treatments were balanced in body weight and age. This was done using the dentition and weight range methods (Sastry and Thomas, 1975; Devendra and Mcleroy, 1988; Adebowale *et al*., 1992).

The design of the experiment was a completely randomized design. The animals were randomly assigned to four treatments and each treatment had four sheep (replicates). The dietary treatments were as follows:

Treatment 1: *Panicum maximum* + Cassava peels (control)

Treatment 2: *Panicum maximum* + Cassava peels + *Gliricidia sepium;*

Treatment 3: *Panicum maximum* + Cassava peels + *Moringa oleifera;*

Treatment 4: *Panicum maximum* + Cassava peels + *Moringa oleifera*, + *Gliricidia sepium;*.

Feeds: *Panicum maximum* (Guinea grass): The grass was harvested at about 10cm from the base of the plant with sickle. It was then chopped into small pieces with a cutlass so as to prevent wastage by the animals.

Cassava Peels: Fresh cassava peels were obtained from Garri processing factory in Ado-Ekiti. The fresh cassava peels were sun-dried for about 4-6days depending on weather condition.

***Gliricidia sepium* and *Moringa oleifera* –** Fresh *Gliricidia sepium* and *Moringa oleifera* leaves were harvested from Gliricidia and Moringa plantations on the campus of Ekiti state University, Ado Ekiti and left overnight to wilt.

Feeding trial: A preliminary feeding period of seven days was observed during which the animals were allowed to adjust to the experimental diet. Feeding trial period lasted for 12 weeks, during which the animals were fed on basal diets containing dried cassava peels and *Panicum maximum* supplemented with or without *Gliricidia sepium* and *Moringa oleifera* leaves.

Intake: Measured quantities of the leaves were offered to the animals each day and the quantity left over were weighed the following morning to determine daily feed intake.

Body weight: The weights of animals were determined using metallic mobile Salter 100kg scale. The weights of the animals were taken at the beginning of the feeding trial and subsequently every week for an assessment of growth rate.

Hearth girth: It is a measurement of the circumference of the body just behind the fore legs. Each animal was restrained and measurement was taken at least three times and the mean recorded.

Body length: A centimeter graduated tape was used to measure the body length which is the average of left and right sides measurement of the distance between the head and the pine-bone. Efforts were made to ensure that the sheep were standing uprightly i.e. unshaken before the measurement was taken.

Height at whither: This is the distance between the most cranial palpable spinous and the ground. It was determined with the aid of centimeter graduated tape with the sheep standing vertically straight.

Haematology: Blood Collection: Blood was collected from the jugular vein of the sheep at the start and at two-week intervals for analysis. The blood was collected into a vial containing Ethylenediaminetetral-acetic acid (EDTA), which prevents coagulation by complexing Ca^{2+}. The vials or bijou bottles were immediately capped and the content rocked gently for about a minute by repeated inversion. The blood smears were prepared immediately after the collection.

Packed Cell Volume (Haematocrit): Packed cell volume (PCV) was determined by spinning about 75µl of each blood sample in heparinised capillary tubes in a haematocrit centrifuge for about five minutes. The PCV was then read on haematocrit reader as described by Benson *et al*. (1989) and Jain (1993).

Erythrocyte (RBC) Count: RBC was determined using haemocytometer method as described by Lamb (1981). The blood sample collected in each replicate was diluted at a ratio of 1:200 for RBC count using red cell diluting fluid. Samples of RBC were obtained using the relationship Red Blood Cell / µl = Number of cell counted x 5 x 10 x 200.

Haemoglobin Estimation: The haemoglobin content in the blood of each sheep estimated using Cyanomethaemoglobin method. 0.02cm^3 of blood from each sheep was expelled into 4cm^3 DrabKins solution. The mixture was allowed to stand for five minutes for full colour development. Also, standard haemoglobin was prepared by diluting blood of known haemoglobin concentration as in the test samples. The test samples and standard were read on the calorimeter at 624 manometers using green filter.

Samples haemoglobin concentration was obtained using this relationship:

$$\text{Sample Haemoglobin} = \frac{\text{Reading of test}}{\text{Reading of standard}} \times \text{Standard Haemoglobin Con. } (g/100cm^3)$$

haematological indices also measured were erythrocyte sedimentation rate (ESR), Lymphocytes, Neutrophils, Monocytes, Eosinophils and Basophils.

Estimation of absolute Haemoglobin Value

Mean Corpuscular Haemoglobin Concentration (MCHC):

$$MCHC = \frac{\text{Haemoglobin Content } (g/100cm^3)}{PCV} \times 100$$

Mean Corpuscular Haemoglobin (MCH)

$$MCH = \frac{\text{Haemoglobin content } (g/100cm^3)}{RBC} \times 100$$

Mean Corpuscular Volume (MCV)

$$MCV = \frac{\text{Packed Cell Volume}}{RBC} \times 10(\mu^3)$$

Chemical and statistical analysis: For the chemical analysis all values were mean for triplicate determinations. The proximate analysis of the *Panicum maximum,* cassava peels, moringa and gliricidia were determined by the procedures of AOAC (2005). Data obtained were subjected to one-way analysis of variance according to the method of Steel and Torrie (1980) (ANOVA). Significant treatment means were compared using Duncan's Multiple Range F-Test (Duncan, 1955).

Results

Diet Composition: **Table 1** shows the proximate analysis of the *Gliricidia sepium* leaves, cassava peels, *Panicum maximum* and *Moringa oleifera* leaves.

The *Gliricidia sepium* leaves contained 92.85g $100g^{-1}$ Dry matter (DM), 6.67g $100g^{-1}$ Ash, 12.29g $100g^{-1}$ Ether extract (EE), 8.61g $100g^{-1}$ Crude fibre (CF), 25.08 $g100g^{-1}$ Crude protein (CP), 40.21g $100g^{-1}$ Nitrogen free extract (NFE) and 16.20MJ kg^{-1} Gross energy (GE).

The Cassava peels had 94.54g $100g^{-1}$ Dry matter (DM), 6.89g $100g^{-1}$ Ash, 6.90g $100g^{-1}$ Ether extract (EE), 7.12g $100g^{-1}$ Crude fibre (CF), 10.94g $100g^{-1}$ Crude protein (CP), 62.67g $100g^{-1}$ Nitrogen free extract (NFE) and 15.99MJ kg^{-1} Gross energy (GE).

The *Panicum maximum* (Guinea grass) contained 84.35g $100g^{-1}$ Dry matter (DM), 13.26g $100g^{-1}$ Ash, 3.52g $100g^{-1}$ Ether extract (EE), 35.12g $100g^{-1}$ Crude fibre (CF), 8.14g $100g^{-1}$ Crude protein (CP), 42.78g $100g^{-1}$ Nitrogen free extract (NFE) and 22.03MJ kg^{-1} Gross energy (GE).

The DM, Ash, EE, CF, CP NFE and GE of *Moringa oleifera* were 93.63g $100g^{-1}$, 7.96g $100g^{-1}$, 16.77g $100g^{-1}$, 6.77g $100g^{-1}$, 22.23g $100g^{-1}$, 40.28g $100g^{-1}$ and 14.79MJkg^{-1} respectively.

Performances of the Rams: The effect of various dietary treatments on weight gain, dry matter intake (DMI) and feed conversion ratio are shown in Table 4.

The dry matter intake (DMI) of rams fed supplemental diets varied from 23.96kg to 28.85kg, while that of the control diet was 37.38kg.

The weight gain of rams fed supplemental rations of *Gliricidia sepium, Moringa oleifera* and *Moringa oleifera* + *Gliricidia sepium* were 2.70$\pm$0.09kg, 2.80$\pm$0.09kg and 3.15$\pm$0.45kg respectively and were significantly higher than the rams fed only the basal diet *Panicum*-cassava peels (1.57±0.10kg). The rams fed supplemental diet of *Moringa oleifera* + *Gliricidia sepium* had the highest weight gain.

The metabolic weight gain ($W^{0.75}$) of rams fed *Moringa oleifera* + *Gliricidia sepium* was found to be 2.36kg, 2.16kg for *Moringa oleifera*, 2.10kg for *Gliricidia sepium*, and 1.40kg for *Panicum*-cassava peels diet. The metabolic weight gains of the rams fed *Moringa oleifera, Gliricidia sepium* and *Moringa oleifera* + *Gliricidia sepium* were significantly higher than those fed *Panicum*-cassava peels. The metabolic weight gains were influenced by the dietary treatments.

The Linear body measurements were higher in rams fed supplemental diet, while the rams fed basal diet only had the least value as shown in Table 5.

The feed conversion ratios of rams fed supplemental diets were 7.60, 9.16, 10.68 while that of the control was 23.80. Rams on the supplemental *Gliricidia* + *Moringa* had the highest feed conversion ratio with a value of 7.60 whereas animals fed basal diet without supplementation recorded least feed conversion ratio of 23.80.

Haematological Variables: Table 6 presents the haematological variables of rams fed *Panicum*-cassava peels ration supplemented with *Moringa oleifera*, *Gliricidia sepium* and *Moringa* + *Gliricidia* .

The Packed Cell Volume (PCV) value for rams fed supplemental diets ranged from 29.00 to 32.50 % with the least value recorded in control and highest value observed in *Gliricidia sepium* + *Moringa oleifera*. The Red Blood Cell (RBC) varied from $9.25x10^6mm^{-1}$ in control diet to $10.17x10^6mm^{-1}$ in *Gliricidia sepium* + *Moringa oleifera*. The highest value of RBC was in *Gliricidia sepium* + *Moringa oleifera*. The White Blood Cell (WBC) was highest ($10.05x10^3mm^{-1}$) in control diet while the least value ($9.05x10^3mm^{-1}$) was recorded in rams fed *Gliricidia sepium* supplement. The Haemoglobin Concentration (HBC) was lowest in rams fed control diet (9.10g $100mm^{-1}$) and the highest value was obtained in rams fed *Moringa oleifera* + *Gliricidia sepium* supplement (11.07g $100mm^{-1}$). The Erythrocyte Sedimentation Rate (ESR) (mm/hr) varied from 0.62 in control diet to 0.87 in *Moringa oleifera* supplement.. The Lymphocyte value for control, *Gliricidia sepium, Moringa oleifera* and *Moringa oleifera* + *Gliricidia sepium* were 60.00, 61.25, 62.25 and 65.25 respectively. The values for the supplemental diets were significantly higher than the value for control diet. Neutrophils value was significantly ($P<0.05$) higher in *Moringa oleifera* + *Gliricidia sepium* than the control.

The Monocytes (%), Eosinophils(%) and Basophils (%) values of the *Gliricidia sepium, Moringa oleifera* and *Gliricidia sepium* + *Moringa oleifera* were significantly ($P<0.05$) higher than the values recorded for the rams fed control diet. While the Mean Corpuscular Haemaglobin Concentration (g $100mm^{-1}$) ranged from 0.31 in rams fed basal diet only to 0.34 in rams fed supplemental *Gliricida sepium* + *Moringa oleifera*. The Mean Corpuscular Volume (μm^{-3}) (MCV) was highest in rams fed *Gliricidia sepium* (3.29). The Mean Corpuscular Haemoglobin (MCH) was highest in rams fed *Moringa oleifera* + *gliricidia sepium* (1.08).

All haematological variables of rams fed supplemental diets were significantly ($P<0.05$) influenced by the dietary treatments. The rams fed control diet showed the least values for most of the haematological variables.

Discussion

The proximate composition of *Panicum maximum* obtained in this study were at variance with the result obtained by

Ogunsola (2005) for example, Ogunsola value for crude protein was 6.27g $100g^{-1}$ which was lower than 8.14g $100g^{-1}$ obtained in this study. Also, the Ash and the Ether Extract values obtained in this study were not the same with the result obtained by Ogunsola (2005). However, crude fibre obtained (35.21g $100g^{-1}$) in this study agreed with the crude fibre reported by Ogunsola (2005).

The cassava peels used in this study has dry matter value of 94.54g $100g^{-1}$which was within the range of 86.5g $100g^{-1}$ to 94.5g $100g^{-1}$ reported by Adegbola (2002). The Ash content of 6.89g/100g was higher in comparism to the value of 3.8 – 4.44g $100g^{-1}$ obtained by Oyenuga (1968). The crude protein value of 10.94g $100g^{-1}$ was higher than the value obtained by Oyenuga (1968). The Nitrogen free extract value of 62.67g $100g^{-1}$ was in line with the value of 78.25g $100g^{-1}$ obtained by Oyenuga (1968). The value of crude fibre 10.94g $100g^{-1}$ fell within the range of 10 – 31g $100g^{-1}$ reported by Adegbola (2002), Devendra (1977).

The differences in this value obtained from this study with those of other workers or researchers might be due to the stage of harvest of the crop, the amount of edible parts and the head added to the waste.

The improved weight gain, which cumulated in the relative higher values of the final weight gain in the supplements, could be attributed to the Non-protein nitrogen hydrolysis in the rumen throughout the day (Habib *et al*., 1991). This helps in complementing the beneficial effect of *Moringa* and *Gliricidia* on microbial growth in the rumen with attendant utilization of the diets. The dry matter intake and the performance of rams in this study, in most cases compared with those reported for sheep (Tjiptosumirat *et al*., 1990; Habib *et al*., 1991). However, the apparently lower rams performance in the control diet might be due to the fact that the animals were maintained on only *Panicum*-cassava peels that is of low content and that the animals have not be restrained before.

Report from literature showed that blood indices are important for the assessment of the nutritive component of a given ration (Aletor and Egberongbe, 1992; Agbede and Aletor, 1993b). All the blood indices measured throughout the trial were significantly ($P<0.05$) higher in rams fed *Panicum*-cassava peels supplemented with *Moringa* and *Gliricidia* leaves.

This tends to show that the feeding of the *Moringa oleifera* and *Gliricidia sepium* leaves did not have adverse effect on the health status of the animals.

Conclusion:

This study reveals that the *Panicum*-cassava peels are of low protein and Ash contents, but the nutritive value can be enhanced when used with other browse plants such as *Moringa oleifera* and *Gliricidia sepium*. It further demonstrates that rams fed *Panicum*-cassava peels supplemented with *Moringa oleifera* and *Gliricidia sepium* had better performance than those fed *Panicum*-Cassava peels only. This study clearly demonstrates that feeding of *Moringa oleifera* and *Gliricidia sepium* leaves as supplements to the basal diet to animals is a useful strategy in overcoming dry season weight losses, poor performance or health hazard in rams.

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Table 1: Proximate Analysis of Cassava peels, *Panicum maximum, Moringa oleifera* and *Gliricidia sepium* (g 100g-^{1})

Treatment	Ash	DM	CP	EE	CF	NFE	GE(MJkg^{-1})
Moringa	7.96	93.63	22.23	16.77	6.77	40.28	14.79
Gliricidia	6.67	92.75	25.08	12.29	8.16	40.21	16.20
Panicum	13.26	84.35	8.14	3.52	35.12	42.78	22.03
Cassava Peels	6.89	94.54	10.94	6.90	7.12	62.67	15.99

Table 2: Mineral Compositions of Cassava Peels, *Panicum maximum, Moringa oleifera* and *Gliricidia sepium*

	Na	K	Ca	Mg	Zn	Fe	Mn	Cu
Moringa	4.56	7.32	5.43	3.62	4.58	2.31	0.05	0.001
Gliricidia	4.82	6.79	0.94	4.79	6.31	4.28	0.21	0.002
Panicum	188.74	519.68	512.88	148.74	102.49	95.23	N.D	N.D
Cassava Peels	174.98	156.16	135.47	122.30	77.14	7.53	3.76	N.D

Table 3: Mean Feed Intake of West African Dwarf Sheep fed *Panicum maximum* and Cassava peels Supplemented with or without *Gliricidia sepium* and *Moringa oleifera* Diets

Control	Gliricidia	Moringa	Moringa + Gliricidia
1.20	1.34	1.40	1.43
1.27	1.38	1.45	1.43
1.25	1.44	1.47	1.41
1.26	1.46	1.49	1.55
1.30	1.49	1.51	1.55
1.35	1.52	1.55	1.59
1.36	1.53	1.58	1.61
1.38	1.57	1.60	1.63
X 1.29	1.46	1.50	1.52
S.D 0.08	0.07	0.07	0.07

Table 4: Performance of Sheep fed *Panicum maximum and* Cassava peels supplemented with or without *Moringa oleifera* and *Gliricidia sepium* diets

Treatment	DMI (kg)	Initial Weight (kg)	Final Weight (kg)	Weight Gain(kg)	Initial $W^{0.75}$ (kg)	Final $W^{0.75}$ (kg)	$W^{0.75}$ Gain (kg)	FCR
Control	37.38	13.67±1.10	15.25±1.15	1.57±0.10c	7.11	7.71	1.40b	23.80c
Gliricidia	28.85	13.45±1.09	16.15±0.99	2.70±0.09^{b}	7.02	8.05	2.10^{a}	10.68^{b}
Moringa	25.66	13.67±1.20	16.52±1.39	2.80±0.09^{b}	7.11	8.09	2.16^{a}	9.16^{b}
Gliricidia + Moringa	23.96	13.45±0.96	16.60±0.92	3.15±0.45^{a}	7.02	8.22	2.36^{a}	7.60^{a}

a, b, c means with differing superscripts in the same column are significantly ($P<0.05$) different

Table 5: Morphostructural differentiation of Sheep fed *Panicum maximum and* Cassava peels Supplemented with or without *Moringa oleifera* and *Gliricidia sepium* diets

Treatment	Initial Heart Girth (cm)	Final Heart Girth (cm)	Heart Girth Gain (cm)	Initial Height at whither (cm)	Final Height at whither (cm)	Height at whither Gain (cm)	Initial Body Length (cm)	Final Body Length (cm)	Body Length Gain (cm)
Control	60.00±2.00	68.33±2.86	8.33±0.58^{a}	59.67±0.58	66.00±1.00	6.33±1.53^{a}	78.67±4.93	86.67±3.21	8.00±1.73^{a}
Gliricidia	55.33±1.16	66.33±0.86	11.00±1.73^{a}	55.12±6.56	63.67±4.04	8.55±0.11^{b}	75.67±10.07	85.67±7.64	10.00±3.61^{a}
Moringa	58.00±2.06	66.67±1.51	8.67±2.08^{a}	56.67±5.77	65.67±8.50	9.00±4.36^{b}	73.67±3.21	84.33±5.68	10.66±3.06^{a}
Gliricidia + Moringa	53.33±0.77	66.67±2.51	13.34±1.04^{a}	55.00±4.36	64.00±4.36	9.00±1.00^{b}	72.67±13.05	84.33±5.68	11.66±5.13^{a}

a, b means with differing superscripts in the same columns are significantly ($P<0.05$) different

Table 6: Haematological Indices of WAD Sheep fed *Panicum maximum* and Cassava peels Supplemented with *Gliricidia sepium* and *Moringa oleifera* Diets

Haematological Indices	Control	Gliricidia	Moringa	Gliricidia + Moringa
Packed Cell Volume (PCV) (%)	29.00	32.50	31.50	32.50
Red Blood Cell (RBC) (x $10^{6}mm^{-1}$)	9.25	9.85	10.00	10.17
White Blood Cell (WBC) (x $10^{3}mm^{-1}$)	10.05	9.05	9.37	9.07
Haemoglobin Concentration (HBC) (g $100mm^{-1}$)	9.10	10.42	9.97	11.07
Erythrocyte Sedimentation Rate (ESR) (mm hr^{-1})	0.75	0.62	0.87	0.75
Lymphocyte (%)	60.00	61.25	62.00	65.25
Neutrophils (%)	31.25	27.50	26.25	21.25
Monocytes (%)	6.50	7.50	7.00	8.75
Eosinophils (%)	2.75	3.00	3.75	4.25
Basophil (%)	0.75	0.75	1.00	0.50
Mean Corpuscular Haemoglobin Concentration (MCHC) (g $100cm^{3}$)	0.31	0.32	0.32	0.34
Mean Corpuscular Haemoglobin (MCH) (pg)	0.98	1.05	0.99	1.08
Mean Corpuscular Volume (MCV) (μm^{-3})	3.13	3.29	3.15	3.19

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