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Haematological and Serum Biochemical Indicies of Rams Fed *Panicum Maximum* and Concentrate at Different Sequence and Durations

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ABSTRACT

This study was conducted to investigate the effect of feeding *Panicum maximum* and concentrate at different sequence and durations on the haematological and serum biochemical indices of West African Dwarf rams. Fifteen (15) West African Dwarf rams were randomly allotted to five groups of 3 rams each, each group randomly assigned to each treatment as follows: TI: Fresh *Panicum maximum* fed 1hr before feeding concentrate, T2: Fresh *Panicum maximum* fed 2hrs before fed concentrate, T3: Concentrate fed 1hr before fresh *Panicum maximum*, T4: Concentrate fed 2hrs before fresh *Panicum maximum*, T5: Concentrate given with fresh *Panicum maximum* at the same time for a period of 3 weeks. Diets were fed after an initial acclimatization of 1 week. The results obtained showed that Packed Cell Volume (PCV), Neutrophil (N), Lymphocyte (L), Eosinophil (E) and Basophil (B) concentrations in the blood did not differ significantly ($P > 0.05$) between the treatments. However, there were significant differences in Haemoglobin (Hb), Red Blood Cell (RBC), White Blood Cell and Monocytes (M) among the groups. The mean Hb and RBC of WAD Rams on Tl were significantly ($P < 0.05$) higher than those on T3 and T4 (9.55 gdl /vs 8.70 and 8.65 g/dl; 2.95×10^6ul/mm^3 vs 2.55 and 2.50×10^6ul/mm^3 respectively). Rams on T5 diet recorded the highest for WBC (27.50×10^3/ul) but it was similar ($P > 0.05$) with those on T3 and T4 (22.10 and 23.63 $\times10^3$ul/mm^3 respectively). The total protein of the WAD rams on T2 was significantly ($P < 0.05$) the highest (57.50g/dl) among the treatment means while those on T5 were least (53.33g/dl). The mean serum urea of animals fed diet T1 was significantly ($P < 0.05$) different from those fed T2, T3 and T5 diets. (3.65 mg/dl vs 3.00 mg/dl, 3.00 mg and 3.06 mg/dl respectively). The mean serum glucose of rams fed diets T2 and T5 were significantly ($P < 0.05$) different from those on T1 diet (5.00mgdl /and 5.00mgdl /vs 4.10mg/dl). It is thus concluded that WAD rams fed *Panicum maximum* and concentrate at different sequence and durations had no deleterious effect on the haematological and serum biochemical parameters evaluated.

KEYWORDS: Haematology, Panicum maximum, Rams, Serum biochemical, Sequence

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INTRODUCTION

Poor nutrition has remained one major factor limiting productivity of the indigenous sheep and goat in Nigeria (Ogundipe and Sanni, 2002). In tropical animals, feed is often lacking for at least a part of every year (Chesworth, 1992). During this period, animals will often stop growing and indeed may start to lose weight. However, once feed is again plentiful, it is hoped that they will start to gain more weight than they had originally lost. In some regions, there is a shortage of high quality feed that can be used to offset an abundance of poor quality grazing. It has been reported by Banerjee (2007), that browse plants and grasses play an important role in averting nutritional deficiencies in ruminants particularly Sheep and provides cheapest source of ruminant feeds.

Sheep are widely produced throughout Nigeria under variety of production systems. Although the most prevalent system of production is the extensive system (Lakpini *et al.,* 2002). The low level of input invested in sheep and goats production can be said to be function of the level of income and awareness with regard to the use of available production inputs (Ogundipe, 2002).

While many factors are known to have contributed to the deterioration in the performance of the livestock and poultry sub-sector, the most important one is generally believed to be the feed problem in its entire ramification (Ogunfowora *et al.,* 1984). Feeding

forms the largest component of production cost in livestock enterprise (Lakpini, 2002). Each of these situations bring different practical problems but the nutritional problems are similar.

Haematological and serum biochemical values have been considered useful for the evaluation of body condition and the nutritional and immune status in animal where other tissue related measurements are not available (Bush, 1991, Ogunsanmi *et al.,* 1994, Anurudu and Ewuola. 2010). The significance of determining haematological and biochemical indices of domestic animals have been well documented (Oduye and Otesile, 1977) and changes of these parameters have been studied in cattle (Ghereghariu *et al.,* 1984), sheep (Oduye and Adadevoh, 1976, Oduguwa *et al.,* 2007, Sowande *et al.,* 2008, Fajemisin *et al.,* 2010) and goat (Ahamefule *et al.,* 2006, Usuhor *et al.,* 2009). When blood is examined, it provides a good opportunity to clinically investigate the presence of several metabolites and other constituents in the body of an animal. This is in line with the recommendation of WHO (WHO, 2002) on the use of blood biochemical values in medical nutritional assessment.

Blood examination is also a good way of assessing the health status of an animal as it plays a vital role in the physiological, nutritional and pathological status of an animal/organism (Onifade and Tewe, 1993). Haematological and serum biochemical parameters are good indices of the physiological status of animals and changes in the values of these parameters can be used to assess the response of animals to various physiological situations (Esonu *et al.,* 2006). Tewe (1981) reported that the importance of investigating blood composition is to have a way of distinguishing normal status from state of stress. Such stress factor can be nutritional, environmental or physical.

The sum of the daily feed intake, rate and time of feedings and presentation of the encoded ration are the major factors in feed management that influence the growth and feed conversion ratio (Jobling, 1995; Goddard, 1995). Feeding ruminants at a suitable frequency and intervals would enhance their growth, blood health and survival because their feed intake is regulated in relation to their energy demand (Ali *et al.,* 2005; Schnaittacher *et al.,* 2005). In addition, feeding at the optimal frequency can result in marvelous savings in the cost of feed (Davies *et al.,* 2006). To improve on small ruminants farming and save the environment from excess wastage of feed, more information on the management strategies in the area of feeding frequency and regime to produce ruminants within the shortest possible time at a minimal cost with good quality feed is inevitable (Zakes *et al.,* 2006); thus, this study was designed to evaluate the haematological and serum biochemical values of WAD sheep fed *Panicum maximum* and concentrate supplements at different frequencies and intervals.

MATERIALS AND METHODS

The experiment was conducted at the Sheep unit of the Department of Animal Science, University of Uyo, Uyo, Nigeria. Uyo is located between 112,000mS 118,000mN and 604,000m-610,000Mw in the UTM Zone 32. On longitudinal and latitudinal bases, Uyo is between latitudes 4^0×59' and 5^0×4^{l}N and longitudes 7°53' and 8°00'E. It is on an elevation of about 60.96m above sea level. It has a bi-modal rainfall pattern in July and September/October with a mean annual rainfall of 2,190 mm and mean relative humidity of 81%. (University of Uyo Meteorological station, 2021).

Animals and Experimental Design

Fifteen (15) West African Dwarf weaned rams of average live weight of 13.78 kg aged between 6months-1year were separated from the sheep flock and used in this research to evaluate the effect of feeding *Panicum maximum* and wheat offal based concentrate on their haematological and serum biochemical indices. The animals were weighed individually and randomly allocated to five treatments groups to give a total of three animals per treatment group.

T1 = fresh *Panicum maximum* 1hr before feeding concentrate
T2 = fresh *Panicum maximum* 2hrs before feeding concentrate
T3 = concentrate 1hr before fresh *Panicum maximum*
T4 concentrate 2hr before fresh *Panicum maximum*
T5 concentrate given with fresh *Panicum maximum* at the same time (controlled group)

Experimental Diets and Management of Animals

The experimental diets consisted of fresh guinea grass (*Panicum maximum*), and the concentrate supplement mixture compounded to contain wheat offal 64%, PKC 32%, bone meal 3%, common salt 0.5% and 0.5% premix (See Table 1). Before the commencement of the trial, the lambs were subjected to treatment, Co-Ral wettable powder was used for the control of ecto-parasites, they were dewormed with a broad spectrum anthelminthic (Zambezole) to control internal parasites. The animals were weighed and randomly assigned to each of the treatment groups and allowed to acclimatize for 7 days. During each feeding time, the animals in treatments 1 and 2 were offered grass at 1 and 2 hours, respectively, before feeding the concentrate supplement, while the animals in treatments 3 and 4 were given the concentrate supplement at 1 and 2 hours, respectively, before offering fresh grass. The controlled group were offered fresh grass and concentrate supplement both at the same time. Water was offered *ad libitum* and changed every morning.

Table 1: Gross composition (%DM basis) of the concentrate supplement diet.

Ingredients	Composition (%.)
Wheat	64
PKC	33
Bone meal	3
Premix	0.5
Common salt	0.5
Total	100

Blood Samples Collection and Analysis

Blood samples were collected from each animal from different treatment group on the last day of the feeding trial before terminating the experiment. Blood samples were collected by jugular-venipuncture of each animal using disposable syringes and sterile needles (18 gauge inches). Prior to feeding in the morning, bleeding was done and an average of 10ml of blood was collected from each animal. The blood samples were placed in 20 vacutainers. 10 vacutainers containing ethylene diamine tetra-acetic acid (EDTA) for hematological studies (pack cell volume, haemoglobin, red blood cell, white blood cell, neutrophil, lymphocytes, eosinophil and basophils) and the other 10 anti-coagulant free vacutainers for selected serum studies (urea, creatinine, glucose, total protein, albumin and globulin) using an automatic haematological analyser (VET abc, Montpellier, France) and Blood Analyzer (Exprees Plus, USA) respectively.

Statistical Analyses

Data generated from the haematological indices and serum biochemical parameters were subjected to one-way analysis of variance (ANOVA). Significant difference between treatments means were separated using Duncan's Multiple Range Test (Statistical analysis system, 1999). The statistical design was Completely Randomized.

RESULTS AND DISCUSSION

Haematological Indices

The results of the haematological response of the WAD Rams are as shown in Table 2. The results obtained showed that Packed Cell Volume (PCV), Neutrophil (N), Lymphocyte (L), Eosinophil (E) and Basophil (B) concentrations in the blood did not differ significantly (P>0.05) between the dietary treatments. However, there was significant (P<0.05) differences in Haemoglobin (Hb), Red Blood Cell (RBC), White Blood Cell (WBC) and Monocytes (M). The mean values of Hb (Haemoglobin) and RBC (Red Blood Cells) of WAD Rams on diet T1 were significantly (P<0.05) higher than those on T3 and T4 (9.55g/dl vs 8.70g/dl and 8.65g/dl; 2.95 x 10^6ul/mm^3 vs 2.55ul/mm^3 and 2.50 x 10^6ul/mm^3 respectively). Animals on T1 were similar (P > 0.05) with those on T2 and T5 for Hb count (9.55g/dl vs 9.25g/dl and 8.95g/dl respectively). The least count for RBC (2.50×10^6/mm^3) was recorded for animals on T4 which was similar (P > 0.05) with those on T3 and T5 (2.55×10^6/mm^3 and 2.7×10^6/mm^3) However, animals on T1 diet were also similar (P > 0.05) with these on T2 (2.95×10^6/mm^3 vs 2.8×10^6/mm^3). Rams on T4 diet recorded the highest value for WBC but it was similar (P > 0.05) with those on T3 and T5 (22.1×10^3/mm^3 and 27.50×10^3/mm^3 respectively), while those on T1 and T2 diets were also similar (13×10^3/mm^3 and 14.3×10^3/mm^3 respectively) and the least. For monocytes, animals on T1, T2, T4 and T5 diets were similar (P > 0.05) while those on T3, T4, and T5 were also similar (P > 0.05). Rams on diet 4 recorded the least (P<0.05) values for RBC and Hb counts. The PCV, N, L, E and B values ranged from 29.50% in animals on T4 to 35.33% (T3); 26.50% (T1) – 35.50% (T3 and T4); 61.50% (T4) - 70.00% (T1); 1.00% (T2) - 2.00% (T3 and T4) and 0.00% (T1, T3 and T4) - 0.35% (T2 and T5).

Table 2: Haematological parameters of WAD rams fed *Panicum maximum* at different sequence and durations

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
PCV (%)	33.50^a	32.00^a	35.33^a	29.50^a	31.00^a	2.46
HB (g/dl)	9.55^a	9.25^{ab}	8.70^b	8.65^b	8.95^{ab}	0.23
RBC ($x10^6$/mm^3)	2.95^a	2.80^{ab}	2.55^c	2.50^c	2.70^{bc}	0.08
WBC $x10^3$/mm^3)	13.00^b	14.30^b	22.10^a	23.63^a	27.50^a	1.78
Neutrophils (%)	26.50^a	28.50^a	35.50^a	35.50^a	29.00^a	2.89
Lymphocyte (%)	70.00^a	68.50^a	62.00^a	61.50^a	67.50^a	2.58
Eosinophil (%)	1.33^a	1.00^a	2.00^a	2.00^a	1.50^a	0.32
Basophil (%)	0.00^a	0.35^a	0.00^a	0.00^a	0.35^a	0.21
Monocyte (%)	1.50^a	1.50^a	0.50^b	1.00^{ab}	1.00^{ab}	0.26

$^{a, b, c}$ means on the same row with different letter differ significantly (p<0.05); SEM= Standard error of mean

Serum Biochemical Indices

Presented in Table 3 are the serum biochemistry of the WAD rams fed *Panicum maximum* and concentrate at different frequencies and intervals. The total protein of the WAD rams fed the T2 (57.50g /dl) was the highest ($P < 0.05$) amongst the treatment means while the least ($P<0.05$) of 53.33g/dl was recorded for animals on diet T5. Animals on T2 were similar ($P > 0.05$) with those on T1, T3 and T4 (57.00g/dl, 57.00g/dl and 54.00g/dl respectively). The means serum globulin and creatinine of the rams assessed in this study, were not significantly influenced by the dietary treatments. The globulin ranged from 23.00g/dl (T1 and T2) to 25.50gl/dl (T5), while creatinine ranged between 64.40mg/dl (T5) and 92.50mg/dl (T2 and T3). Serum albumin of animals on T3 (35.50 g/dl) diet was significantly ($P < 0.05$) higher than those fed T4 and T5 diets (35.50 g/dl vs 30.50 and 30.50g/dl). However, animals on T1, T2 and T3 were similar ($P > 0.05$) for albumin.

Animals fed diet T4 was significantly ($P < 0.05$) different from those fed T2, 13 and T5 diets. (3.65 mg/dl vs 3.00 mg/dl, and 3.06 mg/dl respectively) as regards mean serum Urea. Animals fed T1 and T4 diets did not elicit any significant differences ($P > 0.05$), moreso those on T2, T3 and T5. The mean serum glucose of rams fed diets T2 and T5 were significantly ($P < 0.05$) different from those on TI diet (5.00mg/dl and 5.00mgdl /vs 4.10mg/dl). However, animals on T2, T3, T4 and T5 diet were similar ($P > 0.05$).

Table 3: Serum Biochemical parameters of WAD sheep fed *Panicum maximum* at different sequence and durations.

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Urea (mg/dl)	3.65^{a}	3.00^{b}	3.00^{b}	3.60^{a}	3.06^{b}	0.13
Creatinine (mg/dl)	70.00^{a}	92.50^{a}	92.50^{a}	87.50^{a}	64.40^{a}	12.64
Glucose (mg/dl)	4.10^{b}	5.00^{a}	4.40^{ab}	4.60^{ab}	5.00^{a}	0.19
Total protein (g/dl)	57.00^{ab}	57.50^{a}	57.00^{ab}	54.00^{ab}	53.33^{b}	1.17
Albumin (g/dl)	34.00^{a}	34.50^{a}	35.50^{a}	30.50^{b}	30.50^{b}	0.52
Globulin (g/dl)	23.00^{a}	23.00^{a}	23.00^{a}	23.50^{a}	25.50^{a}	0.91

$^{a, b}$ means within the same row with different letter differ significantly ($p<0.05$); SEM= Standard error of mean

Discussion

Haematological Indices

The PCV range of 29.50% - 35.33% obtained in this study were within the values (22.00% - 37.00%) reported by Sowande *et al.* (2008) for normal healthy sheep (WAD). These values were also relatively close to 29.90% - 33.60% reported by Mitruka and Rawnsley (1977) for clinically healthy sheep. In addition, the PCV obtained in the present study was within the normal range (28.47% - 30.25%) reported for sheep (Banerjee, 2007). Daramola *et al*. (2005) had opined that PCV below the normal range is an indication that the animal is anemic and is due to poor quality of protein of the diet. This was not observed in this study inferring that the diet, sequencing and duration had no negative effect and was adequate in terms of animal health.

The Hb values obtained in this study fell within normal values (8.47g/dl - 9.7g/dl) recorded for healthy sheep (Amuda and Okunlola, 2018). The concentration of Hb in the cytoplasm of the red blood cells gives an indication of an Oxygen carrying capacity of the blood of the individual. The Hb value obtained also compared favorably with the Hb of 8.00 g/dl - 14.00g/dl (Mitruka and Rawsnley, 1977). The values indicated that the rams had sufficient blood pigment for proper transportation of Oxygen thus they were healthy (Binuomote and Babayemi, 2017).

The RBC values obtained in this study fell within the range value of 2.40 - 4.20 reported by Sowande *et al.,* (2008) for sheep which indicated that the animals used in this study were not susceptible to anaemia related diseases. Moreover, the diet supported good health status of the rams.

The WBC values reported in this study were higher than those reported by Amuda and Okunlola (2018) of 8.58 x 10^3ul/ml - 11.51 x 10ul/ml for WAD sheep. The higher WBC counts indicates that the WAD. Sheep (rams) seems to possess protective system providing a rapid and potent defense against any infection agent (Amuda and Okunlola, 2018).

The value for Neutrophils and lymphocytes were above normal range reported for healthy sheep (Mitruka and Rawnsley, 1977) while values for Eosinophilis, Basophil and monocytes were within normal range reported by the same authors for clinical healthy sheep. Reason for the higher range can be likened to that of the WBC Scenario. There was no indication of leukemia which showed that the feed was not toxic and had no adverse effect in the animal's health status and neither did the sequencing elicit any adverse noticeable in the haematology.

Serum Biochemical Indices

The mean ranged values for serum protein recorded for WAD rams in this study were above ranged values (45mg/dl - 57mg/dl) reported by Oduguwa *et al*. (2007). The increased level of serum protein observed in this study may be due to high protein content of the diets, since nutritional status and malnutrition is often associated with the total protein (Amuda, 2013). A high serum protein is an indication of healthy liver because severe liver damage or prolonged protein deficiency usually leads to reduced plasma protein

synthesis (Eburuaja *et al.,* 2020). The albumin mean range value obtained in this study was within the range reported by Mitruka and Rawnsley (1977) of 41.50% - 65.50%. Albumin are required to maintain blood pressure. The serum urea level of animals reported in this study fell within the normal values range of 15 - 36mg/dl reported by Mitruka and Rawasley (1977) for healthy sheep.

The serum creatinine in this study were above the range of 0.70 mg/dl 3.00mg/dl reported by Mitruke and Rawnsley (1997). However, the values were comparable with those reported by Njidda *et al*. (2014) for sheep (Yankasa - 97mmol/L; Ouda - 103 mmol/L and Balami - 156mmol/L). High creatinine is indicative of poor protein and amino acid metabolism that can lead to impaired renal function and cardia infarction (Gray and Howarth, 1980).

The Serum globulin values obtained in this study was higher than the range value (5 - 20%) reported by Mitruka and Rawnsley (1977) and that reported by Amunda and Okunlola (2018) of 4.63 g/dl - 8.70g/dl. A higher globulin recorded in this study inferred that the sequencing and diet had the greater ability to stimulate immunity to fight infection (Eburuaja *et al.,* 2020). For serum glucose the values obtained in this study was lower the normal range of 55 mg/dl - 131mg/dl reported for normal healthy sheep by Mitruka and Rawnsley (1977). Glucose is the chief source of energy for all living organism. The levels obtained across the dietary treatments suggest that feed may not have been adequate in energy supply for the animals. Lower levels of glucose in serum suggests hypoglycemia (Olorunnisomo *et al.,* 2012).

CONCLUSION

The haematological and serum biochemical constituents of WAD rams fed *Panicum maximum* and concentrate at different sequence and durations showed no adverse effect on the health status of the animals. From the results of this study, it is concluded that haematological and serum biochemical constituents of West African Dwarf rams were not markedly influenced by the sequence, but by the duration of feeding concentrate supplement and grass (*Panicum maximum*).

RECOMMENDATION

It is recommended that, under intensive management system, concentrate supplement be fed 2 hours subsequent to grass (*Panicum maximum*) for the attainment of the overall health in West African Dwarf rams. It is also suggested that longer interval times and sequence be investigated in future research.

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