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BODY WEIGHT CHANGES, HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF WEST AFRICAN DWARF (WAD) RAMS FED AMMONIUM SULPHATE FORTIFIED DIETS

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Key words. Ammonium sulphate . Haematology . Serum biochemistry . Weight gain . West African dwarf rams .

Abstract

Weight gain, haematology and serum biochemical parameters of sixteen (16) West African Dwarf (WAD) rams weighing 12.8+0.12kg were assigned to diets containing 0g/kg, 2.5g/kg, 5.0g/kg and 7.5g/kg levels of ammonium sulphate ($(NH_4)_2SO_4$) as T0, T2.5, T5.0 and T7.5, respectively. The animals were fed the diet and wilted guinea grass in a 60:40. Daily weight gain, feed conversion ratio, platelet, lymphocytes, neutrophil, cholesterol, Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) and Alkaline Phosphatase (ALP) values of the rams fed ammonium sulphate fortified diets were significantly ($p<0.05$) higher than the control. Haemoglobin concentration increased in ramsfed ammonium sulphate fortified diets from 14.00-14.68% compared to control. The white blood cell ($x10^6/mm^3$) varied from T0 (4.31) to T7.5(5.15). The lowest packed cell volume (41.00%) was obtained for rams on control diet. Red blood cell ($x10^6/mm^3$) ranged from T0 (11.86) to T7.5 (13.02) while alanine aminotransferase (ALT) ranged from 10.25 (T0) to 25.25 (T7.5) ($x10^6/\mu L$). The study revealed that inclusion of ammonium sulphate fortified diets of WAD rams up to 7.5g/kg had no deleterious effects on weight gain, haematological and serum indices of WAD rams.

Introduction

Sheep and goats constitute a very important part of the livestock sub sector in the Nigerian agricultural economy (Lakpini *et al.*, 2002). The use of sheep and goats for religious and social ceremonies adds unquantifiable value to their economic importance. They fulfill a most useful task in supplying human population with meat, milk, skin, hair and other products (Adeloye, 1998). The full exploitation of the numerous attributes of small ruminants is limited by the constraints in production and reproduction. Producers of sheep and goats face problems of seasonal malnutrition resulting in fluctuating productivity and economic losses (Lakpini *et al.*, 2002). Consequently, the use of unconventional feed resources has been advocated as a way out of this problem. The health implication of feeding these unconventional feeds however, has not been evaluated.

Blood is known to be vital to the life of an organism. This is a medium through which nutrients are conveyed to various parts of the body of an organism. A readily available and fast means of assessing clinical and nutritional status of an animal on feeding trial may be the use of blood analysis (Olabanji *et al.*, 2009). Haematological parameter is an important and reliable medium used to monitor and evaluate health and nutritional status of animals (Babatunde *et al.*, 1992; Onifade, 1993; Gupta *et al.*, 2007). It therefore becomes imperative to evaluate blood parameters of an animal particularly when unconventional feeds are fed to animals in order to determine the performance of the experimental animals as well as suitability to livestock.

Some of the unconventional feed ingredients that could easily be obtained in this area are ammonium sulphate. They are often used conventionally as fertilizer to supply nutrients to the soil. Ammonium sulphate feed ingredients could therefore provide alternative usage as they easily dissociate in the rumen and in addition lower cost of feeding. One way of monitoring the health status of animals is through the evaluation of weight gain, haematological and biochemical indices. This study was therefore aimed at evaluating the weight gain, haematological and biochemical indices of WAD rams fed ammonium sulphate fortified diets

Materials and Methods

Experimental site

The experiment was conducted at the Small Ruminant Unit of the Teaching and Research Farm, University of Ibadan, Nigeria. The location is 7° 27′N and 3° 45′E at altitude 200-300m above sea level. The climate is humid tropical with mean temperature of 25-29°C and the average annual rainfall of about 1250mm.

Experimental animals and management

On arrival, the rams were subjected to anti-stress and prophylactic treatments consisting of intramuscular injection of multi-vitamin (1ml/10kg BW) and long acting oxytetracycline (1ml/10kg BW). They were dewormed with Ivomectin ® (1ml/50kg BW) and bathed with amitrax solution to eliminate ecto-parasites. The rams were also vaccinated against *Pestes de Petit Ruminant* (PPR) disease. The experiment lasted for 105 days.

Collection of blood samples

Ten milliliters (10 ml) of blood sample was collected from individual ram at the end of the feeding trial. Blood were drawn via the jugular vein with sterilized 19-gauge needle and syringe as described by Coles (1986). Three ml of each sample collected was put in bottle containing EDTA (anticoagulant) for haematological studies. The remaining 7ml was placed in a universal bottle (without anticoagulant) for serological studies. It was allowed to stand for about 2 hours at room temperature. Serum was obtained by centrifugation and the serum

samples were stored in a deep freezer (at -10°C) until analyzed.

Body weight changes

The rams were weighed once a week before the morning feed was offered. The daily feed provided and the left over of the previous day's feed were weighed to determine the total voluntary feed intake of each ram and was determined on a daily basis. Feed conversion ratio was determined by dividing the feed intake weight by the body weight gain.

Haematological analysis

Packed Cell Volume (PCV) was determined by microhaematocrit method (Schalm *et al.*, 1975). Haemoglobin (Hb) concentration was measured by cyanomethaemoglobin method using spectrophotometer (Swensen, 1951) and (Schalm *et al.*, 1975) (SP6-500 UV spectrophotometer (Pye UNICAM, England). The red blood cell (RBC) and white blood cell (WBC) counts were estimated using Neubauer-haemocytometer after appropriate dilution (Schalm*et al.*, 1975). Mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC) and mean corpuscular haemoglobin (MCH) were calculated from Hb, PCV and RBC (Jain, 1986).

Serum biochemical analysis

Serum total protein was determined using Buiret method as described by Reinhold, (1953) and Kohn and Allen (1995) while albumin was determined using bromocresol green (BCG) method as described by Peter *et al.* (1982). The globulin concentration was obtained by subtracting albumin from the total protein while the albumin/globulin ratio was obtained by dividing the albumin value by the calculated globulin value. Serum urea was determined by urease method and creatinine by Folin-wu filtrate methods as described by Toro and Ackermann (1975). Also, serum glucose was determined by O-Tluidine method using acetic acid (Cooper and McDaniel, 1970) while serum cholesterol was determined using appropriate laboratory kits (Friedwald *et al.*, 1972, Gowenlock *et al.*, 1988).

Statistical analysis

Data generated from parameters investigated were subjected to Analysis of Variance (ANOVA) using Statistical Analysis System (SAS, 2000). Significant differences between treatment means were separated using Least Significant Differences (LSD) of the same package.

Results

Body weight changes of West African dwarf rams fed ammonium sulphate fortified diets

Presented in Table I are the body weight changes of WAD rams fed ammonium sulphate fortified diets. The daily weight gain (DWG) ranged from 70g/day (T0) to 90g/day (T7.5). The DWG increased with increasing levels of ammonium sulphate and were significantly different ($p<0.05$) from each other. The DMI obtained were 996.18g/day, 741.54g/day, 752.38g/day and 759.23g/day for T0,

T2.5, T5.0 and T7.5, respectively (Table II). However, no significant difference ($p>0.05$) was observed between these values. The FCR obtained in the study was highest in T0 (17.90) and least in T7.5 (11.96). The FCR decreased across the treatments with increasing levels of ammonium sulphate. There were significant differences ($p<0.05$) in FCR across the dietary treatments.

Haematological indices of West African dwarf rams fed ammonium sulphate fortified diets

Shown in Table III is the heamatological index of West African Dwarf rams fed ammonium sulphate fortified diets. The PCV obtained in the present study was within the range of 39.50 - 44.00%. There was no significant differences ($p>0.05$) between the T0 and other treatment means observed in PCV. The result of the haemoglobin (Hb) value shows that T7.5 (14.68 g/dL) had higher values than other treatments. Results on WBC indicated similar values for T0 ($4.31 \times 10^6/mm^3$) which served as control, T2.5 ($4.55 \times 10^6/mm^3$) and T5.0 ($4.77 \times 10^6/mm^3$). Lymphocytes and Neutrocytes for T0 (65.75% and 23.00%) and T7.5 (72.75% and 31.00%) were significantly different ($p< 0.05$) from each other.

Serum biochemical indices of West African dwarf rams fed ammonium sulphate fortified diets

Presented in Table IV are serum biochemical indices of West African Dwarf rams fed ammonium sulphate fortified diets. Serum biochemical values obtained ranged from 8.15g/dL to 8.68g/dL for BUN; 3.33 g/dL to 3.68 g/dL for albumin and 4.82 g/dL to 5.05g/dL for globulin respectively. These indices ranged from T0 to T7.5. Similarly, total protein concentration obtained was higher in T7.5 (8.68g/dL) than T0 (8.15g/dL). BUN, albumin, globulin and total protein values from all the treatments were not significantly different ($p< 0.05$). The urea level in the study showed that T7.5 (10.75mg/dL) had higher values than T0 (9.75mg/dL).

Discussion

Body weight changes of West African dwarf rams fed ammonium sulphate fortified diets

Thomas *et al.*, (1951) demonstrated that the addition of inorganic sulphate to a sulphur deficient purified ration improved weight gain and the nitrogen and sulphur retention of sheep. The tendency for a negative effect of control diet (T0) on daily weight change may be due to reduction in muscular development as a result of depletion of the sulphur-containing amino acids necessary for formation of sulphur-amino acids (Onwuka *et al.*, 1992). Promkot *et al.*, (2007) reported that goats on low sulphur, cassava-based diets had the greatest weight losses as compared to sulphur supplemented groups. It appears that diets fortified with ammonium sulphate had tendency to improve feed utilization. Sulphur, being a precursor for the other S-containing amino acids (NRC, 2000), improved the quality of synthesized microbial protein or amino

Table I. Gross composition of experimental diet (% DM)

	Ammonium sulphate			
Ingredients (%)	T0	T2.5	T5.0	T7.5
Dry cassava peel	60.00	60.00	60.00	60.00
Brewers dry grain (BDG)	23.00	23.00	23.00	23.00
Palm kernel cake (PKC)	10.00	10.00	10.00	10.00
Urea	1.00	1.00	1.00	1.00
Dicalcium phosphate	1.00	1.00	1.00	1.00
Oyster shell (OS)	2.00	2.00	2.00	2.00
Common salt (Nacl	2.00	2.00	2.00	2.00
Premix (grower)	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00

Table II. Body weight changes of West African dwarf rams fed Ammonium sulphate fortified diets

	Ammonium sulphate				
Parameters	T0	T2.5	T5.0	T7.5	SEM
Initial body weight (kg)	12.25	12.25	11.75	12.50	0.88
Final body weight (kg)	19.60	19.82	20.15	21.95	0.68
Daily weight gain (g/day)	70.00^{b}	72.05^{b}	80.00^{a}	90.00^{a}	1.00
Dry matter intake (g/day)	996.18	741.54	752.38	759.23	1.20
Feed conversion ratio	15.12^{a}	10.13^{b}	9.19^{b}	9.10^{b}	1.18

a, b, c, d: Means within rows with different superscripts are significantly different from each other ($P<0.05$).

Table III. Haematological indices of West African dwarf rams fed Ammonium sulphate fortified diets

Parameters	Ammonium sulphate					
	T0	T2.5	T5.0	T7.5	SEM	Ref
Packed cell volume (%)	41.00	42.00	43.50	44.25	1.11	27-45
Heamoglobin (g/dL)	13.40	14.00	14.45	14.68	0.38	9-15
Red blood cell ($x10^6/mm^3$)	11.86	12.34	12.81	13.02	0.25	9-15
Platelet ($x10^6/mm^3$)	6.87^c	8.13^b	9.50^a	9.93^a	0.50	8-11
Mean corpuscular volume (µm3	34.57	34.04	33.96	33.99	0.40	
Mean corpuscular haemoglobin (pg)	11.30	11.35	11.28	11.28	0.13	
Mean corpuscular haemoglobin conc.(%)	32.68	33.33	33.22	33.18	0.12	
White blood cell ($x10^9/mm^3$)	4.31	4.55	4.77	5.15	0.20	5-10
Lymphocytes (%)	65.75^d	66.00^c	68.00^b	72.75^a	1.40	40-55
Neutrophils (%)	23.00^d	27.25^c	29.00^b	31.00^a	1.55	10-50
Eosinophils (%)	1.75	2.75	2.75	3.00	0.26	0-10
Monocytes (%)	1.00	1.75	1.75	2.25	0.18	0-6

a, b, c, d: Means within rows with different superscripts are significantly different from each other ($P<0.05$), SEM=Standard error mean. Ref: Merck Veterinary Manual.

Table IV. Serum biochemical indices of West African dwarf rams fed Ammonium sulphate fortified diets

Parameters	Ammonium sulphate					
	T0	T2.5	T5.0	T7.5	SEM	Ref.
Total protein (g/dL)	8.15	8.50	8.55	8.68	0.08	6-8
Albumin (g/dL)	3.33	3.60	3.63	3.63	0.06	2-3
Globulin (g/dL)	4.82	4.90	4.92	5.05	0.01	4-5
Aspartate aminotransferase(units/L)	76.25^b	77.50^b	103.75^a	108.00^a	12.61	12-229
Alanine aminotransferase(units/L)	10.25^c	12.75^b	24.75^a	25.25^a	2.14	3-47
Alanine phosphatase (units/L)	235.50^b	269.00^{ab}	283.75^a	289.25^a	14.39	70-390
Blood urea nitrogen (mg/dL)	9.75	10.00	10.00	10.75	0.20	8-20
Creatinine (mg/dL)	1.08	1.20	1.35	1.48	0.06	1-2
Cholesterol (mg/dL)	57.75^b	59.50^b	61.75^a	63.00^a	1.37	52-76

a, b, c, d: Means within rows with different superscripts are significantly different from each other ($P<0.05$), SEM=Standard error mean. Ref: Merck Veterinary Manual.

acid. It was shown by Ferreiro *et al.*, (1977) that addition of 1g ammonium sulphate per kg of fresh sugar cane improved daily gain significantly on a ration composed of only sugar cane and urea.

Haematological indices of West African dwarf rams fed ammonium sulphate fortified diets

Packed cell volume (PCV) concentration obtained in this study was within the range of values reported by Mitruka and Rawnsley (1977) for rams. This indicated that the PCV has not been affected in all the treatments. It further showed that in all the treatments, rams did not suffer from anaemia or dehydration. This confirms the report of Merck Veterinary Manual (1998) that a low PCV value was an indication of anaemia while sharp increase in PCV is most often caused by dehydration. White blood cells, neutrophils, basophils, lymphocytes, eosinophils and monocytes from all the treatments are within the range obtained by Maigandi *et al.* (2003) and Taiwo and Ogunsanmi (2003) which were normal for healthy rams. It could therefore be concluded that all the treatments have non toxic effect on the rams. The Hb range in this study fell within the range of 7-15 g/L reported by Daramola *et al.* (2005) but higher than the values of 5-6 g/dL obtained by Belewu and Ogunsola (2010) for goats fed fungi-treated *Jatropha curcas* kernel cake rations. With the relatively higher Hb concentration obtained in this study, the dietary treatments generally seemed to be capable of supporting high oxygen carrying capacity in blood of the rams. The RBC counts reported in this study were within the range of 9.2-13.5 g/l reported by Tambuwal *et al.* (2002), 9.9-18.7 g/L by Taiwo and Ogunsanmi (2003), and 10.25-12.85×10^{12}L) obtained by Ajala *et al.* (2000). The increased RBC counts recorded for rams in the T0 (11.86 x 10^{6}mm) and T4 7.5g/kg $(NH_4)_2SO_4$ fortified diets present a likely resistance to anaemia-related disease conditions by these rams.

Serum biochemical indices of West African dwarf rams fed ammonium sulphate fortified diets

Although Blood urea nitrogen level was slightly higher for T7.5 (10.75mg/dL) compared to T0 (9.75mg/dL), they were within the normal ranges. This could be due to the higher CP contents ofT2.5, T5.0 and T7.5 in which there was improvement in the CP content of the feed confirming the observation of Mc Donald *et al.*, 1998 that traces of inorganic sulphur improves the utilization of urea as a nitrogen source. However, the mean total protein values obtained in this study were within the range reported for various ruminant species (Taiwo and Ogunsanmi, 2003). Albumin and globulin values obtained were also similar to those reported by Coles (1986).

Serum protein obtained in this study at the end of the experiment, though not significant, compared favourably with values reported by Daramola *et al.* (2005) and Tambuwal *et al.* (2002). The diets in

this study did not significantly affect the globulin levels in the serum of the rams, thus indicating the safety of these ammonium sulphate fortified diets for rams. The higher values for total protein, albumin and globulin in this study compared to reports of Esugbohungbe and Oduyemi (2002) which suggested that ammonium sulphate fortified diets led to increase excretion of endogenous protein which is subsequently passed out in the faeces and so may not alter protein metabolism. In this study, the transaminases values even at the highest level of 7.5g/kg $(NH_4)_2SO_4$ fortified diets at the end of the experiment could be an indication that the test diets differ in their effects on enzyme secretion mechanism. However, the result of this study suggests a reverse in this regard indicating the potential of ammonium sulphate fortified diets of rams and confirming the observation of Ekpenyong and Biobaku (1986) with rabbits that liver enzymes are known to be high in the blood when the plane of nutrition is low.

Conclusion

Rams fed ammonium sulphate fortified diets had the highest nutrient intake per body weight which culminated in the optimal weight gain. The results of hematology and serum biochemistry of the rams fed ammonium sulphate fortified diets revealed that it is safe and not detrimental to the health of the rams. The implication of this result is that increase in total protein in the sera of the experimental rams in T7.5 (7.5g/kg $(NH_4)_2SO_4$) suggested that protein synthesis was efficient.

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