PERFORMANCE OF WEST AFRICAN DWARF SHEEP FED DIETS SUPPLEMENTED WITH RARE EARTH ELEMENTS (REE)

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ABSTRACT

An experiment to investigate the possible growth promoting effect of rare earth elements (REE) in growing West African dwarf sheep as well as their influence on the hematological and blood serum biochemical changes was conducted for 12 weeks. Forty West African dwarf sheep were allotted to four dietary treatments: a control group and REE- treated groups that were supplemented with 100mg, 200mg and 300mg of REE (Lanthanum oxide) per kg feed constituting diets, A, B, C and D respectively. the whole feeding trial lasted for 3 months during which the experimental animals were fed *ad-libinum*. The REE groups had a better daily weight gain, total weight gain and also feed conversion. REE had no significant ($p>0.05$) influence on Aspartate amino transferase (AST). Alanine amino transverse (ALT), Cholesterol, Urea, total protein, albumin and globulin. All the hematological parameters were not significantly higher compared to the control group.\

Key words: Performance, West African Dwarf sheep, rare earth metals

INTRODUCTION

The Rare earth elements (REEs) are metals in group III of the periodic table. Rare earth is a group of 17 elements including; Lanthanum La, Cerium Ce, Prasedymium Pr, Neodymium Nd, Promethium Pm, Samarium Sm, Europium Eu, Gadolinium Gd, Terbium Tb, Dysprosium Dy, Holmium Ho, Erbium Er, Thulium Tm, Ytterbium Yb and Lutetium Lu, located in the periodic table from atomic number 57 to 71 and Seandium Se numbered 21 and Yttrium Y, (Liptrot, 1980). The use of REEs in agriculture as trace nutrient is dated back to the 1920. (Guo, 1987).

Rambeck. *et al*., (1990) reported that the application of Res by a combination of seed dressing and leaf spraying could increase yields of crops, fruits, vegetables, wheat, soybean, grapes, sugarcane, tomatoes and orange. The supplementation of REE could improve weight gain and feed conversion of beef. The same

author also reported that the application of REE could increase milk production in dairy cattle and egg production in laying hens when mixed with feed ingredients during milling process.

Lately, positive effects of REE on body weight gain and on the feed conversion ratio of piglets were reported (Rambeck *et al*., 1999; He *et al*., 1999; He and Rambeck, 2000; Schuller *et al*., 2001). These results were in agreement with those reported in the Chinese literature (Li *et al*., 1992; Zhu *et al*., 1994; He and Xia, 1998). REE might be of interest as new, safe and inexpensive alternative growth promoters. However, there is little to its usage in the tropics (Adu, 2005). This study was therefore performed to investigate the possible effects of REE in growing West African dwarf sheep in the tropical region.

METHODOLOGY

Forty (40) growing West African Dwarf breed of sheep with an average weight of 9.03kg of about 8 months old were used for the experiment that last for 12 weeks. Before the commencement of the experiment, the animals were dewormed using Ivomectin to take care of the endo – and ecto parasites respectively. The animals were randomly allocated to four dietary treatments containing 0, 100mg, 200mg and 300mg inclusion levels of REE (Lanthanum oxide) constituting diets A, B, C and D respectively. Each treatment has ten (10) animals with each animal standing as a replicate in a completely randomized design of one-way ANOVA. The animals were housed individually in a clean disinfected pens, feed and water was given *ad-libtum*. The compounded diets were made available to the animals twice daily at 8.00hours and 16.00hours respectively. in between these hours, *Panicum maximum* was made available to the animals as a basal diet. The different body weights of the animals were taken at the beginning of the experiment, thereafter weekly.

About 4mls of blood was collected from each of the forty animals at the beginning and end of the experiment through the jugular vein into two separate vacutainer tubes. 2mls was collected into the Ethylene diamine tetra acetic acid (EDTA) bottles to prevent blood coagulation and taken to the laboratory for the determination of hematological parameters and the other without EDTA. The blood without EDTA was allowed to clot and later decanted for serum biochemical and enzymological studies. All the blood parameters i.e. haemoglobin (Hb), White blood cell (WBC), Red blood cell (RBC) and Packed cell volume (PCV) were determined using Wintrobes micro haemocytometer (Schalm et al., 1975), while hemoglobin concentration and blood constants: Mean cell volume (MCV),Mean cell hemoglobin (MCH) and Mean cell hemoglobin concentration (MCHC) were determined using cyanomethhaemoglobin method as described by Jain (1986). Serum total protein, Albumin and Globulin were determined as described by Kohn and Allen (1995) while Aspartate amino transferase (AST) and Alanine amino transferase (ALT) were determined using spectrophotometric method described by Rej and Hoder (1983). The results were subjected to statistical analysis using analysis of variance of SAS (1999). The treatment means were compared using the Duncan procedure of the same software.

RESULTS AND DISCUSSIONS

The performance of West African dwarf sheep as influenced by REE is presented in Table 3. Statistical analysis of the data obtained revealed that Lanthanum oxide inclusion in the diets of the experimental animals significantly ($p<0.05$) increased weight gain and feed conversion ratio. Animals fed diet containing 300mg inclusion of REE gained more weight than those fed 200mg, 100mg and the control diets respectively. feed intake in the REE group was the same as those in control group. The result obtained in this study is in agreement with that of Rambeck *et al*., (1999) who reported that REEs when fed as feed supplement improved the growth performance of pigs. In a related research, the same author also reported that REEs improved the weight gain of goat. The performance enhancing effect of REEs in pigs may be achieved through their antimicrobial properties (Muroma 1958; Evans, 1990). It has also been reported that REE can improve digestibility and utilization of nutrients in the diets of pigs, broilers and rabbits (Li *et al*., 1992; Zhu et al., 1994; Cheng *et al*., 1994; Lu and Yang, 1996; Adu, 2005), which might be achieved through influencing activities of the growth hormones.

In the present study, the supplementation of feed with REE for sheep had no significant influence ($p>0.05$) on all the haemoglobins, red blood cells and serum biochemical and enzyme parameters studied (Table 5). They all falls within the normal range as reported by Mitruka and Rawnsley, 1977) except the White blood cell which was significantly different from the control group. The health of the animals were not adversely affected by the supplementation with REE because none of the experimental animals was sick or died during the course of the experiment.

Table 1: Gross composition of the experimental diet

Ingredient Dietary treatment %

	A	**B**	**C**	**D**
Maize offal	29.00	29.00	29.00	29.00
Maize	20.00	20.00	20.00	20.00
Groundnut cake	15.00	15.00	15.00	15.00
Spent grain	19.50	19.50	19.50	19.50
Oyster	0.50	0.50	0.50	0.50
Rice bran	15.00	15.00	15.00	15.00
Salt	1.00	1.00	1.00	1.00
REE (mg)	-	100	200	300
	100.00	100.00	100.00	100.00
Calculated Composition				
Crude Protein 18.76%				
Ether Extract 4.21%				
Crude Fiber 7.38%				
Metabolisable Energy (Kcal/kg) 2375.16				

Table 2: Proximate analysis of the experimental diet

Parameters	A	B	C	D
Dry matter (%)	95.60	90.70	89.99	89.20
Crude protein (%)	17.22	17.10	17.50	17.30
Ether Extract (%)	4.20	3.90	4.00	3.85
Crude Fibre (%)	11.19	11.10	11.20	11.15
Ash (%)	7.95	5.96	5.82	8.65
Nitrogen free Extract (%)	59.44	61.94	61.48	59.05

Table 3: performance of sheep fed diet supplemented with REE

	Dietary REE levels				
Parameter (kg)	Control	100ppm	200ppm	300ppm	SEM
Initial weight	8.87	8.90	9.20	9.25	0.10
Final weight	12.96	15.30	15.90	16.65	3.50
Total weight gain	4.09	6.40	6.70	7.40	0.05
Daily matter intake	0.25	0.25	0.25	250	0.003
Feed conversion Ratio	5.13	3.28	3.13	2.83	0.43
Daily weight gain	0.04	0.076	0.079	0.088	0.04
Weekly weight gain	0.34	0.53	0.55	0.61	0.09

Table 4: Haematological parameters of sheep fed diet supplemented with REE

Dietary REE levels					
Parameter	Control	100ppm	200ppm	300ppm	SEM
Packed Cell Volume (%)	34.0	33.0	35.0	36.5	4.65
Haemoglobin (g/dl)	11.0	13.0	12.5	12	0.76
Red blood cell ($x10^{12}/1$)	13.0	12.0	13.0	14	0.65
MCV (u)	31.50	32.15	31.20	30.9	3.93
MCH (u/g)	10.25	9.95	10.15	10.30	0.31
MCHC (%)	33.10	32.90	33.46	32.20	2.27
WBC ($x10^{9}/1$)	6.62a	9.50b	9.80b	10.0b	1.01
Lymphocyte (%)	48.50	49.20	47.35	48.97	2.68
Neutrophil (%)	30.0	33.2	33.6	35.0	2.54
Eosinophils (%)	5.20	4.90	5.60	5.48	0.42
Monocytes (%)	3.0	3.1	3.3	3.3	0.06

a, b, mean with different superscripts on the same row are significantly ($p<0.05$) different MCV=Mean corpuscular volume; MCH=Mean cell haemoglobin; MCHC=Mean cell haemoglobin concentration; WBC-White blood cell; SEM=Standard Error of mean.

Table 5: Serum Proteins and Enzyme parameters of sheep fed experimental diets

Parameter	Dietary REE levels				
	Control	100ppm	200ppm	300ppm	SEM
Total Protein(g/dl)	5.80	5.98	5.75	6.10	0.46
Albumin (g/dl)	2.70	2.89	2.98	3.00	0.07
ALT (i.u/l)	35.70	38.30	39.60	36.90	2.45
AST (i.u/l)	45.56	42.90	43.10	44.90	3.65
Globulin (g/dl)	3.10	3.09	2.77	3.10	0.50
Albumin/Globulin	0.87	0.93	1.07	0.96	0.04
Cholesterol (mg/dl)	86.78	88.12	85.90	87.90	5.20
Urea (mg/dl)	20.50	19.85	20.66	21.01	3.34

ALT=Alanine amino transferase, AST=Aspartate amino transferase; SEM=Standard Error of Mean.

CONCLUSION AND RECOMMENDATION

Rare earth elements (REEs) have a growth promoting effect on growing sheep which was observed in this study to be positive even at an inclusion level of 300mg. the effect on blood and serum biochemical parameters were also not negatively affected, as they were all within the normal range for healthy animals. The study has shown that REE is safe and a good alternative growth stimulant in animal production hence it is recommended for sheep, goats and other ruminants.

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