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THE PERFORMANCE OF WEST AFRICAN DWARF GOAT ON DIETARY MAGNESIUM SULPHATE SUPPLEMENTS.

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Target Audience: Animal nutritionists, commercial goat producers.

ABSTRACT

A 56-day feeding trial was conducted to evaluate the effect of dietary magnesium sulphate on the performance of West African Dwarf (WAD) goat using 12 does weighing 7 – 10kg. There were four dietary levels of $MgSO_4$ (D1), 0.5(D2),1.0 (D3) and 1.5% (D4). Dry matter intake, growth and Mg retention were used as the criteria for judgment. Result showed that addition of magnesium sulphate significantly ($P<0.05$) increased mean daily gain from 34.00 –46.00g. The dry matter intake declined ($P<0.05$) with increased level of dietary magnesium sulphate (3.21-2.34Kg/$W^{0.75}$kg) Goat fed diet D4 depicted an optimum feed conversion ratio (10.50) while the least was observed for animals fed D1 (14.50). The result further showed that the magnesium requirement for body maintenance was 0.003g/kgBW/day while the requirement for maximum growth was 1.5% of the diet.

Key words: Magnesium sulphate, goats, performance, maintenance requirement

DISCRIPTION OF PROBLEM

Farm animals derive their mineral nutrients mainly from their diets (1). The increasing consciousness on the necessity for mineral fortification of feeds has been attributed to some factors. These include changes in methods of procession feedstuffs, increased animal production, greater use of synthetic ingredients and less use of animal by –products (which are excellent sources of mineral elements) and confined rearing and feeding (2). Mineral supplements are incorporated into diets to ensure that animals receive the required minerals. The effectiveness of magnesium phosphate, calcium magnesium phosphate and ammonium phosphate has been studied (3,4). This study therefore, investigates the performance of West African dwarf goat fed diets supplemented with varying levels of magnesium sulphate using dry matter intake, daily gain and feed conversion ration as criteria for evaluation.

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MATERIALS AND METHODS

Experimental Animals and their Management

Twelve non-pregnant, non-lactating female West African Dwarf (WAD) goats aged 8-12 months and weighing 7 to 10kg were used for the experiment. The goats were routinely given Ivomec injection (1ml/50kg BW) against endoparasites and dipped in Asuntol powder solution (3 litre of water) to control ectoparasites. They were then housed in well –ventilated and disinfected pens. The goats were intensively managed for 4 weeks during which they were fed wilted *panicum maximum* grass and salt solution sprinkled-dry cassava peels. Water was provided *ad libitum*. Four experimental diets (D1,D2, D3, and D4) of varying levels of magnesium sulphate were prepared as contained in Table 1. The twelve goats were randomized into four groups of three goats each balanced for body weight. Each group was assigned an experimental diet for 8 weeks. Feeding was based on 4% body weights of the animals while water was provided *ad libitum*.

Data Collection

The weight of individual animal was taken at the beginning of the experiment and every fortnight after 14-16hrs withdrawal of feed to minimize gut-fill effect. Any residue was weighed to estimate intake. Blood samples were collected with hypodermic needle and syringe via jugular venipuncture (5) at the beginning and end of experiment and sera were harvested. During the last 7 days of the experiment, 2 goats were randomly selected from each treatment and transferred into individual metabolism cage for collection of faecal and urine samples. About 25% of faeces collected for 7 days were oven-dried at 80^0C and bulked for

each animal. The urine sample bottles were rinsed with dilute sulphuric acid which served as preservative before storing at -20^0C in plastic specimen bottles until required for chemical analysis. The sera samples were also stored at -20^0C.

Chemical Analyses

The proximate composition of the experimental diets was determined (6). The magnesium concentration of feeds, sera, faeces and urine was determined using Pekin Elmer Atomic Absorption Spectrophotometer (Model 290).

Statistical Analyses

The data generated were subjected to analysis of variance (7) and the treatment means separated (8). The magnesium intake and retention were calculated and used in regression analysis to determine the magnesium requirement for maintenance as follows:

$Y=bX+c$

Where,

Y= Magnesium retention

X= Magnesium intake

C= Intercept on y-axis

B= regression coefficient

The value of "c" is the Mg retained when intake "X" is hypothetically zero. Hence, "c" is the Mg requirement for maintenance.

RESULTS AND DISCUSSION

The mean concentration of Mg in serum, faeces and urine at the on set of the experiment were 1.06±0.04mg/100ml, 295.30±22.6mg/kg and 0.77±0.6mg/100ml respectively. The serum Mg (mg/100ml) was similar to the values reported for healthy goats (9,10). The chemical composition of the diets is shown in Table 1

Table1: Composition of magnesium sulphate supplement diets fed to female West African Dwarf goat(%).

Ingredients	D1	D2	D3	D4
Wheat offal	50.00	50.00	50.00	50.00
Dry cassava peels	20.0	19.50	19.50	18.50
Palm kernel cake	18.00	18.00	18.00	18.00
Dry *Gmelina arborea* leaves	12.00	12.00	12.00	12.00
Magnesium sulpate[1]		0.50	1.00	1.50
Chemical composition (%of dry matter)				
Dry matter (%)	87.60	88.60	87.20	87.00
Crude protein (%)	13.10	11.00	11.40	11.00
Crude fibre (%)	34.80	35.00	45.00	37.00
Ether extract(%)	3.00	4.00	3.00	3.50
Total ash (%)	5.40	5.20	5.40	5.20
Nitrogen free extract (%)	43.67	44.86	35.22	43.36
Magnesium (%)	0.31	0.40	0.53	0.70

[1]9.75% magnesium and 99% pure magnesium salt.

The values did not follow a consistent trend. However, the magnesium contents of the diets increased with the addition of the magnesium sulphate from 0.31% to 0.70% (D1 – D4). Dry matter intake (DMI) was significantly ($P<0.05$) influenced by the treatments. The DMI slightly increased for goats on diet D2 (0.5% magnesium sulphate) and then declined for animals on diet D4 (1.5% magnesium sulphate) Dry mater intake of goats was reported to increase up to 1.0% level of magnesium salt inclusion (11) beyond which there was a decline (12,13). This could be due to the taste of Mg salt compared to common salt. Magnesium sulphate treated groups significantly gained more body weight than the control. However, the goats on D4 exhibited the highest average daily gain (ADG). Diet 4 promoted the best FCR (10.5) while the control group depicted the poorest FCR. This showed that magnesium sulphate in the diet of the goats had beneficial effects on DMI,ADG and FCR. The circulating Mg in the serum significantly ($P<0.05$) increases from 2.87mg/100ml(D1) to 3.47mg/100ml (D4) with increase in dietary levels of the salt, as obtained elsewhere (11,14). The peak value of Mg in the serum (D4) higher than the maximum value of 3.20mg/100ml reported for cattle and sheep (15). The least serum Mg was recorded for on the control diet.

The benefit of increased circulating serum Mg due to dietary supplementation, is reflected in the better performance in goats fed diets D2 –D4 since Mg is involved in the metabolism of carbohydrate, protein, lipids and hence growth. Faecal Mg was significantly ($P< 0.5$) influenced by dietary treatments suggesting that addition of supplementary Mg to diet provoked an increase in faecal mg as obtained in literature (10,11,12,14, 16). The urinary Mg excretion followed the same pattern as in faecal mg (Table 2).

Table 2: Performance of goats fed diets containing magnesium sulphate as supplement

Parameters	D1	D2	D3	D4	SEM
Average daily gain(g/d)	34.00[b]	42.00[a]	39.00[a]	46.00[a]	6.20
Dry matter intake ($kg/W^{0.75}kg$)	2. 85[b]	3.21[a]	3.06[a]	2.34[c]	0.19
Feed conversion ratio	14.50	114	13.41	10.50	0.86
Mg intake (g/kgBW)	0.147[b]	0.214[b]	0.270[a]	0.273[a]	0.03
Faecal Mg (g/kgBW)	0.034[b]	0.055[a]	0.059[a]	0.068[a]	0.01
Urinary Mg (g/L)	0.006[a]	0.005[b]	0.007[a]	0.009[a]	0.001
Mg retention (g/kgBW)	0.107[b]	0.154[a]	0.204[a]	0.205[a]	0.02
erum Mg (mg/100ml)	2.87[b]	2.89[b]	3.24[a]	3.47[a]	0.45

[a,b,c] means along the same row with similar superscripts are not significantly different($p>0.05$)

The magnesium intake and magnesium retention increased ($P<0.05$) with increasing level of dietary magnesium as reported for sheep (4). In this study. the magnesium requirement for maintenance in the goats as determined by regression analysis ($= 0.760X - 0.012$: $R^2 = 0.996$) was 0.012g/kg BW. This is lower than the 0.0167g/kg live-weight previously reported (17). The regression equation relating growth to Mg retention ($Y=78.628X=27.06$: $R^2=0.536$) revealed that the Mg retention of 0.205g/kg BW in goats fed D4 exhibited the highest average daily gain. This implied that the Mg requirement for maximum growth. in this study . was induced by 1.5% Mg salt supplementation in the diet. This value is higher than 0.12-0.18% growth requirement for sheep (180 .It therefore, means that magnesium requirement depends on species. type and quality of feed.

CONCLUSIONS AND APPLICATION

1. The result of this study revealed t'hat magnesium sulphate could be added to goats diet up to 0.5% level beyond which the dry matter intake would be significantly reduced.
2. The decline in DMI would not affects weight gain up to 1.5% level of the diet
3. Magnesium sulpahate has beneficial effects on dry matter intake average daily gain and feed conversion ratio .of goats.
4. The West African Dwarf goat would require 0.012g Mg/kg Bw for body maintenance and 1.5% inclusion in their diet for maximum growth.

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