PERFORMANCE AND BIOECONOMICS OF FEEDING GROWING WEST AFRICAN DWARF (WAD) GOATS WITH DIFFERENT COPPER SALTS BASED DIETS

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Abstract

Performance and bioeconomics of feeding 20 growing West African Dwarf (WAD) goats with varying levels of different copper salts was studied. The goats were randomly allotted to five dietary treatments, comprising of four goats each, with T_1 (control), T_2 (15 mg Cu/Kg DM of Copper Sulphate), T_3 (20 mg Cu/Kg DM of Copper Sulphate), T_4 (15 mg Cu/Kg DM of Copper Nitrate) and T_5 (20 mg Cu/Kg DM of Copper Nitrate). Performance and bioeconomics parameters of the experimental goats were determined. The results obtained indicates that copper salts had no significant effect ($P>0.05$) on the performance and bioeconomic of the goats. The general poor performance of goats including those on the control diet could be due to unfavourable environmental condition which led to low feed intake and low weight gain of the goats. Poor weight gain could also be due to the fact that, WAD Goats are not used to confinement. The season (rainy season) the research was carried out is associated with several ailments of goats. The weight loss experienced by goats in T_5 could be due to the inability of those goats to withstand the earlier mentioned conditions when compared to those on other treatments (the place of individual difference). Weight loss in T_5 could also be due to unknown reasons. It is recommended that WAD goats should not be totally confined, when carrying out research and that the addition of copper salts to the diets of WAD goats have no economical value.

Key words: WAD Goats, Copper Sulphate, Copper Nitrate, Performance and Bioeconomics

Introduction

The major constraint to ruminant livestock production in the tropics is the unavailability of cheap and quality feedstuffs, especially in periods of drought or dry season. For a greater part of the year, grassland does not supply sufficient minerals and other nutrient to stock for greater productivity. Minerals likely to be highly involved are Magnesium and Copper (McDowell *et al.*, 1977). Research has shown that significant differences exist in mineral metabolism between species (Arnold *et al.*, 1993), even between ruminants (Haenlein, 2004). Copper (Cu) is an essential element required by goats and other animals for a number of biochemical functions (Davis and Mertz, 1987). Dietary Cu, when fed at pharmacological concentrations has been shown to alter lipid metabolism in goats (Solaiman *et al.*, 2006). In the past ruminant's Cu deficiencies have usually been corrected by supplementation with inorganic mineral supplements. Some deficiency symptoms have been identified; however excessive amounts have also been

associated with deleterious effects. In view of this, scientists have recognized the need for the inclusion of certain recommended levels of either organic or inorganic Cu salts in animal diets to improve performances. During the last several years, free choice and chelated minerals have become popular for use in free choice mineral supplements.NRC (1980) indicated that sheep are more sensitive to high Cu supplementation than cattle and goats. Limited research had been done on Cu supplementation in sheep. A lot of work has been done on the use of copper salt, but few reports are available on the comparison of different copper salt. This study is aimed at comparing the effect of different copper salts on the performance of West African Dwarf goats.

Materials and Methods

The Study was conducted at the Sheep and Goat Unit of the Teaching and Research Farm of Kogi State University, Anyigba. The copper salts ($CuSo_4$, and $CuNo_3$) were included at two levels ($CuSo_4$ 0.15%) in T_2, ($CuSo_4$ 0.20%) and T_3, and ($CuNo_3$ 0.15%) in T_4, ($CuNo_3$ 0.20%) in T_5 respectively, while T_1 with no copper salt inclusion serves as the control diet. A total of 20 growing male West African Dwarf goats of about 5-6months, having an average initial weight of 5.85kg were used for this experiment. The goats were randomly allotted in a completely randomized design to five (5) groups of four (4) goats each, having a goat as a replicate. An adjustment period was allowed for the goats before data collection commenced. It addition to feeding the copper-based diets, Northern Gamba grass (*Andropogon gayanus kunth*) was fed to the goats based on cut and carry basis. Data were subjected to one-way analysis of variance (ANOVA) and means that were significantly different were separated by Least Significant Difference (LSD) using SPSS window Version 16 package.

Results and Discussions

From Table 1, all the performance parameters obtained were not significantly ($P>0.05$) affected by treatments. In agreement with the present findings, Cu supplementation at 10 to 40mg Cu/kg DM did not affect daily weight gain, daily concentrate intake compared with controls in steers (Engle and Spears, 2000a, 2000b; 2001). Mullis *et al.* (2003) found out that Cu supplementation at 7 to 14mg Cu/kg DM did not have significant ($P>0.05$) affect on the animals. According to Engle and spears (2000b), Cu supplementation to finishing steers at 20 or 40mg Cu/kg DM decreased average daily gain and average daily feed intake as compared to the control diet. Asare-Bediko and Aina (2013) reported that Cu supplementation at 20mg Cu/kg DM to fattening goats did not affect average initial body weights (AIBW) and final body weight (FBW) of the animals. Furthermore, Aina *et al.* (2011) found that Cu supplementation at 20mg Cu/kg DM to West African Dwarf Sheep were not significantly ($P>0.05$) different, but values obtained for feed intake in the control was higher than those obtained in the other treatments. There are many factors that could affect an animal response to Cu supplementation, such as differences in breed (Mullis *et al.* 2003). Mondal and Biswas (2007)) found out that concentration of Cu supplementation, Cu concentration of the basal diet, the duration and form of Cu supplementation (organic or inorganic), the absence and presence of dietary Cu antagonists (S, Mo, Zn, Fe), initial Cu status of the animal, environmental and health factors affects the utilization of Cu. Arthington and Pate (2002) also reported that Cu supplemental level and the composition of the experimented diet can also affect the animal's performance.

Table 1: Performance Characteristics of Experimental Goats Fed Copper Salts-Based Diet

Parameters	T1	T2	T3	T4	T5	LOS
AIBW (g)	5375±225.00	5600±350.00	6550±50.00	5150±350.00	5550±500.00	NS
FBW (g)	5725±25.00	5900±250.00	6775±25.00	5340±440.00	5395±605.00	NS
TWG (g)	350±250.00	300±100.00	225±25.00	190±90.00	-155±105.00	NS
DWG (g)	16.67±11.91	14.29±4.77	10.71±1.19	9.05±4.29	-7.38±5.00	NS
TCI (g)	2945±195.00	2508±468.00	2815±225.00	1664±696.00	1824±584.00	NS
DCI (g)	140±9.29	119±22.27	134±10.72	79.24±33.14	86.84±27.79	NS
TFI (g)	8393±298.00	7250±1530.0	8265±325.00	7525±885.00	8103±417.00	NS
DFI (g)	399.64±14.17	345.24±72.86	393.58±15.48	358.34±42.15	385.86±19.86	NS
TWI (ml)	4500±500	3340±50.00	3235±1195	3480±1030	2050±1000	NS
DWI (ml)	214.29±23.81	159.05±2.38	154.04±56.91	165.72±49.05	97.62±47.62	NS
TFI (g)	11338±102.50	9758±1062.50	11080±550.00	9189±1581	9927±166.50	NS
FCR	65.71±46.64	37.92±16.18	50.14±8.02	67.44±40.27	-117±78.19	NS

LOS- Level of Significant; NS- Non Significant; AIBW= Average Initial Body Weight; FBW= Final Body Weight; TWG= Total Weight Gain; DWG= Daily Weight Gain; TCI= Total Concentrate Intake; DCI= Daily Concentrate Intake; TFI= Total Forage Intake; DFI= Daily Forage Intake; TWI= Total Water Intake; DWI= Daily Water Intake; TFI= Total Feed Intake; FCR= Feed Conversion Ratio; T1(control, no supplemental Cu); T2(15 mg Cu/Kg DM from Copper Sulphate); T3(20 mg Cu/Kg DM from Copper Sulphate); T4(15 mg Cu/Kg DM from Copper Nitrate) and T5(20 mg Cu/Kg DM from Copper Nitrate).

From Table 2, it can be deduced that, all the bioeconomics parameters were not significantly (P>0.05) affected by the treatments. The highest total feed cost recorded by T_3 is due to the cost of copper salt inclusion, and total concentrate consumed, which is higher than T_2, T_4 and T_5 but lower than that consumed by T_1. The highest Benefit cost ratio recorded by T_4 could mean that, the farmer had a better chance to make more profit. The higher the Benefit cost ratio, the better the investment. The feed conversion ratio was lowest in T_5 (-117±78.19) and highest in T_4. The negative value in T_5 is as a result of weight loss of the experimental goats. Values obtained for gross margin was lowest in T_3 and highest in T_4. The lowest protein and energy efficiency ratio obtained in T_5 and highest in T_2 could mean that the goats in T_2 were more efficient in protein and energy utilization. The higher the protein and energy efficiency, the more efficient the animal and vice versa. This negative value in T_5 is attributed to weight loss of the goats.

Table 2: Economics of Feeding Copper Salts-Based Diet to West African Dwarf Goats

Parameters	T1	T2	T3	T4	T5	LS
FC/Kg (₦)	49.42±0.00	59.10±0.00	63.13±0.00	59.99±0.00	63.33±0.00	NA
FC/Kg G (₦)	3247±2305	2241±956	3115±498	4045±2416	-7410±4952	NS
TVCP (₦)	3192±9.64	3194±27.19	3221±13.98	3146±41.75	3162±37.05	NS
BCR	1.13±0.01	1.13±0.01	1.12±0.01	1.15±0.02	1.14±0.01	NS
TFC (₦)	146±9.64	148±27.63	175±13.98	99.83±41.76	115±36.96	NS
FCR	65.71±46.64	37.92±16.18	50.14±8.02	67.44±40.27	-117±78.19	NS
R (₦)	3600±0.00	3600±0.00	3600±0.00	3600±0.00	3600±0.00	NS
GM (₦)	408±9.64	406±27.19	379±13.98	454±41.75	438±37.05	NS
PER	0.045±0.003	0.157±0.067	0.105±0.017	0.098±0.059	-0.059±0.040	NS
EER	0.000568±0.00	0.000590±0.00	0.000359±0.00	0.000428±0.00	-0.000279±0.00	NS

LS - Level of significantly; NA - Not Analyzed; NS - Non significant; FC/Kg= Feed cost per Kg; FC/Kg G= Feed cost per Kg gain; TVCP= Total Variable Cost of Production; BCR= Benefit Cost Ratio; TFC= Total Feed Cost; FCR= Feed Conversion Ratio; R= Revenue GM= Gross Margin; PER= Protein Efficiency Ratio; EER= Energy Efficiency Ratio; T1(control, no supplemental Cu); T2(15 mg Cu/Kg DM from Copper Sulphate); T3(20 mg Cu/Kg DM from Copper Sulphate); T4(15 mg Cu/Kg DM from Copper Nitrate) and T5(20 mg Cu/Kg DM from Copper Nitrate).

Conclusion

From this study, it was found out that both the performance and bioeconomics parameters of the goats were not significantly affected by Cu inclusion in the diets.

Recommendations

Micro mineral analysis to show the total copper present in the experimental diets should be carried out to prevent copper toxicity. When carrying out research with WAD goats, goats should not be totally confined. Further research is needed to determine the possible roles of copper salts on performance and other physiological parameters of West Africa Dwarf goats. More research should be carried out using different breeds and species of ruminants, fed the experimental based diets, using other levels of inclusions.

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