INFLUENCE OF COPPER GLYCINE SUPPLEMENTATION ON CHEMICAL COMPOSITION OF MEAT FROM WEST AFRICAN DWARF SHEEP

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ABSTRACT
A 90 day trial was conducted to evaluate the influence of copper glycine (Cu-G) supplementation on chemical composition of meat of West African Dwarf (WAD) sheep. A total of sixteen (16) WAD Sheep were randomly assigned into four dietary treatments in a completely randomized design. Cu-G supplementation was incorporated at varying levels of 0, 5, 10 and 15 mg/kg to formulate four (4) dietary treatments. Following the feeding trial, three sheep per treatment were chosen at random and slaughtered. Meat was obtained from various sections of the animals to get a homogenized sample for chemical composition of mutton. Cu-G supplementation had no significant (P>0.05) influence on the chemical composition of mutton from WAD sheep fed the experimental diet except the copper content of the meet sample. The copper content (3.00 – 5.00 x 10-3mg/kg) of the meat sample varied significantly across the dietary treatment in which mutton obtained from WAD sheep fed 10 mg/kg Cu-G supplementation recorded the highest copper content (5.00 x 10-3mg/kg). It can be concluded that Cu-G supplementation up to 10 mg/kg in the diet of WAD sheep enhanced tissue copper.
Key words: Copper deficiency, Mutton, Chelate, Proximate Analysis, Microelements, Supplement

INTRODUCTION

Sheep are ruminant animals, and their rearing is one of the most important sources of income and food security for the majority of rural populations, particularly in developing nations (Birteeb *et al.,* 2012). Sheep are considered the second most significant livestock species in Nigeria, accounting for 24% of the country's meat supply. The demand for sheep meat is very high especially in rural areas where it often commands higher market price than beef (Odeyinka, 2000). Sheep are the most sensitive among farm animals to excess copper, and as highlighted by Suttle (2010), a dietary level of 12-36 mg/kg of Cu may cause chronic copper toxicity. Copper (Cu) is one of the microelements used in combination with amino acids. It is an essential component of several enzymes called cupro-enzymes. Feed grade chelates based on glycine seem to be a good solution to supplement microelement deficiency in feed rations. Glycine, as a chelate component, is the most easily assimilable amino acid, which, with its wide range of applications, additionally improves the values of this additive (Kwiecień *et al.,* 2014). Cu plays functional roles in bone metabolism and turnover. It is known to be essential for normal growth and development of the skeleton in humans and in animals (Rodríguez *et al.,* 2002). Copper deficiency reduces feed intake, growth and immunity, making animals more susceptible to diseases, while also leading to loss of metabolic enzymes (Dorton *et al*., 2006).The important role of Cu in nutrition is well documented. Some deficiency symptoms have been identify, however excessive amounts have also been associated with deleterious effects. Hence, this necessitated the need to evaluate the efficacy of Cu on the chemical composition of meat from WAD sheep in this study.

Material and Methods

Experimental site and duration: The experiment was conducted at the Teaching and Research Farm, Federal College of Animal Health and Production Technology, Moor Plantation, Apata, Ibadan. The experiment lasted for 90 days, the temperature and relative humidity ranges from 35°C-40°C and 76-78% respectively.

Experimental animals, diet and design: A total number of sixteen (16) West African dwarf (WAD) sheep were purchased from Akinyele market in Ibadan, Oyo state. Prior to the arrival of the animals, the pens were thoroughly washed and disinfected with morigad purposely to prevent the growth of micro-organisms. They were confined in individual pen and quarantined for a period of four (4) weeks prior to the onset of the study. Fresh cool clean water and feed were made available *ad libitum.* The sheep were vaccinated against *Peste des petits* ruminant (PPR) and given prophylactic treatments.

After adaptation period, the sixteen animals were balanced as closely as possible for body weight and allotted into four dietary treatments, during which they were fed with the experimental diet and basal ration (*Pennisetum purpureum*). Copper glycine (Cu-G) was purchased from Alli-tech incorporation limited. It was incorporated at varying levels of 0, 5, 10 and 15 mg/kg respectively with other ingredients to formulate four experimental diets as shown in Table 1. Starch and molasses were introduced into their feed at ratio of 1:2 purposely to formulate 6 mm pelletized feed. Starch served as binder while molasses was used as sweetener.

Table1: Gross and Chemical Composition of the experimental diet

Ingredients	%
Maize bran	48.00
Corn cob	5.50
Wheat offal	34.00
Groundnut cake	5.00
Premix (Cu free)	0.50
Limestone	3.00
Common salt	1.00
Starch/molasses	3.00
Total	**100.00**

T1= Basal diet, T_2 = Basal diet +5% Cu-G, T_3 = Basal diet + 10% Cu-G, T_4 = Basal diet + 15% Cu-G

Table 2: Chemical Composition of the experimental diet and *Panicum maximum*

Parameters	Cu-G supplementation (mg/Kg)				
	0	5	10	15	PM
Dry matter	75.93	74.09	72.59	74.17	75.05
Crude Protein	12.55	12.63	12.63	11.02	13.35
Ether extract	3.19	2.99	2.55	3.02	0.40
Ash	27.43	25.48	16.28	29.19	12.67
NFE	37.51	47.40	45.67	39.61	31.33
Acid Detergent Fibre	5.14	5.81	3.95	3.95	9.94
Acid Detergent Lignin	1.81	1.82	1.09	16.18	4.76
Neutral Detergent Fibre	16.18	16.02	14.59	11.83	34.69
Cellulose	3.33	4.49	2.86	2.89	5.18
Hemicellulose	11.04	10.21	10.64	7.90	24.75

Data Collection

At the end of the experiment, three (3) WAD sheep per treatment were randomly selected, starved for 16 hours to lower the gut content, but were given access to clean cool water prior to slaughtering. Meat samples were obtained from various parts of the animals to determine the chemical composition of mutton.

Chemical Analysis

Chemical composition of sample of meat from sheep processed under boneless meat cut were taken from different part of the carcass such as loin, rack, rump, neck, flank, etc and homogenized The composites were used to determine the proximate composition of the mutton fed the different experimental diet in the laboratory. Total moisture content/dry matter was measured by determining the difference in the sample weight before and after drying in an oven. Dry matter, crude protein, ash and ether extract were determined according to the methods described by AOAC,(2000).

The following mineral content were determined; Cu, Fe, Zn, and Ca using the AAS flame technique in a unicam 939 (AA spectrometer unicam) apparatus after ashing at 550ºC other minerals were determined according to the standard method of (AOAC 2000)

Statistical Analysis: All data obtained were subjected to analysis of variance using statistical package of SAS (2005). The means among the variables were separated using Duncan Multiple Range Test of the same statistical package

Results

Presented in Table 2 is the influence of copper glycine (Cu-G) supplementation on chemical composition of meat of West African Dwarf (WAD) sheep. Cu-G supplementation did not significantly (P>0.05) influence the chemical composition of meat from WAD sheep fed experimental diet except the Copper content of the meat. Copper values (3.00 – 5.00 x 10^{-3}mg/kg) obtained in this study varied significantly across the dietary treatments as Cu-G supplementation increased. Sheep fed 10 mg/kg Cu-G supplementation recorded the highest Cu values (5 x 10^{-3}mg/kg) while the lowest Cu value was obtained in sheep on 15 mg/kg Cu-G supplementation group (3.00 x 10^{-3}mg/kg). The dry matter, crude protein, ash, ether extract, nitrogen and zinc values obtained in this study ranged from 23.33 – 25.39%, 63.50-70.55%, 2.75 -3.40%, 21.54-26.52%, 10.16 - 11.29%, 2.35 – 2.63% and 0.22-0.26% respectively.

Table 3: Influence of copper glycine supplementation on chemical composition of mutton from West African dwarf sheep

Parameters	Inclusion level of copper glycine (mg/kg)				
	0	5	10	15	SEM
Proximate					
Dry matter	24.82	23.33	25.11	25.39	0.63
Crude Protein	68.47	70.55	70.18	63.50	1.51
Ash	2.75	2.75	3.40	2.88	0.14
Ether extract	23.30	21.54	21.61	26.52	1.28
Minerals					
Nitrogen	10.96	11.29	11.23	10.16	0.24
Sulphur	2.63	2.35	2.50	2.55	0.66
Iron	0.24	0.21	0.21	0.19	0.02
Zinc	0.24	0.22	0.26	0.25	0.01
Copper (x10^{-3}mg/kg)	4.50^{ab}	3.50^{bc}	5.00^{a}	3.00^{c}	0.33

^{a,b}Means along the same row with different superscripts are significantly different (P<0.05)

DISCUSSION

Copper is being added to ruminant animal's diet in order to overcome Cu deficiency and other significant diseases attributed to Cu deficiency. Copper is commonly added to ruminant diets not only to overcome copper deficiency even when no signs of diseases are present in livestock (Suttle, 1991). Non-significant difference observed on the proximate analysis of mutton fed dietary Cu-G supplementation was similar to the findings of Winiarska-Mieczan and Kwiecier (2015) who reported that Cu-G supplementation had no influence of proximate values of broiler chickens. The increased copper deposition in the tissue of WAD sheep fed that contain up to 10mg/kg Cu-G supplementation could be attributed to the high bio-availability of Cu supplemented in the diet coupled with its high bio-availability.

CONCLUSION

It can be concluded that Cu-G supplementation up to 10 mg/kg in the dietary treatment of WAD sheep improved the copper deposition in the tissue of the animal.

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