Trop. J. Anim. Sci. 1(1):141 - 146 (1999)
ISSN : 1119-4308

EFFECT OF COPPER SULPHATE SUPPLEMENTATION ON RABBIT PERFORMANCE UNDER NIGERIAN CONDITIONS

W. O BIOBAKU, S. K. AKINSANMI AND O. A. SODIMU[1]
Department of Animal Production and Health
University of Agriculture
P. M. B. 2240
Abeokuta/Nigeria

Target audience: Animal nutritionists, livestock farmers and research scientists.

ABSTRACT

The effect of supplementation of varied levels of copper sulphate ($CuSO_4$) on the performance of rabbits was studied. The levels of $CuSO_4$ supplement used were 0, 0.10, 0.20 and 0.40 %, respectively. The inclusion of $CuSO_4$ at different levels in the rabbit diets improved growth rate (6.44 - 21.92 %), feed intake (4.40 - 10.68 %) and feed efficiency (4.00 - 12.00 %) as compared to the control diet. The carcass weights and dressing percentage were also higher ($P < 0.05$) in 0.20 % $CuSO_4$ diets than in the other diets. The residual levels of copper in the liver and heart increased significantly ($P < 0.05$) as the copper sulphate content of the diets increased.

Key words : Rabbits; dietary copper sulphate; performance; carcass.

DESCRIPTION OF PROBLEM

Nigeria, like many other developing countries, faces a dietary protein shortage. To alleviate the problem of protein malnutrition, which is normally caused by the high cost of meat, rabbit production in Nigeria over the past 10 years has been intensified. In many parts of Nigeria, the keeping of large animals for meat production is becoming more difficult because of the quantity of feed consumed, the space requirement for rearing these animals, the length of time they require to mature, theeir low production cycle, diseases and, most importantly, the problem of storage of large quantities of meat at any one time. Rabbit, being one meal size, avoids the need for storage, requires small slace to rear, has a short gestation period, can reach slaughter age within a short period with low mortality rate and its meat consumption is not restricted by any taboos or beliefs. These benefits give rabbits many advantages as sources of the much needed animal protein over other animals.

[1]College of Animal Science and Livestock Production Farm, University of Agriculture, P. M. B. 2240, Abeokuta/Nigeria.

Sources of minerals for livestock include natural feed, soil and ora. supplementation. Increased fertility level has been observed in grazing cattle with mineral supplementation. Copper sulphate is a supplementary source of copper in the diet of animals. Copper is needed by pigs and rabbits to prevent microcytic hypochromic anaemia, dermatosis and bone marrow problems and to maintain the integrity of the cardiovascular system. It has been reported that supplemental copper may have a growth stimulating effect on growing rabbits (1, 2).

The symptoms of copper deficiency in rabbits include reduction in growth, lowered haemoglobin, lowered haematocrit, achromotrichia, alopecia and dermatosis. The toxic level of copper in the rabbit is not known. However, some studies (2, 3) indicate that the thinning of the caecum and the wall of the small intestine is usually associated with a high level of copper in rabbits which may facilitate absorption of nutrients into the body.

The objective of this study was to evaluate the effect of copper sulphate supplementation on the performance of rabbits.

MATERIALS AND METHODS

Sixty four New Zealand White five-week-old rabbits weighing 400 - 460 g, obtained from the University Teaching and Research farm, were randomly divided into four groups of 16 animals, with an average weight of 420 g for eacg group. The animals in each group were further sub-divided into two sub-groups of eight animals. All rabbits were housed two/cage.

Four rations, consisting of a basal rabbit diet (0 % copper sulphate, $CuSO_4$) and three experimental diets containng $CuSO_4$ (0.10, 0.20 and 0.40 %) as shown in Table 1, were given to the four groups of animals with water provided *ad libitum* . The chemical composition of these diets is shown in Table 2. The trial was conducted for eight weeks.

Weekly body weight gain, feed intake and feed efficiency were recorded during the eight weeks. Random samples of the rabbits were slaughtered and the liver, kidney, heart and caecum were removed, blotted on filter paper and then weighed. Total copper content of the organs were determined using the atomic absorption spectrophotometer while the chemical composition of the diets was analysed (4).

Performance records of the animals were subjected to one way analysis of variance (5) and the method of least significant difference (LSD) was used to determine significant differences between means.

RESULTS AND DISCUSSION

Although copper is classified as a trace element, it is one of the most important mineral elements required by all classes of livstock, including

rabbits. All feedstuffs contain certain amount of copper but the quantity may be too low to meet the body requirement of rabbits and therefore need to be supplemented. Copper deficiency is rare in pigs and rabbits fed on balanced diets (6) but inadaequate copper intake may arise under certain dietary conditions and copper is needed by the rabbit to perform several metabolic functions.

Table 1: Percentage Composition of Experimental Diets

	Dietary level of $CuSO_4$			
Components	0%	0.10%	0.2%	0.4%
Yellow corn	50.60	50.50	50.40	50.20
Soyabean meal	12.00	12.00	12.00	12.00
Blood meal	2.00	2.00	2.00	2.00
Fish meal	1.50	1.50	1.50	1.50
Wheat offals	30.00	30.00	30.00	30.00
Oyster shell	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00
Methionine	0.40	0.40	0.40	0.40
$CuSO_4$ [a]Vit/[b]Min	0.10	0.20	0.40	0.00
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated Analyses				
M.E.(KJ/gm)	10.65	10.63	10.61	10.58
Crude protein(%)	18.70	18.70	18.70	18.70
Crude fibre(%)	18.89	18.86	18.84	18.82
Calcium(%)	1.20	1.20	1.20	1.20
Available Phosphorus(%)	0.34	0.34	0.34	0.34
Methionine(%)	0.26	0.26	0.26	0.26
Lysine(%)	0.82	0.82	0.82	0.82

[a]Vitamin Mix contained (g/kg diet): Thiamine (0.02), riboflavin (0.033), pyridoxine (0.10), vitamin B12 (0.00003), niacin (0.10), calcium pentothenate (0.10), Paminobenzoic acid (0.10), vitamine. A.acetate (0.04), ergo calciferol (0.04) and choline Hcl (2.00).

[b]Mineral mix contained (g/kg diet): $CaCo_3$(15.258), $Cocl_2$. 6H20 (0.001), $CuSo_4$ .5H20(0.019), $Feso_4$.H20(1.078), $Mgso_4$ (2.292), $Mnso_4$.2H20 (0.178), KI (0.032), K_2PO_4(15.559).

The performance of rabbits fed the different experimental diets was not significantly different in the final body weight (Table 3). The rabbits fed 0.20 % $CuSO_4$ diet had the greatest body weight gain, which was significantly higher ($P < 0.05$) than those of rabbits fed 0 and 0.10 % $CuSO_4$ diets. Average daily gain increased with increase in $CuSO_4$ supplementation. The significantly ($P < 0.05$) higher growth rate observed in the rabbits fed 0.20 % $CuSO_4$ diet was expected and is in agreement with the findings of Butcher et al. (7). Table 3 also shows that the animals on 0.20 % $CuSO_4$ diet utilised the feed consumed more efficiently, with one kg of feed producing 0.25 kg increase in body weight. This agrees with the findings of Omole (3) which reported that rabbits utilised their feed more efficiently and grow very rapidly when 200 ppm of copper was incorporated in their diets.

Table 3: Effect of Diets on Growth Performance Rabbits

Performance Parameters	Dietary level of $CuSO_4$* 0%	0.1%	0.2%	0.4%	SEM**
Number of Rabbits	16	16	16	16	
Initial Body Wt (g)	420.20	420.20	420.20	420.20	10.40
Final Body Wt (g)	1024.43^b	1104.22^b	1194.01^a	1144.04^a	32.28
Daily Weight gain (g/day)	10.79^b	12.21^b	13.82^a	12.93	1.46
Daily Feed intake (g/day)	49.03^c	50.88^b	54.89^a	52.46^b	3.36
Feed/Gain	4.54^b	4;17^a	3.97^a	4.06^a	
Feed Efficiency	0.22	0.24	0.25	0.25	0.056
Carcass Weight (g)	614.45^c	663.02^b	775.74^a	684.46^b	14.64
Dressing Percentage	59.98^b	60.04^b	64.95^a	62.48^a	4.68

** Standard error of mean, values are the means of Sixteen analyses.

* Means along the same row with diferent superscipts are significantly different ($P<0.05$)

Table 2: Chemical Composition of the Experimental Diets on Dry Matter Basis.

Chemical Composition (%)	Dietary level of CuSO4 0%	0.1%	0.2%	0.4%
Moisture	9.44	9.39	9.40	9.42
Crude Protein	21.00	21.06	21.04	21.00
Ether Extract	3.70	3.68	3.70	3.72
Crude Fibre	16.89	16.84	16.85	16.92
Nitrogen-free Extract	41.66	41.64	41.57	41.56
Ash	7.31	7.39	7.44	7.40
MINERALS				
Potassium (%)	0.140	0.144	0.148	0.142
Sodium (%)	0.034	0.036	0.038	0.036
Phosphorus (%)	0.138	0.142	0.146	0.148
Magnesium (%)	0.036	0.042	0.052	0.054
Calcium (%)	0.516	0.524	0.536	0.532
Zinc (ppm)	268	268	258	260
Manganese (ppm)	272	268	264	272
Iron (ppm)	130	134	138	136

Post-mortem treatment measurements in Table 3 show that the carcass yield was significantly influenced by supplemented $CuSO_4$ in consonance with an earlier finding (3). The organ weights expressed as percentage of body weight were however not influenced by the addition of graded levels of $CuSO_4$ to rabbit diets (Table 4). The table alsi shows the residual copper levels in the various organs of the animals in each treatment. The liver and heart contained more copper than the other organs but not at the levels that were toxic to the animal.

Table 4: Copper Content of Organs of Rabbits Fed Different Experimental Diets

ORGANS	Dietary level of $CuSO_4$			
	0%	0.1%	02%	04%
LIVER				
Wet Weight (g)	32.70±0.010	35.03+0.021	35.68+0.015	35.42+0.001
Dry Weight				
(% of body Wt)	0.88±0.001	0.81+0.001	0.77+0.001	0.88+0.001
Cu Content (ppm)	2.28	12.50	17.00	15.40
KIDNEY				
Wet Weight (g)	5.11±0.001	5.63±0.002	6.03+0.002	5.84+0.002
Dry Weight				
(% of body Wt)	0.11+0.001	0.12+0.001	0.08+0.001	0.10+0.001
Cu content (pmm)	0.82	3.00	5.20	4.64
HEART				
Wet Weight (g)	3.05+0.001	2.20+ 0.001	3.02+0.01	2.84+0.001
Dry Weight (g)				
(% of bodyWt)	0.08±0.010	0.05+0.00	0.06+0.001	0.05+0.001
Cu content (pmm)	0.09	0.32	0.32	0.32
CAECUM				
Wet Weight (g)	6.00±0.200	7.00±0.050	7.64±0.120	7.34±0.042
Dry Weight				
(% of body Wt)	0.16±0.090	0.14+0.002	0.13+0.001	0.13+0.001
Cu content (pmm)	0.08	0.12	0.15	0.14

CONCLUSION AND APPLICATION

1. The results from this study on utilisation of $CuSO_4$ by rabbits suggest that rabbit performances can be substantially promoted using different levels of $CuSO_4$ as supplements in rabbit diets, with optimum growth level obtained at 0.2 % $CuSO_4$ supplementation.
2. It can also be suggested that rabbit meat can get to the table fast and thereby supplement the low animal protein intake by Nigerians.
3. The use of $CuSO_4$ in supplementing rabbit feed may reduce the cost of meat to consumers.
4. It can therefore be suggested that $CuSO_4$ can be safely incorporated into rabbit diet up to 0.2 % level with no adverse effect on the health of the animal.

REFERENCES

1. Kind, J. O. L., 1975. The feeding of copper sulphate to growing fowls. Brit. Poult. Sci. 13: 61 - 65.
2. Omole, T. A., 1976. The effects of graded levels of copper in the diets of growing rabbits on their performance characteristics and carcass and organ measurement. Nig. J. Anim. Prod. 3(2): 93 - 95.
3. Omole, T. A., 1979. Copper in the nutrition of pigs and rabbits: A review. Livest. Prod. Sci. 7: 253 - 268.
4. A. O. A. C., 1970. Official methods of analysis (12th ed), Association of Official Analytical Chemists, Washington.
5. Snedecor, G. R. and W. L. Cochran, 1967. Statistical methods. The Iowa State University Press.
6. Omole, T. A., 1980. The use of leaf protein concentrate as rabbits feed. Nutr. Report Int. 21 (4): 587 - 593.
7. Butcher, C., M. J. Bryant, D. H. Machin, E. Owen and J. E. Oweri, 1981. The effect of metabolizable energy concentration on performance and digestibilty in growing rabbits. Trop. Anim. Prod. 6: 93 - 100.