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RESEARCH ARTICLE

FERTILITY OF PUBERTAL BOARS FED DIETARY COPPER

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ABSTRACT

Thirty-two male large white weanling pigs of 8-9 weeks of age averaging 7.49 ± 0.36kg were used to evaluate the effect of dietary copper on fertility of pubertal boars. The animals were randomly assigned in a Completely Randomized Design to 4 diets containing 0.2, 100, 200 and 300ppm Cu/kg. The control, diets 1, 2 and 3 respectively, in a 6-month feeding trial such that each treatment had 8 animals. The feeding trial was divided into 3 physiological phases [weanling (starter), pre-pubertal (grower) and pubertal (finisher)]. At the end of the feeding trial, 4 boars selected at random from each treatment, were each mated to 2 gilts (i.e. 1 boar to 2 gilts) following the gilts' synchronization to determine the fertility rate of the boars. The mated gilts were sacrificed at the end of the 1st trimester and their uteri cut open longitudinally to check for conception, count the number of embryos therein and the embryo survival rate determined. The results showed significant (P>0.05) difference on all fertility parameters assessed except the foetal crown rump length and the conception rate which was 75% for diet 3 and 100% for other diets. The study revealed that male weanling pigs for breeding could be fed dietary copper of between 100-300ppm for better reproductive performance.

INTRODUCTION

The use of copper as trace nutrient in agriculture was not recognised until 1920s, before then copper was believed to be used for medicinal purpose only (Berger, 1993). Evidence that copper is a dietary essential was however obtained in 1924 as reviewed by McDonald et al. (2002), when an experiment with rat showed that copper was necessary for haemoglobin formation. The majority of agricultural research on copper as growth promoter involved field demonstration with the use of small amounts of copper supplement to livestock especially pigs (Jondreville et al., 2002). The copper application reported are inclusion in drinking water, mixed with feed ingredient during the milling process (Adu and Egbunike, 2005) or administered by intravenous injection (Zhou et al., 1994b). Research have reported physiological responses as good bone formation, normal blood cell formation, normal myelination of brain cell and spinal cord while its deficiency is known to cause anaemia, diarrhoea, bone disorder, impaired glucose and lipid metabolism and a low immune system (Davis and Mertz,1987). The growth promoting ability, as well as, higher feed intake, better feed efficiency and feed conversion ratio of copper in animal have been well documented especially in the west (Cromwell et al., 1989; Skrivan et al., 2002) while little has been done on the influence of dietary copper on fertility in the tropics.

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The purpose of this study was to find out the effect of long-term feeding of dietary copper on the fertility of growing rabbits in the tropics.

MATERIALS AND METHODS

Collection of Pigs

Thirty-two clinically normal male Large White weaned piglets of about 8-9 weeks of age averaging 7.49 ± 0.36kg were sourced from the Piggery Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. The animals were housed individually in concrete-floor indoor pens, and were randomly assigned into one of the four diets (eight per treatment) after a 2-week physiological adjustment period.

Feeding trial

The feeding trial, which was conducted at the Animal Physiology Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria (7°20'N, 3°50'E, 200m above sea level with an average daytime temperature of 24-25°C and relative humidity 80-85%) during the early dry season, lasted 6 months. The feeding was divided into 3 physiological phases [weanling (starter), pre-pubertal (grower) and pubertal (finisher)].

Determination of Fertility Rate of the Boars

To determine the fertility rate of the pubertal boars fed varied dietary copper, 4 boars selected at random from each treatment, were each mated to 2 gilts (i.e. 1 boar to 2 gilts) following the gilts' synchronization with PG–600® (Intervet America Inc.). At the end of the 1st trimester, the

mated gilts were sacrificed and their uteri cut open longitudinally to check for conception, count the embryos therein and measure the crown-rump lengths as well as the weights of the embryos. The embryo survival rate was determined as described by Egbunike (1979).

Statistical Analysis

The design used for this experiment is Complete Randomization Design (CRD). All the data obtained were subjected to statistical analysis using the general linear model (SAS, 1999) and the treatment means compared using the Duncan's option of the same software.

RESULTS

The physiological phases of feeding are compositions of the diets fed ad libitum for 6, 10 and 8 weeks during the weanling, pre-pubertal and pubertal phases, respectively are shown in Table 1. The results of the effect of varied levels of dietary copper on fertility of pubertal boars are shown in Table 2. The results showed no significant ($p>0.05$) influence on all the fertility parameters determined except for the litter size and embryo weight and embryo survival rate. The gestation length which ranged between 113.50-115.25 days for all treatments was within the 114-116 days for normal swine.

DISCUSSION

In this study, the diets satisfied the nutrient requirements of the animals at the various physiological phases as recommended by National Research Council (NRC, 1998). The varied levels of dietary copper did positively influence the conception rate, embryo survival rate but did not influence foetal crown rump length. The litter size, embryo weight and size were significantly higher with increased dietary copper and this agreed with the work of Ahmed et al. (1997) who reported improved litter size and embryo weight at birth in rabbits fed dietary copper at 60 and 120ppm. Flowers (1997) reported the boars that consistently produce semen with 80% and above motile spermatozoa may be responsible for higher farrowing rates and litter size. From this study the motile spermatozoa of the animals on diets 2, 3 and 4 were 15.29, 15.61 and 15.81 $x10^9$ respectively against $13.21x10^9$ for the control which accounted for 84.42, 82.01 and 80.49% of the control and this may be the reason for the higher farrowing rate and litter size in the copper fortified diets.

The result of this study which showed significant differences in the litter size and embryo weight

Table 1. Gross composition (%) of the test diets for the various physiological phases

Ingredient (%)	Weanling	Pre-pubertal	Pubertal
Maize	58.90	51.30	32.10
Groundnut cake	27.50	12.50	3.50
Wheat offal	10.00	31.10	41.80
Palm Kernel Cake	-	-	20.00
Lysine	0.15	0.15	0.15
Methionine	0.05	0.05	0.05
Bone meal	2.00	1.75	0.25
Oyster shell	0.75	0.50	1.50
Vitamin Premix	0.20	0.20	0.20
Salt	0.45	0.45	0.45
Fish meal	-	2.00	-
Total	100.00	100.00	100.00
Analysed Nutrient			
Crude Fibre (%)	6.35	7.20	10.83
Crude Protein (%)	20.20	17.20	15.20
DE* (Kcal/Kg)	3360	3110	2906

**Digestible Energy*

Table 2: Fertility of pubertal boars fed varied levels of dietary copper

Parameters	Diet 1 Control	Diet 2 100ppm	Diet 3 200ppm	Diet 4 300ppm	±SEM
Conception rate (%)	100.00	100.00	75.00^b	100.00	**0.56**
Embryo number (litter size)	5.74^d	7.06^c	7.98^a	7.21^b	**0.96**
Embryo survival rate (%)	50.89^d	59.78^c	66.72^a	60.59^b	**1.34**
Embryo weight (g)	5.62^b	7.64^a	7.69^a	7.67^a	**0.37**
Foetal crown-rump length (cm)	7.48	7.54	7.58	7.61	**0.18**
Gestation period/length (days)	113.75	133.50	114.00	115.25	**0.55**
Litter weight	0.98	1.08	0.96	1.06	**0.40**

abcd: Means on same row with different superscripts differ significantly ($P<0.05$).±SEM : Standard Error of Mean

correspond with Fascetti et al. (1998) who reported an increased litter size and weight in cats fed dietary copper at 10mg/kg compared to the control. This, however, is in contrast with the report of Brinster and Cross (1972) that weekly body weights and implantation data (corpora lutea, implantation sites and implantation loss) were not significantly influenced in gravid Swiss mouse dosed orally with 0,10 and 30mg CG/Kg BW per day from days 6 to 14 of gestation at any level of copper tested. They further observed that the numbers of foetuses/litter as well as foetal viability and resorption sites in treated groups were not significantly different from controls, and that the average weight and length of foetuses were comparable among all groups. De la Iglesia (1973) reported that diets cotaining copper gluconate did not affect the fertility potential of either male or female rats fed 0, 3 or 30mg copper gluconate (CG)/Kg BW per day but the result of this study is contrary as all fertility parameters studied (litter size, embryo weight and size) were influenced by dietary copper.

CONCLUSION

The results showed that dietary copper positively affect all fertility parameters assessed except the foetal crown rump length and the conception rate. The study revealed that male weanling pigs for breeding could be fed dietary copper of between 100-300ppm for better reproductive performance.

REFERENCE

Adu, O.A and Egbunike, G.N. 2005. Spermatogenesis and Daily Sperm Production of rabbits fed diets with different levels of Copper Sulphate. Journal of Agriculture, Forestry and Social Sciences. 32: 126-131

Ahmed, H., Syah, D., ter Merulen, U and Hermis, I.1997. Effect of using copper sulphate as a feed additive on the productivity performance in growing rabbits. Tropentag Hohenheim. 177-180.

Berger, L. L. 1993. Effective copper nutrition for farm animals. Salt Institute. University of Illinois,USA.

Brinster, R.L and Cross, P.C. 1972. Effect of copper on the preimplantation mouse embryo. Nature. 238: 398-399.

Cromwell, G.L; Stahly, T.S and Monegue, H, J. 1989. Effects of source and level of copper on performance and liver copper stores in weanling pigs. Journal of Animal Science 67:2996–3002.

Davis, G.K and Mertz, W. 1987. Copper In. Trace elements in human and animal nutrition– 5th Edition, vol. 1.Ed.W. Mertz, Beltsville Human nutrition centre, Beltsville, Maryland. Academic press, Inc; 301-364.

De la Iglesia, F.A. 1973. Fertility study of W10219A (copper gluconate) in male and female albino Wistar rats. Res. Rept. No. 250-0061. Warner-Lambert Res. Inst; Sheridan, Ontario.

Egbunike, G.N. 1979. Development of puberty in Large White boars in a humid tropical environment. Acta.104, 400-405.

Fascetti, A.J., Morris, J.G and Rogers, Q.R. 1998. Dietary copper influences reproductive efficiency of queens. J. Nutr. 128, 2590S-2592S.

Flowers, W.L. 1997. Management of boars for efficient semen production. J. Reprod. Fert. Suppl. 52, 67-78.

Jondreville, C. Rery, R.S and Dourmad, J. Y. 2002. Le cuirre dans lalimentation du Porc. Oligoelement essental, facteur de croissance et risque potential pour l'homme et l'homme et l'environment. INRA, Prod. Anim.15, in press.

NRC. 1998. Nutrient requirement of swine.10th ed.Natl.Acad.Press, Washington, DC.

SAS Institute Inc., 1999. SAS/STAT User's Guide. Version 8 for Windows.SAS Institute Inc; SAS Campus Drive. Carry, North Carolina, U.S.A.

Skrivan, M; Skrivanova, V; Marounek, M; Tamova, E and Wolf, J. 2002. Influence of dietary fat source and copper supplementation on broiler performance, fatty acid profile of meat and depot fat and on cholesterol content in meat. *Brit. Poultry Sci*. 41: 608-614.

Zhou, W; Kornegay, E.T; Lindemann, M.D, Swinkels, J.W; Welten M.K and Wong, E.A. 1994b. Stimulation of growth by intravenous injection of copper in weanling pigs. Journal of Animal Science 72: 2395-2403.

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