SEMEN INDICES AND SEMINAL ZINC CONCENTRATION OF MALE RABBITS FED DIETS SUPPLEMENTED WITH ZINC

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ABSTRACT
An experiment was carried out to assess the effect of dietary levels of zinc on semen indices and seminal zinc concentration of rabbit bucks. Twenty male rabbits aged 6 months old were randomly allocated to four groups and fed diets containing 0, 50, 100 and 150 mg of zinc gluconate per kg diet respectively for eight (8) weeks with five bucks per group. Semen was collected from the bucks weekly using an artificial vagina. Samples of fresh semen were assessed for semen volume (ml), spermatozoa motility (%) and sperm concentration ($x10^8$/ml). The number of spermatozoa per ejaculate ($x10^8$) was also calculated. Seminal plasma was separated from the semen by centrifugation and seminal zinc concentration was determined using atomic absorption spectrophotometry. Data obtained were subjected to statistical analysis. The result showed that all semen parameters assessed were not significantly influenced by zinc levels fed to the bucks. Seminal zinc concentration was higher in bucks administered dietary zinc levels ($Z_{50,}$ Z_{100} and Z_{150}) compared to those on the control (Z_0). Bucks fed 100mg/kg diet had the highest seminal zinc concentration while the least was recorded in bucks on the control. It was concluded that dietary level of zinc gluconate as observed in this study may not enhance semen quality of rabbit bucks. However, supplemental levels of zinc gluconate may result in increased seminal zinc concentration in rabbit bucks.
Keywords: Zinc gluconate, Male reproduction, Seminal plasma

INTRODUCTION
Poor semen production is a factor that hinders efficient reproductive performance in males. In the tropics, male rabbits are used for breeding purposes from about 6 months of age and expected to produce semen consistently from this age. This is not so in many tropical breeds and their crosses; as their performance is influenced by several factors among which diet play a significant role. Diets low in micronutrients contributes to inefficient spermatogenesis as they are essential for growth and development. Microelements are often provided to animals in diets as a component of the premix added and supplemented in diet or water as necessary. Certain microelements may be present in sufficient quantities in feed but their deficiency symptoms may still be observed in the animals due to their varying bioavailability or forms that cannot be utilized in the body (Wang *et al*., 2010). Salts of minerals are often used in oxides, carbonates, chlorides, and sulphates forms and the use of chelate forms is on the increase (Wang *et al*., 2010, Chrastinova *et al*., 2015). Zinc gluconate is a chelated form of dietary zinc and it has been used extensively in human. Zn is vital for growth and development, sexual maturation and reproduction, dark vision adaptation, olfactory and gustatory activity, insulin storage and release and for a variety of host immune defenses (Biswajit *et al*., 2013). The presence of Zn in the proper concentration in the diet of the animals is of immense importance not only for the well-being of the animals but also for optimizing the overall performance of the animals and to enhance their production potential (Shinde *et al*., 2006). Improvement in the sperm production and fertility has been achieved following the supplementary feeding of Zn (Biswajit *et al*., 2013). Zinc functions as a cofactor of numerous enzymes and is involved in cell division processes; higher levels are required for reproduction and fur production than for maintenance and meat production (Halls, 2010). The zinc requirements for rabbits vary from 25 to 60 mg/kg diet (Mateos *et al*., 2010).

Oliveira *et al*. (2004) affirmed that the inclusion of zinc in the diet of breeding animals can influence spermatozoa concentration. Zinc is essential for the development of sex organs and spermatogenesis in the males. In order to select bucks on the basis of high fertility for breeding purpose, there is need to assess their semen quality especially at the age they are termed matured and supplement for zinc where necessary. Hence, this study aimed at evaluating semen characteristics and seminal zinc concentration of rabbit bucks fed supplemental levels of zinc in chelated form (zinc gluconate).

MATERIALS AND METHODS

A total of twenty (20) bucks aged 6 months with an average weight of 1.88kg were used for this experiment. The study was conducted at the rabbitry unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria. Rabbits were housed individually in cages and fed same diet for two weeks for acclimatization. They were randomly allotted into 4 groups of 5 bucks per group and fed the experimental diet containing 0, 50, 100 and 150 mg zinc gluconate per kg diet for 8 weeks. The groups were designated as Z_0, Z_{50}, Z_{100} and Z_{150} respectively. The experimental diet was presented in a pelletized form and clean water was supply daily. The experimental diet contained 16.13% crude protein, 2396.6kcal/kg digestible energy and 10.38% crude fibre. Semen was collected from the bucks weekly using an artificial vagina. Samples of semen were assessed for semen volume, spermatozoa motility and sperm concentration. The number of spermatozoa per ejaculate was calculated as the product of semen volume and spermatozoa concentration. Seminal plasma was separated from the semen by centrifugation at 4000 rpm for 15 minutes and assessed for seminal zinc concentration using atomic absorption spectrophotometry. Data obtained were subjected to statistical analysis of variance procedure using Statistical Analytical System (SAS, 2009). Treatment means were compared using Duncan Multiple Range Test of the same software.

RESULTS AND DISCUSSION

Improvement in the sperm production and fertility has been achieved following the supplementary feeding of Zn (Biswajit *et al*., 2013). Table 1 shows the result on semen indices of rabbit bucks fed dietary levels of zinc. All the semen parameters assessed were not significantly influenced by supplemental levels of zinc fed to the bucks. The values obtained for the semen indices assessed are semen volume (1.38 – 1.69 ml), spermatozoa motility (80.31 - 89.88 %) and sperm concentration (3.78 – 5.05 $x10^8$/ml). This study therefore showed that dietary supplementation of chelated form of zinc as zinc gluconate may not improve semen production in male rabbits. The result from this study corroborates the report of Chrastinova *et al*. (2015) who observed a weak influence of Glycinoplex-Zn in young rabbit's performance. Egwurugwu *et al*. (2013) reported a significant effect of oral zinc administration on sex hormones and sperm quality in wistar rats. However, findings from this study is at variance with that of Moce *et al*. (2003) who reported a significantly higher total sperm production in adult male rabbit administered 100mg/kg dietary levels of zinc sulphate. Ogbu and Herbert (2018) reported a significant decrease in follicle stimulating hormone and interstitial cell stimulating hormone when dietary levels of zinc gluconate was fed to two (2) months old rabbits. Based on the relationship between reproductive hormones and semen production, it implies that supplementing rabbit diet with zinc gluconate within this age range (2 – 6 months old) may not result in improve semen production. The result on seminal zinc concentration (mg/l) is presented in figure 1. The values obtained was significantly higher in bucks fed Z_{100} (1.09) and Z_{150} (0.95) than those fed the control diet Z_o (0.33) however the values were not significantly different from that of bucks fed Z_{50} (0.61). The increase in seminal plasma concentration of zinc shows that dietary levels of zinc influenced the activity of the accessory sex gland (prostate gland). This may help to enhance prostate health as Bentley and Grubb (1991) reported that apart from red and white blood cells; zinc is also stored in the prostate gland.

Table 1: Semen Indices of Rabbit Bucks Fed Supplemental Levels of Zinc

SEMEN INDICES	Z_0	Z_{50}	Z_{100}	Z_{150}	±SEM
Semen Volume (ml)	1.67	1.69	1.38	1.50	0.09
Spermatozoa Motility (%)	89.88	84.70	80.31	87.20	2.00
Sperm Concentration ($x10^8$/ml)	4.07	3.78	5.05	4.08	0.31
Number of spermatozoa /ejaculate ($x10^8$)	6.80	6.39	6.97	6.12	0.54

Z – Zinc

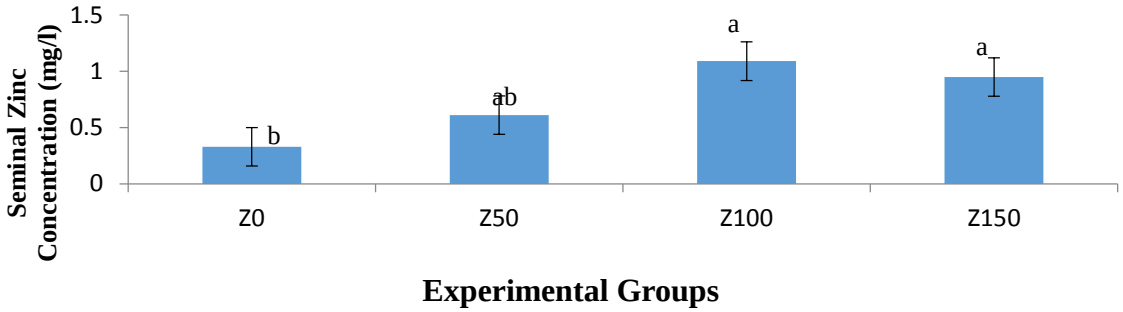

Figure 1: Seminal zinc concentration of male rabbits fed dietary zinc levels

CONCLUSION

It was concluded from the study that dietary levels of chelated form of zinc (zinc gluconate) may not improve semen quality of rabbit bucks. However, supplemental levels of zinc gluconate may result in increased seminal zinc concentration in rabbit bucks which is indication of improved prostate health.

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