**PROCEEDINGS OF THE 11th WORLD RABBIT CONGRESS**
Qingdao (China) - June 15-18, 2016
**ISSN 2308-1910**

Session
# FEEDS & FEEDING

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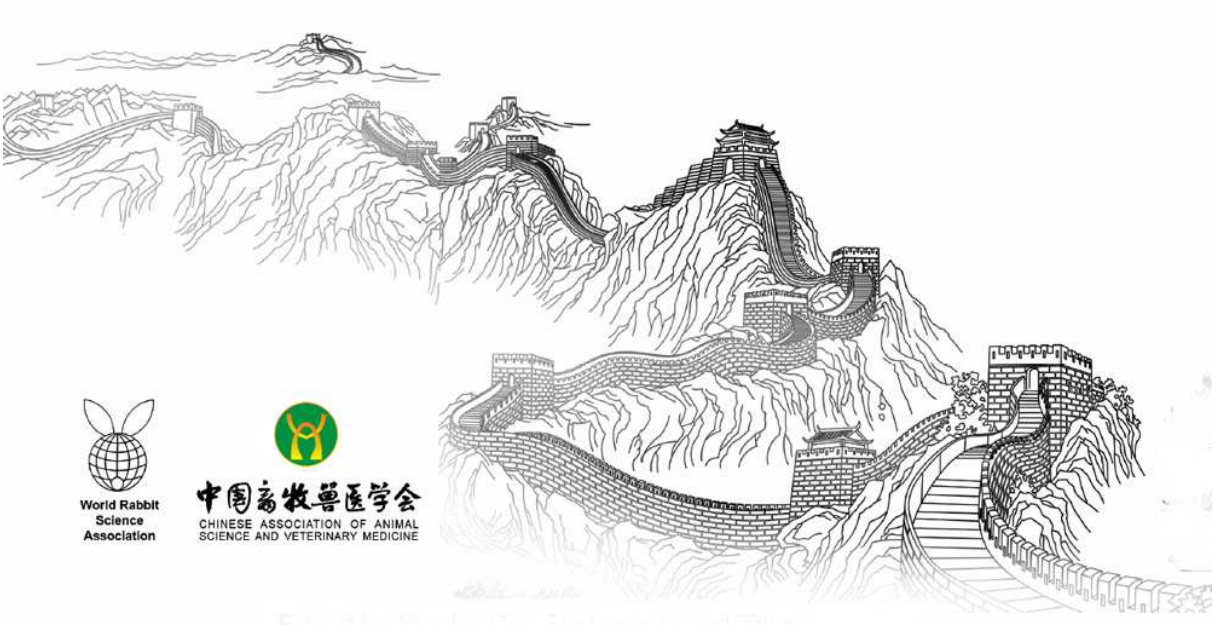
**Full text of the communication**

*How to cite this paper :*
Abdel-Khalek, Ragab Ayat A.., 2016 - Effect of dietary zinc levels on some performance traits of doe and weaning rabbits under summer season conditions *Proceedings 11th World Rabbit Congress - June 15-18, 2016 - Qingdao - China, 353-356.*



# EFFECT OF DIETARY ZINC LEVELS ON SOME PERFORMANCE TRAITS OF DOE AND WEANING RABBITS UNDER SUMMER SEASON CONDITIONS

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## ABSTRACT

Two separate experiments were carried out on APRI rabbits to study the effect of dietary zinc levels (30, 60, 90 or 120 mg/kg diet) on reproductive performance of breeding does and on growth performance of weaned rabbits during summer season. Sixty- multi-parious does (Exp. I) and other eighty weaned (Exp. II) were equally assigned to the dietary Zn treatments. In Exp. I, results indicate that dietary Zn levels had no significant effect on parameters including live body weight at kindling, litter size at kindling, litter weight at kindling and feed intake during gestation. Also, activity of superoxide dismutase enzyme in blood of lactating does was not affected by dietary Zn level. While, litter weight at weaning and feed intake during lactation were significantly higher in does fed 90 mg Zn/kg diet compared to other treatments ($P$<0.05). In Exp. II, results indicate significant treatment differences ($P$<0.05) for all studied growth variables (live weight gain, feed intake and feed conversion ratio). Again, the best results were recorded with dietary Zn level of 90 mg/kg diet compared to the other dietary Zn levels. Rabbits fed 90 mg Zn/kg diet had 25.3% more total weight gain and 14.6% better feed conversion ratio compared to rabbits fed 30 mg Zn/kg diet. In conclusion it is recommended to provide the diets for pregnant and lactating rabbits, as well as fattening rabbits with 90 mg Zn/kg diet to maximize performance during summer season.

**Key words:** doe-rabbit, growing rabbit, dietary zinc, summer, performance.

## INTRODUCTION

High ambient temperature adversely affects feed intake, live weight gain, feed efficiency, mortality and health of the rabbit (Marai et al., 2002). Zinc is an essential nutrient required for many physiological functions, including immune and antioxidant function as it involves in superoxide dismutase (SOD), one of the main antioxidants enzymes' participating against oxidative stress (Shay and Mangian, 2000). Zinc requirements published in the literature vary between 30 and 60 ppm with higher values proposed for breeders than weanlings (Mateos and de Blas, 1998). Because of zinc's environmental impact, the maximum level allowed in the EU for rabbit feeds is 150mg.kg$^{-1}$ (Maret and Sandstead, 2006). Further studies have indicated that rabbits are efficient in using extra dietary Zn beyond recommendation levels. On one hand, a scarcity in studies on the effect of supplemental Zn in breeding does has been emerged. Marai et al. (2000) reported that supplementing doe-rabbit diet with 66.86 mg Zn/kg decreased significantly pre-weaning morality at 28 days of age and increased significantly litter size and litter weight compared to the control (30mg Zn/kg diet). On the other hand, Hossain and Bertechini (1993) reported that the dietary requirement of Zn for maximum rabbit growth was established at 90 mg/kg diet. Ayyat and Marai (2000) reported that supplementing with 100, 200 or 300 mg Zn/kg in rabbit diets significantly increased live weight gains, but had no effect on feed intake and feed conversion ratio of rabbits compared with the control (30mg Zn/kg diet). In contrary, Al-Khalifa (2006) reported that supplementing with 50, 100 or 200 mg Zn/kg diet had no significant effect on live weight gain and feed conversion ratio. Selim et al. (2012) reported that increasing Zn level up to 200mg/kg diet did not improve in total weight gain and feed conversion compared to the control diet.

Results on the effect of dietary Zn levels on performance of rabbits are controversial and there is a scarcity on the effect during summer season. This study aimed at investigating the effect of dietary Zn levels (30, 60, 90 and 120 mg/kg diet) on some reproductive and growth aspects of doe and weaned during summer season.

## MATERIALS & METHODS

### Treatments, feeding and management:

Sixty muli-parious does and other eighty weaned APRI rabbits raised during summer season, each were, equally assigned to study the effect of dietary zinc level (30, 60, 90 or 120 mg/kg diet) as zinc sulphate. Vitamin-mineral premixes were adjusted for the studied Zn levels. Experimental diets were formulated to satisfy the NRC' (1977) recommendations. Ingredient and chemical composition of the basal diet are presented in Table 1. Rabbits were kept under the same managerial routine during July-September months.

In breeding does experiment, mating of all groups (15 does/group) was carried out by natural mating. Detection of conception was carried out by palpation at 10 days after mating and the non pregnant were remated immediately. One-parity traits were recorded; litter size and weight at kindling and weaning (28 day of age) were examined. Feed intake during pregnancy and lactation was recorded for each doe-rabbit. Blood samples were drawn from ear veins of does during lactation to determine SOD activity. Activity of SOD was measured by the xanthine oxidase method, which monitored the inhibition of reduction of nitro blue tetrazolium by the sample (Winterbourn et al., 1975). Concurrent growth trial using 80 weaned rabbits (20 rabbits/ group) about 4-5 weeks old was performed using the same dietary Zn levels on growth criteria (incremental live weight, feed intake and feed conversion ratio).

**Table (1):** Ingredients and calculated chemical composition of the basal diet

| | |
|---|---|
| **Ingredients:** | barley 32.0%,clover hay 31.0%, soybean meal (44%) 20.9%, wheat bran 9.2%, molasses 3.0%, Di calcium phosphate 2.2 %, limestone 0.7%, NaCl 0.30%, vitamins & minerals premix* 0.30%, Dl-methionine 0.2%, anti-coccidial 0.10% and anti-fungal 0.10 %; **Total:** 100.0%. |
| **Chemical composition:** | DM, 89%; CP, 18.35%; DE (kcal/kg) 2498; CF, 13.4%; Ca, 1.29%; P, 0.81%; Lysine, 0.97%; methionine + cystene 0.75%. |

*Supplied per 1 kg diet: 6000 IU vit. A; 900 IU, vit. $D_3$; 40 mg, vit. E; 2.0 mg, vit. $K_3$; 2.0 mg vit., $B_1$; 4.0 mg ,vit. $B_2$; 2.0 mg, vit. $B_6$; 0.010 mg, vit. $B_{12}$; 5.0 mg, vit. PP; 10.0 mg vit., $B_5$; 0.05 mg, $B_8$; 3.0 mg, $B_9$; 250 mg, choline; 50.0 mg, Fe;50.0 mg, Zn; (30, 60, 90 or 120 mg), Mn; 5.0 mg Cu; 0.20 mg I, and 0.01 mg Se.

### Statistical procedures

Data were subjected to a one-way analysis using SAS (1990). Variables having significant differences were compared using Duncan's Multiple Range Test (Duncan, 1955).

## RESULTS & DISCUSSION

The recorded rabbitry temperatures throughout the experimental period were between 30-32°C and the relative humidity was between 50-65% during day hours.

Results on the response of does to dietary Zn levels are provided in Table 2. dietary Zn levels had no significant effect on parameters including live body weight at kindling, litter size at kindling, litter weight at kindling and feed intake during gestation. Also, activity of superoxide dismutase enzyme in blood of lactating does was not affected by dietary Zn level. While, litter weight at weaning and feed intake during lactation were significantly higher in does fed 90 mg Zn/kg diet compared to other treatments ($P$<0.05).On the contrary, Marai et al. (2000) reported that doe-rabbit diet with 66.86 mg Zn/kg increased significantly litter size and litter weight compared to the control (30mg Zn/kg diet). However, zinc is essentially function as a component of numerous enzymes and is involved in the biosynthesis of nucleic acids and in cell division processes (Mateos et al., 2010), increasing dietary Zn level up to 90mg/kg did not have a significant effect on plasma activity of SOD enzyme.

**Table (2):** Reproductive performance and SOD activity of doe rabbits

| Criteria | Dietary Zinc level (mg/kg diet) | | | | Sig |
|---|---|---|---|---|---|
| | 30 | 60 | 90 | 120 | |
| Live body weight at mating (g) | 2773±78 | 2777±115 | 2810±47 | 2752±80 | ns |
| Live body weight at kindling (g) | 2796±72 | 2737±88 | 2786±49 | 2762±72 | ns |
| Litter size at kindling | 5.68±0.52 | 6.86±0.75 | 6.73±0.66 | 5.46±0.60 | ns |
| Litter size at weaning | 3.52±0.39 | 3.53±0.49 | 4.13±0.53 | 2.80±0.44 | ns |
| Litter weight at kindling (g) | 289±30 | 305±27 | 347±32 | 322±27 | ns |
| Litter weight at weaning (g) | $1649^{b}$±344 | $1644^{b}$±268 | $2016^{a}$±268 | $1657^{b}$±256 | * |
| Feed intake during gestation (g) | 6900±250 | 7087±253 | 7206±196 | 6889±294 | ns |
| Feed intake during lactation (g) | $7760^{b}$±570 | $7788^{b}$±539 | $9160^{a}$±210 | $8406^{b}$±252 | * |
| SOD activity in lactating does (u/ml) | 582±65 | 663±83 | 583±78 | 591±67 | ns |

ns: not significant
* $^{a, b}$ means in the same row with different superscripts differ significantly (P<0.05).

Results on the response of weaning rabbits to dietary Zn levels are illustrated in Table 3. Results indicate significant treatment differences (*P*<0.05) for all studied growth variables (live weight gain, feed intake and feed conversion ratio). Again, the best results were recorded with dietary Zn level of 90 mg/kg diet compared to the other dietary Zn levels. Rabbits fed 90 mg Zn/kg diet had 25.3% more total weight gain and 14.6% better feed conversion ratio compared to rabbits fed 30 mg Zn/kg diet. Results are in complete agreement with those reported by Hossain and Bertechini (1993), who reported that the dietary maximum requirement of Zn for rabbit growth was established at 90 mg/kg diet. Also, findings are in line with results of Ayyat and Marai (2000) who reported that supplementing rabbit diets with 100 mg Zn/kg significantly increased live weight gain of rabbits compared with the control (30mg Zn/kg diet). However, other studies indicated that supplemental Zn over the control had no further effect on growth of the rabbit (Al-Khalifa, 2006 and Selim et al., 2012).

**Table (3):** Growth performance of weaned rabbits

| Criteria | Dietary Zinc level (mg/kg diet) | | | | Sig. |
|---|---|---|---|---|---|
| | 30 | 60 | 90 | 120 | |
| Initial live weight (g) | 598±37 | 593±52 | 595±30 | 595±44 | ns |
| Total weight gain (g) | $835^{c}$±32 | $912^{ab}$±52 | $1046^{a}$±45 | $950^{ab}$±52 | * |
| Total feed intake (g) | $4210^{b}$±50 | $4410^{ab}$±50 | $4590^{a}$±100 | $4460^{a}$±80 | * |
| Feed conversion ratio | $5.27^{b}$±0.33 | $5.20^{b}$±0.35 | $4.50^{a}$±0.16 | $4.97^{ab}$±0.29 | * |

ns: not significant
* $^{a, b,c}$ means in the same row with different superscripts differ significantly (P<0.05).

## CONCLUSION

Results of the current study suggest 90 mg Zn/kg diet to improve the performance of doe-rabbits during gestation and lactation and for fattening purposes during summer season.

## ACKNOWLEDGEMENT

Thanks for AGRIVET, Egypt for providing the vitamins-minerals premixes for different experimental diets with the specified zinc levels.

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