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GROWTH PERFORMANCE AND CARCASS TRAITS AS AFFECTED BY BREED AND DIETARY SUPPLEMENTATION WITH DIFFERENT ZINC LEVELS, UNDER EGYPTIAN CONDITIONS

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ABSTRACT

Fifty New Zealand White (NZW) and fifty of Californian (Cal) weaned male rabbits were used in the present study. The aim was to study growth performance of rabbits in the two breeds as affected by, dietary zinc supplementation (0, 100, 200, 300 and 400 mg/kg diet), under Egyptian sub-tropical conditions. Body weight at 4 weeks and daily gain weight during 0-4 weeks of the experimental period were significantly higher in NZW than in Cal rabbits. Feed efficiency or profit percentage did not show remarkable differences with genotype. Breed did not show any significant effect on blood components or slaughter traits. The increase of zinc from 0 to 200 mg zinc/kg diet increased, generally, each of live body weight, daily gain weight and gain / 100 g body weight, then they decreased gradually by increasing zinc level more than the latter level. Feed intake and feed conversion were improved with dietary zinc supplementation. Feed cost slightly increased with increasing dietary zinc level, while the profit percentage increased up to 200 mg zinc, then decreased afterwards. Plasma total protein, albumin, globulin end blood haemoglobin were affected significantly ($P<0.01$) by dietary zinc supplementation. Slaughter traits were insignificantly affected by dietary zinc supplementation. Dressing percentage slightly increased in rabbits fed diets supplemented with 100 or 200 mg than that fed the control diet. The above results confirmed that the level 400mg/kg diet seemed to be nearly toxic. The interactions between rabbit breed and dietary zinc level on the studied traits were not significant, under Egyptian conditions.

Keywords: Zinc, rabbits, growth performance, feed efficiency, profit, blood, carcass.

INTRODUCTION

Importance or zinc for the animal's body appears from the fact that zinc acts as activator for many enzymes and hormones (Rirodan and Vallee, 1976). Zinc supplementation has various beneficial effects on body functions, such as acid base balance, nutrient metabolism and immunity protection (Gross *et al*., 1979, Banerjee, 1988 and Hahn and Baker, 1993). However, the commonly used grains in rabbit diets is rich in phytate content that may reduce availability of zinc, since phytic acid inhibit absorption of zinc through formation of an insoluble complex (zinc phytate) in the lumen of the intestine (Clarke *et al*., 1977 and Baker and Halpin, 1988). Lebas (1975) recommended addition of zinc in rabbit diets at level of 50 mg/kg diet. On the other hand, Hossain and Bertechini (1993) reported that the requirement of zinc was determined to be 106 mg/ kg for growing rabbits. Kulikov *et al*. (1985) indicated the need to supplement commercial young rabbit diets with 200 mg zinc sulfate per kg diet. Wang *et al*. (1989) found that zinc supplementation in rabbit diets increased growth rate.

The present experiment was conducted to study the growth performance of rabbits as affected by breed, dietary zinc supplementation (0, 100, 200, 300 and 400 mg/kg diet) and the interaction between breed (genotype) and zinc supplementation, under Egyptian sub-tropical conditions.

MATERIALS AND METHODS

The numbers of fifty NZW and fifty Cal weaned male rabbits of 35 days of age, were used in the present study. Within each breed, the animals were randomly allotted to 5 groups of nearly equal average weight with 20 animals in each. Groups of each breed were supplemented with zinc oxide to supply 0, 100, 200, 300 or 400 mg zinc/kg diet. The experimental period was 8 weeks; i.e. until marketing age.

All animals were fed a pelleted diet and watered *ad libitum*. Each kilogram of the basal diet consisted of 300 g alfalfa hay, 240 g corn, 130 g soybean meal, 280 g wheat bran, 30 g molasses, 14 g limestone, 3 g sodium chloride and 3 g vitamins and minerals premix. The diet contained 16.3% crude protein, 13.2% crude fibre (both were analyzed according to AOAC, 1980) and10.12 Mj//kg digestible energy according to Maertens *et al*. (1990).

The rabbits were kept under similar managerial and hygienic conditions, during the experimental period. The weanlings were raised in cages provided with feeders and automatic nipple drinkers and were housed in naturally ventilated building and provided with sided electric fans.

The rabbits were individually weighed at the beginning of the experiment, and then at biweekly intervals. Weighing was carried out before offering the morning meal at 8.00 h and live body weight gain was calculated biweekly, but only averages of body weights at 0, 4 and 8 weeks were recorded in the results. Absolute daily gain weights between 0-4, 4-8 and 0-8 weeks of the experimental period, were studied. At the end of the experimental period, 3 male rabbits from each group were randomly taken for slaughter. Blood samples were collected during slaughter by using tubes containing anticoagulant to obtain plasma. After complete bleeding, pelt, viscera and tail were removed and the carcass and some carcass components were weighed. Carcass component percentages were calculated from actual means. Plasma total protein, albumin, urea-N and blood haemoglobin were determined by using commercial kits. Economic evaluation was calculated as the following equation, Profit (%)= [(Income from body gain weight - Feed cost) x 100] / Feed cost. Other overhead costs were assumed constant.

Statistical analysis of the data of body weight, body gain weight, blood components and slaughter traits were carried out by 2 X 5 factorial design (Snedecor and Cochran, 1982) according the following model: $Y_{ijk} = \mu + B_i + Z_j + BZ_{ii} + e_{ijk}$, where μ is the overall mean, B_i is the fixed effect of i^{th} breed (1, 2), Z_j is the fixed j^{th} effect dietary zinc supplementation level (1, . . 5), BZ_{ij} is the interaction between breed and zinc supplementation level and e_{ijk} is the random error. Significant differences were determined by Duncan's Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Breed effect: Body weight was significantly ($P<0.05$) affected by genotype at 4 weeks of the experimental period at which the average body weight was higher in NZW than in Cal weanlings (Table 1). The average daily gain was significantly ($P<0.05$) higher in NZW than in Cal rabbits, only during the interval 0-4 weeks of the experimental period (Table 1). Similarly, Ayyat and Anous (1995) reported that the average daily gain was significantly ($P<0.001$) higher in NZW than in Cal rabbits during the intervals 0-4 or 0-8 weeks of the trial. Feed efficiency or profit percentage did not show remarkable differences with genotype (Table 2). Similarly, breed did not show any significant effect on blood components or slaughter traits (Tables 3 and 4).

Dietary zinc supplementation effect: Supplementation of zinc oxide in rabbit diets significantly increased body weight at 4 weeks ($P<0.05$) and 8 weeks ($P<0.01$), daily gain weight at 0-4 (P<0.05), 4-8 and 0-8 (P<0.01) weeks of the experimental period. The increase of zinc from 0 to 200 mg zinc/kg diet increased generally live body weight and daily gain weight, then decreased nearly gradually by increasing zinc level than the latter level (Table 1). The improvement in growth performance of rabbits fed diets supplemented with zinc up to 200 mg/kg diet may be attributed to the sufficient zinc to Increase the activity of zinc-rnetalloenzymes, which stimulate the synthesis of body protein and improvement of growth rate (Rirodan and Vallee, 1976 and Freeman, 1983). Profit increased with increasing dietary zinc level, up to 200 mg zinc/kg diet, then decreased afterwards (Table 2). Plasma total protein, albumin, globulin and blood haemoglobin were affected significantly (P<0.01) by dietary zinc supplementation. The obtained values increased with the increase of the dietary zinc level between 0 and 200 mg, then decreased up to 400 mg level (Table 3). The beneficial effect obtained by supplementation with 200 mg zinc may be due to that that level elevated the available zinc of the offered diets to animal requirements, since Barker and Halpin (1988) indicated that soybean meal, corn or wheat bran, which are major ingredients of rabbit diets are rich in phytate content that have an antagonistic effect on the available zinc. Slaughter traits were insignificantly affected by dietary zinc supplementation (Table 4).

Interaction between breed and zinc supplementation: The interactions between rabbit breed and dietary zinc levels on the studied traits were not significant, so only the main effects were discussed (Tables 1 - 4). Ayyat and Anous (1995) also found that the interaction between rabbit breed and growth promoter on gain performance was not significant, while on carcass weight was significant (P<0.05).

In conclusion, supplementation rabbit diets with 100 - 200 mg zinc/kg diet could be recommended, since it showed the highest final weight, body gain weight, final margin and carcass components, while the level 400 mg/kg diet seemed to be nearly toxic.

REFERENCES

AOAC (1980). Association of Official Analytical Chemists. *Official Methods of Analyses*. 13th Edition, Washington, USA.

Ayyat, M.S. and Anous M.R. (1995). Magnitude and direction of genetic- environmental interaction in rabbis with special reference to live and slaughter performance and carcass cut-out. World Rabbit Science, 3: 3-8.

Baker D.H. and Halpin K.M. (1988). Zinc antagonizing effects of fish meal, wheat bran and corn-soybean mixture when added a phytate and fibre-free casein-dextrose diet. Nutrition Research, 8: 213-218.

Banerjee G.C. (1988). Feeds and Principles of Animal Nutrition. 2nd Edition, Oxford and IBH Publishing Co. PVT Ltd.

Clarke H.E., Coates M.F., Eva J.K. Ford D.J., Milner C.K., O'Donoghue P.N., Scot P.P. and Word R.J. (1977). Dietary standards for laboratory animals. Report of the Laboratory Animals Center. Diets Advisory Committee, Laboratory Animals, 11: 1-28.

Duncan D.B. (1955). Multiple range and multiple F-test. Biometrics, 11: 1-42.

Freeman B.W. (1983). Physiology and Biochemistry of the Domestic Fowl. 4th Edition, Academic Press, p. 181, New York and London.

Gross R.L., Osolin N., Fong L. and Newberne P.M. (1979). Depressed immunological function in zinc deprived rats as measured by nitrogen response of spleen, thymus and peripheral blood. American Journal of Clinical Nutrition, 32: 1260-1266.

Hahn 4J.D. and Baker D.H. (1993). Growth and plasma zinc responses of young pigs fed pharmacological levels of zinc. Journal of Animal Science, 71: 3020-3024.

Hossain S. and Bertechini A.G. (1993). Requirement of zinc for growing rabbits. Arquivo

Brasileriro de Medicina Veterinaria e Zootecnia, 45: 323-329.
Kulikov N.E., Morozova K.N. and Aleksandrova V.S. (1985). Requirement of young rabbits for minerals. Krolikovodstvo i Zverovodstvo, 1: 14-15.
Lebas F. (1975). Nutrient requirements of rabbits. The Commercial Rabbit Journal, 3: 7.
Maertens L., Janssen W.M.M., Steenland E.M., Wolters D.F., Branje E.B. and Jager F. (1990). Tables de composition, de digestibile et de valer energetique des matieres premieres pour lapins. 5e Journees de la Recherche Cunicole, Paris. Ed. ITAVI, Communication 57.
Rirodan J.F. and Vallee B.L. (1976). Trace elements in human health and disease. Structure and function of zinc metalloenzymes. Academic Press, New York, London, pp. 227-256.
Snedecor, G.W. and Cochran, G.W. (1982). Statistical Methods. 6th Edition. The Iowa State University Press, Ames, USA.
Wang Y.Z., Yan D.Z., Zhang Y.Q. and Hua S.R. (1989). Effect of nutrient additive on growth of Angora rabbits. Fur Animal Farming, 43: 3-6.

Table 1. Live body weight and daily gain (g) as affected by breed and zinc level at the different experimental periods.

Items	W0	W4	W8	G0-4	G4-8	G0-8
Breeds:						
NZW	570.7±17.5	1362.1±22.3[a]	2048.4±30.5	28.3±0.7	24.5±1.0	26.4±0.5
Cal	569.9±11.5	1296.0±20.1[b]	2040.7±34.5	25.9±0.6	26.6±0.7	26.3±0.6
Significance	NS	*	NS	**	NS	NS
Dietary zinc supplementation (mg/kg diet):						
0	563.9±24.5	1307.4±35.9[ab]	1927.5±29.9[b]	26.6±1.0[ab]	22.2±1.1[b]	24.3±0.5[b]
100	574.2±24.6	1375.6±33.9[a]	2144.0±45.5[a]	28.6±1.0[a]	27.4±1.3[a]	28.0±0.7[a]
200	572.6±23.0	1348.4±23.6[ab]	2169.3±40.6[a]	27.7±0.9[a]	29.3±1.1[a]	28.5±0.9[a]
300	570.3±23.1	1361.5±30.5[a]	2127.9±40.0[a]	28.3±1.0[a]	27.4±1.2[a]	27.8±0.7[a]
400	570.8±24.8	1254.7±40.3[c]	1855.1±55.0[b]	24.4±1.2[b]	21.4±1.4[b]	22.9±0.9[b]
Significance	NS	*	**	*	**	**

W = Week, G = Daily gain, NZW = New Zealand White breed and Cal = Californian breed.
NS = Not significant, * $P<0.05$ and ** $P<0.01$.
Means within the same column within the same classification bearing different letters, differ significantly ($P<0.05$).

Table 2. Feed efficiency and profit analysis as affected by breed and zinc level at the different experimental periods.

Items	Daily feed Intake (g)	Feed conversion (g feed/g gain)	Profit %[1]
Breeds:			
NZW	107.3	4.064	166.23
Cal	106.9	4.065	171.32
Dietary zinc supplementation (mg/kg diet):			
0	102.9	4.235	160.38
100	108.3	3.868	190.13
200	108.3	3.800	190.13
300	111.1	3.996	175.95
400	105.1	4.590	140.11

NZW = New Zealand White breed and Cal = Californian breed.
1. Profit % = ((Income from body gain – Feed cost) x 100) / Feed cost.

Table 3. Some blood components as affected by breed and zinc level at the different experimental

periods.

Items	Haemoglobin (g/100 ml)	Total protein (g/100 ml)	albumin (g/100 ml)	Globulin (g/100 ml)	Urea (mg/100 ml)
Breeds:					
NZW	9.05±0.15	7.18±0.21	3.91±0.14	3.28±0.10	12.20±0.25
Cal	9.02±0.15	7.15±0.22	3.84±0.14	3.31±0.11	12.13±0.26
Significance	NS	NS	NS	NS	NS
Dietary zinc supplementation (mg/kg diet):					
0	8.56±0.13[d]	6.49±0.17[b]	3.63±0.13[b]	2.86±0.08[d]	12.91±0.39[a]
100	9.36±0.14[b]	7.96±0.24[a]	4.48±0.14[a]	3.48±0.11[ab]	12.36±0.30[a]
200	9.82±0.06[a]	8.08±0.05[a]	4.30±0.12[a]	3.78±0.08[a]	12.62±0.39[a]
300	9.00±0.07[ac]	6.91±0.15[b]	3.61±0.14[b]	3.30±0.14[cd]	11.08±0.26[b]
400	8.43±0.09[d]	6.41±0.11[b]	3.36±0.07[b]	3.05±0.05[cd]	11.85±0.11[ab]
Significance	**	**	**	**	**

NZW = New Zealand White breed and Cal = Californian breed.
NS = Not significant and ** $P<0.01$.
Means within the same column within the same classification bearing different letters, differ significantly ($P<0.05$).

Table 4. Some carcass and non-carcass components (g) as affected by breed and zinc level at the different experimental periods.

Items	Pre-slaughter weight	Carcass weight	Liver weight	Kidney fat weight	Empty gut weight	Dressing percentage
Breeds:						
NZW	2248.3±60.6	1290.7±36.3	65.7±3.3	17.7±1.5	241.7±7.5	57.41
Cal	2249.0±50.5	1270.0±29.3	62.0±2.5	19.7±1.1	238.0±6.2	56.48
Significance	NS	NS	NS	NS	NS	
Dietary zinc supplementation (mg/kg diet):						
0	2183.3±71.3	1217.5±46.3	58.3±4.2	18.3±1.7	244.2±9.0	55.72
100	2299.2±68.1	1325.0±36.7	67.5±4.0	20.8±2.4	238.3±7.0	57.66
200	2335.0±56.3	1337.5±35.3	73.3±5.9	16.7±2.1	259.2±7.7	57.28
300	2227.5±89.5	1265.0±55.3	57.5±2.5	18.3±2.1	236.7±4.8	56.90
400	2198.3±88.2	1256.7±54.0	62.5±3.6	19.2±2.4	220.8±5.2	57.16
Significance	NS	NS	NS	NS	NS	

NZW = New Zealand White breed and Cal = Californian breed.
NS = Not significant.