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EFFECT DIETARY ENERGY LEVEL AND FIBRE LEVEL AND ZINC SUPPLEMENTATION ON RABBIT PERFORMANCE, UNDER EGYPTIAN CONDITIONS.

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ABSTRACT: One hundred and Twenty male New Zealand White rabbits, 28 day old, with nearly equal live body weight at the beginning of the experiment were randomly allotted to twelve treatment groups, of 10 rabbits each. The first six rabbit groups were fed on the normal energy diet (2500 kcal DE/kg diet), while the other six groups were fed on the high energy diet (2750 kcal DE/kg diet). Within each dietary energy level, the first three groups were fed on the normal fibre diet (12% CF), while the other three groups were fed on the low fibre diet (10% CF). Within each dietary fibre level, the first group was fed on the diet without supplementation, the second group was fed on the diet supplemented with 100 mg zinc/kg diet, while the third group was fed on the diet supplemented with 200 mg zinc/kg diet. Final live body weight and daily weight gain were significantly (P<0.001) increased with 15.42% and 19.82%, respectively, in rabbit groups fed high energy level than those fed normal energy level. Feed conversion was improved with increasing dietary energy level. Feed cost decreased with 9.19%, while return from body gain and final margin increased with 19.9 and 35.65%, respectively, in rabbits fed high-energy diet than those fed normal-energy diet. Serum total protein, albumin, urea-N, creatinine AST and ALT concentrations were increased significantly (P<0.001) with increasing energy level in rabbit diets. Analysis of covariance indicated that the dietary energy level significantly affected carcass weight (P<0.001), hind part weight (P<0.05) and prime cuts weight (P<0.001). Rabbits fed low-fibre diet recorded lower body weight

and daily weight gain with 7.21 and 10.28%, respectively, than those fed normal-fibre diet. Feed cost increased with 1.57%, while return from body gain and final margin decreased with 10.27 and 16.79%, respectively, in rabbits fed low-fibre diet than those fed normal-fibre diet. Serum total protein albumin and globulin concentrations decreased significantly (P<0.01 or 0.001) with decreasing fibre level in rabbit diets than the normal level. Serum urea-N and creatinine concentrations insignificantly were affected by the dietary fibre levels. Analysis of covariance indicated that the dietary fibre level insignificantly affected all carcass components weights. Rabbits fed diets supplemented with 100 or 200 mg zinc/kg diet recorded higher body weight with 7.56 and 10.68%, respectively, than those fed diet without zinc supplementation. Feed conversion was improved with dietary zinc supplementation at the level 100 or 200 mg zinc when compared with those fed diet without supplementation. Feed cost was not affected with dietary zinc supplementation, while return from body gain and final margin were increased with dietary zinc supplementation. Serum total protein and albumin were significantly increased with zinc supplementation in rabbit diets. Serum urea-N and creatinine concentrations were insignificantly affected by the dietary zinc supplementation. Dietary zinc supplementation significantly affected carcass weight (P<0.01), hind part weight (P<0.05) and prime cuts weight (P<0.05). Carcass, hind part and prime cuts weights increased significantly with increasing zinc supplementation in rabbit diets. Live body weight at 8 weeks of the experimental period were insignificantly affected with the interaction between dietary energy, fibre and zinc supplementation. Rabbit group fed diet with high energy-normal fibre and supplemented with 200 mg zinc/kg diet recorded lower fed cost and higher return from body gain and final margin than the other experimental groups. Serum total protein, albumin, urea-N, creatinine, AST and ALT concentrations were insignificantly affected by the interaction between dietary energy and fibre levels and zinc supplementation. The interaction between dietary energy, fibre levels and zinc supplementation in rabbit diets insignificantly affected carcass and non carcass weights.

INTRODUCTION

Energy is not a nutrient but a property of energy-yielding nutrients when they are oxidized during metabolism. Rabbits voluntarily adjusted their feed intake to meet their energy requirements, unless the intake is limited by gut capacity (Lebas, 1975). Animals normally regulate their feed intake to meet their energy requirements. Maertens *et al*. (1986) reported that body gain slightly increased with increasing dietary energy level. Butcher *et al*. (1983) found that the rabbits fed on the low energy diet consumed more dry matter and metabolizable energy in total, but grew more slowly than those fed on the high energy diet. On the other hand, Ayyat *et al*. (1994) reported that dietary energy level (2707, 2436 and 2276 kcal DE/kg) had no effect on live body weight and body gain. It was concluded that the best economic returns were achieved by feeding a low energy diet.

Fibre content of the diet decrease digestibility and the energy concentration of the diet may be a limiting factor for rabbit growth, feed producers tend to reduce the fibre content in the commercial feed with the aim of the growth-performance improving. Fekete and Gippert (1985) concluded that on the basis of mortality rate and performance, it was better to wean the rabbit at 35 than at 28 days old fed it on diet containing 15 to 16% crude fibre. Ortiz *et al*. (1989) found that energy digestibility and overall efficiency of use of metabolizable energy (ME) for growth decreased curvilinearly and linearly when dietary fibre content increased.

Zinc is an essential element in the nutrition of man, animals and plants. It functions as an integral part of numerous enzymes. Zinc, as contained in food and drink, is absorbed through the gut mucosa which is the normal route of entry into the body. It is absorbed at several sites in the gastrointestinal tract. The initial site of absorption is the stomach and occurs within 15 minutes after ingestion (Cheeke, 1987). Abd El-Rahim *et al*. (1995) found that supplemented rabbit diets with 170 mg zinc/kg diet increased each of body gain, feed conversion, digestibility of all nutrients and apparent absorption. Feed intake was not affected by level of Zn supplementation, but rabbits supplemented with Zn 170 mg/kg diet showed an improvement in feed conversion efficiency, digestibility of all nutrients, and apparent absorption and retention of nitrogen, Zn, copper, iron, manganese and calcium.

MATERIALS AND METHODS

The experiment was conducted at the Department of Animal Production Faculty of Agriculture, Zagazig University, Zagazig, Egypt. The practical work was carried out at Privet Rabbit Farm at Dukahlia Governorate, Egypt.One hundred and Twenty male New Zealand White rabbits, 28 day old, with nearly equal live body weight at the beginning of the experiment were randomly allotted to twelve treatment groups, of 10 rabbits each.The first six rabbit groups were fed on the normal energy diet (2500 kcal DE/kg diet), while the other six groups were fed on the high energy diet (2750 kcal DE/kg diet). Within each dietary energy level, the first three groups were fed on the normal fibre diet (12% CF), while the other three groups were fed on the low fibre diet (10% CF). Within each dietary fibre level, the first group was fed on the diet without supplementation, the second group was fed on the diet supplemented with 100 mg zinc/kg diet, while the third group was fed on the diet supplemented with 200 mg zinc/kg diet. The experimental period extended for 8 weeks; i.e. until marketing age. The rabbits were fed on pelleted ration *ad libitum.* Rabbits in all groups were kept under the same managerial and hygienic conditions. The rabbits were housed in batteries provided with feeders and automatic drinkers. The batteries were located in a conventional confined and windowed building not heated and naturally ventilated, side electric fans were used. Rabbits were weighed at the beginning of the experiment and at weekly intervals thereafter during the experimental period (8 weeks). Body weight gain was calculated by subtracting the live body weight at the beginning of the experimental period from the live body weight at the end of the experimental period. Body gain per 100 grams live body weight was calculated according to Ayyat (1991) by using the following model:

Body gain/100 g body weight =

$$\left(\frac{W_2 - W_1}{\frac{1}{2}(W_1 + W_2)} \times 100\right)/\text{period (day)},$$

Where, W_1 is the initial body weight at the beginning of experimental period and the W_2 is the final body weight at the end of experimental period. Feed consumed was recorded weekly as the difference between the afford feed weight at the beginning of experimental period and the end of experimental period. Feed conversion ratio was calculated as grams feed to produce one gram gain for each treatment group. Economic evaluation was calculated as the following equation (According to Ayyat, 1991), Margin = Return from body gain weight - Feed cost. Other overhead costs were assumed constant. The price of one kg of diets were shown in Table 1, and price of selling of one kg live body weight of rabbits was 10.0 LE (Egyptian pound = 16 cent). At the end of experimental period three rabbits from each group were randomly selected to collecting the blood samples. The blood samples were centrifuged at 3000 r.p.m for 20 minutes to separate the serum. The collected serum were stored at -20 °C until assay. Total proteins, albumin, urea-N, creatinine and serum transaminase enzymes (AST and ALT) were estimated in blood serum by colormetric methods using commercial kits. At the end of the experimental period three rabbits from each group were randomly taken for slaughter after being fasted for 12 hours. After complete bleeding, the carcass and some non-carcass components were weighed. The carcass was separated into three cuts (fore-limbs, trunk and hind-limbs). Each of the three cuts was weighed. Statistical analyses of body weight, body gain weight, blood components and slaughter traits data were carried out by 2 X 2 X 3 factorial design (Snedecor and Cochran, 1994) according the following model:

$$Yijk = \mu + E_i + F_j + Z_k + EF_{ij} + EZ_{ik} + FZ_{jk} + EFZ_{ijk} + e_{ijkl}$$,where

μ is the overall mean, Ei is the fixed effect of ith dietary energy level (1, 2), Fj is the fixed effect of ith dietary fibre level (1, 2), Zk is the fixed jth effect dietary zinc supplementation level (1, . . 3), EFij is the interaction between dietary energy and fibre level, EZik is the interaction between dietary energy level and dietary zinc supplementation, FZjk is the interaction between dietary fibre level and dietary zinc supplementation, EFZijk is the interaction between dietary energy and fibre level and zinc supplemenation and eijkl is the random error. Slaughter data were analyzed by analysis of covariance according the following model:

Yijkl = μ + Ei + Fj + Zk + EFij + EZik + FZjk + EFZijk + b(X-x) + Eijk ,where

μ, E_i, F_j, Z_k, EF_{ij}, EZ_{ik}, FZ_{jk} and EFZ_{ijk} were as defined in the previous model, b = Regression coefficient of Y on X (slaughter weight) and x is the arithmetic means of x's (slaughter weight).

RESULTS AND DISCUSSION

Effect of dietary energy level:

During the summer conditions, final live body weight and daily weight gain were affected significantly (P<0.001) with dietary energy level (Table 2). The increasing values in daily gain were 15.42% and 19.82%, respectively, in rabbit groups fed high energy level than those fed normal energy level. These findings are in agreement with those obtained by Bassuny *et al.* (1997), Butcher *et al.* (1983) and El-Hindawy *et al.* (1994). Bassuny *et al.* (1997) reported that final body weight and daily weight gain was significantly increased in rabbits fed high energy diet (2700 kcal DE/kg diet) than the normal energy diet (2500 kcal DE/kg diet). On the other hand, Castellini and Battaglini (1992) reported that body weight was not affected by dietary energy level.

Rabbit groups fed high-energy diets recorded lower feed intake than those fed normal-energy diets at the whole of the experimental periods, the decreasing value was 7.56% (Table 3). Feed conversion was improved with increasing dietary energy level, the improving value was 22.95% at 0-8 weeks of the experimental period (Table 3). Maertens *et al.* (1986) reported that daily energy intake decreased with 8% for rabbits fed low energy diet than the high energy diet, while feed intake was greater in low energy diet. Also, Ayyat and Marai (1997). Indicated that rabbits fed high energy diet (11.8 Mj/kg diet) showed lower feed intake than those fed normal energy diet (10.6 Mj/kg diet). The growing rabbit adjusts its feed intake according to the energy concentration of the feeds offered to it where the proteins and other dietary components are balanced.

Feed cost decreased with increasing energy level in rabbit diets, while return from body gain and final margin increased (Table 3). Feed cost decreased with 9.19%, while return from body gain and final margin increased with 19.9 and 35.65%, respectively, in rabbits fed high-energy diet than those fed normal-energy diet.

Serum total proteins albumin and globulin concentrations increased significantly (P<0.001) with increasing energy level in rabbit diets (Table 4). The increasing rates were 16.02, 15.15 and 16.67%, respectively, in rabbit groups fed high energy diets than those fed the normal energy diet. Similar results were obtained by Bassuny et al. (1997). However, Ayyat et al. (1994) found that dietary energy level had no effect on blood components. Also Hemid et al. (1995) found that blood total protein, albumin and globulin fractions were not affected by treatments.

Serum urea-N, creatinine concentrations AST and ALT activity significantly (P<0.001) increased due to the increasing energy level in rabbit diets (Table 5). The rates of increase were 10.74, 6.86, 3.58 and 11.25%, respectively, in rabbits fed high energy diet than those fed normal energy diet. This may indicate slight over-function in kidney due to the increase in dietary energy level. However, Ayyat et al. (1994) found that dietary energy level had no effect on blood components.

Analysis of covariance indicated that the dietary energy level significantly affected carcass weight (P<0.001), hind part weight (P<0.05) and prime cuts weight (P<0.001). Carcass, hind part and prime cuts weights increased significantly with increasing energy levels in rabbit diets (Tables 6 and 7). Kidney fat weight insignificantly increased with increasing dietary energy. Castello and Gurri (1992) reported that the increasing of energy level in rabbit diets improved significantly carcass yield. Also, El-Hindawy et al., (1994) reported that the carcass components were significantly higher when dietary energy level was high. However, Ayyat et al. (1994) reported no effect on carcass and non-carcass components due to dietary energy level.

Effect of dietary fibre level:

Live body weight and daily body gain were affected significantly (P<0.001) with dietary fibre level (Table 2). Rabbits fed low-fibre diet recorded 7.21 and 10.28% lower body weight and daily weight gain respectively, than those fed normal-fibre diet. The obtained results indicated that the level of 12% crude fibre in growing rabbit diets during summer conditions of Egypt was adequate for normal growth. Decreasing fibre content in rabbit diets than 12% reduced growth rate. Abd-Ellah (1995) found that rabbits fed on 12% crude fibre showed the highest final body weight and weight gain than those fed on 2% crude fibre. On the other hand, crude protein 15 to 17% of diet was recommended by Fekete and Gippert (1985). El-Sayaad *et al*. (1996) found that final body weight and average daily gain were not influenced by dietary crude fibre levels.

Rabbits fed low-fibre diet recorded lower feed intake than those fed normal-fibre diet during the whole experimental periods, the decreasing rate was 3.02% at 0-8 weeks of the experimental period (Table 3). Feed conversion was improved with decreasing dietary fibre level during the whole experimental period, the improving rate was 7.57% (Table 3). Ayyat and Marai (1997). Indicated that rabbits fed low fibre diet showed lower feed intake and improved feed conversion than those fed high fibre diet (10.6 Mj/kg diet).

Feed cost was increased, while return from body gain and final margin were decreased with increasing dietary fibre level. Feed cost increased with 1.57%, while return from body gain and final margin was decreased with 10.27 and 16.79%, respectively, in rabbits fed low-fibre diet than those fed normal-fibre diet (Table 3).

Serum total proteins albumin and globulin concentrations were decreased significantly ($P<0.01$ or 0.001) with decreasing fibre level in rabbit diets than the normal level (Table 4). The decreasing values were 8.58, 6.51 and 10.60%, respectively, in rabbit groups fed low fibre diets than those fed the normal fibre diet. However, El-Sayaad et al. (1996) reported that blood components were not influenced by the dietary fibre levels.

Serum urea-N and creatinine concentrations were insignificantly affected by the dietary fibre levels (Table 5). Serum urea-N and creatinine concentrations were 4.36 and 1.87%, lower in rabbits fed diets containing low fibre level respectively, than those fed the normal fibre diet. Also, El-Sayaad *et al.* (1996) reported that blood components were not influenced by the dietary fibre levels. The activity of AST and ALT insignificantly affected by the dietary fibre levels (Table 5).

Analysis of covariance indicated that the dietary fibre level insignificantly affected all carcass components weights (Tables 6 and 7). El-Sayaad *et al.* (1996) found that dressing percentage and organ weights were not significantly different with fibre level in rabbit diets. On the other hand, Abd-Ellah (1995) reported that rabbits fed on 12% crude fibre showed the highest carcass dressing percentage than those fed on 2% crude fibre. Diets containing 12 and 17% fibre resulted in the highest empty caecal weights. Weight of stomach contents were increased with dietary fibre; while that of caecal contents was not affected.

Effect of dietary zinc supplementation:

Final live body weight and daily weight gain were affected significantly ($P<0.001$) with dietary zinc supplementation (Table 2). Rabbits fed diets supplemented with 100 and 200 mg zinc/kg diet recorded higher body weight with 7.56 and 10.68%, respectively, than those fed diet without zinc supplementation. Rabbits fed diets supplemented with 100 and 200 mg zinc/kg diet recorded 10.74 and 15.28%, higher body gain respectively, than those fed diet without zinc supplementation. During summer conditions of Egypt, supplemented rabbit diets with zinc improved growth rate. Zinc deficiency decreased growth rate and the deficiency of this element is accentuated by excess calcium in the diets (Cheek, 1987). Ayyat and Marai (2000) found that the increase of zinc from 0 to 200 mg /kg diet increased, generally, each of live body weight and daily gain weight, then they decreased gradually by increasing zinc level more than the latter level.

Daily feed intake did not affected with dietary zinc supplementation (Table 3). However, Feed conversion improved with dietary zinc supplementation at the level 100 or 200 mg zinc when compared with those fed diet without supplementation, during the whole experimental period. The improving rates were 9.81 and 12.95%, respectively, for rabbits fed diets supplemented with 100 and 200 mg zinc. Feed conversion was improved with dietary zinc supplementation (Ayyat. and Marai, 2000). Also, Abd El-Rahim *et al.* (1995) reported that feed intake was not affected by level of zinc supplementation, but rabbits supplemented with zinc 170 mg/kg diet showed an improvement in feed conversion efficiency, digestibility of all nutrients.

Feed cost was not affected with dietary zinc supplementation, while return from body gain and final margin was increased with dietary zinc supplementation (Table 3). Return from body gain increased with 10.81 and 15.29, respectively in rabbit groups fed diets supplemented with zinc at the level 100 or 200 mg/kg feed when compared with those fed diet without supplementation, while final margin was increased with 19.29 and 25.61, respectively. Ayyat.and Marai (2000) found that feed cost slightly increased with increasing dietary zinc level, while the profit percentage was increased up to 200 mg zinc, then decreased afterwards.

Serum total proteins, albumin and globulin fractions were significantly affected ($P<0.05$ or 0.001) with zinc supplementation in rabbit diets (Table 4). Serum total proteins increased with 9.12 and 13.68%, respectively, in rabbits fed diets supplemented with 100 or 200 mg zinc/kg diet when compared with those fed diets without supplementation. Also, albumin increased with 5.86 and 14.01%, respectively, serum globulin increased with 12.55 and 13.51%, respectively. Plasma total proteins, albumin, globulin were affected significantly ($P<0.01$) by dietary zinc supplementation (Ayyat.and Marai, 2000).

Serum urea-N and creatinine concentrations were insignificantly affected by the dietary zinc supplementation (Table 5). Serum urea-N concentration increased with 4.23 and 6.65%, respectively, in rabbits fed diets supplemented with 100 and 200 mg zinc than those fed the diet without supplementation. Abd El-Rahim et al. (1995) reported that blood urea-N significantly ($P<0.05$) decreased in the rabbit group fed diet supplemented with Zn 170 mg/kg diet than those fed diet without supplementation.

The concentration of AST was insignificantly affected by the dietary zinc supplementation in rabbit diets, while ALT concentration significantly (P<0.001) affected (Table 5). Serum ALT concentration increased by 3.46 and 9.19%, respectively, in rabbits fed diets supplemented with 100 or 200 mg zinc.

Dietary zinc supplementation significantly affected carcass weight (P<0.01), hind part weight (P<0.05) and prime cuts weight (P<0.05). Carcass, hind part and prime cuts weights were increased significantly with increasing zinc supplementation in rabbit diets (Tables 6 and 7).

Interaction between dietary energy, fibre level and zinc:

Live body weight at 8 weeks of the experimental period were insignificantly affected with the interaction between dietary energy, fibre and zinc supplementation. Supplemented rabbit diets with 100 or 200 mg zinc recorded higher body gain weight than the other experimental groups (Table 2). Daily body gain weight at 0-8 weeks of the experimental period were insignificantly affected with the interaction between dietary fibre and zinc supplementation at all experimental groups, except at 0-4 weeks body gain was insignificantly (P<0.001) affected, (Table 2). Supplemented rabbit diets with 100 or 200 mg zinc recorded higher body gain weight than the other experimental groups.

Daily feed intake was affected with the interaction between dietary energy and fibre levels and zinc supplementation in rabbit diets (Table 3). Within each energy level, decreasing the diet fibre content decreased the daily feed intake, while dietary zinc supplementation did not affected feed intake. Feed conversion was affected with the interaction between dietary energy and fibre levels and zinc supplementation in rabbit diets (Table 3). Within each energy level, decreasing the fibre content in rabbit diets or dietary zinc supplementation improved feed conversion. Also, increasing dietary energy level improved feed conversion. Rabbits fed high energy- low fibre diet and supplemented with 100 mg zinc recorded the best feed conversion than the other experimental groups.

Increasing dietary energy level and supplemented rabbit diets with zinc and within the normal fibre level recorded the highest margin. Rabbit group fed

Table 1. Formulation and chemical analysis of the experimental diets.

Items	NE-NF	NE-LF	HE-NF	HE-LF
Ingredients:				
Alfalfa hay	24.00	16.00	28.00	20.00
Soybean meal	12.00	12.00	15.00	15.00
Wheat bran	46.00	45.00	28.00	28.00
Yellow corn	13.00	10.00	24.00	24.00
Barley	---	12.00	---	8.00
Molasses	3.00	3.00	3.00	3.00
Limestone	1.40	1.40	1.40	1.40
Sodium chloride salt	0.30	0.30	0.30	0.30
Vitamin and mineral premix	0.30	0.30	0.30	0.30
Chemical composition[1]:				
Crude protein %	15.97	15.81	16.15	16.02
Crude fiber %	12.93	10.56	12.78	10.38
Digestible energy (kcal/kg)[2]	2550.30	2563.30	2739.50	2758.30
Price (LE/Ton)	836.00	877.00	888.00	930.00

NE = Normal energy, HE = High energy, NF = Normal fibre, LF = Low fibre.

1. Analyzed according to A.O.A.C. (1985)

2. calculated according to NRC (1977).

Table 2. live body weight as affected by dietary energy, fiber, and zinc supplementation level and their interactions during the experimental period.

Item	W0	W8	G08
Energy			
Normal	516.66± 3.21	1641.14±17.59	20.08±0.31
High	515.70± 2.62	1863.16±25.04	24.06±0.44
significance	NS	***	***
Fiber			
Normal	514.91± 3.07	1816.47±26.27	23.24±0.46
Low	517.50± 2.76	1685.54±22.96	20.85±0.41
significance	NS	***	***
Zinc			
0 mg	514.18± 3.81	1650.68±20.28	20.29±0.36
100 mg	517.17± 3.14	1775.51±38.46	22.47±0.69
200 mg	517.10± 3.83	1826.97±27.18	23.39±0.47
significance	NS	***	***
Energy x Fiber			
NE x NF	516.03± 4.52	1712.07±17.83	21.35±0.30
NE x LF	517.32± 4.63	1567.68±23.94	18.75±0.44
HE x NF	513.79± 4.22	1920.86±41.40	25.12±0.73
HE x LF	517.67± 3.09	1803.39±23.36	22.95±0.41
significance	NS	NS	NS
Energy x Zinc			
NE x 0 Zinc	515.26± 5.70	1588.95±25.34	19.17±0.47
NE x 100 Zinc	518.42± 4.89	1627.63±27.46	19.80±0.51
NE x 200 Zinc	516.31± 6.28	1706.84±33.05	21.26±0.55
HE x 0 Zinc	513.05± 5.17	1715.83±24.21	21.47±0.40
HE x 100 Zinc	516.00± 4.09	1916.00±54.39	25.00±0.98
HE x 200 Zinc	517.89± 4.56	1947.11±18.51	25.52±0.32
significance	NS	*	*
Fiber x Zinc			
NF x 0 Zinc	513.15± 6.38	1700.00±24.22	21.19±0.40
NF x 100 Zinc	515.00± 4.20	1865.00±62.23	24.10±1.12
NF x 200 Zinc	516.50± 5.39	1881.00±31.27	24.36±0.53
LF x 0 Zinc	515.27± 4.19	1598.61±28.71	19.34±0.54
LF x 100 Zinc	519.25± 4.70	1690.50±38.78	20.91±0.70
LF x 200 Zinc	517.77± 5.58	1766.94±42.17	22.30±0.73
significance	NS	NS	NS
Energy x Fiber x Zinc			
NE x NF x 0 Zinc	513.00± 8.85	1651.50±20.56	20.33±0.35
NE x NF x 100 Zinc	517.22± 7.12	1709.44±22.91	21.29±0.43
NE x NF x 200 Zinc	518.00± 8.00	1775.00±34.32	22.44±0.53
NE x LF x 0 Zinc	517.77± 7.41	1519.44±37.09	17.88±0.73
NE x LF x 100 Zinc	519.50± 7.08	1554.00±34.28	18.47±0.65
NE x LF x 200 Zinc	514.44±10.32	1631.11±48.51	19.94±0.82
HE x NF x 0 Zinc	513.33± 9.78	1753.89±39.60	22.15±0.64
HE x NF x 100 Zinc	513.00± 5.06	2005.00±98.48	26.64±1.77
HE x NF x 200 Zinc	515.00± 7.63	1987.00±21.33	26.28±0.34
HE x LF x 0 Zinc	512.77± 4.25	1677.78±23.68	20.80±0.41
HE x LF x 100 Zinc	519.00± 6.57	1827.00±32.18	23.35±0.59
HE x LF x 200 Zinc	521.11± 4.84	1902.78±24.34	24.67±0.42
significance	NS	NS	NS

NS = Not significance, * = P<0.05 and *** = P<0.001.

Table 3. Feed Efficiency as affected by dietary energy, fiber, and zinc supplementation level and their interactions during the experimental period.

Item	Feed Intake 0-8	Feed Conversion 0-8	Feed Cost (LE/rabbit)	Return From Body Gain (LE/rabbit)	Final Margin (LE/rabbit)
Energy					
Normal	107.72	5.36	5.16	12.36	7.20
High	99.58	4.13	5.06	14.82	9.76
Fiber					
Normal	105.24	4.52	5.08	14.31	9.23
Low	102.06	4.89	5.16	12.84	7.68
Zinc					
0 mg	103.55	5.10	5.11	12.49	7.38
100 mg	103.47	4.60	5.11	13.84	8.73
200 mg	10.93	4.44	5.13	14.40	9.27
Energy x Fiber					
NE x NF	109.75	5.14	5.13	13.15	8.02
NE x LF	105.70	5.63	5.19	11.55	6.36
HE x NF	100.73	4,00	5.00	15.47	10.47
HE x LF	98.43	4.28	5.12	14.13	9.01
Energy x Zinc					
NE x 0 Zinc	107.60	5.61	5.15	11.80	6.65
NE x 100 Zinc	107.65	5.43	5.17	12.19	7.02
NE x 200 Zinc	107.92	5.07	5.12	13.09	7.88
HE x 0 Zinc	99.50	4.63	5.06	13.22	8.16
HE x 100 Zinc	99.30	3.97	5.07	15.40	10.33
HE x 200 Zinc	99.95	3.91	5.12	15.72	10.60
Fiber x Zinc					
NF x 0 Zinc	105.10	4.95	5.07	13.05	7.98
NF x 100 Zinc	105.20	4.36	5.09	14.84	9.75
NF x 200 Zinc	105.42	4.32	5.12	15.00	9.88
LF x 0 Zinc	102.00	5.27	5.15	11.91	6.76
LF x 100 Zinc	101.75	4.86	5.16	12.88	7.72
LF x 200 Zinc	102.45	4.59	5.12	13.73	8.55
Energy x Fiber x Zinc					
NE x NF x 0 Zinc	109.60	5.39	5.13	12.52	7.39
NE x NF x 100 Zinc	109.85	5.15	5.16	13.11	7.95
NE x NF x 200 Zinc	109.80	4.89	5.17	13.82	8.65
NE x LF x 0 Zinc	105.60	5.90	5.18	11.01	5.83
NE x LF x 100 Zinc	105.45	5.70	5.19	11.37	6.18
NE x LF x 200 Zinc	106.05	5.31	5.24	12.28	7.04
HE x NF x 0 Zinc	100.60	4.54	5.00	13.64	8.64
HE x NF x 100 Zinc	100.55	3.77	5.01	16.41	11.40
HE x NF x 200 Zinc	101.05	3.84	5.05	16.18	11.13
HE x LF x 0 Zinc	98.40	4.73	5.12	12.81	7.69
HE x LF x 100 Zinc	98.05	4.19	5.12	14.38	9.26
HE x LF x 200 Zinc	98.85	4.00	5.18	15.19	10.01

Table 4. Total protein(g/l), Albumin(g/l), globulin(g/l) of rabbits as affected by dietary energy, fiber, and zinc supplementation level and their interactions.

Item	TP	AL	GL
Energy			
Normal	5.68±0.17	3.04±0.09	2.64±0.11
High	6.59±0.07	3.50±0.05	3.08±0.06
significance	***	***	***
Fiber			
Normal	6.41±0.12	3.38±0.06	3.02±0.08
Low	5.86±0.18	3.16±0.11	2.70±0.10
significance	***	**	**
Zinc			
0 mg	5.70±0.20	3.07±0.10	2.63±0.14
100 mg	6.22±0.20	3.25±0.11	2.96±0.09
200 mg	6.48±0.15	3.50±0.10	2.98±0.11
significance	***	***	*
Energy x Fiber			
NE x NF	6.16±0.20	3.28±0.11	2.87±0.14
NE x LF	5.21±0.16	2.80±0.11	2.41±0.13
HE x NF	6.66±0.11	3.48±0.05	3.17±0.08
HE x LF	6.52±0.09	3.52±0.10	2.99±0.09
Significance	***	**	NS
Energy x Zinc			
NE x 0 Zinc	5.11±0.22	2.80±0.12	2.31±0.22
NE x 100 Zinc	5.67±0.23	2.97±0.14	2.70±0.10
NE x 200 Zinc	6.27±0.24	3.36±0.16	2.90±0.16
HE x 0 Zinc	6.30±0.03	3.34±0.06	2.95±0.05
HE x 100 Zinc	6.77±0.09	3.53±0.08	3.23±0.06
HE x 200 Zinc	6.70±0.14	3.64±0.11	3.06±0.17
significance	**	NS	NS
Fiber x Zinc			
NF x 0 Zinc	5.94±0.20	3.17±0.09	2.76±0.18
NF x 100 Zinc	6.54±0.19	3.44±0.12	3.09±0.09
NF x 200 Zinc	6.74±0.12	3.54±0.06	3.20±0.13
LF x 0 Zinc	5.47±0.35	2.97±0.18	2.50±0.23
LF x 100 Zinc	5.90±0.32	3.06±0.17	2.83±0.16
LF x 200 Zinc	6.22±0.24	3.45±0.20	2.77±0.14
Significance	NS	NS	NS
Energy x Fiber x Zinc			
NE x NF x 0 Zinc	5.52±0.19	3.00±0.12	2.52±0.32
NE x NF x 100 Zinc	6.15±0.17	3.23±0.16	2.91±0.03
NE x NF x 200 Zinc	6.80±0.08	3.62±0.11	3.18±0.18
NE x LF x 0 Zinc	4.71±0.19	2.60±0.14	2.11±0.34
NE x LF x 100 Zinc	5.19±0.14	2.71±0.07	2.48±0.07
NE x LF x 200 Zinc	5.73±0.10	3.10±0.24	2.63±0.13
HE x NF x 0 Zinc	6.35±0.03	3.34±0.03	3.01±0.06
HE x NF x 100 Zinc	6.93±0.11	3.65±0.10	3.28±0.10
HE x NF x 200 Zinc	6.69±0.25	3.47±0.03	3.22±0.24
HE x LF x 0 Zinc	6.24±0.05	3.35±0.13	2.89±0.07
HE x LF x 100 Zinc	6.60±0.04	3.41±0.12	3.19±0.08
HE x LF x 200 Zinc	6.72±0.19	3.81±0.17	2.90±0.26
significance	NS	NS	NS

NS = Not significance, * = P<0.05, ** = P<0.01 and *** = P<0.001.

Table 5. Serum transaminase enzymes (AST and ALT), Urea-N and Creatinine of rabbits as affected by dietary energy, fiber, and zinc supplementation level and their interactions.

Item	AST(U/l)	ALT(U/l)	Urea-N(mg/dl)	Creatinine(mg/dl)
Energy				
Normal	34.93±0.26	13.42±0.19	12.57±0.22	1.02±0.010
High	36.18±0.16	14.93±0.21	13.92±0.25	1.09±0.013
significance	***	***	***	***
Fiber				
Normal	35.57±0.22	14.40±0.25	13.54±0.21	1.07±0.012
Low	35.55±0.30	13.95±0.28	12.95±0.33	1.05±0.016
significance	NS	NS	NS	NS
Zinc				
0 mg	35.20±0.41	13.60±0.33	12.78±0.35	1.06±0.021
100 mg	35.77±0.26	14.07±0.30	13.32±0.32	1.04±0.014
200 mg	35.71±0.26	14.85±0.26	13.63±0.35	1.07±0.016
significance	NS	***	NS	NS
Energy x Fiber				
NE x NF	35.34±0.41	13.60±0.23	13.11±0.26	1.04±0.009
NE x LF	34.53±0.28	13.24±0.32	12.03±0.27	1.01±0.018
HE x NF	35.80±0.17	15.21±0.22	13.97±0.29	1.10±0.018
HE x LF	36.57±0.22	14.62±0.34	13.86±0.43	1.09±0.019
significance	*	NS	NS	NS
Energy x Zinc				
NE x 0 Zinc	34.23±0.50	12.86±0.34	11.80±0.29	1.00±0.025
NE x 100 Zinc	35.35±0.37	13.25±0.19	12.76±0.30	1.01±0.009
NE x 200 Zinc	35.23±0.39	14.15±0.27	13.15±0.38	1.05±0.010
HE x 0 Zinc	36.16±0.36	14.33±0.39	13.76±0.26	1.12±0.010
HE x 100 Zinc	36.20±0.29	14.90±0.33	13.88±0.49	1.08±0.020
HE x 200 Zinc	36.20±0.27	15.56±0.17	14.11±0.57	1.08±0.032
significance	NS	NS	NS	NS
Fiber x Zinc				
NF x 0 Zinc	35.08±0.55	14.23±0.37	12.96±0.27	1.07±0.019
NF x 100 Zinc	35.71±0.32	14.03±0.46	13.76±0.27	1.05±0.024
NF x 200 Zinc	35.91±0.19	14.95±0.43	13.90±0.48	1.08±0.022
LF x 0 Zinc	35.31±0.67	12.96±0.43	12.60±0.67	1.04±0.039
LF x 100 Zinc	35.83±0.43	14.11±0.45	12.88±0.55	1.03±0.017
LF x 200 Zinc	35.51±0.51	14.76±0.33	13.36±0.55	1.06±0.026
significance	NS	*	NS	NS
Energy x Fiber x Zinc				
NE x NF x 0 Zinc	34.53±1.01	13.46±0.23	12.43±0.17	1.03±0.014
NE x NF x 100 Zinc	35.60±0.60	13.16±0.17	13.36±0.12	1.02±0.016
NE x NF x 200 Zinc	35.90±0.41	14.16±0.54	13.53±0.67	1.06±0.014
NE x LF x 0 Zinc	33.93±0.40	12.26±0.40	11.16±0.06	0.97±0.043
NE x LF x 100 Zinc	35.10±0.52	13.33±0.38	12.16±0.31	1.00±0.008
NE x LF x 200 Zinc	34.56±0.39	14.13±0.27	12.76±0.35	1.05±0.017
HE x NF x 0 Zinc	35.63±0.43	15.00±0.25	13.50±0.23	1.11±0.012
HE x NF x 100 Zinc	35.83±0.40	14.90±0.52	14.16±0.46	1.09±0.040
HE x NF x 200 Zinc	35.93±0.08	15.73±0.23	14.26±0.76	1.09±0.044
HE x LF x 0 Zinc	36.70±0.41	13.66±0.53	14.03±0.48	1.12±0.018
HE x LF x 100 Zinc	36.56±0.38	14.90±0.51	13.60±0.95	1.07±0.020
HE x LF x 200 Zinc	36.46±0.53	15.40±0.26	13.96±1.02	1.08±0.055
significance	NS	NS	NS	NS

NS = Not significance, * = P<0.05 and *** = P<0.001.

Table 6. Actual live body weight and adjusted carcass and liver weights of rabbits as affected by dietary energy, fiber, and zinc supplementation level and their interactions.

Item	Pre-slaughter weight	Carcass weight	Liver weight
Energy			
Normal	1696.17± 31.32	994.27± 6.21	65.63±3.06
High	1855.00± 20.00	1055.38± 6.21	67.36±3.06
significance	***	***	NS
Fiber			
Normal	1813.94± 28.25	1031.04± 5.24	65.61±2.59
Low	1737.22± 33.94	1018.61± 5.24	67.38±2.59
significance	*	NS	NS
Zinc			
0 mg	1700.50± 37.02	1005.97± 7.01	63.92±3.46
100 mg	1778.33± 31.13	1020.09± 6.01	66.90±2.97
200 mg	1847.92± 39.91	1048.42± 6.94	68.66±3.42
significance	**	**	NS
Energy x Fiber			
NE x NF	1755.11± 37.94	1005.75± 7.01	65.21±3.46
NE x LF	1637.22± 43.14	982.80± 9.60	66.06±4.74
HE x NF	1872.78± 32.98	1056.34± 8.36	66.02±4.13
HE x LF	1837.22± 23.11	1054.42± 7.55	68.70±3.72
significance	NS	NS	NS
Energy x Zinc			
NE x 0 Zinc	1608.50± 45.65	976.70±11.68	65.71±5.77
NE x 100 Zinc	1719.17± 49.63	993.17± 8.93	69.60±4.41
NE x 200 Zinc	1760.83± 54.59	1012.95± 8.54	61.59±4.21
HE x 0 Zinc	1792.50± 23.72	1035.23± 8.54	62.13±4.22
HE x 100 Zinc	1837.50± 20.03	1047.02± 9.01	64.21±4.45
HE x 200 Zinc	1935.00± 31.57	1083.90±11.43	75.74±5.64
significance	NS	NS	NS
Fiber x Zinc			
NF x 0 Zinc	1763.50± 38.35	1009.92± 8.53	62.49±4.21
NF x 100 Zinc	1790.00± 26.73	1034.69± 8.53	62.06±4.21
NF x 200 Zinc	1888.33± 65.02	1048.52±10.07	72.28±4.97
LF x 0 Zinc	1637.50± 54.53	1002.01±10.77	65.34±5.32
LF x 100 Zinc	1766.67± 59.12	1005.50± 8.52	71.75±4.20
LF x 200 Zinc	1807.50± 46.14	1048.33± 8.64	65.04±4.27
significance	NS	NS	NS
Energy x Fiber x Zinc			
NE x NF x 0 Zinc	1697.00± 44.24	988.62±12.61	68.49±6.22
NE x NF x 100 Zinc	1770.00± 45.82	1014.84±12.04	63.17±5.94
NE x NF x 200 Zinc	1798.33±102.40	1013.78±12.08	63.96±5.96
NE x LF x 0 Zinc	1520.00± 25.16	964.79±17.16	62.93±8.47
NE x LF x 100 Zinc	1668.33± 87.38	971.50±13.08	76.03±6.46
NE x LF x 200 Zinc	1723.33± 54.87	1012.13±12.29	59.22±6.07
HE x NF x 0 Zinc	1830.00± 31.22	1031.22±12.31	56.50±6.08
HE x NF x 100 Zinc	1810.00± 32.78	1054.54±12.14	60.95±6.00
HE x NF x 200 Zinc	1978.33± 50.52	1083.27±15.46	80.60±7.63
HE x LF x 0 Zinc	1755.00± 20.81	1039.24±12.07	67.76±5.96
HE x LF x 100 Zinc	1865.00± 13.22	1039.50±12.77	67.47±6.31
HE x LF x 200 Zinc	1891.67± 23.51	1084.52±13.25	70.87±6.54
significance	NS	NS	NS

NS = Not significance, * = P<0.05, ** = P<0.01 and *** = P<0.001.

Table 7. Adjusted carcass cuts weights of rabbits as affected by dietary energy, fiber, and zinc supplementation level and their interactions.

Item	Fore part weight	Intermediate part weight	Hind part weight	Prime cuts weight
Energy				
Normal	215.99± 4.34	254.95± 7.70	316.30± 6.97	571.25± 7.02
High	228.72± 4.34	272.54± 7.70	348.14± 6.97	620.69± 7.02
significance	NS	NS	*	***
Fiber				
Normal	224.78± 3.66	262.48± 6.50	338.98± 5.88	601.46± 5.92
Low	219.93± 3.66	265.01± 6.50	325.46± 5.88	590.48± 5.92
significance	NS	NS	NS	NS
Zinc				
0 mg	223.03± 4.89	260.58± 8.69	318.01± 7.86	578.59± 7.92
100 mg	218.03± 4.20	268.27± 7.46	327.42± 6.75	595.69± 6.80
200 mg	226.01± 4.85	262.39± 8.61	351.22± 7.79	613.62± 7.84
significance	NS	NS	*	*
Energy x Fiber				
NE x NF	218.30± 4.90	255.23± 8.70	327.74± 7.87	582.98± 7.93
NE x LF	213.69± 6.70	254.67±11.90	304.85±10.77	559.52±10.85
HE x NF	231.26± 5.84	269.72±10.37	350.21± 9.38	619.94± 9.45
HE x LF	226.18± 5.27	275.36± 9.36	346.07± 8.47	621.43± 8.53
significance	NS	NS	NS	NS
Energy x Zinc				
NE x 0 Zinc	217.04± 8.16	252.45±14.48	296.35±13.11	548.80±13.20
NE x 100 Zinc	208.53± 6.23	260.66±11.07	312.14±10.02	572.81±10.09
NE x 200 Zinc	222.41± 5.96	251.73±10.59	340.40± 9.58	592.14± 9.65
HE x 0 Zinc	229.02± 5.97	268.71±10.60	339.67± 9.59	608.39± 9.66
HE x 100 Zinc	227.54± 6.29	275.87±11.17	342.70±10.11	618.58±10.18
HE x 200 Zinc	229.61± 7.98	273.04±14.17	362.05±12.83	635.10±12.92
significance	NS	NS	NS	NS
Fiber x Zinc				
NF x 0 Zinc	222.12± 5.96	262.10±10.57	322.25± 9.57	584.36± 9.64
NF x 100 Zinc	225.12± 5.96	266.65±10.59	344.63± 9.58	611.28± 9.65
NF x 200 Zinc	227.10± 7.04	258.68±12.50	350.05±11.31	608.73±11.39
LF x 0 Zinc	223.93± 7.53	259.06±13.36	313.76±12.09	572.83±12.18
LF x 100 Zinc	210.95± 5.95	269.88±10.56	310.21± 9.56	580.10± 9.63
LF x 200 Zinc	224.91± 6.04	266.10±10.72	352.40± 9.70	618.51± 9.77
significance	NS	NS	NS	NS
Energy x Fiber x Zinc				
NE x NF x 0 Zinc	221.73± 8.81	245.36±15.64	309.25±14.15	554.62±14.25
NE x NF x 100 Zinc	210.59± 8.41	272.63±14.93	328.32±13.51	600.96±13.60
NE x NF x 200 Zinc	222.56± 8.44	247.70±14.98	345.65±13.56	593.35±13.66
NE x LF x 0 Zinc	212.34±11.99	259.54±21.28	283.44±19.26	542.99±19.40
NE x LF x 100 Zinc	206.47± 9.14	248.69±16.22	295.96±14.68	544.66±14.79
NE x LF x 200 Zinc	222.25± 8.59	255.77±15.24	335.15±13.79	590.92±13.89
HE x NF x 0 Zinc	222.51± 8.60	278.84±15.27	335.25±13.82	614.10±13.91
HE x NF x 100 Zinc	239.65± 8.48	260.66±15.06	360.94±13.63	621.61±13.73
HE x NF x 200 Zinc	231.64±10.80	269.66±19.17	354.44±17.35	624.10±17.47
HE x LF x 0 Zinc	235.53± 8.43	258.58±14.97	344.09±13.55	602.67±13.65
HE x LF x 100 Zinc	215.43± 8.92	291.08±15.84	324.46±14.33	615.54±14.43
HE x LF x 200 Zinc	227.58± 9.26	276.43±16.44	369.65±14.88	646.09±14.98
significance	NS	NS	NS	NS

NS = Not significance, * = P<0.05, *** = P<0.001.

diet with high energy-normal fibre and supplemented with 200 mg zinc/kg diet recorded lower fed cost and higher return from body gain and final margin than the other experimental groups (Table 3).

The interaction between dietary energy and fibre levels and zinc supplementation insignificantly affected serum total proteins and its fractions (Table 4). Rabbits fed HE-NF diet and supplemented with 100 or 200 mg zinc recorded the higher total protein and its fraction concentrations than the other experimental groups.

Serum total proteins, albumin, urea-N, creatinine concentrations, AST and ALT activity were insignificantly affected by the interaction between dietary energy and fibre levels and zinc supplementation (Tables 4 and 5).

The interaction between dietary energy and fibre levels and zinc supplementation in rabbit diets insignificantly affected carcass and non carcass weights (Tables 6 and 7). Rabbits fed HE-NF or HE-LF and supplemented with 200 mg zinc showed highest carcass weight and prime cuts weight.

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تأثير مستوى الطاقة والألياف في الغذاء وإضافة الزنك على معدل أداء الأرانب، تحت الظروف المصرية.

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استخدم في هذه الدراسة ١٢٠ ذكر أرنب نيوزيلاندى ابيض عمر ٢٨ يوم وكانت متقاربة في الوزن الحي في بداية التجربة.وقسمت إلى ١٢ مجموعة في كل مجموعة١٠ حيوانات وتم تغذية أرانب المجموعات الست الأولى على عليقة معتدلة الطاقة(٢٥٠٠كيلو كالورى/كجم)بينما الست مجاميع الأخرى تم تغذيتها على عليقة مرتفعة الطاقة (٢٧٥٠كيلو كالورى/كجم) وتحت كل مستوى طاقة تم تغذية المجاميع الثلاثة الأولى يتم على عليقة معتدلة الألياف(١٢%) بينما غذيت الثلاث مجاميع الأخرى على عليقة منخفضة الألياف(١٠%) وتحت كل مستوى من مستويات الألياف فإن المجموعة الأولى لم

تحتوى على إضافات من الزنك وكانت المجموعة الثانية مضاف إليها عنصر الزنك بمعدل (١٠٠ملجم/كجم عليقة) بينما كانت المجموعة الثالثة تتناول عليقة مضافاً إليها عنصر الزنك بمعدل (٢٠٠ملجم/ كجم عليقة)واستغرقت التجربة فترة ٨ أسابيع.

ويمكن تلخيص النتائج كما يلي:

١_ وزن الجسم ومعدل الزيادة اليومية تأثر معنوياً بمستوى الطاقة في العليقه، فزاد معدل الزيادة اليومية في مجموعة الأرانب التي غذيت علي عليقه مرتفعه في محتواها من الطاقة بمقدار ١٩,٨٢% عند (٠-٨)أسبوع من بداية التجربة، وسجلت أرانب هذه المجوعة أقل معدل لاستهلاك الغذاء، بينما تحسن معدل تحويل الغذاء وانخفضت التكلفة بزيادة مستوى الطاقة في العليقه،وزاد هامش الربح النهائي، زاد كلا من البروتين الكلي و الالبيومين و الجلوبيولين وAST وALT في سيرم الدم بصورة معنوية بينما تأثرت يوريا الدم و الكرياتنين بصورة غير معنوية بزيادة مستوي الطاقة في علائق الأرانب، أشتمل تحليل التباين علي أن مستوي الطاقة في العليقة أثر معنويا علي الوزن الحي للذبيحة قبل الذبح ووزن القطعيات المختلفة بعد الذبح ووزن دهن الكلي فوزن الذبيحة ووزن دهن الكلي زاد معنويا بزيادة مستوى الطاقة في علائق الأرانب.

٢_ وزن الجسم ومعدل الزيادة اليومية تأثر معنوياً بمستوى الألياف في العليقه، فالأرانب التي تغذت علي علائق بها مستوي منخفض من الألياف سجلت أقل وزن للجسم بمقدار ٧,٢١% عند (الأسبوع ال٨) من بداية التجربة عن تلك التي غذيت علي علائق طبيعية في محتواها من الألياف، أنخفض معدل الزيادة اليومية بمقدار ١٠,٢٨%عند (٠-٨)أسبوع من بداية التجربة في المجموعة المنخفضة في محتواها من الأليساف، كما سجلت أقل معدل لاستهلاك الغذاء بينما زاد معدل تحويل الغذاء، زادت تكلفة الغذاء بينما أنخفض العائد النهائي بزيادة مستوى الألياف في العليقة، أنخفض كلا من البروتين الكلي و الالبيومين و الجلوبيولين بصورة معنوية بانخفاض مستوي الألياف في علائق الأرانب عن المستوي الطبيعي، أشتمل تحليل التباين علي أن مستوي الألياف في العليقة أثر معنويا علي الوزن الحي للذبيحة قبل الذبح ووزن القطعيات المختلفة بعد الذبح.

٣_ وزن الجسم ومعدل الزيادة اليومية تأثر معنوياً بمستوى الزنك في العليقه، فالأرانب التي تغذت علي علائق بها ١٠٠ملجم و٢٠٠ملجم زنك/كجم مستوي سجلت أعلي وزن للجسم وأعلي معدل للزيادة اليومية بمقدار ١٠,٧٤ و ١٥,٢٨%علي التوالي عند(٠-٨)أسبوع من بداية التجربة عن تلك التي تغذت علي علائق غير مضاف إليها زنك، لم يتأثر معدل استهلاك الغذاء اليومي بإضافة الزنك بينما زاد معدل تحويل الغذاء بإضافة الزنك، كذلك لم تتأثر تكلفة الغذاء بإضافة الزنك بينما زاد العائد النهائي، زاد كلا من البروتين الكلي و الالبيومين و الجلوبيولين بصورة معنوية في مجموعة الأرانب التي تغذت علي علائق بها ١٠٠و٢٠٠ملجم زنك/كجم عليقة ومن ناحية أخري تأثرت يوريا الدم و الكرياتنين وAST بصورة غير معنوية بينما تأثر ال ALT معنويا بإضافة

عنصر الزنك، وزن الكبد و الكلي و دهن الكلي تأثر بصورة غير معنوية بإضافة عنصر الزنك، فزاد وزن الذبيحة بزيادة مستوي الزنك في علائق الأرانب.

٤_ وزن الجسم ومعدل الزيادة اليومية تأثر بصورة غير معنوية بالتداخل بين مستويات الطاقة والألياف، فالأرانب التي غذيت علي علائق بها مستوي مرتفع من الطاقة وطبيعي من الألياف سجلت أعلي معدل زيادة يومية عن باقي المعاملات كما سجلت أفضل معدل تحويل للغذاء وكذا أفضل تكلفة و أعلي عائد نهائي.

٥_ تأثر وزن الجسم الحي عند (الأسبوع ال٤)من بداية التجربة بصورة غير معنوية بالتداخل بين مستويات الطاقة وإضافات عنصر الزنك بينما عند (الأسبوع ال٨)تأثر بصورة معنوية، فالأرانب التي تغذت علي علائق بها مستوي مرتفع من الطاقة ومضاف إليها زنك سجلت أعلي معدل زيادة يومية، والأرانب التي غذيت علي علائق بها مستوي مرتفع من الطاقة ومضاف إليها ٢٠٠ملجم زنك/كجم عليقة سجلت أفضل معدل تحويل الغذاء وأعلي عائد نهائي عن باقي المعاملات، التداخل بين مستويات الطاقة و إضافات الزنك أثر معنويا علي البروتين الكلي وALT في سيرم الدم بينما أثر بصورة غير معنوية علي الالبيومين و الجلوبيولين و اليوريا و الكرياتنين وAST.

٦_ تأثر وزن الجسم الحي عند (الأسبوع ال٤)من بداية التجربة بصورة غير معنوية بالتداخل بين مستويات الألياف وإضافات عنصر الزنك بينما عند (الأسبوع ال٨)تأثر بصورة معنوية، فالأرانب التي غذيت علي علائق بها مستوي منخفض من الألياف ومضاف إليها ١٠٠و٢٠٠ملجم زنك/كجم عليقة سجلت أعلي معدل زيادة يومية، والعلائق المضاف إليها ٢٠٠ملجم زنك/كجم عليقة سجلت أفضل معدل لتحويل الغذاء عن باقي معاملات التجربة،بينما الأرانب التي تغذت علي علائق طبيعية في محتواها من الألياف ومضاف إليها ٢٠٠ملجم زنك سجلت أعلي عائد، التداخل بين مستويات الألياف و إضافات الزنك أثر بصورة غير معنوية علي البروتين الكلي و الالبيومين و الجلوبيولين و اليوريا و الكرياتنين وAST في سيرم الدم بينما أثر معنويا علي ALT.

٧_ وزن الجسم ومعدل الزيادة اليومية تأثر بصورة غير معنوية بالتداخل بين مستويات الطاقة والألياف وإضافات الزنك في جميع معاملات التجربة، الأرانب التي غذيت علي علائق مرتفعة في محتواها من الطاقة ومنخفض في الألياف ومضاف إليها ١٠٠ملجم زنك/كجم عليقة سجلت أفضل معدل لتحويل الغذاء عن باقي معاملات التجربة بينما مجموعة الأرانب التي غذيت علي علائق مرتفعة في محتواها من الطاقة وطبيعية في الألياف ومضاف إليها ٢٠٠ملجم زنك/كجم عليقة سجلت أقل تكلفة للغذاء وأعلي عائد نهائي، التداخل بين مستويات الطاقة والألياف وإضافات الزنك أثر بصورة غير معنوية علي البروتين الكلي و الالبيومين و الجلوبيولين و اليوريا و الكرياتنين وAST وALT في سيرم الدم، التداخل بين مستويات الطاقة والألياف والزنك المضاف في علائق الأرانب أثر بصورة غير معنوية علي أوزان الذبيحة و القطعيات الأخرى.