DEVALUATION OF DIFFERENT SOURCES OF DIETARY ZINC SUPPLEMENTATION FOR JAPANESE QUAIL: 1- GROWTH PERFOMANCE

BY

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ABSTRACT*:* *This study was carried out at the Poultry Research Station, El-Azab, Fayoum, Egypt. The aim of the present research was to evaluate the effect of inclusion several sources of dietary Zn (either Zn SO4, imported zinc-methionine or local zinc-methionine) on performance and economic efficiency of growing Japanese quails. The studied sources of dietary Zn were incorporated over the basal diet (the control diet) of growing Japanese quails at level of 50 mg Zn/kg diet. A total number of five hundred and fifty five unsexed one-week old chick's Japanese quails were used. These chicks were randomly distributed equally into five dietary treatments, and each dietary treatment was equally subdivided into three replicates. Chicks were housed in battery brooders equipped with raised wire floors and were raised under similar environmental, managerial and veterinarian conditions. The five experimental diets were prepared to be isonitrogenou, 24% CP and isocaloric, 2900 kcal ME/kg diet according to NRC (1994) recommendation. The five experimental diets were as follow: 1- T1: the basal diet (C), without any additives. 2- T2: C + 50 mg Zn (from Zn SO4)/kg diet. 3- T3: C + 50 mg Zn (from Zn SO4)/kg diet + 200 mg methionine/kg diet. 4- T4: C + 50 mg Zn (from imported zinc methionine)/kg diet. 5- T5: C + 50 mg Zn (from local zinc methionine)/kg diet.*

From the applied results which were collected along the entire research period, it could be concluded as the following: 1- Chicks of Japanese quails fed diet supplemented with 50 mg Zn (from the local zinc-methionine)/kg diet achieved the least FI value, and had the best FC ratio, followed by those used up the diet supplemented with the same level of Zn (from the imported zinc-methionine)/kg diet.

2- Most of the carcass traits of Japanese quails chicks were not significantly affected with either the different sources of dietary Zn supplementation.

3- Diet of growing Japanese quails supplemented with 50 mg Zn obtained from local zinc-methionine as a feed additive recorded the lowest feed cost/kg gain and exhibited the best amelioration of economical efficiency, followed with the diet supplemented with 50 mg Zn from imported zinc-methionine.

INTRODUCTION

A lot of feed additives have been utilized in order to improve the productive performance of growing and laying quails. Zinc as an essential micronutrient has significant roles in the organism, probably because it is a co-factor of more than 200 enzymes. So, the presence of adequate zinc in the higher biological systems is necessary for normal development, maintenance and function of the immune system (Dardenne and Bach, 1993 and Sahin et al., 2005). One of the most significant functions of Zn is related to its antioxidant role and its participation in the antioxidant defense system (Powell, 2000). Where, zinc increases the synthesis of metallothionein, a cysteine – rich protein, which acts as a free radical scavenger (Prasad et al., 1993, Bales et al., 1994 and Sahin et al., 2005). Additionally, Salgueiro et al., (2000) and Kim et al., (1998) predicated that zinc as an antioxidant interacts with vitamin E, because vitamin E status is impaired in zinc-deficient animals. Also, zinc can occupy iron and copper binding sites on lipids, proteins and DNA and thus exert a direct antioxidant action (Prasad and Kucuk, 2002 and Tate et al., 1999). Furthermore, Southern and Baker (1983) accentuated that the trace element antagonism shown convincingly between Zn and Cu in chicks, where the antagonism between trace elements is primarily mediated through the absorption process (Van Campen and Scaife, 1967) through formation of insoluble complexes that do not release trace elements in the gastric or intestinal milieu (Spears, 2003), or from other reasons (Kordas and Stoltzfus, 2004). On other hand, no antagonism between Zn and Cu was apparent at the hepatic level (Skrivan et al., 2005). Another important role for zinc represented with its essential component of both DNA and RNA polymerase enzymes and is vital to the activity of a variety of hormones including glucagons, insulin, growth hormone and the sex hormone. So, normal Zn status is of key importance for the immune function in broiler (Hengmin et al., 2004), where, zinc is important for proper functioning of hetrophils, mononuclear phagocytes and T lymphocytes. These components of the cellular immune system are important for disease resistance (Kidd et al., 1996). However, zinc-methionine is a specific organo-amino acid complex of zinc which differs from inorganic zinc proteinates and zinc polysaccharide complexes (American Association of feed control officials, 1990). Zinc-methionine organic complex contains zinc sulphate complexes to DL-methionine, and it is a specific amino acid complex of zinc (Zinpro, 1993). In this respect, Wedekind et al., (1992), Kidd et al., (1994a), and Kidd et al., (1996) predicated that, zinc-methionine, which is an organic complex, may be more available than inorganic sources of zinc (zinc sulphate and zinc oxide) and / or it may be absorbed intact and alter zinc pools and zinc metalloenzymes. In addition, zinc-methionine supplementation of diets fed to broiler breeder has been shown to increase cellular immunity of progeny (Kidd et al., 1992a, 1993). Furthermore, Kidd et al., (1996) suggested that, zinc-methionine may improve the immune system and augment disease resistance when added to the diet of poultry or when passed from dam to chick. However, zinc-methionine supplementation has beneficial effects on turkey macrophage function and humoral immunity (Kidd et al., 1992b). Successively, zinc-methionine enhances the activity of both circulatory and resident components of the mononuclear phagocytic system which considered important for disease resistance (Kidd et al., 1994b). In addition, Zn- methionine has improved performance of broiler (Sanford, 1976), laying hens (Flinchum, 1990) and turkey (Waibel et al., 1974). Ultimately, dietary zinc supplementation increases feed intake, growth rate and feed efficiency in broiler chicks (Roberson and Edwards, 1994) and quail (Sahin and Kucuk, 2003 and Sahin et al., 2005). The objective of the present study was undertaken to determine the impact of inclusion several sources of dietary zinc on the productive performance of growing Japanese quails.

MATERIALS AND METHODS

The present investigation was conducted at El-Azab Poultry Research Station, Fayoum, Egypt, to evaluate the impact of different sources of dietary Zn addition on the performance and economic efficiency of growing Japanese quails. A total number of five hundred and fifty five six unsexed one-week old chick’s Japanese quails were engaged. Chicks were wing banded individually weighed and randomly distributed equally into five groups of one hundred and eleven chicks of each, and each group was equally subdivided into three replicates of thirty seven chicks of each. Chicks were kept in cleaned and fumigated battery brooders equipped with raised wire floors under similar environmental, managerial and veterinarian conditions. The brooding temperature was nearly 35°C during the first week, after that, it was gradually decreased according to usual brooding practices. Chicks of the different treatments received the experimental diets of growers up to 6 weeks of age. Voluntary fresh water and feed were available *ad-libitum* for chicks. The used commercial sources of the dietary Zn were Zn SO4, imported zinc-methionine and local zinc-methionine.

Zinc-methionine complex consists of ZnSO4 complexes to Dl-methionine to yield a 1:1:1 ratio of zinc-methionine the sulfate ion. Zinc is coordinated between the amino and carboxyl groups of methionine, and sulfate occupies the vacant bonds. Thus, zinc-methionine is an organic complex of Zn, whereas ZnO and ZnSO4 forms are inorganic sources (Kidd et al., 1994a). Furthermore, both imported zinc-methionine and local zinc-methionine were obtained from Ibex Company. Dietary zinc were incorporated over the basal diets (the control diets) of growing Japanese quails, at the level of 50 mg Zn/kg diet. The control diets of the growing Japanese quails were formulated for meeting their requirements (Table 1), according to NRC (1994), and were prepared to be iso-nitrogenous (24% CP) and iso-caloric (2900 ME/kg diet). Five experimental diets were utilized with those five dietary treatments. In this respect, the five experimental diets (D) were as follow:

1- T1: the basal diet (the control diet, C), without any additives.

2- T2: C + 50 mg Zn (from Zn SO4)/kg diet.

3- T3: C + 50 mg Zn (from Zn SO4) /kg diet + 200 mg methionine/kg diet.

4- T4: C + 50 mg Zn (from imported zinc-methionine)/kg diet.

5- T5: C + 50 mg Zn (from local zinc-methionine)/kg diet.

Moreover, a continuous light (natural and or artificial sources) was provided along the growing period. During the studied growing period, the criteria of live body weight (LBW) and feed intake (FI) were weekly recorded. Then body weight gain (BWG) and feed conversion (FC) as a weight unit of FI per a weight unit of gain, according to (Hala, 1998) were calculated. At the end of 6th week of age, a slaughter test was performed, where three chicks from each dietary treatment were randomly chosen around the average LBW. The late chicks did not receive feed for 16 hours before slaughtering, and the recorded values were expressed as a percentage of pre-slaughter LBW. At last, economical efficiency were calculated according to input-output analysis.

Data were statistically analyzed according to Steel and Torrie (1980), and the differences among means were compared by engaging Duncan Multiple Range Test, according to (Duncan, 1955).

RESULTS AND DISCUSSION

Productive performance

Growth performance:

At 5 and 6 weeks old, the differences among all the experimental groups in LBW were not significant, and the experimental group fed the imported zinc-methionine gave the best results (Table 2). Similar finding of LBW were obtained by (Yi et al., (1996), Bartove, (1996), and Kout El-Kloub et al., (2004), who reported that, the addition of supplemental Zn in the hen diets either as Zn SO4 or Zn-Met showed no significant differences were recorded in average body weight. At 6 weeks old, all the dietary treatments had an insignificantly improvement on LBW, as compared to those of the control group. This may be imputed to that Zn plays a major role in DNA synthesis, protein and carbohydrate metabolism (Lieberman et al., 1963; Forbes, 1984). In this concern, El-Kaiaty et al., (2001) suggested that, dietary zinc supplementation caused an increase in body weight, growth rate, and the level of 50 ppm zinc/kg diet gave the best results. Also, Kidd et al (1994a) postulated that zinc-methionine supplementation increased LBW by 6 %.

Concerning the live body weight gain, it is clear that, for the two studied periods (1-5 and 1-6 weeks), the differences in LBWG values among all the experimental groups were not significant (Table 2). Moreover, at 1-6 weeks period, feeding diets supplemented with 50 mg Zn from the different sources gave insignificantly higher LBWG values than those of the control chicks. It may be due to that, zinc has numerous biological roles including cell division and multiplication (Rubin, 1972, Rubin and Koide, 1973), cell mediated immune response (Fraker et al., (1977) and Luecke et al, 1978), and performance (Collins and Moran, 1999).

As for FI and FC ratio, at 1-5 and 1-6 weeks periods, the control treatment had significantly the highest values of FI and poorest FC ratio (Table 2). while, the opposite was true with the dietary treatment 5 which recorded the least FI and best FC ratio (Table 2). This findings agree with those obtained by Ferket et al. (1992) who found that, turkey toms fed diets supplemented with Zn-Met improved FC ratio. Properly, supplemental Zn-methionine (Zn-Met) to the control diet significantly, increased body weight gain and improved feed conversion (Abou El-Wafa et al. 2003). So, it is worthy to mention that, FI values for the experimental groups fed diets supplemented with the several Zn sources were lower than those received the control diet. Also, these experimental groups showed amelioration for the final LBW, LBWG and FC values. This improvement in FC due to the efficiency of the several Zn sources supplementation. In this concern, El-Kaiaty et al., (2001) concluded that, zinc supplementation to broiler′ diet had a beneficial effect on broiler′ performance and cost of feed. Therefore, the addition of Zn to the diets of Japanese quails could be utilized as a method for pushing the chicks of Japanese quails toward the best metabolic functions to give the satisfactory productive performance. In this respect, El-Kaiaty et al., (2001) reported that, the level of 50 mg zinc /kg diet gave the best performance of chicks. Mohana and Nys (1999) stated that, dietary zinc concentration of 45 mg /kg was sufficient to obtain a normal broiler performance. It should be suggested that, the chicks of Japanese quails consumed diet supplemented with 50 mg Zn (from the local zinc methionine)/kg realized the least FI value, and brought out the best FC ratio, followed by those used up the diet supplemented with 50 mg Zn (from the imported zinc-methionine)/kg.

Carcass characteristics

Most of the carcass traits in the present study (Table 3) did not significantly affect with inclusion either the different dietary Zn sources, except that of giblet with imported and local sources, heart, liver with imported source and gizzard weights percentages with local source (as percentages of LBW). In this concern, El-Anwer and Attia (2004) found that, all carcass traits were not significantly affected by zinc level except abdominal fat weight for the three levels of zinc, 57, 107 and 157 mg/kg diets. However, chicks fed the diets 4 and 5 (supplemented with 50 mg Zn from imported and local Zn-methionine, respectively) showed a significant impact in total giblets weigh percentages, as compared with the control group. Moreover, no significant differences among all the experimental groups were presented for heart %, exception was seen with dietary treatment 4 (the basal diet plus 50 mg Zn from imported Zn-methionine), which exhibited a significant difference, when compared with the other experimental groups. In addition, chicks received the diet 4, achieved a significantly the highest value of liver weight percentages, in comparison with all the experimental groups, which were not noticed any significant differences. Furthermore, there were a significant elevation in the gizzard percentage values associated with the chicks consumed diet 5, comparing with the control group, whereas, the differences in gizzard weight percentages among the other dietary treatments and the control group were not significant. Abou El-Wafa et al., (2003) reported that, dietary methionine levels and Zn levels had no significant effect on percentages of dressing, liver, gizzard and total edible parts weight. Data in Table (3) show that males of quails fed the treated diets slightly had heaver testes weight percentages than those of the 4 and the control diets but without significant. It is clear that, males used up diet supplemented with 50 mg zinc (from local Zn-methionine) detected the greatest testes weight percentages, this may explain that, quail males fed the late diet toward the near future life will appear higher sexual efficiency and may produce semen with better quality. And the differences in testes weight among all the experimental groups were insignificant. The finding of spleen weights (Table 3) presented that the differences in its weight percentages were insignificant due to supplemented diets with either 50 mg Zn (from imported or local Zn-methionine). Whatever, diets of growing quails supplemented with 50 mg zinc (from local or imported Zn-methionine) /kg diet seemed to be less effective in spleen weight percentages. Results of bursa weights % which are illustrated in Table, 3 represent that, growing quails used up diets supplemented with 50 mg zinc (from different sources) /kg diet except that of diet 3 gave insignificantly higher bursa weight % than that of the control group. This means that, the profound increase in the relative weight of bursa might indicate bursal activity and reflected the stimulatory effect on the humoral branch of immunity (Hamdy et al., 2003).

Economical efficiency

Almost, chicks during period of 1-5 weeks of age had followed the same trend for economical efficiency and relative economical efficiency of those at 1-6 weeks old. Moreover, all the treated groups realized higher economical efficiency and relative economical efficiency values than the control group during period of 1-5 and 1-6 weeks old (Tables 4 and 5). These results are in agreement with those obtained by El-Anwer and Attia (2004) who deposed that chicks fed diet contained 57 mg zinc/kg diet of broiler chicks recorded the least feed cost / kg gain and the best economical efficiency. It is well known that, all the different experimental groups of grower chicks during 1-5 weeks of age had better FC and also gave better economical efficiency than those of 1-6 weeks of age. Thus, it is suggested that marketing age of quail chicks ends at the end of 5th week of age. This suggestion may be related to that females during the 6th week used up the diet for developing their internal organs in order to array their reproductive organs for egg output, however more of the afore females were verity entering up to lay eggs. The foregoing suggestion is also in harmony with those reported by Abdel-Wahed (2003) and Namra (2006). The experimental group which was fed the experimental diet 5 (the control diet+50 mg Zn from local zinc-methionine/kg diet) recorded the highest economical efficiency and relative economical efficiency values, followed by the experimental groups fed diets 4, 2 and 3, respectively. Regarding to the dietary Zn sources, the chicks fed diet 5 (the control diet + 50 mg Zn from local zinc-methionine/kg diet) gave the best economical efficiency and relative economical efficiency values. This may be attributed to the reduction FI and improving FC. While, chicks fed diet 3 (the control diet + 50mg Zn from Zn SO4/kg diet + 200 mg methionine/kg diet) had the lowest economical efficiency and relative economical efficiency values. Generally, it could be suggested that, diets of growing Japanese quails supplemented with different zinc sources as a feed additive improved economical efficiency and it is worthily to note that diet supplemented with 50 mg Zn obtained from local zinc-methionine/kg diet realized the best economical efficiency values.

From the nutritional and economical point of view, it could be concluded that, the chicks of Japanese quails fed diet supplemented with 50 mg Zn (from local zinc-methionine)/kg diet as a feed additive exhibited the least FI value, and realized the best FC ratio, followed by those consumed diet supplemented with the same level of Zn (from the imported zinc-methionine)/kg diet. Most of the carcass traits of Japanese quails were not significantly affected due to either the different dietary sources of zinc supplementation. Diet of growing Japanese quails supplemented with 50 mg Zn obtained from local zinc-methionine recorded the lowest feed cost/kg gain and achieved the best amelioration of economical efficiency, followed with the diet supplemented with 50 mg Zn from imported zinc-methionine.

Table (1): Composition and calculated analysis of the experimental diet of starter and grower of Japanese quails.**

Ingredients	Basal diet
Yellow corn	56.00
Soybean(44%)	30.50
Corn gluten meal (60%)	10.00
Limestone	1.50
Di calcium phosphate	1.00
Premix*	0.60
Salt	0.30
Dl – Methionine	0.10
Total	100
Crude protein %	24.18
ME, kcal/kg diet	2928
Crude fiber %	2.46
Ether extract %	2.71
Calcium %	0.91
Available phosphorus %	0.33
Lysine %	1.20
Methionine %	0.57
Cost/Ton of diet in L. E.***	1885

*Supplied per Kg of diet: vit. A, 12000 IU; vit. D3, 2200 IU; vit. E, 10mg; vit. K3 2mg;vit.B1,1mg; vit.B2, 5mg; vit. B6, 1.5mg; vit. B12, 0.01mg; Nicotinic acid, 30mg; Folic acid, 1mg;Pantothenic acid, 10mg; Biotin, 0.05mg;Choline chloride, 500mg; Copper, 10mg; Iron, 30mg; Manganese, 60mg;Zinc, 50mg;Iodine, 1mg; Selenium, 0.1mg and Cobalt, 0.1mg. ** According to NRC (1994). *** At time of experiment.

Table (2): Impact of feeding the experimental diets on live body weight (LBW), live body weight gain (LBWG), feed intake (FI) and feed conversion (FC), for growing Japanese quails (mean ± S.E.).

Items	Age(weeks)	Diets 1 Control (C)	2 C + 50 mg Zn (from Zn SO4) /kg diet	3 C + 50 mg Zn (from Zn SO4) + 200 mg methionine /kg diet	4 C + 50 mg Zn (from imported zinc- methionine)/ kg diet	5 C + 50 mg Zn (from local zinc-methionine) /kg diet	6 C + 200 mg methionine/kg diet
LBW	5	172.53 ± 2.99 ^{a}	171.52 ± 3.39 ^{a}	170.53 ± 2.65 ^{a}	173.38± 4.60 ^{a}	168.50 ± 4.48 ^{a}	170.75 ± 3.40 ^{a}
	6	202.75 ± 3.28 ^{a}	207.24 ± 3.47 ^{a}	209.27 ± 2.10 ^{a}	211.25 ± 5.41 ^{a}	205.93 ± 4.87 ^{a}	207.10 ± 3.39 ^{a}
LBWG	1-5	147.97 ± 2.69 ^{a}	146.96 ^{a} ± 3.17 ^{a}	149.05 ± 2.67 ^{a}	150.72 ± 3.96 ^{a}	146.04 ± 4.35 ^{a}	146.11 ± 2.94 ^{a}
	1-6	178.19 ± 3.07 ^{a}	182.68 ± 3.34 ^{a}	187.79 ± 2.18 ^{a}	188.59 ± 4.74 ^{a}	183.46 ± 4.77 ^{a}	182.46 ± 3.01 ^{a}
FI	1-5	405.02 ± 1.64 ^{d}	386.46 ± 2.45 ^{c}	400.72 ± 0.92 ^{d}	383.40 ± 1.77 ^{c}	356.05 ± 2.92 ^{a}	374.24 ± 4.49 ^{b}
	1-6	589.11 ± 2.89 ^{d}	545.22 ± 1.37 ^{b}	574.94 ± 3.35 ^{c}	539.36 ± 0.66 ^{b}	512.56 ± 3.04 ^{a}	536.62 ± 6.72 ^{b}
FC	1-5	2.78 ± 0.06 ^{b}	2.66 ± 0.06 ^{ab}	2.70 ± 0.05 ^{b}	2.57 ± 0.08 ^{ab}	2.47± 0.08 ^{a}	2.58 ± 0.06 ^{ab}
	1-6	3.34 ± 0.06 ^{c}	3.01 ± 0.05 ^{ab}	3.07 ±0.0 4 ^{b}	2.89 ± 0.07 ^{ab}	2.82 ± 0.08 ^{a}	2.96 ± 0.06 ^{ab}

a, b, c and d means in the same row within the same item followed by different superscripts differ significantly at $P<0.05$.

Table (3): Impact of feeding the experimental diets on slaughter characteristics of chicks of quails (means ± S.E).

	Diets					
	1	2	3	4	5	6
Treats Items	Control (C)	C + 50 mg Zn (from Zn SO4) /kg diet	C + 50 mg Zn (from Zn SO4) + 200 mg methionine /kg diet	C + 50 mg Zn (from imported zinc-methionine)/ kg diet	C + 50 mg Zn (from local zinc-methionine) /kg diet	C + 200 mg methionine/kg diet
LBW	168.83 ± 2.48^{ab}	168.83 ± 5.42^{ab}	169.25 ± 3.28^{ab}	167.11 ± 3.12^{ab}	159.73 ± 4.42^{a}	172.38 ± 2.91^{b}
Edible parts %	78.27 ± 0.75^{ab}	78.35 ± 0.49^{ab}	77.66 ± 0.46^{a}	78.75 ± 0.37^{ab}	78.87 ± 0.36^{ab}	79.42 ± 0.36^{b}
Carcass %	71.40 ± 0.95^{a}	70.97 ± 0.46^{a}	70.10 ± 0.45^{a}	70.81 ± 0.36^{a}	71.06 ± 0.47^{a}	71.96 ± 0.71^{a}
Giblet %	6.87 ± 0.29^{a}	7.38 ± 0.20^{ab}	7.57 ± 0.26^{ab}	7.94 ± 0.12^{b}	7.81 ± 0.17^{b}	7.46 ± 0.38^{ab}
Heart %	0.87 ± 0.04^{ab}	0.89 ± 0.02^{ab}	0.83 ± 0.02^{a}	0.95 ± 0.02^{b}	0.85 ± 0.04^{ab}	0.79 ± 0.03^{a}
Liver %	1.66 ± 0.11^{a}	1.92 ± 0.12^{a}	2.03 ± 0.21^{a}	2.52 ± 0.24^{b}	1.83 ± 0.11^{a}	1.98 ± 0.11^{a}
Gizzard %	1.34 ± 0.03^{a}	1.52 ± 0.06^{ab}	1.53 ± 0.11^{ab}	1.55 ± 0.07^{ab}	1.67 ± 0.13^{b}	1.52 ± 0.13^{ab}
Testis %	2.97 ± 0.25^{a}	3.00 ± 0.19^{a}	3.15 ± 0.21^{a}	2.89 ± 0.28^{a}	3.42 ± 0.11^{a}	3.14 ± 0.25^{a}
Spleen %	0.038 ± 0.007^{a}	0.039 ± 0.006^{a}	0.029 ± 0.004^{a}	0.029 ± 0.003^{a}	0.036 ± 0.001^{a}	0.038 ± 0.002^{a}
Bursa %	0.09 ± 0.02^{a}	0.16 ± 0.06^{a}	0.08 ± 0.01^{a}	0.16 ± 0.06^{a}	0.11 ± 0.02^{a}	0.10 ± 0.02^{a}

a and b means in the same row within the same item followed by different superscripts differ significantly at $P<0.05$.

Table (4): Impact of feeding the experimental diets on economical efficiency, during 1-5 weeks of age for Japanese quail chicks (mean ± S.E.).

Items	Diets					
	1	2	3	4	5	6
	Control (C)	C + 50 mg Zn (Zn SO4) /kg diet	C + 50 mg Zn (Zn SO4) + 200 mg methionine /kg diet	C + 50 mg Zn (imported zinc-methionine)/ kg diet	C + 50 mg Zn (local zinc-methionine) /kg diet	C + 200 mg Methionine/ kg diet
Average feed intake (1-5 wks), kg/bird (A)	0.405	0.386	0.401	0.383	0.356	0.374
Price / kg feed for 1-5 wks (P.T.) * (B)	188.50	188.61	189.05	189.7	190.75	188.94
Feed cost for 1-5 wks (P.T.) = A X B = (C)	76.34	72.80	75.81	72.66	67.91	70.66
Average LBWG (kg/bird) , (D)	0.148	0.147	0.149	0.151	0.146	0.146
Price / kg live body weight (P.T.), * (E)	2534	2534	2534	2534	2534	2534
Total revenue (P.T.) = D X E = (F)	375.03	372.50	377.57	382.63	369.96	369.96
Net revenue (P.T.) = F – C = (G)	298.69	299.7	301.76	309.97	302.05	299.30
Economic efficiency = (G / C) X 100 = (H)	391.26	411.68	398.05	426.60	444.78	423.58
Relative economic efficiency = (H / H of the control, 0% BY) X 100	100	105.22	101.74	109.03	113.68	108.26

* According to the local market price at the experimental time.

Table (5): Effect of feeding the experimental diets on economical efficiency during 1-6 weeks of age for Japanese quail chicks (mean ± S.E.).

Items	Diets					
	1	2	3	4	5	6
	Control (C)	C + 50 mg Zn (Zn SO4) /kg diet	C + 50 mg Zn (Zn SO4) + 200 mg methionine /kg diet	C + 50 mg Zn (imported zinc-methionine)/ kg diet	C + 50 mg Zn (local zinc-methionine) /kg diet	C + 200 mg methionine/kg diet
Average feed intake (1-6 wks), kg/bird (A)	0.589	0.545	0.575	0.539	0.513	0.537
Price / kg feed for 1-6 wks (P.T.) * (B)	188.50	188.61	189.05	189.70	190.75	188.94
Feed cost for 1-5 wks (P.T.) = A X B = (C)	111.03	102.79	108.70	102.25	97.85	101.46
Average LBWG (kg/bird) , (D)	0178	0.183	0.188	0.189	0.183	0.182
Price / kg live body weight (P.T.), * (E)	2176	2176	2176	2176	2176	2176
Total revenue (P.T.) = D X E = (F)	387.33	398.21	409.91	411.26	398.21	396.03
Net revenue (P.T.) = F – C = (G)	276.30	295.42	301.21	309.01	300.36	294.57
Economic efficiency = (G / C) X 100 = (H)	248.85	287.40	277.10	302.21	306.96	290.33
Relative economic efficiency = (H / H of the control, 0% BY) X 100	100	115.49	111.35	121.44	123.35	116.67

* According to the local market price at the experimental time.

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الملخص العربي

تقييم الإمداد الغذائي بمصادر الزنك المختلفة

باستخدام طيور السمان

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اجريت هذة الدراسة بمحطة بحوث الدواجن بالعزب – الفيوم – مصر بغرض تقييم كل من الفائدة و التأثير الناجم عن امداد الغذاء بعنصر الزنك (كأضافة غذائية) من مصادرتجارية مختلفة (كبريتات الزنك ، زنك - مثيونين محلى ، زنك – مثيونين مستورد) علي الأداء الأنتاجى و الكفاءة الأقتصادية لكتاكيت السمان النامية. و اضيف كل مصدر من هذة المصادر التجارية الى الغذاء القاعدى (الغذاء الضابط) كل على حدة بمستوى 50 ملجم زنك/كجم غذاء. و قد استخدم في هذة الدراسة 555 كتكوت سمان يابانى عمر اسبوع ، تم توزيعها عشوائيا الي خمس مجاميع تجريبية غذائية ذات عدد متساو ، و كل مجموعة تجريبية قسمت عشوائيا الى ثلاثة مكررات متساوية ايضا في العدد. وضعت جميع المعاملات التجريبية الخمسة في ظل ظروف متماثلة من الرعاية و التغذية الي نهاية الدراسة التى امتدت الى ستة أسابيع.

غذيت المجاميع التجريبية الخمس أيضاعلي خمس معاملات غذائية علي النحو التالي:

١ - المعاملة الاولى (1) متمثلة في الغذاء الضابط (الغذاء الكنترول) ، بدون أية اضافات ، و كانت نسبة البروتين بها 24% ، بينما محتوى الطاقة كان 2900 كيلو كالورى/ كجم غذاء.

٢ - المعاملة الثانية (2) متمثلة في العلف الكنترول + 50 ملجم زنك من كبريتات زنك / كجم غذاء.

٣ - المعاملة الثالثة (3) متمثلة في العلف الكنترول + 50 ملجم زنك من كبريتات زنك / كجم غذاء + 200 ملجم مثيونين / كجم غذاء.

٤ - المعاملة الرابعة (غذاء 4) متمثلة في العلف الكنترول + 50 ملجم زنك من زنك – مثيونين مستورد / كجم غذاء.

٥ - المعاملة الخامسة (غذاء 5) متمثلة في العلف الكنترول + 50 ملجم زنك من زنك – مثيونين محلي / كجم غذاء.

ومن النتائج الميدانية المستخلصة من هذة الدراسة التوصية بالاتى:

1- كتاكيت السمان اليابانى المغذاة علي علف كنترول مضاف الية 50 ملجم زنك من زنك – مثيونين محلي / كجم غذاء. استهلكت اقل كمية غذاء ، بينما حققت افضل كفاءة تحويل غذائى.. و تبعتها في ذلك الكتاكيت المغذاة علي علف كنترول مضاف الية 50 ملجم زنك من زنك – مثيونين مستورد / كجم غذاء.

2- لم يكن هناك تأثير معنوى علي صفات الذبيحة نتيجة تغذية كتاكيت السمان اليابانى علي اغذية مضاف اليها 50 ملجم زنك (من اى مصدر تجارى) / كجم علف كنترول.

3- كتاكيت السمان اليابانى المغذاة علي علف كنترول مضاف الية 50 ملجم زنك من زنك – مثيونين محلي / كجم غذاء سجلت اقل تكلفة الغذاء / كجم زيادة (عائد) ، كما أظهرت أعلا تحسن فى الكفاءة الاقتصادية ، و تبعتها في ذلك أيضا الكتاكيت المغذاة علي علف كنترول مضاف الية 50 ملجم زنك من زنك – مثيونين مستورد / كجم غذاء.