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EVALUATION OF DIFFERENT SOURCES OF DIETARY ZINC SUPPLEMENTATION FOR JAPANESE QUAIL: 2 - LAYING PERFOMANCE

By

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ABSTRACT: *The present investigation was performed at the Poultry Research Station, El-Azab. Fayoum, Egypt. The aim of the present investigation was to evaluate the advantage and profound impacts of inclusion different sources of dietary Zn (Zn SO4, imported zinc-methionine and local zinc-methionine) on productive performance and economical efficiency of laying Japanese quails. These different commercial sources of dietary Zn were added over the basal diets (the control diets containing 50 mg Zn/kg diet) of the birds at the level of 50 mg Zn/kg diet. A total number of six hundred and sixty six unsexed one-week old Japanese quail chicks were used. The chicks were randomly distributed equally into six dietary treatments, and each dietary treatment was subdivided equally into three replicates. Chicks were housed in battery brooders and raised under similar environmental, managerial and veterinarian conditions. After that the layers (from the same flock) were reared in quail community batteries also, under similar management, hygienic and environmental conditions. The six experimental dietary treatments (T) and diets (D) were as follow: 1- T1: the basal diet (the control diet, C), without any additives, but contained 50 mg Zn/kg diet through general premix used for all chicks . 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. 6- T6: C + 200 mg methionine/kg diet. Results obtained showed the following: 1- There was no positive response for Zn or methionine supplementation at levels 50 mg Zn or 200 mg methionine/kg diet on egg number, egg production % and egg mass of laying Japanese quails. 2- Layers of Japanese quail fed diet supplemented with 50 mg Zn (from local Zn-*

methionine), recorded the least FI, and also, realized the best FC values, followed by those fed diet supplemented with 50 mg Zn (from ZnSO4). 3- Layers of Japanese quail used up diet supplemented with 50 mg Zn (from imported Zn-methionine) gave the best fertility%. 4- Egg weight, yolk index and egg shape index of laying Japanese quails were not significantly affected by the different diets supplemented with 50 mg zinc or 200 mg methionine. 5- Layers of Japanese quail consumed diet supplemented with 50 mg Zn (from local Zn-methionine) exhibited the least feed cost/egg and realized the best economical efficiency value, followed with those fed diet supplemented with 50 mg Zn (from ZnSO4), which provided better economical efficiency than the other experimental groups.

It is concluded that increasing Zn over NRC (1994) recommendation (50 mg /kg diet) for laying Japanese quail hens had no significant impact on egg production, egg weight, feed conversion or economical efficiency. However, Zn_supplementation as Zn-methionine at a level higher than that of NRC (1994) recommendation improved fertility %. Inclusion of 50 mg Zn over NRC, 1994 recommendation or 200 mg methionine hydroxyl analogue free acid (88%) to the diets of Japanese quail layers insignificantly, ameliorated both egg weight and yolk weight % values, but did not improve both albumen weight%, yolk color and egg shell quality (egg shell weight and egg shell thickness).

INTRODUCTION

Zinc is the most common metal constituent of cellular enzymes and as such plays essential roles in cell proliferation and death, immune development and response, reproduction, gene regulation, and defense against oxidative stress and damage. Likely reflecting its role in gene regulation, zinc is required for the synthesis of two key structural proteins: keratin (the major structural protein of feathers, skin, beaks and claws) and collagen (the major structural protein of the extracellular matrix and connective tissues), (Richards and Dibner, 2005). Fundamentally, some multi functional affects of Zn could be denoted as follow: 1- Induction of metallothionein, modulation of the transition elements and its relationship with the antioxidant vitamins such as vitamin A and E (Salgueri et al., 2000), 2- Zinc induces the production of metallothionein, an effective scavenger of hydroxyl radicals, therefore Zn- metallothionein complexes in the islet cells may provide protection against immune-mediated free radical attack (Shaheen and Abd El-Fattah, 1995), 3- Zinc has a capacity to displace transition metals (Fe, Cu) from binding sites. It can compete with iron and copper to bind to cell membrane and decrease the production of free radicals, thus exerting a direct antioxidant action (Tate et al., 1999), 4- Zinc is a cofactor of the main antioxidative enzyme Cu Zn-superoxide dismutase, it may play a key role in suppressing free radicals and inhibiting NADPH-dependent lipid peroxidation (Prasad, 1997) as well as in preventing lipid peroxidation via inhibition of glutathione depletion.(Gibbs et al., 1985). Ultimately, Poultry diets are often supplemented with Zn above the amount recommended by the National Research Council, in order to assure optimal performance (NRC, 1984). Evidently, the great affect of Zn could be in respect that, zinc has numerous roles in some biological functions as well as protein metabolism (Forbes, 1984), DNA synthesis (Lieberman et al., 1963), cell division and multiplication (Rubin and Koide, 1973) and the cell mediated immune response (Luecke et al., 1978) and overall performance (Collins and Moran, 1999 and Mohanna et al., 1999). Poultry diets are often supplemented with Zn above the amount recommended by the National Research Council, in order to assure optimal performance (NRC, 1984). A number of compounds have been used as a source of zinc in poultry nutrition. Those commonly used as feed grade are zinc sulphate(22.7 % Zn) and zinc oxide(80.3 % Zn). Among various zinc compounds zinc in zinc sulphte is considered to be completely available to the chick. Fundamentally, zinc-methionine complex (commercially produced) consists of zinc sulphate ($ZnSO4$) and DL- methionine to yield a 1:1:1 ratio of zinc:methionine:sulfate . Zinc is coordinated between the amino and carboxyl groups of methionine, and sulfate occupies the valent bonds. Another type of zinc and methionine combination occures between the metal and methionine hydroxy analogue –free acid where one atom of zinc is chelated by two molecules from the analogue (1:2). Thus, zinc-methionine is an organic source for Zn because of methionine, whereas ZnO and $ZnSO4$ are inorganic sources (Kidd et al., 1994). Differences could be found between organic and inorganic sources of zinc in availability and effectiveness on poultry performance. In this respect, Kout El-Kloub et al., (2004) concluded that zinc-methionine at levels of 100 and 150 mg/kg and ZnO at level of 100 mg/kg as feed additives in Silver Montazah laying hens diets obtained better productive and reproductive performance. In this concern, Flinchum, (1990) found that, zinc-methionine has improved performance of laying hens and also, it ameliorated turkey performance (Waibel et al., 1974). 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.

The aim of the present study was to evaluate the beneficial and evident impact of incorporation different sources of dietary Zn on productive performance and economical efficiency of laying Japanese quails.

MATERIALS AND METHODS

The present *investigation* was conducted at El-Azab Poultry Research Station, Fayoum, Egypt, to evaluate the impact of addition several sources of dietary Zn on performance and economical efficiency of layer Japanese quails. A total number of six hundred and sixty six unsexed one-week old chicks of Japanese quail were used. Chicks were wing banded individually weighed and randomly distributed equally into sex dietary treatments of one hundred and eleven chicks each. Each dietary treatment was also subdivided equally into three replicates of thirty seven chicks each. The chicks were set in cleaned and fumigated battery brooders raised under similar environmental, managerial and veterinarian conditions. The temperature of brooding was nearly 35°C at the first week old, after that, it was gradually decreased according to usual brooding practices. While, along the egg production period the layers (from the same flock) were reared in quail community batteries also, under similar management, hygienic and environmental conditions. Chicks and layers of the different treatments consumed the experimental diets of growers and layers up to 6 weeks and 16 weeks of age, respectively. Fresh water and feed were available ad-libitum for both chicks and layers. A continuous light (natural and or artificial sources) was provided along the growing period (6 weeks), while, throughout the laying stage (ten weeks), layers were exposed to photoperiod for constant 16 hours.

Two types of zinc were used in the experiment : organic (zinc methionine imported and local) and inorganic (zinc sulphat). The imported zinc-methionine (zinc bound to DL – methionine) and local zinc-methionine(zinc bound to methionine hydroxy analogue) were obtained from Ibex international Company (28, Moraad Street, Giza, Egypt).These two products were registered in the Ministry of Agriculture , Egypt.The used inorganic source of Zn was Zn SO4(Feed Grade. These different commercial sources of dietary Zn were incorporated over the basal diets (the control diets) of either grower or layer quails at the level of 50 mg Zn/kg diet. The control diets of both the growing and laying Japanese quails were formulated to meet their requirements (Table, 1), according to NRC (1994), and were prepared to be iso-nitrogenous (24, 20% CP) and iso-caloric (2900 ME/kg diet) for both the chicks and layers, respectively. Six experimental diets were utilized with these sex dietary treatments. However, the six experimental dietary treatments (T) were as follow:

1- T1: the basal diet (the control diet, C), without the experimental 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.
6- T6: C + 200 mg methionine/kg diet.

Moreover, a continuous light (natural and or artificial sources) was provided along the growing period (6 weeks), while, throughout the laying stage (ten weeks), layers were exposing to photoperiod for constant 16 hours. In addition, feed intake (FI), egg number (EN), and egg weight (EW) were weekly recorded, and also, egg production percentage (EP %), egg mass (EM) and feed conversion ratio (FC) were weekly calculated. Furthermore, egg quality and fertility percentage were also studied according to (Hala, 1998, and Namra, 2000). Economical efficiency study was conducted according to input-output analysis as showen in Table, 4.

The data were statistically analyzed according to Steel and Torrie (1980), and the differences among means were separated using Duncan Multiple Range Test, (Duncan, 1955).

RESULTS AND DISCUSION

Egg production traits:

Data in Table 2 showed that, inclusion of 50 mg Zn (from each of the three different sources) or 200 mg methionine/kg diet did not positively affect egg number, egg production % and egg mass, as compared to the control. The differences among all the different experimental groups were not significant. The control group achieved slight increase in egg number, egg production %

and egg mass than the other experimental groups. However, the insignificant differences in egg production parameters may be attributed to the iso-nitrrogenous and iso-energetic formula of the treated diets (El-Ghamry et al., (2004). Data of egg mass (Table, 2) showed similar trend to that found for egg production. This means that, EM values per layer were closely correlated with those of EP values. Kout El-Kloub et al., (2004) reported that, supplementing the diet with Zn- methionine or ZnO at two levels for both the two sources, 100, 150, 50 and 100 mg/kg diet, respectively, resulted in significantly greater egg production values than the control. In general, the findings of EN, EP and EM indicated that there was no positive response for Zn or methionine supplementation at levels 50 mg or 200 mg/kg diet, respectively. Furthermore, data of egg weight (Table, 2) showed that the differences among all the experimental groups were not significant, and the control group gave a slight decrease in egg weight than the other experimental groups. El-Habbak et al., (2005) declared that, egg weight proved to be negatively affected by high dietary Zn level applied (20000 ppm "mg \ kg" Zn SO_4). However, Azazi et al., (2006) and Abd-Elsamee (2005) reported that adding methionine to laying hen diets increased egg weight value.

Feed intake, FI and feed conversion ratio, FC

The differences in FI and FC among the experimental groups (Table, 2) due to adding either the several sources of Zn (50 mg Zn/kg diet) herein or 200 mg methionine/kg diet were insignificant compared with the control group. Moreover, an incorporation of different sources of zinc to the diet of laying Japanese quails (50 mg Zn/kg diet) gave lower FI and better FC than the control diet. Hassan et al. (2003) found that, using 100 mg Zn plus 4 g methionine/kg diet improved FC, compared to the control group. However, the layers fed diet 5 (C + 50 mg Zn (from local zinc methionine)/kg diet), recorded the least FI, and also, realized the best FC values, compared to the other experimental groups. El-Habbak et al., (2005) accentuated that, adding Zn to the basal diet at the level of 2000 ppm severely significantly reduced the amount of feed consumed. Japanese quail layers fed diet supplemented with 50 mg Zn (from local Zn-methionine) recorded lower FI and realized better FC than the other experimental groups followed by those fed diet supplemented with 50 mg Zn (from $ZnSO_4$). These finding may be attributed to that the activity of post absorbed organic Zn (Greene et al, 1988) as complex molecules might be metabolically different from their inorganic forms. So, methioionine supplementation to laying hen diets improved FC especially with dietary zinc (Hassan et al., (2003).

Fertility %

Fertility % (Table 2), indicated that, the differences among all the experimental groups were insignificant, with no clear trend resulting of consuming different experimental diets used in the present study. Furthermore, the best value of fertility percentage (96.07%) was attained with layers received the diet, 4 (C + 50 mg Zn from imported zinc methionine /kg diet. This may be due to the improvement in egg and semen quality and higher sexual efficiency of males for the late group, and methionine may be effective for improving Zn utilization in layers, (El-Habbak et al., 2005 and Hassan et al., 2003). Furthermore, Abdel Galil, and Abdel Samad, (2004) deduced that supplementing diets with Zn (100 mg/kg diet) improved fertility %. Also, Kout El-Kloub et al., (2004) reported that laying hens received diets supplemented with levels of either 100 or 150 mg zinc-methionine /kg diet resulted in significantly higher fertility percentage. While those supplemented with ZnO4 (at 50, 100 and 150 mg levels) and those of 50 mg zinc-methionine insignificantly increased fertility percentages compared to the control. It could be suggested that, Zn supplementation as Zn-methionine at a level higher than that of NRC (1994) recommendation improved fertility %.

Egg quality

Egg weight, yolk index and egg shape index of Japanese quail layers fed diets supplemented with 50 mg Zn or 200 mg methionine/kg diet were not significantly affected (Table, 3). The dietary treatments showed lower albumen weight% values than the control group which, significantly detected the highest value, and the differences among the dietary treatments were insignificant. The decrease in albumen weight % may be due to that diets supplemented with 50 mg Zn or 200 mg methionine/kg diet caused depreciation in total protein of blood serum (Harvey et al., 1993). However, inclusion 50 mg Zn or 200 mg methionine/kg over the control diet induced a positive effect in yolk weight %, however, the control group significantly recorded the least value, compared with the dietary treated groups, which appeared insignificant differences among them. Shell weight % values were tending to be reduced by dietary treatments, except treatment 2, "C + 50 mg Zn (from Zn SO4)/kg diet. This reduction in Shell weight % may be related to the antagonism between the high level of both dietary Zn and Ca (El-Habbak et al., 2005), with reference to that, egg shell contain large amounts of calcium (Mc Dowell, 1992). Moreover, insignificant differences in shell weight percentage were observed among the experimental groups except for group 5, which, significantly detected the least shell weight percentage. Data of Table 3, revealed that, birds fed the different dietary treatments (except those fed died 4, "C + 50 mg Zn from imported zinc-methionine/kg diet"), significantly influenced yolk color with no specific trend, compared to the control diet, which had the highest value. Dietary treatments: 3 (C + 50 mg Zn (from Zn SO4 /kg diet + 200 mg methionine/kg diet) & 5 (C + 50 mg Zn from local zinc methionine/kg diet) significantly decreased egg shell thickness, as compared with other groups. However, no significant effect was observed in shell thickness between treatment, 2 (C + 50 *mg Zn from Zn SO4/kg diet) and the other experimental treatments. In addition, there was a significant depression in shell thickness when laying Japanese quails fed the diets 5 (C + 50 mg Zn from local zinc-methionine/kg diet) & 3 (C + 50 mg Zn from Zn SO4 +200 mg methionine/kg diet), compared with the control group. Furthermore, nearly there was the same trend in both shell percentage and shell thickness. El-Habbak et al., (2005) deposed that, egg shell quality proved to be negatively affected by high dietary Zn level applied (20000 pp Zn SO4). From the above mentioned results, inclusion of Zn sources to the diets of laying Japanese quail insignificantly ameliorated both egg weight and yolk %values, but did not improve both albumen weight%, yolk color and egg shell quality (egg shell weight and egg shell thickness).

Economical efficiency

Layers received diet 5, recorded the best economical efficiency and relative economical efficiency, this may be due to the best FC and the least FI (Table, 4). While, the group consumed diet 2 brought out better economical efficiency than the other groups. However, the group used up diet 6, had the lowest economical efficiency and relative economical efficiency. Beside the least FI and the best FC, layers fed diet supplemented with 50 mg Zn (from local Zn-methionine), gave the highest economical efficiency and relative economical efficiency values. This could be profitable for poultry producer thereby, its enable them to bring down the cost of laying Japanese quail diets. Therefore, satisfactory economical efficiency could be attained after supplementing the diets of laying Japanese quail with either local Zn-methionine (50 mg Zn/kg diet) or Zn SO4 (50mg Zn/kg diet) to the diet of laying Japanese quail. This amelioration in economical efficiency and relative economical efficiency values for these layers fed on both diet supplemented with 50 mg Zn (from local Zn-methionine) and diet supplemented with 50 mg Zn (from $ZnSO_4$), could be related to low feed consumption and also due to improvement in FC.

On the basis of nutrition and economical point of view, it is suggested that, layers of Japanese quail consumed diet supplemented with 50 mg Zn (from local Zn-methionine) recorded the least feed cost/egg and the best economical efficiency value, followed by those supplemented with 50 mg Zn (from $ZnSO_4$), which achieved better economical efficiency than the other experimental groups.

Table (1): Composition and calculated analysis of the experimental diets of layers of Japanese quail.

Ingredients	Layer diets
Yellow corn	58.00
Soybean(44%CP)	17.00
Corn gluten meal (60%)	11.50
Wheat bran	5.00
Vegetable oil	0.90
Limestone	5.65
Di calcium phosphate	1.25
Premix*	0.30
Salt	0.30
DL- Methionine	0.10
Total	100
Crude protein %	20.06
ME, kcal/kg diet	2901.2
Crude fiber %	2.66
Ether extract %	2.86
Calcium %	2.52
Available phosphorus %	0.35
Lysine %	0.79
Methionine %	0.52
Cost/Ton of diet in L. E.***	2454.40

*Supplied per Kg of diet: vit. A, 12000 IU; vit. D3, 2200 IU; vit. E, 10mg; vit. K3 2mg; vit.B, 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): Effect of feeding of the experimental diets on egg number, egg/layer/week (EN), egg production %/layer/day, (EP), egg weight, g (EW), egg mass, g/layer / week (EM), feed intake ,g/layer/week (FI), feed conversion (FC), fertility % (Fe), for Japanese quail layers (mean ± S.E.).

Treatments	Diets					
	1	2	3	4	5	6
Items	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
Egg number / layer/week, (EN)	6.13 ± 0.04	5.82 ± 0.30	5.87± 0.32	5.93 ± 0.27	5.87 ± 0.32	5.41 ± 0.31
Egg production % / layer/day, (EP)	87.62 ± 0.61	83.15 ± 4.26	83.88 ± 4.59	84.74 ± 3.87	83.84 ± 4.6	77.30 ± 4.49
Egg weight, (EW)	9.73 ± 0.09	9.85 ± 0.07	10.01± 0.12	9.87± 0.11	9.93 ± 0.15	9.92 ± 0.13
Egg mass, g/layer / week, (EM)	59.69 ± 0.93	57.38 ± 3.30	58.85 ± 3.80	58.52 ± 2.52	58.27 ± 3.48	53.74 ± 3.76
Feed intake, g / layer/week,(FI)	154.71 ± 5.96	143.13 ± 2.67	147.85 ± 4.22	148.90 ± 2.53	142.04 ± 4.46	143.12 ± 5.02
Feed conversion (FC)	2.59 ± 0.07	2.51 ± 0.13	2.53 ± 0.13	2.56 ± 0.15	2.45 ± 0.13	2.68 ± 0.11
Fertility % (Fe)	95.10 ± 2.09	93.32 ± 1.56	94.58 ± 1.50	96.07 ± 0.86	92.87 ± 2.27	91.76 ± 1.27

Table (3): Effect Of Feeding The Experimental Diets On Egg Quality Of Laying Japanese Quails (Mean ± S.E.).

Treatments / 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
Egg weight (g)	10.52 ± 0.16	10.67 ± 0.16	10.83 ± 0.20	10.89 ± 0.20	10.71 ± 0.19	10.86 ± 0.15
Albumen weight %	60.76 ± 0.50 ^{a}	59.44 ± 0.62 ^{ab}	59.39 ± 0.70 ^{ab}	58.79 ± 0.59 ^{b}	59.68 ± 0.73 ^{ab}	58.25 ± 0.68 ^{b}
Yolk weight %	29.85 ± 0.49 ^{a}	30.97 ± 0.64 ^{ab}	31.24 ± 0.80 ^{b}	31.26 ± 0.83 ^{b}	31.40 ± 0.66 ^{ab}	32.46 ± 0.73 ^{b}
Shell weight %	9.39 ± 0.12 ^{ab}	9.50± 0.14 ^{a}	9.20 ± 0.20 ^{ab}	9.37 ± 0.11 ^{ab}	8.96 ± 0.16 ^{b}	9.29 ± 0.13 ^{ab}
Yolk index	42.86 ± 0.71	42.65 ± 0.50	42.02 ± 0.46	42.84 ± 0.47	40.69 ± 1.51	41.43 ± 0.56
Egg shape index	79.58 ± 0.41	79.32 ± 0.59	78.79 ± 0.59	79.42 ± 0.68	79.66 ± 0.50	78.71 ± 0.69
Yolk color	7.59 ± 0.17 ^{a}	6.54 ± 0.17 ^{c}	7.04 ± 0.12 ^{b}	7.25 ± 0.08 ^{ab}	7.22 ± 0.08 ^{b}	7.19 ± 0.08 ^{b}
Shell thickness (mm)	23.79 ± 0.25 ^{a}	23.57 ± 0.29 ^{a}	22.78 ± 0.37 ^{b}	23.79 ± 0.37 ^{a}	22.58 ± 0.34 ^{b}	23.70 ± 0.17 ^{a}

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

Table (4): Effect Of Feeding Different Experimental Diets Of Quail Layers On Feed Cost/Egg And Economical Efficiency For Quail Layers (Mean ± S.E.).

Treatments	Diets					
	1	2	3	4	5	6
Items	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 Zn-methio-nine) /kg diet	C + 50 mg Zn (local Zn-methio-onine) / kg diet	C +(200 mg meth-ionine)/kg diet
Feed intake (kg) /layer/week (a)	0.155	0.143	0.147	0.149	0.142	0.143
Price / kg feed (P.T.) * (b)	245.44	245.56	246.34	246.96	248.19	246.22
Feed cost /layer/week (P.T.) = a X b = (c)	38.04	35.12	36.21	36.80	35.24	35.21
Egg number/layer/week (d)	6.13	5.82	5.87	5.93	5.87	5.41
Feed cost / egg = c / d = (e)	6.21	6.03	6.17	6.21	6.00	6.51
Price of one egg (P.T.)* (f)	30	30	30	30	30	30
Price of total eggs /layer /week = d x f = (g)	183.90	174.60	176.10	177.90	176.10	162.3
Net revenue (P.T.) = g – c = (h)	145.86	139.48	139.89	141.10	148.86	127.09
Economical efficiency = (h / c) X 100 = (i)	383.44	397.15	386.33	383.42	420.27	360.95
Relative economical efficiency = (i / i of the control treatment) X 100	100	103.58	100.75	99.99	109.61	94.13

*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

٢- ألأداء الإنتاجي للسمان البياض

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أجريت هذة التجربة بمحطة بحوث الدواجن بالعزب – الفيوم – مصر بهدف تقييم تأثير إمداد العلف بعنصر الزنك (كإضافة غذائية) من مصادر تجارية مختلفة (كبريتات الزنك، زنك - مثيونين محلى، زنك – مثيونين مستورد) علي الأداء الأنتاجي و الكفاءة الاقتصادية لطيور السمان البياض. وقد أضيف كل مصدر من هذة المصادر إلي *العلف الاساسي* (الغذاء الضابط ، الذى يحتوى على ٥٠ ملجم زنك/كجم غذاء) منفردا بمستوى ٥٠ ملجم زنك/كجم غذاء. واستخدم في هذة التجربة ٦٦٦ كتكوت سمان يابانى عمر اسبوع ، تم توزيعها عشوائيا إلي ست مجاميع تجريبية غذائية ذات عدد متساوي ،و كل مجموعة تجريبية قسمت عشوائيا إلي ثلاثة مكررات متساوية أيضا في العدد. وضعت جميع المعاملات التجريبية الستة في ظل ظروف متماثلة من الرعاية و التغذية إلي نهاية التجربة التي امتدت إلى عمر ستة عشرة أسبوع.

غذيت المجاميع التجريبية الستة علي ست معاملات غذائية كما هو مبين:

١- المعاملة الأولى (*علف ١*) و تمثل الغذاء الضابط (الغذاء الكنترول ، الذى يحتوى على ٥٠ ملجم زنك/كجم غذاء) ، بدون أية إضافات ، بنسبة بروتين ٢٤% ، و بمحتوى طاقة ٢٩٠٠ كيلو كالورى/ كجم غذاء.

٢- المعاملة الثانية (علف ٢) : الغذاء الضابط (الغذاء الكنترول) + ٥٠ ملجم زنك/ كجم غذاء من كبريتات زنك.

٣- المعاملة الثالثة (علف ٣) : الغذاء الضابط (الغذاء الكنترول) + ٥٠ ملجم/ كجم غذاء زنك من كبريتات زنك + ٢٠٠ ملجم مثيونين / كجم غذاء.

٤- المعاملة الرابعة (علف ٤) : الغذاء الضابط (الغذاء الكنترول) + ٥٠ ملجم زنك / كجم غذاء من زنك – مثيونين مستورد.

٥- المعاملة الخامسة (علف ٥) : الغذاء الضابط (الغذاء الكنترول) + ٥٠ ملجم زنك/ كجم غذاء من زنك – مثيونين محلي.

٦- المعاملة السادسة (علف ٦) : الغذاء الضابط (الغذاء الكنترول) + ٢٠٠ ملجم مثيونين / كجم غذاء.

وكانت اهم النتائج المتحصل عليها كما يلي :

١- لم يكن لإضافة الزنك (بمستوى ٥٠ ملجم زنك/ كجم غذاء) أو المثيونين (بمستوى ٢٠٠ ملجم زنك/ كجم غذاء) الي غذاء طيور السمان الياباني البياضة تأثير ايجابي علي كل من عدد البيض/طائر/أسبوع ، نسبة إنتاج البيض/طائر/يوم ، و كتلة البيض/طائر/اسبوع.

٢- أعطت طيور السمان اليابانى البياضة المغذاة علي غذاء قاعدى (ضابط) مضاف إلية ٥٠ ملجم زنك/ كجم غذاء (من زنك – مثيونين مستورد) أعلا نسبة إخصاب.

٣- لم يكن لإضافة كل من الزنك (بمستوى ٥٠ ملجم زنك/كجم غذاء) أو المثيونين (بمستوى ٢٠٠ ملجم زنك/كجم غذاء) تأثير معنوى على كل من وزن البيضة ، دليل الصفار، دليل شكل البيضة. كما ان اضافتة لم تحسن لا من وزن الالبيومين أو لون الصفار ولا من الصفات النوعية لقشرة البيضة.

يستخلص من النتائج أن زيادة مسنوى الزنك عن ٥٠ ملجم/كجم غذاء و الموصى بها من قبل NRC لم تؤدى الى زيادة معنوية فى كل من انتاج البيض ، وزن البيضة ، كتلة البيض ، الكفاءة الاقتصادية. بينما اضافة الزنك- مثيونين ادى الى زيادة نسبة الخصوبة و تحسن كل من وزن البيضة ووزن الصفار بصورة غير معنوية ، الا ان اضافتة لم تحسن من كل من وزن الالبيومين ولون الصفار والصفات النوعية لقشرة البيضة.