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EFFECT OF DIFFERENT LEVELS OF CADMIUM AND SELINIUM ON 1- PERFORMANCE OF BROILER CHICKENS

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Abstract:*A total number of 540, one day old of commercial broiler chicks were used to study the effect of selenium (Se) and cadmium (Cd) separately and in mixture on broiler chicks' performance (from one day to 49 days of age). Birds were distributed randomly into 18 dietary treatments groups, each groups represented by triplicate pens (10 chicks each) until the end of the experiment (49 days of age). The 16 treatments were divided into 4 major groups. First group was used as a control (T1,T7 and T13) and fed the starter and finisher basal diet. The second treatment group was fed the basal diet supplemented with 0.5, 1.0, 1.5, 2.0 and 2.5 mg Se as a sodium selenite (Na_2SeO_3) /kg of the starter diet and 2.0, 4.0, 6.0, 8.0 and 10.0 mg Se as a sodium selenite (Na_2SeO_3)/kg of the finisher diet,(T2, T3, T4, T5 and T6), respectively. The third treatment group was fed the basal diet supplemented with 0.25, 0.5, 0.75, 1.0 and 1.25 mg Cd as a cadmium chloride ($CdCl_2$) /kg of the starter dtet and 1.0, 2.0, 3.0, 4.0and 5.0 mg Cd as a cadmium chloride ($CdCl_2$) /kg of the finisher diet, (T8, T9, T10, T11 and T12), respectively. The fourth group was fed the starter and the finisher basal diet supplemented with mixture of the different levels of Se and Cd as previously mentioned in the second and the third groups (T14, T15, T16, T17 and T18).*

Average BW, BWG, FI and FCR decreased linearly with increasing of Se levels through the experimental periods. Moreover, the average BWG, FI and FCR among each of experimental periods showed quadratic responses with increasing of Se supplementation. Supplementation different levels of Cd to broiler diets during whole the experimental periods indicated that the average BW showed linear decrease and quadratic response while their BWG showed quadratic response during starter period wks with increased Cd levels. All the growth performance showed quadratic response from 5-7 wks, while only the average BWG showed the same response from 0-7 wks of age with increased mixture supplementation. No

significant differences observed in the average livability among groups supplemented with Se, Cd and Se and Cd mixture levels.

INTRODUCTION

Metals are redistributed naturally in the environment by both geologic and biological cycles. The later includes bio-concentration by plants and animals and incorporation into food cycles. These natural cycles may exceed the anthropogenic cycle (Ng and Paterson, 1981).

The potential toxicity of selenium was first suspected over 50 years ago, and through the years, well defined syndromes of toxicity have been described in animals and humans living in somniferous areas when the soil content is relatively rich in selenium, contributing to relatively high selenium in vegetation. Many of these plants are consumed by livestock and within a few weeks cause a disease syndrome (Hogberg and Alexander, 1986). Although the permissible levels of selenium for most animal species ranges between 0.1 and 0.2 mg Se/ kg diet, it is clear that excess level over requirement reflects the toxicologic potency of the metal (Coyer, 1985). Multiple roles played by selenium in the maintenance of the homeostatic condition in animals are still being discovered. However, the need for adequate selenium nutrition in both humans and food production animals appears to be less than optimal in many parts of the world (Edens and Brake 2006).

Consequences of insufficient selenium intake in farm animals including nutritional myodystrophy (white muscle disease), oxidative diathesis, disorders of liver and pancreatic functions and many other syndromes have been well described. Associated production problems are poor animal performance, reproductive disorders and considerable economic loss due to morbidity and mortality. Another situation might be induced by marginal selenium deficiency and/or by the use of solely inorganic selenium sources to supplement the feedstuff. In such cases delayed immune system development of young chicks, poor feathering with associated energy losses, increased mortality and culling, reduced egg production and increased embryonic mortality are noted (Ohishi, 1991).

The FAO/WHO Expert Committee on Food Additives (1972) established the provisional tolerable intake of cadmium (Cd) at 0.07 to 0.054 mg/d for a 70 kg adult. Maximum tolerable levels of dietary Cd for avian species were set at 0.5 mg/kg diet. Deficiency of Cd may result in decreased growth rat and reproductive disorders (Regius-Mocsenyl, *et al.*, 1985). Nezel *et al.* (1981) observed that cadmium acetate and cysteine-bound cadmium (20 and 40 mg Cd/kg diet) had similar adverse effects on

chicks growth performance, while cadmium sulfide (20 and 40 mg Cd/kg diet) had no effect. Czarnecke and Baker (1982) reported that Cd levels (30 or 60 mg/kg diet) depressed both BWG and FCR of chicks. Erdogan *et al.* (2005) indicated that cadmium decreased the broiler BW, BWG, (FER) significantly, whereas its effect on FI was not significant. Berzina *et al.* (2007) reported that growth retardation occurred in chicken fed the cadmium-enriched diet for 30 days.

Interaction between parenterally administrated cadmium and selenium occurs in several mammalian species, selenium counter acts the toxicity of cadmium and cadmium alters the metabolism of selenium (Meyer, *et al.*, 1982). Aspite *et al.* (1982) found that high Cd diet depressed growth.

To provide further information concerning the toxicity of selenium and cadmium as well as focused light on the interaction effect of their high levels, the following measurements were carried out to explore the effect of high dietary selenium and cadmium levels supplemented in diet separately or in a mixture of both fed to broiler chickens.

MATERIALS AND METHODS

A total number of 540, one day old of commercial broiler chicks with average BW ranged between 35 and 40 g were randomly housed in galvanized wire-floored pens (10 chicks each) until the end of the experiment (49 days of age). The pens were divided into 16 dietary treatments groups, each groups represented by three replicate pens. The 16 dietary treatments were divided into 4 major groups. First group was used as a control and fed the starter and finisher basal diet, T1,T7 and T8 , (Table 1). The second treatment group was fed the basal diet supplemented with 0.5, 1.0, 1.5, 2.0 and 2.5 mg Se as a sodium selenite (Na_2SeO_3) /kg of the starter diet and 2.0, 4.0, 6.0, 8.0 and 10.0 mg Se as a sodium selenite (Na_2SeO_3) /kg of the finisher diet, (T2, T3, T4, T5 and T6), respectively. The third treatment group was fed the basal diet supplemented with 0.25, 0.5, 0.75, 1.0 and 1.25 mg Cd as a cadmium chloride ($CdCl_2$) kg/kg of the starter diet and 1.0, 2.0, 3.0, 4.0and 5.0 mg Cd as a cadmium chloride ($CdCl_2$) /kg of the finisher diet, (T8, T9, T10 , T11 and T12), respectively. The fourth group was fed the starter and the finisher basal diet supplemented with mixture of the different levels of Se and Cd as previously mentioned in the second and the third groups (T13, T14, T15, T16, T17 and T 18). Feed and water were provided *ad libitum* throughout the experimental period (one day-49 days of age). Birds were illuminated with constant (24 hr) light. Vaccination and medical care were done according to common veterinary care under veterinarian supervision.

Individual body weight (BW) was ascertained at one day old and subsequent 7-days intervals to 49 day of age. Feed intake (FI), body weight gain (BWG), feed conversion ratio (FCR) and mortality rate were recorded and calculated at the end of each week intervals. At the end of the experimental period (49 days of age), four birds from each 16 dietary treatments were randomly selected. The birds were fastened 12-16 hrs prior to slaughter, weighted and sacrificed by cervical dislocation. After scalding, feather picking and organs (heart, gizzard, spleen, liver and breast meat) were weighed and immediately kept frozen at – 20°C until used.

Table (1) Composition of the experimental diets.

Ingredient	Starter diet %	Finisher diet %
Yellow Corn	65	75
Soybean meal (44% CP)	25	15
Concentrate (52%CP)*	10	10
Total	100	100
Calculated analysis		
Crude protein (%)	21.79	18.25
ME (kcal/kg)	2966	3088
C/P ratio	136	170
Ether extract %	2.50	3.26
Fiber%	3.05	2.70
Calcuim %	0.94	0.91
Avi.Phosphorus %	0.45	0.47
Lysine%	1.20	1.0
Selenium mg	0.1	0.1

Concentrate analysis: - 52%CP, 2440 ME kcal/kg, 2.0% EE, 3.0%CF, 7.5% Ca 3.5% P and salt 5%.

Table (2): Effect of dietary selenium additions to starter and finisher diets on performance of broiler chickens.

Tr.	Starter period					Finisher period				
	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)
T1	650.0±14.31	594.3±16.79	1.33±0.03	2.23±0.03	90.0±0.00	1321.8±57.55	435.6±37.42	2.43±0.14	5.68±0.94	63.4±0.00
T2	616.1±22.38	574.0±22.25	1.21±0.01	2.10±0.07	90.0±0.00	1250.0±42.92	399.0±22.62	1.94±0.06	4.86±0.08	80.8±9.19
T3	564.8±19.22	523.1±19.01	1.19±0.01	2.28±0.05	90.0±0.00	1176.5±44.58	352.4±20.17	1.88±0.11	5.38±0.04	73.0±16.6
T4	588.1±21.27	545.7±20.90	1.18±0.03	2.18±0.20	90.0±0.00	1081.3±50.18	268.1±29.25	2.07±0.21	7.68±0.79	64.2±7.40
T5	601.1±15.53	559.2±15.42	1.16±0.06	2.08±0.16	90.0±0.00	923.5±47.96	135.8±34.31	1.86±0.01	10.02±0.34	67.5±4.10
T6	564.4±17.00	521.6±17.32	1.17±0.00	2.25±0.17	90.0±0.00	736.8±33.29	-13.7±22.58	1.63±0.04	20.22±2.17	80.8±9.19
Q.C.	NS	NS	*	NS	NS	NS	**	NS	**	NS
L. C.	**	*	**	NS	NS	**	*8	**	**	NS
R C	-12.71**	-10.99*	-0.0268**	-0.0018	NS	-25.82**	-22.14**	-0.0288**	0.6464**	0.27

*Significant component at p< 0.05. **Significant component at p< 0.01. NS :- No Significant >

Q C = Quadr.Comp L. C. = Liner Comp. R.C. =Regr. Coeff.(b)

T1:-Se . levels during starter and finisher periods are 0.0 mg/kg diet.

T2:-Se . levels during starter period is 0.5 and during finisher period is 2.0 mg/kg diet.

T3:-Se . levels during starter period is 1.0 and during finisher period is 4.0 mg/kg diet.

T4:-Se . levels during starter period is 1.5 and during finisher period is 6.0 mg/kg diet.

T5:-Se . levels during starter period is 2.0 and during finisher period is 8.0 mg/kg diet.

T6:-Se . levels during starter period is 2.5 and during finisher period is 10.0 mg/kg diet.

Table (3): Effect of different dietary cadmium additions to starter and finisher diets on on performance of broiler chickens.

Tr.	Starter period					Finisher period				
	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)
T7	650.0±14.31	594.3±16.79	1.33±0.03	2.23±0.03	90.0±0.00	1321.8±57.55	435.6±37.42	2.43±0.13	5.67±0.94	63.4±0.00
T8	626.9±18.29	584.5±17.82	1.30±0.02	2.23±0.12	90.0±0.00	1194.4±26.16	385.6±19.18	1.97±0.14	5.05±0.11	76.7±13.29
T9	575.8±19.10	537.5±20.04	1.17±0.13	2.19±0.03	90.0±0.00	1210.5±42.51	452.1±23.23	2.06±0.01	4.56±0.27	80.8±9.19
T10	563.6±17.22	523.0±17.18	1.18±0.10	2.25±0.05	90.0±0.00	1111.1±49.93	371.1±34.07	2.15±0.04	5.83±0.90	71.6±0.00
T11	623.7±14.07	581.7±13.79	1.24±0.00	2.13±0.10	90.0±0.00	1179.4±25.02	400.9±18.75	2.23±0.10	5.22±0.48	67.5±4.10
T12	593.5±16.21	551.5±15.75	1.25±0.04	2.26±0.05	90.0±0.00	1215.8±41.72	449.0±25.54	2.07±0.27	4.80±0.88	80.8±9.19
Q.C.	*	*	NS	NS	NS	NS	NS	NS	NS	NS
L. C.	**	NS	NS	NS	NS	NS	NS	NS	NS	NS
R C	-8.70*	-6.77	-0.0162	-0.0020	NS	0.96	2.21	0.0066	-0.0187	0.36

*Significant component at p< 0.05. **Significant component at p< 0.01. NS :- No Significant

Q C = Quadr.Comp **L. C.** = Liner Comp. **R.C.** =Regr. Coeff.(b)

T7:-Cd levels during starter and finisher periods are 0.0 mg/kg diet.

T8:-Cd levels during starter period is 0.25 and during finisher period is 1.0 mg/kg diet.

T9:-Cd levels during starter period is 0.5 and during finisher period is 2.0 mg/kg diet.

T10:-Cd levels during starter period is 0.75 and during finisher period is 3.0 mg/kg diet.

T11:Cd levels during starter period is 1.0 and during finisher period is 4.0 mg/kg diet.

T12:-Cd levels during starter period is 1.25 and during finisher period is 5.0 mg/kg diet.

Table (4): Effect of different dietary selenium and cadmium mixture additions to starter and finisher diets on performance of broiler chickens.

Tr	Starter period					Finisher period				
	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)	Body weight (g)	Body weight gain (g)	Feed Intake (kg feed/bird)	Feed efficiency (g feed/g gain)	Livability (%)
T13	650.0±14.31	594.3±16.79	1.33±0.03	2.23±0.03	90.0±0.00	1321.8±57.55	435.6±37.42	2.43±0.13	5.67±0.94	63.4±0.00
T14	578.5±17.79	536.3±17.72	1.12±0.03	2.08±0.08	90.0±0.00	1079.0±40.70	356.2±20.33	1.26±0.00	3.55±0.27	80.8±9.19
T15	596.7±15.82	552.5±15.59	1.29±0.10	2.33±0.22	90.0±0.00	1130.0±30.39	371.0±16.85	1.53±0.13	4.03±0.20	61.2±10.39
T16	568.8±17.53	526.3±17.57	1.19±0.06	2.26±0.00	90.0±0.00	1055.3±40.26	289.2±29.67	1.18±0.13	4.19±0.61	80.8±9.19
T17	585.9±17.12	544.3±17.01	1.19±0.09	2.18±0.01	90.0±0.00	913.9±25.82	138.9±23.29	1.05±0.04	7.03±0.91	71.6±0.00
T18	550.9±13.96	508.3±13.66	1.22±0.06	2.39±0.01	90.0±0.00	712.5±40.69	-6.3±21.48	1.04±0.11	12.37±0.35	64.2±7.40
Q.C.	NS	NS	NS	NS	NS	**	**	**	**	NS
L. C.	**	**	NS	NS	NS	**	**	**	**	NS
R C	-14.33**	-12.35**	-0.0124	0.0292	NS	-24.09**	-20.09	-0.0568**	0.3147**	-0.03

*Significant component at p< 0.05. **Significant component at p< 0.01. NS :- No Significant>

Q C = Quadr.Comp L. C. = Liner Comp. R.C. =Regr. Coeff.(b)

T13:-Se + Cd levels during starter and finisher periods are 0.0 mg/kg diet.

T14:-Se + Cd levels during starter period is0.5+ 0.25 and during finisher period is 2.0+1.0 mg/kg diet.

T15:- SE + Cd levels during starter period is1.0+ 0.5 and during finisher period is4.0+ 2.0 mg/kg diet.

T16:-Se + Cd levels during starter period is 1.5+0.75 and during finisher period is6.0+ 3.0 mg/kg diet.

T17:Se + Cd levels during starter period is 2.0+ 1.0 and during finisher period is8.0+ 4.0 mg/kg diet.

T18:-Se + Cd levels during starter period is 2.5+1.25 and during finisher period is10.0+ 5.0 mg/kg diet.

Table (5): Effect of dietary selenium, cadmium and their mixture addition to both starter and finisher diet on performance of broiler chickens.

Tr.	Se Treatments			Tr.	Cd Treatments			Tr.	Se +Cd Treatments		
	Body weight gain(g)	Feed efficiency (g feed/g gain)	Livability (%)		Body weight gain (g)	Feed efficiency (g feed/g gain)	Livability (%)		Body weight (g)	Feed efficiency (g feed/g gain	Livability (%)
T1	1279.7±57.35	2.93±0.15	63.4±0.00	T7	1279.7±57.38	2.93±0.15	63.4±0.00	T13	1279.7±57.38	2.94±0.15	63.4±0.00
T2	1207.9±42.73	2.61±0.08	80.8±9.19	T8	1151.5±25.58	2.77±0.14	76.7±13.29	T14	1036.7±40.50	3.25±0.13	80.8±9.19
T3	1134.5±44.45	2.71±0.03	73.4±16.6	T9	1167.4±42.73	2.92±0.08	80.8±9.19	T15	1085.9±30.17	3.90±0.40	61.2±10.39
T4	1038.6±50.71	3.15±0.30	64.2±7.40	T10	1070.2±50.12	3.26±0.28	71.6±0.00	T16	1012.7±40.09	3.24±0.05	80.8±9.19
T5	881.6±47.81	3.43±0.18	67.5±4.10	T1	1134.7±23.61	3.26±0.22	67.5±4.10	T17	872.4±26.12	3.75±0.05	71.6±0.00
T6	692.9±33.91	4.05±0.33	80.8±9.19	T12	1173.8±41.69	2.74±0.15	80.8±9.19	T18	670.1±40.59	4.96±0.83	64.2±7.40
Q.C.	NS	*	NS	Q.C.	NS	NS	NS	Q.C.	**	NS	NS
L. C.	**	**	NS	L. C.	NS	NS	NS	L. C.	**	*	NS
R C	-20.83**	0.0484**	0.22	R C	0.61	0.0045	0.29	R C	-19.27**	0.0627*	-0.02

*Significant component at p< 0.05. **Significant component at p< 0.01. NS :- No Significant.

Q C = Quadr.Comp **L. C.** = Liner Comp. **R.C.** =Regr. Coeff.(b)

T1:-Se . levels
T2:-Se . levels.
T3:-Se . levels.
T4:-Se . levels.
T5:-Se . . levels.
T6:-Se . levels.

T7:-Cd . levels.
T8:-Cd . levels .
T9:-Cd . levels
T10:-Cd . levels.
T11:-Cd . levels.
T12:-Cd . levels.

T13:-Se+Cd. Levels
T14:-Se+Cd levels
T15:-Se+Cd levels
T16:-Se+Cd levels
T17:-Se+Cd levels
T18:-Se+Cd levels

Statistical analysis:

Data was subjected to analysis of variance with completely randomized design. Orthogonal polynomials were used for treatment comparisons (steel and Torrie, 1960). Linear, quadratic and cubic terms of treatments were calculated according to the computer program.

RESULTS AND DISCUSSION

Effect of dietary selenium

Supplementation different levels of Se to broiler diets during starter (0-4wks), finisher (5-7 wks) and for whole the experimental periods (0-7 wks) indicated that the average BW, BWG, FI and FCR decreased linearly with increasing of Se levels through the experimental periods Table (2 and 5). Moreover, the average BWG, FI and FCR among each of experimental periods showed quadratic responses with increasing of Se supplementation. No significant differences observed in the average livability among treatment groups supplemented with Se levels. Consequently, no toxic effect was observed at the levels of Se under investigation as expressed by average mortality. However, the significant reduction in the average BW, BWG, FI and FCR through the experimental periods, suggesting the developing toxicity. This toxicity attributed to the displacement of sulfur by Se in sulfur-containing amino acids in proteins and accumulation of Se in organs containing SH proteins (Goyer, 1986).

El-Deek *et al.* (1988) showed that dietary Se levels had no significant effect on mortality. On the other hand Mokasnes and Norheim (1982) reported that BW of broilers fed up to 6 mg Se /kg in practical diet as Na_2SeO_3 for 6 wks, was not affected by dietary Se. However, Ohishi (1991) indicated that the growth of chickens tended to increase due to increase of Se addition to commercial formula until the fifth wks, but it is disappeared from the seventh wk. El-Sebai (2000) showed an increase in growth of broiler chickens fed diets supplemented with Se. Downs *et al.* (1999) studied the effect of dietary supplementation of an inorganic or organic Se source (0.3 ppm Se /kg diet) on broiler performance at day 21, 42 and 49. Average body weight and feed conversion were similar between treatments. Also, Edens *et al.* (1999) found that feed conversion ratios and body weight were not affected by Se supplementation (0.3 ppm Se /kg diet). Hegazy and Adchi (2000) and Mahmoud and Edens (2005) demonstrated that Se yeast improved body weight, feed conversion and decreased mortality in broiler chickens growing to 42 d of age.

Effect of dietary cadmium

Supplementation different levels of Cd to broiler diets during starter (0-4wks), finisher (5-7 wks) and for whole the experimental periods (0-7 wks) indicated that the average BW showed linear decrease and quadratic response while their BWG showed quadratic response only from 0-4 wks with increased Cd levels Table (3 and 5). Although, the average BW, BWG, FI, FER and livability showed neither linear nor quadratic responses from 5-7 wks, they tended to decrease non significantly with increased Cd supplementation. The non significant decrease attributed to the amount of Cd exceeds that of metallothionein available for binding (Nomiyama and Nomiyama, 1986). No toxic effect of Cd was detected as expressed by average mortality and the chicken could tolerate the dietary Cd levels supplementation over the period of investigation. This result indicated that most of the Cd supplementation bound to metallothionein within tissues (Philip *et al.*, 1983; Debec *et al.*, 1985; Mohamed *et al.*, 1987 and Casarette and Doull, 1991). However, our findings agree with that obtained by Meyer *et al.* (1982) they reported that increased Cd intake depressed BWG, probably because of decreased FI and reduced FCR. Pritzl *et al.* (1974); Hrisic and Knezevic (1980); Nezel (1981) and Czarnecki and Baker (1982) showed that increasing the amount of Cd in the diet fed for chickens depressed growth performances. Moreover, Nezel (1981) reported that more than 400 ppm Cd in the commercial chicks diet was very toxic. Erdogan *et al.* (2005) indicate that oxidative stress, induced by cadmium, plays a role in decreasing the performance of broilers.

Effect of dietary selenium and cadmium mixture

Data obtained from studying the effect of dietary Se and Cd mixture levels supplemented to starter and finisher diets fed to broiler chickens for 7 wks indicated that their average BW, BWG, FI and FCR decreased linearly with increasing mixture levels through the experimental periods (starter, 0-4wks, finisher, 5-7 wks and for whole the experimental periods, 0-7 wks) Tables (4 and 5). Moreover, all the growth performance showed quadratic response from 5-7 wks, while only the average BWG showed the same response from 0-7 wks of age with increased mixture supplementation. No toxic effect was observed at the levels of Se and Cd mixture under investigation as expressed by average mortality. However, the significant reduction in average BW, BWG, FI and FCR suggesting the developing toxicity (Goyer, 1986). It was worthy to note that the high Se and Cd mixture supplementation did not elevated symptoms of toxicity than that observed in chickens supplemented with Se alone. This is could be

attributed to first, the antagonism of Se metabolism by Cd; second, Se forms insoluble Cd complex; third, Se decreased Cd absorption from gastrointestinal tract (Niaoki and Chieko, 1988); fourth, Cd alters the metabolism of Se (Meyer *et al.*, 1982). These finding agree with the reported by Hill (1974) who found that dietary Cd alleviated dietary Se toxicity in chicks.

In conclusion, for the whole period, Se supplementation at 0.5 up to 2.5 ppm showed quadratic component on BWG and FI mean, while the effect on FCR were linear and quadratic, too. Cd supplementation for 0.25 to 1.25 ppm did not significantly affect BWG, FI and FCR. Furthermore, there was a linear and quadratic component of SE and Cd mixture on broilers growth. However, the effect on FI and FCR was not significant although the negative influence on these parameters of commercial significance.

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الملخص العربي

تأثير المستويات المختلفة من السلينيوم والكادميوم ومخلوطهما على أداء كتاكيت اللحم

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استخدم فى هذة التجربة عدد ٥٤٠ كتكوت عمر يوم من سلالة لحم تجارية ، لدراسة تأثير المستويات المختلفة من عنصر السيلينيم وكذلك عنصر الكادميوم ومخلوطهما على اداء النمو لكتاكيت اللحم من عمر يوم الى عمر ٤٩ يوم.

تم توزيع الكتاكيت الى ١٨ معاملة غذائية وكل معاملة بها ٣٠ كتكوت على ثلاث مكررات وتم تقسيم المعاملات الى اربع مجاميع رئيسية.

١- المجموعة الأولى(كنترول) فى مرحلة البادئ والناهى (المعاملة ١ و٧ و١٣).

٢-المجموعة الثانية: أضافة مستويات مختلفة من السيلينيم الى العلف وهى ٠.٥ و ١.٠و١.٥و٢.٠ و٢.٥ مجم/كجم علف فى صورة صوديوم سلينات، اما الناهى كانت المستويات هى ٢ و ٤و ٦و ٨و١٠ مجم/كجم علف (المعاملات ٢ و ٣ و ٤و ٥ و ٦).

٣- المجموعة الثالثة: أضافة مستويات مختلفة من الكادميوم الى العلف وهى ٠.٢٥ و ٠.٥ و ٠.٧٥ و ١.٠ و ١.٢٥ مجم/كجم علف فى صورة كلوريد كادميوم ، اما الناهى كانت المستويات هى ١ و ٢ و ٣ ٤ و٥ مجم/كجم علف (المعاملات ٨ و٩ و١٠ و١١ و ١٢).

٤- المجموعة الرابعة: أضيف الى علفها المخلوط من السلينيم و الكادميوم الذى قدم فى مرحلة البادئ وكذلك الناهى فى المجاميع الثالثة والرابعة (المعاملات ١٤ و ١٥ و١٦ و ١٧ و ١٨).

أوضحت النتائج ان متوسط وزن الجسم والزيادة فيه واستهلاك العلف ومعامل التحويل الغذائى يقل خطيا مع زيادة مستويات عنصر السلينيم خلال فترة التجربة فى مراحل البادئ و الناهى وكذلك وجد أن الزيادة فى وزن الجسم واستهلاك العلف ومعامل التحويل الغذائى لكل فترة الدراسة أظهرت استجابة كوادرتك مع زيادة واضافة مستويات السلينيم.

اضافة مستويات مختلفة من الكادميوم الى اعلاف كتاكيت اللحم يخفض خطيا وكوادرتك النمو فى كتاكيت اللحم و بينما كان التأثير منخفضا كوادرتك للزيادة فى الوزن خلال مرحلة البادئ راجع الى زيادة مستويات الكادميوم.

جميع مقايس الأداء للنمو اظهرت استجابة كوادرتك من ٥-٧ اسابيع بينما متوسط وزن الزيادة فى الجسم اوضح نفس الأستجابة، ولكن من عمر يوم حتى عمر ٧ اسابيع مع زيادة مخلوط كل من السلينيم و الكادميوم فى العلف ولم تظهر اى اختلافات معنوية على متوسط الحيوية بين المجاميع التى اضيف الى علفها كل من السلينيم والكادميوم او مخلوطهم.