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EFFECT OF DRIED ALFALFA MEAL AND CHROMIUM ON THE PERFORMANCE OF INSHAS LAYERS.

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ABSTRACT:

A 3x4 factorial design experiment was conducted to study the effect of three levels of dried alfalfa meal (0, 5 and 10%) and four levels of chromium picolinate, CrPic (0, 600, 1200 and 1800 µg/Kg diet) on performance and egg quality of Inshas layers during the period from 24 to 38 weeks of age. A total number of 216 laying hens and 36 cocks of Inshas strain at 24 weeks of age were randomly distributed into 12 treatment groups (18 hens + 3 cocks / each treatment) nearly equal in average body weight and average daily egg production. Each treatment group was sub-divided into three replicates (6 hens and one cock) in each. Productive and reproductive performance, egg quality, cholesterol content in blood serum, egg yolk, and liver were studied.

Inclusion of 10% dried alfalfa meal in laying hen diets significantly ($P<0.05$) decreased body weight, egg number, egg production, egg mass, economical efficiency and exhibited the poorest feed conversion value during experimental period. In addition of 5% dried alfalfa meal in laying hen diets significantly ($P<0.05$) decreased feed intake during 30 to 34 weeks of age, egg yolk %, cholesterol and lipids % in blood serum, egg yolk and liver as compared with the control diet. Chromium supplementation at different levels had no effect on live body weight, while it a significant ($P<0.05$) increase in egg weight, fertility and hatchability percentages, egg specific gravity at 38 weeks of age and economical efficiency. However, serum cholesterol, yolk and liver cholesterol was significantly ($P<0.05$) decreased as a result of chromium supplementation. Laying hens fed diets containing 5% alfalfa meal plus 1200 Cr µg /Kg diet recorded *the best economical efficiency values as compared with the other treatment groups.*

In conclusion, *using 5% alfalfa meal with 1200 or 1800 µg Cr/Kg diet were beneficial in egg production and reducing egg yolk and liver cholesterol contents, and increasing the economical return*.
Keywords: Dried alfalfa meal, chromium, performance, Inshas layers.

INTRODUCTION

During the past 25 years there has been considerable interest in the factors that influence cholesterol metabolism in the laying hens and its deposition in the egg, blood and meat. Most of the cholesterol found in the egg yolk is synthesized in liver of the hen and transported by the blood in the form of lipoprotein, and deposited in the growing follicles. It thus logical to assume that a relationship should exist between yolk and plasma cholesterol levels (Hammad *et al.,* 1996).

Alfalfa is a readily available, high protein, high fiber feedstuff with one of lowest rate of passage through the avian system (Garcia *et al.,* 2000). Alfalfa is well balanced in amino acids and rich in vitamins, carotenoids and xanthophylls that give poultry carcasses and egg yolk their desirable yellow color (Sen *et al.,* 1998 and Ponte *et al.,* 2004). Alfalfa also contains high levels (2 to 3% DM) of saponins, which have been shown to have hypocholesterolemic, anticarcinogenic, antiinflammatory, and antioxidant properties (Klita *et al.,* 1996 and Ponte *et al.,* 2004). Some saponins form insoluble complexes with cholesterol in the digest inhibited the intestinal absorption of endogenous and exogenous cholesterol (Oakenfull and Sidhu, 1990). They added that, saponins can affect the enter hepatic circulation of bile acids by forming mixed micelles, which directly affect the re-absorption of bile acids from the terminal ileum. Some studies have shown that saponins from different sources lower serum cholesterol levels in a variety of animals including human subjects (Southon *et al.,* 1988 and Matsuura, 2001).

The biologically active form of chromium is called glucose tolerance factor (GTF). It is a small organic molecule containing nicotinic acid, glycine, glutamic acid, cysteine and chromium (Mertz and Roginski, 1975)**.** Without chromium at its core GTF is inactive **(**Hossain *et al.,* 1998)**.**

Previous studies revealed the chromium role in the regulation of carbohydrates, lipids, proteins and nucleic acids metabolism via an enhancement of insulin action (Evans and Bowman, 1992; Lien *et al.,* 2001; Kroliczewska *et al.,* 2004). Chromium also reduces plasma cholesterol (Press *et al.,* 1990; Boleman *et al.,* 1995 and Lien *et al.,* 2001) and egg yolk cholesterol contents (Lien *et al.,* 1996). However, chromium deficiency in diet may result in slow growth, impaired glucose tolerance, diabetes and coronary artery diseases (Abrham *et al.,* 1991). Because of the relationship between cholesterol and coronary heart disease in humans, researchers have devoted considerable efforts for obtaining low cholesterol products, for example, low cholesterol egg. Both alfalfa and chromium can reduce the concentration of cholesterol in plasma and egg yolk and alter lipids metabolism.

Therefore, this study investigates the effect of using chromium and dried alfalfa meal on the productive and reproductive performance, egg quality, total lipids and total cholesterol contents in serum and egg yolk of lnshas layers.

MATERIALS AND METHODS

The experimental work of this study was carried out at Inshas Poultry Research Station, Animal Production Research Institute, Agriculture Research Center, Giza, Egypt, during the period from June to September 2007.

A 3 x 4 factorial design experiment was conducted to study the effect of three levels of dried alfalfa meal (0, 5 and 10%) each with four levels of chromium picolinate (0, 600, 1200 and 1800 µg/Kg diet) on the performance and egg quality of Inshas layers from 24 to 38 weeks of age. A total number of 216 laying hens and 36 cocks of lnshas stran at 24 weeks of age were randomly distributed into 12 treatment groups (18 hens + 3 cocks / each treatment). Laying hens of each treatment group were nearly equal in average body weight and average daily egg production. Each treatment group was sub-divided into three replicates (in each 6 hens and 1 cock). The basal experimental diets were formulated to contain 0, 5 and 10% dried alfalfa meal. Each diet was supplemented with chromium picolinate, CrPic (contain 12.27% Cr) at 0, 600, 1200 or 1800 µg Cr /Kg of diet. The composition and chemical analysis of the experimental basal diets are presented in Table 1. All the experimental diets were

Table 1. Composition and chemical analysis of the experimental diets fed during the experimental period.

Ingredients	Dried alfalfa meal %		
	0	**5**	**10**
Yellow corn (8.5 %)	48.10	57.30	57.60
Soybean meal (44 %)	21.80	21.65	20.60
Wheat bran	14.60	3.70	0.00
Dried alfalfa meal (20%)	0.00	5.00	10.00
Limestone ($CaCO_3$)	7.70	7.50	7.30
Di-calcium phosphate	2.00	2.00	2.00
DL-methionine	0.10	0.10	0.10
Salt (NaCl)	0.25	0.25	0.25
Vit. Min. premix*	0.30	0.30	0.30
Cotton seed oil	5.15	2.20	1.85
Total	**100**	**100**	**100**
Price of ton feed (LE).	1697.95	1663.65	1648.05
Chemical analysis:-			
a-Calculated analysis **:-			
Crude protein, %	16.03	16.04	16.02
ME Kcal/kg	2739	2727	2717
Calcium, %	3.38	3.38	3.38
Available phosphorus, %	0.50	0.50	0.50
Crude fiber %	4.19	4.19	4.73
Lysine, %	0.80	0.78	0.77
Methionine,%	0.36	0.36	0.35
Methionine + cystine %	0.65	0.63	0.61
b-Determined analysis ***:-			
Crude protein,%	15.91	15.85	15.89
Crude fiber,%	4.31	4.30	4.86
Ash %	3.03	2.88	3.00

* ***Vit. Min. premix*:** Each 2 kg of vitamin and mineral premix (Commercial source AGRIVET Co.) contains: Vit. A. 12000000 IU, Vit. D_3 2000000 IU, Vit. E. 10000 mg, Vit. K_3 2000 mg, Vit. B_1 100 mg, Vit. B_2 5000 mg, Vit. B_6 1500 mg, Vit. B_{12} 10 mg, Biotin 50 mg, Choline chloride 250000 mg, Pantothenic acid 10000 mg, Nicotinic acid 3000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, Carrier(Ca CO_3) add to 2kg.

** Calculated according to NRC (1994).

*** Determined according to the methods of AOAC (1990) formulated to cover the nutrient requirements of layers according to NRC (1994). All birds in each treatment group were housed individually in one cage. Each cage was provided with an individual feeder and one automatic pipette drinkers. Cocks were used to collect semen and artificially inseminated to hens (cock/6 hens) for two times per week. Birds were fed *ad-libitum* and the fresh water was available all the time during the experimental period. The cages were located in a temperature-controlled room, and the photoperiod during the experiment was fixed at 16 h. All experimental period were kept under the same managerial, environmental and hygienic conditions.

Individual body weight of laying hens was recorded at 24, 30, 34 and 38 weeks of age, while egg number and egg weight were recorded daily and feed intake was calculated weekly. Egg mass was calculated by multiplying egg number by average egg weight. Feed conversion (g feed/g egg mass) was also calculated weakly.

At 30, 34 and 38 weeks of age, two eggs were randomly taken from each replicate, being, 6 eggs for each treatment group and used to study egg quality measurements. Egg dimension (width and length) were measured using digital caliper to calculate egg shape index according to Romanoff and Romanoff (1949) using the following equation: Egg shape index = egg width (mm) / egg length (mm) x 100.

Yolk index were calculated according to Funk *et al.,* (1958). Specific gravity of eggs was determined by using the saline floatation method according to Hempe *et al.*, (1988). Salt solution was made in incremental concentrations of 0.005% in the range from 1.065 to 1.120%.

At 30, 34 and 38 weeks of age, about 36 eggs from each treatment group were collected and incubated. After hatching, chicks were counted and non-hatched eggs were broken to determine the percentages of fertility and hatchability. Fertility was calculated as the percentage of fertile eggs from the total number of set egg, while the hatchability was expressed as chicks hatched from fertile eggs and from total eggs.

At the end of the experimental period (38 weeks of age) 3 hens from each treatment group were randomly chosen having average body weight around the treatment mean, slaughtered. Blood and liver samples were collected individually at slaughtering from these birds representing each treatment for determination of serum cholesterol according to Warnick *et al.* (1983), total lipids according to Zollner and Kirsch (1962). Liver samples were prepared to determine the cholesterol according to Warnick *et al.* (1983) and total lipids according to Assmann *et al*. (1984).

At the end of the experimental period, 5 eggs were taken from each replicate and prepared to determine the egg yolk cholesterol and total lipids according to the method of Floch *et al*. (1973). The economical efficiency (EEf) of the experimental diets was estimated depending upon feeding cost and price of produced eggs.

Data were statistically analyzed according to ANOVA Procedures of SAS (SAS Institute, 1999). Means differences were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Productive performance

Effect of dried alfalfa meal:

Results in Table 2 indicated that laying hens received the diet containing 10 % dried alfalfa meal (DAM) had significantly ($P<0.05$) lower body weight than those received 0 or 5 % DAM at 38 weeks of age. Similarly, Mourao *et al.* (2006) confirmed that inclusion of 15% alfalfa in the diets of laying hens significantly ($P<0.05$) decreased body weight at 44, 48 and 52 weeks of age. The aforementioned results may be due to that digestion and absorption of nutrients were negatively affected by DAM saponins which had an irritating effect on the membranes of the gastrointestinal tract (Oleszek, 1996).

The present results demonstrated that feeding laying hens diets furnished with 0% or 10% DAM revealed a significant ($P<0.05$) increase in feed intake during the period from 30 to 34 weeks of age (Table 2). These results agreed with those of Al-Haweizy and Al-Sardary (2007) who declared that increasing dehydrated alfalfa meal (8% or more) resulted in a significant ($P<0.05$) increase in feed consumption. Moreover, Bolden and Jensen (1985) observed no differences in body weight and feed consumption of laying hens when fed corn soy diet or the previous diet with 5% fish meal, alfalfa meal and torula yeast.

Feeding the high level of DAM (10%) during the period from 24 to 38 weeks of age resulted in significant ($P<0.05$) decrease in egg number, egg

production and egg mass, moreover, it exhibited the poorest ($P<0.05$) feed conversion value (Tables 3, 4 and 5). These results agreed with those of Potter *et al.,* 1993; Jenkins and Atwal. 1994 reported that dietary saponins depressed egg production in poultry. This negative effect have been ascribed to several properties of saponins such as reduced intestinal motility (Oleszek *et al.*, 1994), and reduction in digestibility (Shimoyameda *et al.,* 1998). Also, Mourao *et al.* (2006) found that 15% dietary alfalfa for laying hens significantly ($P<0.05$) decreased total egg mass values. Al-Haweizy and Al-Sardary (2007) declared that increasing dehydrated alfalfa meal (8% or more) resulted in a significant ($P<0.05$) decrease in egg mass and exhibited the poorest feed conversion. Also, Turk and Barnett (1972) found that adding alfalfa meal to a corn-soy laying hen diet was the most effective of the fiber sources tested for decreasing feed efficiency and egg production. Contradicting results were obtained by Guclu *et al.* (2004) they observed that addition of 9% alfalfa meal to laying quail diets had no adverse effect on performance. Alfalfa in high concentration in the diet of layers decreases growth and egg production (Hey Wang *et al.,* 1959).

Effect of chromium:

Results in Table 2 showed that no significant differences in body weight between treatment groups at different levels of chromium from 24 to 38 weeks of age. These results are in agreement with those of Fatma *et al.* (2002) and Lee *et al.* (2003) who reported that CrPic had no effect on growth, but feed efficiency was improved. Diets supplemented with 1200 µg Cr /Kg diet showed a significant ($P<0.05$) decrease in feed intake during the whole experimental period (24-38 weeks of age) and an improvement in both egg number, egg production, egg weight, egg mass and feed conversion during the period from 24 to 30 weeks of age (Tables 2, 3,4 and 5). Similar results were obtained by Sahin *et al.* (2002a) who reported that increased supplemental chromium level (200, 400, 800 or 1200 µg Cr /Kg) in laying quail diets linearly increased egg weight, egg production and feed conversion. Also, Sahin *et al.* (2001) and Page (1991) demonstrated that organic chromium supplementation caused to improve in egg production in layers and quails. Furthermore, El-Koteat *et al.* (2008) found that chromium supplementation significantly improved egg production and egg mass during 40 to 52 weeks of age when compared to the control diet. Contrarily,

Table 5: Feed conversion $\left(\overline{X} \pm SE\right)$ of Inshas layers as affected by dietary dried alfalfa meal, chromium levels and their interactions during the different experimental periods.

Items		Feed conversion (g. feed/g.egg mass)			
		24-30 weeks	30-34 weeks	34-38 weeks	24-38 weeks
Dried alfalfa meal (%)		NS	*	NS	*
0		5.52±0.32	3.45±0.15^{b}	3.32±0.13	4.00±0.09^{b}
5		5.40±0.36	3.26±0.08^{b}	3.33±0.08	3.92±0.09^{b}
10		6.19±0.42	3.93±0.13^{a}	3.87±0.33	4.55±0.20^{a}
Cr/Kg diet (µg)		*****	**NS**	**NS**	**NS**
0		6.70±0.36^{a}	3.62±0.15	3.62±0.12	4.48±0.13
600		5.90±0.45^{ab}	3.53±0.15	3.54±0.40	4.18±0.19
1200		4.81±0.32^{b}	3.72±0.19	3.49±0.28	4.01±0.22
1800		5.41±0.35^{b}	3.32±0.17	3.36±0.13	3.96±0.15
Interaction effects:					
Dried alfalfa meal (%)	**Cr/Kg diet (µg)**	*	*	NS	*
0	**0**	6.24±0.48^{ab}	3.39±0.28^{abc}	3.70±0.32	4.30±0.16^{ab}
	600	6.12±0.98^{ab}	3.59±0.09^{ab}	3.05±0.03	4.08±0.22^{ab}
	1200	4.63±0.41^{b}	4.00±0.09^{a}	2.99±0.08	3.88±0.14^{b}
	1800	5.11±0.14^{ab}	2.82±0.14^{c}	3.53±0.31	3.74±0.12^{b}
5	**0**	6.50±0.97^{ab}	3.39±0.09^{abc}	3.36±0.05	4.22±0.11^{ab}
	600	5.39±0.42^{ab}	3.17±0.13^{bc}	3.22±0.20	3.86±0.20^{b}
	1200	4.56±0.07^{b}	3.12±0.22^{bc}	3.55±0.20	3.75±0.12^{b}
	1800	5.14±0.81^{ab}	3.38±0.22^{abc}	3.20±0.16	3.85±0.26^{b}
10	**0**	7.35±0.28^{a}	4.08±0.18^{a}	3.79±0.09	4.92±0.12^{a}
	600	6.20±1.05^{ab}	3.85±0.36^{ab}	4.37±1.18	4.59±0.48^{ab}
	1200	5.23±0.95^{ab}	4.04±0.34^{a}	3.95±0.83	4.42±0.66^{ab}
	1800	5.97±0.74^{ab}	3.76±0.22^{ab}	3.35±0.22	4.28±0.30^{ab}

Means having different letters at the same column are differ significantly.
* = ($P<0.05$); NS= Not significant

Fatma *et al.* (2002) and Lien *et al.* (2004) showed that Cr supplementation had no influence on egg production of laying hens.

Interaction effects:

All studied traits (body weight, feed intake, egg number, egg production, egg weight, egg mass and feed conversion) were significantly

(P<0.05) influenced by the interaction between alfalfa meal and chromium during the period from 24 to 38 weeks of age (Tables 2, 3, 4 and 5).

Laying hens fed the high level of alfalfa meal (10%) without chromium supplementation exhibited the poorest egg number, egg production, egg mass and feed conversion values as compared with the other treatment groups during the whole experimental period.The best values of egg number and egg production were recorded with the diets containing 5% alfalfa meal and supplemented with 600 µg Cr /Kg diet while, egg weight, egg mass and feed conversion were recorded with the diets containing zero alfalfa meal and supplemented with 1800 µg Cr /Kg diet as compared with the other treatments during the experimental period from 24 to 38 weeks of age (Tables 3, 4 and 5).

Egg quality and egg components:

Effect of dried alfalfa meal:

The average of the three experimental periods (30, 34, and 38 weeks) clearly showed no significant differences between all the treatment groups for egg specific gravity and egg shape index (Table 6). No significant differences were observed among all the treatment groups concerning yolk index and egg shell % at 30, 34, 38 weeks of age and the average of all the previous periods (Table 7). Egg yolk % was almost significantly (P<0.05) decreased while, albumen % increased due to addition of dried alfalfa meal at 38 weeks of age (Table 8). In this respect, Nakaue *et al.* (1980) found no significant differences in specific gravity of eggs among groups of layers fed different levels of alfalfa meal. Similarly, Mourao *et al.* (2006) indicated that alfalfa supplementation did not affect egg specific gravity. Also, Abdel–Azeem (2005) showed that all egg quality traits were not affected by feeding laying Japanese quails on diets containing high fiber alfalfa meal.

Effect of chromium:

The effect of chromium supplementation on the overall mean of egg specific gravity was significantly (P<0.05) affected as presented in Table 6. Results of chromium supplementation at 600, 1200 and 1800 µg Cr /Kg diet increased (P<0.o5) egg specific gravity as compared with the control group. These results are in good agreement with these obtained by Sahin *et al.* (2002 a and b) who reported that increasing supplemental chromium

linearly increased ($P<0.05$) egg specific gravity. On the other hand, addition of different levels of chromium in layer diets decreased yolk index, albumen % and yolk % while, shell % increased at 38 weeks of age and the average for the three periods as compared with the control diet (Table 7 and 8). However, the previous results disagreed with those obtained by El-Koteat *et al.* (2008) who found that dietary treatments with Cr did not affect egg components (yolk %, albumen % and shell %).

Interaction effects:

The Interaction between dietary dried alfalfa meal and chromium at different levels showed significant ($P<0.05$ and $P<0.01$) differences among the treatment groups on egg quality (egg specific gravity, egg shape index and yolk index) and egg components (shell %, albumen % and yolk %) at 38 weeks of age. Moreover, the lowest values of the overall mean of yolk index and yolk % recorded with the diets containing 5 % alfalfa meal and supplemented with 1200 µg Cr /Kg diet as compared with the other treatments (Tables 6, 7 and 8).

Reproductive performance

Effect of dried alfalfa meal:

Results in Table 9 showed no significant differences in fertility and hatchability percentage values due to including of dried alfalfa meal in laying hen diets. However, dried alfalfa meal addition resulted in an insignificant decrease in fertility and hatchability values. In this respect, Kingan and Sullivan, (1964) stated that saponin content in alfalfa meal has negative effects on production rate, fertility and hatchability. Also, Stolzenberg and Parkhurst (1976) reported that the negative effects of saponins on animal reproduction have long been known and have been ascribed to abortifacient, antizygotic and implantation properties. On the other hand, Benie *et al.* (1990) demonstrated that alfalfa meal contains high levels of saponins (2 to 3 % of DM) were found to be extremely strong stimulators of luteinising hormone release from cultured hypophysial cells.

Effect of chromium:

At 38 weeks of age, fertility and hatchability percentages were significantly ($P<0.05$) increased for laying hens fed diets fortified with different level of chromium as compared with those of the control group

(Table 9). These results are agreement with those obtained by Contreras *et al.* (2002). Also, Richard and Marilyin (1981) indicated that male rats raised on a low chromium diet containing less than 100 µg chromium had lower fertility values compared to those fed the Cr-supplemented diets. On contrast, Butkauskas and Sruoga (2004) showed that chromium supplementation had no effect on Japanese quail fertility. However, in spite of their long term practical impact on reproduction, a few trace elements as chromium have not received much attention in formulating animal diets (Prasad and Gowda, 2005).

Interaction effects:

Layers fed on dried alfalfa meal with different levels of chromium did not show any significant interaction effects on reproductive performance, during the different experimental periods (Table 9).

Lipid and Cholesterol

Effect of dried alfalfa meal:

The results obtained revealed that increasing dried alfalfa meal percentage in laying hen diets decreased significantly ($P<0.05$) lipids and cholesterol in blood serum, egg yolk and liver as compared with the control group (Table 10). The possible explanation may be due to that dehydrated alfalfa meal is a good source of hypochloestrolemic compounds such as saponins which interact with the cholesterol to form complexes that may reduce sterols absorption from the gut as reported by Ponte *et al.* (2004). The present results are in partial agreement with the findings of McNaughton (1978) who observed a significant reduction in egg yolk cholesterol of laying hens fed alfalfa meal. Moreover, Guclu *et al.* (2004) and Abdel–Azeem (2005) found that liver cholesterol, liver lipids, plasma cholesterol, plasma lipids and yolk cholesterol level decreased by feeding laying quail diets containing alfalfa meal. On the contrarily, Mourao *et al.* (2006) found that the inclusion of alfalfa meal (15%) in diets of laying hens was unable to lower the levels of cholesterol content in the egg yolk. Efforts to reduce egg cholesterol levels by feeding sources of saponins to laying hens were generally not successful (Nakaue *et al.,* 1980; Sim *et al.,* 1984). The main source of egg cholesterol is endogenous synthesis in the ovary so reductions in blood cholesterol in laying hens don’t result in lower egg cholesterol. Sim *et al.* (1984) showed that dietary sarsasponin failed to lower the cholesterol

content of egg yolk or serum of laying hens even though it increased the excretion of cholesterol and decreased the transfer of dietary cholesterol to the eggs.

***Effect of chromium*:**

The effect of chromium level on serum cholesterol, yolk and liver cholesterol and lipids was significant ($P<0.05$) as shown in Table 10.The higher level of chromium exhibited the lowest serum cholesterol, this reduction is consistent with yolk and liver cholesterol and lipids (Table 10). The egg cholesterol reductions observed were similar to those obtained by Lien *et al.* (1996 and 2004) and Fatma *et al.* (2002) and also reductions in laying hens plasma cholesterol (Boleman *et al.*, 1995 and Lien *et al.*, 2001) as a result of chromium supplementation. Similarly, El-Koteat *et al.* (2008) found that egg yolk cholesterol and serum total lipids and cholesterol were significantly ($P<0.05$) decreased by Cr supplementation of laying hen diets. Also, Ezzat *et al.* (2006) and El–Hommosany, (2008) demonstrated that supplementing the diets of quail and broiler with chromium is beneficial in reducing egg cholesterol.

Interaction effects:

Cholesterol in blood serum and egg yolk were significantly ($P<0.05$) affected by the interaction between dried alfalfa meal and chromium as indicated in Table 10. Birds fed diets supplemented with 1800 µg Cr /Kg diet and contained 10 % dried alfalfa meal recorded the lowest blood serum and egg yolk cholesterol levels. However, it is clear that increasing the level of chromium in all diets with different levels of DAM showed gradual decrease in lipids and cholesterol of blood serum, yolk and liver (Table 10).

Economical efficiency:

Inclusion of 5% dietary dried alfalfa meal improved economical efficiency (EEf) as compared with the control diet (Table 11). Economical efficiency of chromium supplemented diets showed an improvement when compared with the control diet. Similar results were obtained by Ezzat *et al.* (2006) reported that the highest value of economical efficiency was obtained for quails fed diet supplemented with chromium up to 800 µg Cr / Kg diet.

Table 11. Economical efficiency $\left(\overline{X} \pm SE\right)$ of Inshas layers as affected by dietary supplementation of chromium, dried alfalfa meal levels and their interactions at 38 weeks of age.

Items		Egg number	Price/ egg (LE)	Total Revenue hen (LE)	Total feed intake/ hen(kg)	Price /Kg feed (LE)	Total feed cost/ hen (LE)	Fixed / hen price (LE)	Total cost Hen (LE)	Net Revenue /hen (LE)	(EEf) %
Dried alfalfa meal %											
0		59.35	0.5	29.68	10.39	1.71	17.77	2.00	19.77	9.91	50.12
5		61.57	0.5	30.79	10.34	1.67	17.27	2.00	19.27	11.52	59.77
10		54.12	0.5	27.06	10.36	1.66	17.20	2.00	19.20	7.86	40.96
Cr/Kg diet (µg)											
0		55.33	0.5	27.67	10.41	1.67	17.38	2.00	19.38	8.28	42.72
600		58.80	0.5	29.40	10.49	1.68	17.62	2.00	19.62	9.78	49.82
1200		58.89	0.5	29.45	10.14	1.68	17.04	2.00	19.04	10.41	54.69
1800		60.36	0.5	30.18	10.41	1.69	17.59	2.00	19.59	10.59	54.04
Interaction effects:											
Dried alfalfa meal %	**Cr/Kg diet (µg)**										
0	**0**	58.20	0.5	29.1	10.51	1.70	17.87	2.00	19.87	9.23	46.47
	600	58.87	0.5	29.435	10.49	1.71	17.94	2.00	19.94	9.50	47.63
	1200	58.07	0.5	29.035	10.00	1.71	17.10	2.00	19.10	9.94	52.02
	1800	62.27	0.5	31.135	10.55	1.72	18.15	2.00	20.15	10.99	54.55
5	**0**	58.87	0.5	29.435	10.37	1.66	17.21	2.00	19.21	10.22	53.19
	600	63.40	0.5	31.700	10.42	1.67	17.40	2.00	19.40	12.30	63.39
	1200	62.87	0.5	31.435	10.18	1.68	17.10	2.00	19.10	12.33	64.56
	1800	61.13	0.5	30.565	10.40	1.69	17.58	2.00	19.58	10.99	56.14
10	**0**	48.93	0.5	24.465	10.34	1.65	17.06	2.00	19.06	5.40	28.35
	600	54.13	0.5	27.065	10.57	1.66	17.55	2.00	19.55	7.52	38.47
	1200	55.73	0.5	27.865	10.24	1.66	17.00	2.00	19.00	8.87	46.67
	1800	57.67	0.5	28.835	10.28	1.67	17.17	2.00	19.17	9.67	50.44

Total revenue = Egg number / hen X Price/egg (LE). Fixed hen (LE) = Price bird (LE) + Rearing cost.
Net revenue/hen (LE) = Total revenue - Total cost/hen.
EEf = Net revenue/hen (LE) / Total cost/hen (LE).
Price of 1Kg chromium picolinate = 150 (LE)
EEf : Economical efficiency

Laying hens fed diets containing 5% alfalfa meals and supplemented with 1200 µg chromium /Kg diet recorded the best economical efficiency values, while laying hens fed diets containing 10% alfalfa meal without any chromium supplementation recorded the poorest economical efficiency values as compared with the other treatment groups.

In conclusion, using 5% alfalfa meal with 1200 or 1800 µg Cr/Kg diet were beneficial in egg production and reducing egg yolk and liver cholesterol contents, and increasing the economical return.

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تأثير مسحوق البرسيم الحجازي المجفف والكروميوم على أداء دجاج أنشاص البياض.

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صممت تجربة عامليه ٣ × ٤ لدارسة تأثير ثلاث مستويات من مسحوق البرسيم الحجازي المجفف (٠ ، ٥ ، ١٠%) وأربع مستويات من الكروميوم (٠ ، ٦٠٠ ، ١٢٠٠ ، ١٨٠٠ميكروجرام / كجم) على الأداء وصفات البيض لسلاله دجاج إنشاص البياض من عمر ٢٤حتي ٣٨ أسبوع. استخدم عدد ٢١٦ دجاجة بياضة و ٣٦ ديك عند عمر ٢٤ اسبوع قسمت عشوائيا إلى ١٢ مجموعة (١٨ دجاجة + ٣ ديوك / مجموعة) متساوية تقريبا في متوسط الوزن ومتوسط إنتاج البيض اليومي. قسمت كل مجموعة إلى ثلاث مكرارات في كلا منها ٦ دجاجات وديك واحد. وتم دراسة الأداء الانتاجي والتناسلي وصفات البيض ومحتوي الدم وصفار البيض والكبد من الكوليسترول.

وأوضحت النتائج ما يلي:

أدي استخدام ١٠% من مسحوق البرسيم الحجازي المجفف في علائق الدجاج البياض إلي خفض معنوي ($P<0.05$) لكل من متوسط وزن الجسم و إنتاج البيض ، عدد البيض ، حجم البيض ، الكفاءة الاقتصادية وأظهرت أسوأ كفاءة تحويل غذائية. كما أدت إضافة ٥% من مسحوق البرسيم الحجازي المجفف إلى نقص معنويا($P<0.05$) في كل من الغذاء المأكول خلال الفترة من ٣٠ إلي ٣٤ أسبوع ونسبة صفار البيض ونسبة الكولسترول والدهون في سيرم الدم وصفار البيض والكبد مقارنة بعلقة المقارنة.

إضافة الكروميوم لم تؤدي إلي أي تأثير معنوي علي متوسط وزن الجسم الحي ، بينما أدت إلي تحسن معنوي في وزن البيض ، نسبة الخصوبة ، الفقس ،الكثافة النوعية للبيضة عند ٣٨ أسبوع والكفاءة الاقتصادية. بينما أدت إضافة الكروميوم إلي خفض معنويا لكل من كوليسترول الدم و صفار البيضة و الكبد.

الدجاج البياض المغذي على علائق تحتوى على ٥%من مسحوق دريس البرسيم الحجازي مع ١٢٠٠ أو١٨٠٠ ميكروجرام كروميوم / كجم علف سجل اعلي كفاءة اقتصادية مقارنة بالمجاميع الأخري أو مجموعة المقارنة.

التوصية: أدي استخدام مسحوق البرسيم الحجازي المجفف بنسبة ٥% مع إضافة الكروميوم بمعدل ١٢٠٠ أو ١٨٠٠ ميكروجرام /كجم علف إلي زيادة إنتاج البيض وخفض الكوليسترول في الدم و صفار البيض والكبد وكذلك أدي إلي زيادة العائد الاقتصادي.