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# EFFECT OF DIETARY SUPPLEMENTATION WITH PHYTOESTROGENS SOURCES BEFORE SEXUAL MATURITY ON PRODUCTIVE PERFORMANCE OF MANDARAH HENS

By

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**Abstract:** *This study was conducted to research the effect of dietary herb supplementation fenugreek or licorice on performance of Manadrah hens before the sexual maturity, during the period (16-28 weeks of age). A total number of 240 hens of local Mandarah strain at 16 week randomly divided into 5 groups, control diet (16.2% CP, 2725 ME/kg ), control diet plus 0.1% or 0.5%, fenugreek and control diet plus 0.1% or 0.5% licorice. Each group contained three replicates (n= 16 birds/replicates). Supplementing the control diet with 0.5% fenugreek significantly increased body weight gain after 12 weeks of treatment. The average feed consumption was significantly lower in all herb treatment than the control except for 0.1% fenugreek. As for feed conversion ratio, the level of 0.5% licorice had the best feed conversion ratio in all the stages of the experiment. Sexual maturity was delayed in 0.5% fenugreek compared with other treatments. All herbal supplemented groups were superior to the control in production in all the stages of the experiment significantly. Moreover, fenugreek treatment tended to be more efficient than licorice in this aspect. A positive trend of herbal supplementation over control was observed in the data of egg mass. The relative weight of ovary was significantly increased comparing to the control especially with 0.5% fenugreek. The indicator of albumin quality of (Haugh unit) was significantly increased with 0.5% fenugreek treatment. Herbal supplemented treatments significantly reduced total cholesterol level in egg yolk and plasma. In conclusion, supplementing diets with either fenugreek or licorice up to 0.5% before the sexual maturity enhanced the performance of the laying hen and have provable effect in reducing cholesterol level in egg and plasma. Furthermore, fenugreek tended to be more effective than licorice in this aspect.*

## INTRODUCTION

Herbs have been used extensively in folklore medicine to treating common ailments. Observations from studies on animals suggest that herbs have the ability to stimulate protective enzymes involved in xenophobic metabolism. Herbs rich in some of these phytochemicals can play a major role in providing protection from xenobiotics. The use of herbs is a time-honoured approach to strengthening the body and treating disease. However, herbs may contain some active substances that can trigger side effects and interact with other herbs, supplements, or medications. For these reasons, herbs should be taken with care, under the supervision of a specialist in the field of botanical medicine. **Blumenthal and Klein (1996).** Herbs and spices are not just valuable in adding flavor to foods or drinks. Their antioxidant activity not only helps to preserve foods from oxidative deterioration but may have many other clinical effects along with other components, mostly phenolic compounds and flavonoids **(peter 2001).**

In animal production since banning antibiotic growth promoters in animal feeds, there are a number of non- therapeutic alternatives to antibiotic growth promoters, including enzymes, organic acids, probiotics, prebiotics, herbs, immune stimulants and specific management practices. The use of herbs in animal production may relate to their wide spectrum of physiological and nutritional effects depending on the herb. These effects may include but not limited to growth promoting effect, antimicrobial and hormonal-like effects. Fenugreek (*Trigonella foenum graecum*) is an annual herb belonging to the family Leguminosea **(Alarcon-Aguilara et *al.*, 1998),** widely grown in Mediterranean region, India and China. It has a high proportion of protein (approximately 20%-30%), the fatty acids ranged from 5-10% which are predominantly linoleic, linolenic, oleic and palmitic acids. It had 45-65% total carbohydrates with 15 % of galactomannan (a soluble fiber). Also, it contains flavonoids, saponins and more calcium, phosphorous, iron, zinc and manganese **(Schryver, 2002).** It contains amino acid (4hydroxyisoleucine) which has been shown to stimulate insulin secretion and improve glucose tolerance in normal and diabetic animals as the result of direct ß- cell stimulation **(Broca *et al.*, 1999 ; Sauvaire *et al.*, 1998; Schryver, 2002).** Saponins components are considered as an appetizer and helps digestion. Fenugreek contains phytoestrogens **(Mazur *et al.*, 1998),** and it have been recognized as a potential source of diosgenin, a basic compound in the hemisynthesis of steroidal sapogenins such as cortisol and sex hormones **(Brenac and Sauvaire, 1996 a, b)**

On the other hand, Licorice root and also known as Glycyrrhiza (*Glycyrrhiza glabra L.* (family Leguminosae)) contains glycyrrhizin glycyrrhetinic acid, flavonoids, asparagine, iso-flavonoids,and chalcones. Licorice root has been used in Europe since prehistoric times, and its medicinal use is well documented **(Fiore et al 2005)**. References to licorice dated back to approximately 2500 BC on Assyrian clay tablets and Egyptian papyrus. It has been used as both a food and a medicine since ancient times. Studies have shown that Licorice stimulates the excretion of hormones by the adrenal cortex. Some researchers have suggested that it can be used as a drug to prolong the action of cortisol. Licorice has a similar chemical structure to corticosteroids released by the adrenals, and further studies have suggested that it might one day prove useful in improving the function of hormone drugs, or be used as an aid in helping to reduce withdrawal symptoms from dependency on some corticosteroid hormones. Licorice has also shown estrogenic activity in laboratory animals, and is experimentally antiinflammatory, antirheumatic, and antibacterial. In China, licorice root is used as an antacid, **(Tyler, 1994).**

Because of the extensive consumption of both fenugreek and licorice in Egypt beside the relative cheap price of these herbs, we assumed that including such herbs in hens' diet may stimulate the performance according to its phytoestrogenic effects especially at the age of sexual maturity.

## MATRIAL AND METHODS

The present experiment was carried out in Sakha station of Poultry production, Kafer El-Sheikh, Animal Production Research Institute, Ministry Of Agriculture.

**Birds:**

A total number of 240 hens of local Mandarah strain at 16 week with approximately same body weight (1.2 kg) randomly divided into 5 treatment groups each three replicates (n= 16). Birds of each group were housed in open floor pen. All birds were kept under the same environmental conditions. Hens were individually weighted and leg-banded.

**Treatments:**

The experimental treatments were as follow:

1- Control diet.

2- Control diet supplemented with 0.1% grounded fenugreek seeds.

3-Control diet supplemented with 0.5% grounded fenugreek seeds.

4- Control diet supplemented with 0.1% grounded licorice seeds.

5- Control diet supplemented with0.5% grounded licorice seeds.

Both fenugreek seeds and licorice roots were from the local market. the dietary for 12 weeks. Age of first egg was recorded as age of sexual maturity, then egg production was recorded daily, body weight was recorded every 4 weeks. In the last 2 weeks of treatments eggs were collected for egg quality analysis (n= 30). At age of 28 weeks 4 birds from each replicate were slaughtered for carcass and organs analysis, liver samples were stored at -20°C for further analysis. Blood samples were collected in heparin zed tubes and centrifuged at 3000 rpm for 15 min to separate plasma. Plasma samples were kept in -20°C for biochemical analysis.

**Measurements:**

Live body weight (BW), birds were weighted individually of each successive four week from 16 up to 28 week to the nearest grams. Feed consumption (FC), in each pen, was calculated through division of total FC by number of birds. Feed conversion ratio (FCR), as follows: grams feed consumed /gram egg produced. Egg production (EP), calculated as Hen Day production % = (number egg produced / number live hens) X 100. Egg weight (EW) and egg mass (EM) by multiplying egg number by the average egg weight in each replicate per day. **Romanoff and Romanoff, (1949),** including Haugh units (HU) **Haugh (1937).** Biochemical analysis includes plasma total cholesterol **Siedel, (1983),** Liver cholesterol and lipids contents **Zollner and Kirsch (1962)** and Yolk cholesterol and lipids contents **Floch et al, (1957).**

**Statistical analysis:**

The differences among treatments were statistically analyzed by general linear model using 17.0 (Statistical Packages for the Social Sciences, released 23 August 2008). The significant differences among means of treatments were compared by P 0.05 was set as limit of significance.

**Table 1.** Nutrients composition of the basal diet

| Ingredients | % |
|---|---|
| Yellow corn | 64.94 |
| Soybean meal (44%) | 23.50 |
| Wheat bran | 1.74 |
| Lime stone | 7.63 |
| Di calcium phosphate | 1.51 |
| Nacl | 0.30 |
| Premix[1] | 0.30 |
| DL-Methionine | 0.08 |
| Total | 100 |
| *Calculated analysis:* | |
| Crude protein (%) | 16.18 |
| Metabolizable energy (kcal/kg) | 2725 |
| Crude fibre % | 3.26 |
| Available Phosphors % | 0.40 |
| Calcium % | 3.30 |
| Lysine % | 0.81 |
| Methionine % | 0.34 |
| Methionine+Cystine% | 0.62 |

1. Each 3 kg of Vit. and Min. Mixture contains: Vit. A, 10000,000 IU; Vit. D3, 2000,000 IU; Vit. E, 10,000 mg; Vit. k3, 1000 mg; Vit. B1, 1000 mg; Vit. B2, 5000 mg; Vit. B6, 1500 mg; Vit. B12, 10 mg; Pantothenic acid, 10,000 mg; Niacin, 30,000 mg; Folic acid, 1000 mg; Biotin, 50 mg; Choline, 250,000 mg; Manganese, 60,000 mg; Zinc, 50,000 mg; Copper, 10,000 mg; Iron, 30,000; Iodine, 1000 mg; Selenium, 100 mg; Cobalt, 100 mg; $CaCO_3$ to 3,000 gm.

## RESULTS AND DISCUSSION

**Growth performance:**

No significant effect observed in live body weight among all treatment at age 4 or 8 weeks of experimental period (Table 2). However, significant increase in live body weight was achieved in all dietary treatments than the control fenugreek treatments had significant higher body weight gain than licorice and control group. Birds fed diets supplemented with the fenugreek had significantly higher body weight gain than those fed diets supplemented with licorice or control groups. Feed consumption was decreased with 0.5% fenugreek after 4 and 8 weeks of treatment compared to other groups, but it increased significantly after 12 week of treatment. The average feed consumption was significantly lower in all herbal treatments than the control, except for 0.1% fenugreek. As for feed conversion ratio, high level of licorice 0.5% had the best feed conversion ratio in all the stages of the experiment including the average. The enhancement of growth performance may be due to the fenugreek supplementation which improves digestion. In vivo studies

have identified that it enhances the activity of pancreatic and intestinal lipase, and sucrose and maltase thereby providing support to this traditional use **Platel and Srinivasan( 1996, 2000)**. On the other hand, the antioxidant contents of these herbs may contribute positively is this aspect. Studies by **Eid, et al., (2003)** with using some other models proved that antioxidants enhance the growth under normal and abnormal conditions. In vitro research has identified seven antioxidant compounds from an acetone extract of licorice: four isoflavans (hispaglabridin A, hispaglabridin B, glabridin and 4'-Omethylglabridin), two chalcones (isoprenylchalcone derivative and isoliquiritigenin) and an isoflavone (formononetin) **Vaya et al (1997)**. Isoflavones from licorice were also shown to be effective in protecting mitochondrial function against oxidative stresses **(Haraguchi 2000). Abaza 2007** had the similar results for decreasing feed consumption when laying hens were fed 0.5% fenugreek for Matrouh hens at age of 32 weeks. **Moustafa (2006)** indicated that fenugreek at level of 0.05% revealed insignificant effect on feed consumption compared to the control group. In this respect, **El-Kaiaty et al. (2002) and Radwan (2003)** reported that there were no effect of supplemented fenugreek on feed consumption for laying hens and broilers, respectively. **Mazur et al., (1998)** demonstrated that the presence of phytoestrogens in fenugreek may also have a great value because of its antifungal and antioxidant activities. **Moustafa (2006)** found that fenugreek at the level of 0.05% improved feed conversion. **Morsy (1995)** found that feed conversion was improved by combination of cinnamon, fenugreek and clove species compared to the control. The action of licorice glycyrrhetinic acid in blocking the enzyme 11HSD type 1 at the level of fat cells may help to explain preliminary evidence suggesting an ability to reduce body fat mass and the thickness of thigh fat (**Armanini et al 2003, 2005**). **EL-Mallah et al.(2005)** noted that increasing the level of fenugreek seeds to 2% in diet of turkey chicks caused significant increase in digestibility of NFE% and this may be due to saponin content in fenugreek seeds that stimulate insulin activity).

**Egg production performance**:

Hens supplemented with 0.5% fenugreek needs less time to reach the sexual maturity (about 152 days) comparing with other groups (Table 3).Birds fed diets supplemented with herbs recorded significantly the highest egg production % compared with those fed the control diets at all experimental periods. Moreover, fenugreek treatment tended to more efficient than licorice in this aspect. The average of egg weight increased at 0.1% licorice than the control, and lowest recorded for 0.5% fenugreek. This could be explained because of the reverse relationship between egg production and

egg weight. A positive trend of herbal effect over control was observed in the data of egg mass table 2. However, our results are not in agreement of **Tollba et al., 2005, Abaza, (2007) and Safaa, (2007)** they reported that Fenugreek did not have a significant effect on egg production, egg weight and egg mass. This difference in results may due to the difference of hens age used in these experiments. In this study we started the fenugreek treatment before the sexual maturity of the hens assuming that the phytoestrogen contents of fenugreek and licorice may have stimulating effect on egg production, by looking to our results we can confirm this assumption especially for fenugreek. On the other hand, fenugreek may improve the productive performance, health and immunity in poultry **Mohamed et al., (2004).** Licorice contains isoflavones, including licochalcone-A, which are also known as 'phyto-estrogens', in vitro studies suggest that stimulation of aromatase activity promotes estradiol synthesis **Takeuchi et al (1991).** Liquiritigenin and isoliquiritigenin have displayed estrogenic affinity to sex hormone-binding globulin and oestrogen receptors in vitro Hillerns et al ( 2005) and glabridin and glabrene have both demonstrated estrogen-like activities similar to oestradiol-17(beta) in animal studies **(Somjen et al 2004).**

**Carcass characteristics:**

There were no significant effects between control and herb groups concerning the relative percentage of eviscerated carcass, liver and gizzard as shown in Table 4. On the other hand, the treatment with licorice showed a significant increase in the relative weight of spleen and heart comparing to the control group. Interestingly, the relative weight of ovary is significantly increased comparing to the control table 4. This could be connected to high egg production of these groups. Licorice contains glycyrrhetinic acid which may results in delayed excretion and prolonged activity of cortisol **Kato et al (1995)** this may lead to increase the oxidative stress levels in the body resulting in increase in the weight of heart. However, currently we have no data to confirm this assumption. Phytoestrogens administration at daily doses of 0.5, 1.0, or 5.0 mg/bird/day dramatically increased ($P < 0.05$) oviduct weights in Scaled quail but with no effect on ovary **Cain, (1987),** fenugreek effect on ovary weight in high dose may to refer to its administration before the sexual maturity.

**Egg quality characteristics:**

Effects of dietary herbs supplementation on egg quality characteristics

are presented in Table 5. The major findings in these data are that the yolk percent of the egg was decreased significantly by 0.5% fenugreek compared to control group. On the other hand, 0.5% licorice decreased shell thickness. The indicator of albumin quality haugh unit was significantly increased in 0.5% fenugreek comparing to the control group. When hens fed diet supplemented with fenugreek had numerically highest values of shell thickness and albumen weight percentage **Abaza, (2007).** The glycyrrhetinic acid constituent in licorice (and its metabolite 3-monoglucuronyl-glycyrrhetinic acid) inhibits the enzyme 11HSD **Kato et al (1995),** which catalyses the conversion of cortisol into its inactive metabolite, cortisone. This results in delayed excretion and prolonged activity of cortisol. Additionally, glycyrrhetinic acid binds to mineralocorticoid and glucocorticoid receptors and may displace cortisol from its carrier molecule, transcortin **Nissen (2003).** And egg mass were obtained by **Harms and Russell (1995).**

**Biochemical characters:**

Effects of dietary herbs supplementation on total lipids in liver and egg yolk are presented graphically in Fig (1) 0.5% fenugreek and both of licorice treatments significantly reduce total lipids in liver comparing to the control group. The same trend was observed in egg yolk lipids with the exception that 0.5% fenugreek decreased yolk lipid than the other treatment and control. Figure 2 shows the effect of fenugreek and licorice on the cholesterol level in liver, egg yolk and blood plasma. All herbs reduced cholesterol level in liver comparing to the control group, except 0.1% licorice figure 2 A. As a result of that significantly low levels of cholesterol were transferred to the egg yolk comparing to the control Figure 2B. This significant reduction in yolk cholesterol may refer to low blood circulating levels of cholesterol beside the reduction of cholesterol synthesis in liver Figure 2 C. 0.5% fenugreek was superior in decreasing blood cholesterol level. **El- Husseiny et al. (2002)** noticed that addition of fenugreek to broiler diet decreased total cholesterol and increased GOT and GPT values compared to control group. Several clinical studies conducted in people with and without diabetes have identified significant lipid-lowering activity with different fenugreek preparations, such as defatted fenugreek, germinated seed and hydro-alcoholic extracts **Gupta & Gupta (2001).** Significant cholesterol-lowering activity has been demonstrated in several animal studies and human studies with diabetic volunteers **Gupta & Gupta (2001).** Although the mechanism of action is still unclear, it appears that the fiber and steroidal saponin content are important for activity. Recent study by **Gyeong et al (2010),** proved that licorice water extract have hypolipidemic effect and can

effectively decrease lipid peroxidation in human with smoking habit. Fenugreek in the form of unroasted and roasted powdered seeds was given in low (2 g/kg) and high (6 g/kg) dose to normal and alloxan-induced diabetic rats. Both the unroasted and roasted forms produced a significant fall in various serum lipids like total cholesterol, triglycerides, LDL and VLDL cholesterols in normal rats; decreased their raised levels and increased HDL cholesterol in the diabetic rats **Khosla et al.,( 1995), Hugues et al., (2010). Nofal et al, (2006), Tollba et al, (2005) and El-Kaiaty et al(2002)** observed that adding black seed or fenugreek for local strains and commercial layer decreased the yolk cholesterol and total lipids and may produce eggs with low cholesterol and total lipids content.

In conclusion, supplemented diets with plant derived phytoestrogens either fenugreek or licorice up to 0.5% before the sexual maturity enhanced the performance of the laying hen and have provable effect in reducing cholesterol level in egg yolk and plasma, fenugreek tended to be more effective than licorice in this aspect.

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**Table 2.** Effects of dietary levels fenugreek or licorice on performance of Mandarah hens

| Age | Control | Fenugreek | | Licorice | |
|---|---|---|---|---|---|
| | | 0.1% | 0.5% | 0.1% | 0.5% |
| *Body weight (BW) by gram* | | | | | |
| BW 0w | 1205.6 ± 11.9 | 1207.6 ± 11.8 | 1204.4 ± 11.3 | 1229.2 ± 10.8 | 1227.8 ± 14.1 |
| BW 4w | 1322.2 ± 13.9 | 1316.2 ± 10.2 | 1694.2 ± 13.1 | 1319.4 ± 10.0 | 1333.3 ± 11.3 |
| BW 8w | 1398.1 ± 12.3 | 1393.0 ± 6.5 | 1409.7 ± 9.1 | 1391.7 ± 9.9 | 1388.6 ± 10.4 |
| BW 12w | $1405.8^{b}$ ± 8.4 | $1453.8^{a}$ ± 6.5 | $1472.2^{a}$ ± 6.7 | $1470.8^{a}$ ± 6.7 | $1457.8^{a}$ ± 9.6 |
| BW gain | $200.3^{b}$ ± 14.7 | $246.2^{a}$ ± 15.0 | $267.8^{a}$ ± 13.3 | $241.7^{ab}$ ± 11.0 | $230.0^{ab}$ ± 17.6 |
| *Feed consumption (FC) by gram* | | | | | |
| FC 4w | $3201.3^{b}$ ± 15.6 | $3313.1^{a}$ ± 2.2 | $3108.0^{c}$ ± 37.3 | $2893.3^{d}$ ± 11.2 | $2893.3^{d}$ ± 22.3 |
| FC 8w | $3276.0^{a}$ ± 3.9 | $3330.5^{a}$ ± 6.7 | $2940.0^{c}$ ± 51.1 | $3126.7^{b}$ ± 11.2 | $3080.0^{b}$ ± 33.5 |
| FC 12w | $3313.3^{c}$ ± 2.2 | $3340.3^{b}$ ± 8.7 | $3360.0^{a}$ ± 4.6 | $3304.0^{c}$ ± 3.9 | $3360.0^{a}$ ± 4.2 |
| Average | $3263.6^{b}$ ± 4.5 | $3328.0^{a}$ ± 4.5 | $3136.0^{c}$ ± 25.9 | $3108.0^{c}$ ± 5.9 | $3111.1^{c}$ ± 16.2 |
| *Feed conversion ratio* | | | | | |
| FCR 4w | $8.99^{a}$ ± 0.03 | $7.83^{a}$ ± 0.05 | $7.75^{b}$ ± 0.04 | $7.32^{c}$ ± 0.03 | $6.60^{c}$ ± 0.04 |
| FCR 8w | $7.06^{ab}$ ± 0.04 | $5.81^{a}$ ± 0.03 | $4.53^{b}$ ± 0.05 | $6.09^{bc}$ ± 0.03 | $5.41^{c}$ ± 0.04 |
| FCR12w | $5.99^{b}$ ± 0.04 | $4.62^{ab}$ ±0.03 | $4.96^{a}$ ± 0.04 | $5.12^{ab}$ ± 0.03 | $3.87^{c}$ ± 0.08 |
| Average | $7.25^{b}$ ± 0.03 | $5.76^{ab}$ ±0.02 | $5.75^{a}$ ± 0.09 | $6.04^{bc}$ ± 0.02 | $5.07^{c}$ ± 0.06 |

**Table 3.** Effects of dietary level of fenugreek or licorice on egg production, egg weight and egg mass in Mandarah hens.

| | control | fenugreek | | Licorice | |
|---|---|---|---|---|---|
| | | 0.1% | 0.5% | 0.1% | 0.5% |
| *Age at sexual maturity (SM) by days* | | | | | |
| SM | $167.7 \pm 5.1^{a}$ | $166.0 \pm 3.0^{a}$ | $151.6 \pm 3.0^{b}$ | $164.7 \pm 2.05^{a}$ | $162.1 \pm 3.9^{a}$ |
| *Percent of egg production (EP)* | | | | | |
| EP 4w | $29.6^{b}$ ± 2.4 | $41.0^{a}$ ± 2.2 | $42.9^{a}$ ± 2.7 | $36.4^{a}$ ± 2.8 | $40.5^{a}$ ± 2.1 |
| EP 8w | $38.4^{c}$ ± 2.4 | $48.1^{ab}$ ± 1.4 | $53.3^{a}$ ± 1.5 | $43.7^{b}$ ± 1.8 | $47.1^{b}$ ± 2.2 |
| EP 12w | $46.5^{c}$ ± 2.4 | $57.9^{ab}$ ± 1.5 | $59.7^{a}$ ± 2.1 | $52.8^{b}$ ± 1.7 | $57.6^{ab}$ ± 1.5 |
| Average | $38.2^{c}$ ± 1.9 | $49.0^{a}$ ± 1.3 | $52.0^{a}$ ± 1.3 | $44.3^{b}$ ± 1.6 | $48.4^{ab}$ ± 1.5 |
| *Egg weight (EW) by gram* | | | | | |
| EW 4w | $38.61^{b}$ ±0.45 | $39.06^{a}$ ± 0.58 | $33.38^{a}$ ± 2.32 | $38.67^{a}$ ± 0.53 | $38.51^{a}$ ± 0.54 |
| EW 8w | $43.11^{a}$ ± 0.55 | $42.50^{a}$ ± 0.45 | $40.75^{b}$ ± 0.58 | $42.04^{ab}$ ± 0.53 | $43.18^{a}$ ± 0.53 |
| EW 12w | $44.90^{b}$ ± 0.63 | $44.56^{b}$ ± 0.55 | $42.79^{b}$ ± 0.64 | $43.63^{b}$ ± 0.55 | $53.81^{a}$ ± 4.88 |
| Average | $42.21^{b}$ ± 0.42 | $42.04^{b}$ ± 0.39 | $38.97^{c}$ ± 0.92 | $41.44^{bc}$ ± 0.35 | $45.18^{a}$ ± 1.79 |
| *Egg mass (EM)* | | | | | |
| EM 4w | $11.42^{b}$ ± 5.5 | $16.01^{a}$ ± 24.9 | $14.32^{a}$ ± 40.6 | $14.07^{ab}$ ± 31.8 | $15.59^{a}$ ± 26.4 |
| EM 8w | $16.55^{c}$ ± 29.8 | $20.44^{ab}$ ±17.2 | $21.71^{a}$ ± 18.3 | $18.37^{bc}$ ± 24.3 | $20.33^{ab}$ ± 29.2 |
| EM 12w | $20.87^{b}$ ± 32.9 | $25.80^{b}$ ± 22.9 | $25.54^{b}$ ± 26.5 | $23.03^{b}$ ± 22.8 | $30.99^{a}$ ± 87.0 |
| Average | $16.12^{c}$ ± 23.1 | $20.59^{ab}$ ± 6.8 | $20.26^{ab}$ ± 18.7 | $18.35^{bc}$ ± 20.5 | $21.86^{a}$ ± 37.7 |

**Table 4.** Effects of dietary level of fenugreek or licorice on slaughter characteristics in Mandarah hens.

| (%) | Control | fenugreek | | Licorice | |
|---|---|---|---|---|---|
| | | 0.1% | 0.5% | 0.1% | 0.5% |
| Carcass | 69.99 ± 2.68 | 71.04 ± 1.44 | 73.65 ± 0.72 | 72.88 ± 1.63 | 69.20 ± 1.02 |
| Liver | 2.09 ± 0.04 | 2.18 ± 0.11 | 2.11 ± 0.11 | 2.24 ± 0.14 | 2.55 ± 0.11 |
| Spleen | $0.16^{c} \pm 0.01$ | $0.20^{bc} \pm 0.02$ | $0.17^{c} \pm 0.01$ | $0.25^{a} \pm 0.02$ | $0.23^{ab} \pm 0.01$ |
| Heart | $0.40^{c} \pm 0.02$ | $0.41^{c} \pm 0.02$ | $0.42^{bc} \pm 0.02$ | $0.50^{ab} \pm 0.03$ | $0.53^{a} \pm 0.04$ |
| Gizzard | 2.60 ± 0.05 | 2.50 ± 0.14 | 2.30 ± 0.12 | 2.46 ± 0.16 | 2.44 ± 0.13 |
| Ovary | $0.77^{c} \pm 0.01$ | $2.11^{b} \pm 0.16$ | $2.93^{a} \pm 0.33$ | $2.10^{b} \pm 0.17$ | $1.66^{b} \pm 0.19$ |

**Table 5.** Effects of dietary level of fenugreek or licorice on egg quality parameters in Mandarah hens.

| | | fenugreek | | Licorice | |
|---|---|---|---|---|---|
| | | 0.1% | 0.5% | 0.1% | 0.5% |
| Egg weight | 46.98±0.35 | 47.44±0.47 | 46.98±0.22 | 47.61±0.13 | 47.49±0.51 |
| Egg Length (mm) | 49.29 ± 0.41 | 49.48 ± 0.36 | 48.70 ± 0.45 | 49.03 ± 0.40 | 49.33 ± 0.45 |
| Egg Width (mm) | $34.48^{a} \pm 0.31$ | $35.33^{ab} \pm 0.27$ | $35.74^{b} \pm 0.40$ | $35.14^{ab} \pm 0.39$ | $37.00^{c} \pm 0.34$ |
| Egg shape index | $70.03^{c} \pm 0.72$ | $71.50^{bc} \pm 0.75$ | $73.54^{ab} \pm 1.03$ | $71.83^{bc} \pm 1.04$ | $75.19^{a} \pm 1.02$ |
| Yolk Width (mm) | 32.52 ± 0.58 | 34.22 ± 0.68 | 34.24 ± 0.61 | 34.14 ± 0.86 | 33.74 ± 0.52 |
| Yolk Hight (mm) | $16.59^{c} \pm 0.25$ | $16.97^{bc} \pm 0.23$ | $17.35^{ab} \pm 0.25$ | $17.71^{a} \pm 0.19$ | $17.31^{ab} \pm 0.25$ |
| Yolk Weight (g) | $14.58^{b} \pm 0.22$ | $14.17^{bc} \pm 0.21$ | $13.64^{c} \pm 0.23$ | $14.14^{bc} \pm 0.26$ | $15.34^{a} \pm 0.30$ |
| Yolk % | $31.09^{ab} \pm 0.55$ | $29.90^{bc} \pm 0.46$ | $29.13^{c} \pm 0.63$ | $29.75^{bc} \pm 0.63$ | $32.40^{a} \pm 0.76$ |
| Albumin weight | 27.99 ± 0.56 | 28.85 ± 0.49 | 28.81 ± 0.57 | 28.72 ± 0.55 | 27.45 ± 0.63 |
| Albumin % | $59.47^{ab} \pm 0.78$ | $60.71^{b} \pm 0.63$ | $61.20^{b} \pm 0.72$ | $60.20^{b} \pm 0.83$ | $57.65^{a} \pm 1.01$ |
| Shell Weight (g) | 4.41 ± 0.12 | 4.42 ± 0.15 | 4.53 ± 0.12 | 4.75 ± 0.13 | 4.70 ± 0.13 |
| Shell % | 9. 38± 0.31 | 9.31 ± 0.41 | 9.64 ± 0.38 | 9.79± 0.33 | 9.89 ± 0.24 |
| Shell Thickness (nm) | $0.33^{a} \pm 0.06$ | $0.33^{ab} \pm 0.09$ | $0.33^{ab} \pm 0.06$ | $0.33^{ab} \pm 0.06$ | $0.32^{b} \pm 0.09$ |
| Haugh Unit | $81.07^{b} \pm 1.59$ | $83.29^{ab} \pm 1.85$ | $86.33^{a} \pm 1.81$ | $83.81^{ab} \pm 1.29$ | $84.77^{ab} \pm 1.39$ |

Figure 1. Effects of dietary level of fenugreek or licorice on liver (A) and egg yolk (B) total lipids in Mandarah hens after 12 weeks of treatment.

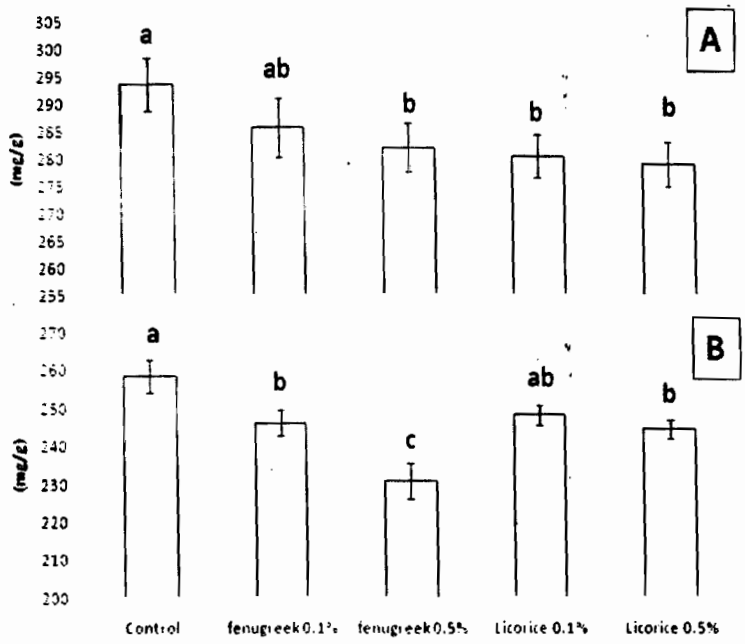
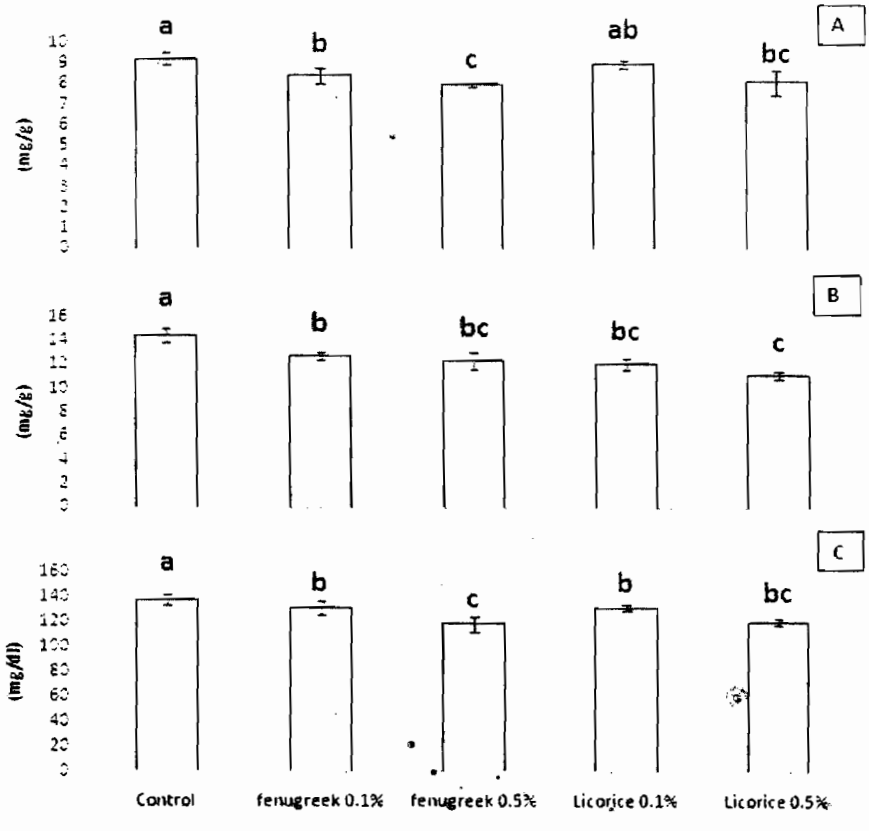


Figure 2. Effects of dietary level of fenugreek or licorice on cholesterol levels of liver (A), egg yolk (B) and blood plasma in Mandarah hens.



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## الملخص العربى

## تأثيرا ضافة الاستروجينات النباتية قبل النضج الجنسى على الاداء الانتاجى فى دجاجات المندرة

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قسم أنتاج الدواجن – كلية الزراعة – جامعة كفرالشيخ

أجريت هذة الدراسة على عدد ٢٤٠دجاجة من سلالة المندرة عمر ١٦ اسبوع قسمت الى ٥معاملات كل معاملة قسمت الى ٣ مكررات غذيت على العلائق الاتية:

١ العليقة الاساسية كنترول

٢ العليقة الاساسية مضاف اليها ١% بذور حلبة

٣ العليقة الاساسية مضاف اليها ٠.٥% بذور حلبة

٤ العليقة الاساسية مضاف اليها١% عرقسوس

٥ العليقة الاساسية مضاف اليها ٠.٥% عرقسوس

لم يكن هناك اختلافات معنوية فى وزن الجسم وكان تاثير الحلبة اعلى فى الوزن بالمقارنة بالعرقسوس والكنترول

-انخفض معدل الغذاء المستهلك فى كل المعاملات مقارنة بالكنترول وكانت الكفاءة الغذائية اعلى عند مستوى ٠.٥ عرقسوس.

- بالنسبة للدجاجات المضاف اليها ٠.٥حلبة تحتاج وقت اقل للوصول للنضج الجنسى حوالى ١٥٢يوم بالمقارنة بالمجاميع الاخرى.

١ - زاد معدل وزن البيض عند مستوى ١% عرقسوس بالمقارنة بالكنترول واقل مستوى سجل عند ٠.٥%حلبة.

٢ - كان للحلبة تاثير معنوى على انتاج البيض ووزنة و كتلة البيض.

٣ - لم يكن هناك تاثيرات معنوية بين الكنترول والمجاميع الاخرى على نسبة الذبيحة والكبد والقونصة وكذلك المجاميع التى غذيت على عرقسوس زاد معنويا وزن الطحال والقلب ووزن المبيض مقارنة بالكنترول.

٤ - انخفض نسبة صفار البيض عند مستوى٠.٥% حلبة بينما انخفض سمل القشرة عند مستوى٠.٥% عرقسوس وزاد الالبيومين ووحدات هوف معنويا عند مستوى٠.٥% حلبة بالمقارنة بالكنترول.

٥ - انخفضت معنويا نسبة الدهون الكلية فى الكبد وفى صفار البيض بالمقارنة بالكنترول وكذلك ايضا انخفضت معنويا نسبة الكوليسترول فى الكبد وفى صفار البيض وفى بلازما الدم بالمقارنة بالكنترول.

٦ - عامة اضافة الاستروجينات النباتية مثل الحلبة والعرقسوس الى الدجاجات بيحسن من الصفات الانتاجية وبيخفض من مستوى الدهون الكلية والكوليسترول فى الكبد وصفار البيض وفى بلازما الدم وخاصة الحلبة بتكون اعلى تاثيرا عن العرقسوس.