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EFFECTS OF USING FENUGREEK, CHAMOMILE AND RADISH AS FEED ADDITIVES ON RODUCTIVE PERFORMANCE AND DIGESTIBILITY COEFFICIENTS OF LAYING HENS.

BY

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Abstract*: A total number of 150 Matrouh laying hens a local strain of 32 weeks old were used to study the effect of using some medicinal plants as feed additives on performance, egg quality, digestibility, blood constituents and economical efficiency of laying hens. Hens had nearly similar initial body weight and were randomly divided into five equal treatment groups (30 hens each) and were housed in individual cages in an open system house. Treatment 1 received the basal diet (control). Treatments 2, 3 and 4 received the basal diet supplemented with fenugreek (F.S), chamomile (CH.F) and radish (R.R) at the levels of 0.5% for each, respectively, while the fifth treatment received kemzyme* dry *product (K.M) at the level of 0.1%. Hens were fed the experimental diets for three months.*

The results obtained could be summarized as follows:

1- *Addition of R.R at the level of 0.5% numerically increased egg number and egg mass by 12.42 and 12.43 %, respectively, compared to the control group.*

2- *Hens fed basal diet supplemented by R.R, K.M, CH.F and F.S numerically increased egg number than those fed basal diet (control) by 12.42, 7.31, 5.42 and 2.23%, respectively.*

3- *Feed consumption with hens fed control diet had significantly the maximum amounts of diet compared to the other treatments throughout all intervals studied.*

4- *In addition F.S, CH.F and K.M supplementation decreased significantly feed consumption compared to control and R.R groups.*

5- *Addition of K.M, CH.F, R.R and F.S improved feed conversion compared to control group during 40- 43 wks. of age.*

6- *All treatments did not cause significant effect on egg quality traits and digestibility values of laying hens.*

7- *Addition of K.M supplementation significantly increased plasma total protein and globulin values followed by those fed diets including R.R, while hens fed diets containing CH.F, F.S and control did not statistically differ.*

8- *Addition of CH.F significantly decreased total cholesterol and GOT values compared with the other groups. The highest values of GPT value recorded by hens fed diet containing R.R..*

9- *The best relative economical efficiency was recorded with hens fed R.R followed by those fed either K.M, CH.F or F.S, respectively.*

10- *These results indicated that the diets containing R.R, K.M, CH.F and F.S were more economical than the control diet.*

INTRODUCTION

Herbs and herbal products are incorporated in livestock feeds instead of chemical products and antibiotics in order to stimulate the effectiveness of feed nutrients which result in more rapid gain, higher production and better feed efficiency. Herbs and the logically active substances content stimulate body metabolism, improve digestion, have bactericidal, immunostimulant action and improved productivity of poultry (Sabra and Mehta, 1990). Practically, reports have shown that supplementing poultry diets with various herbs have favorable effects on the performance and health of reared birds (El – Gendi, 1996).

Fenugreek (*Trigonella foenum graecum L.*) is an annual plant from the family of leguminosae. Fenugreek as a medical plant is considered to be a good source of crude protein, crude fat and total carbohydrates (Abd EL-Aal and Rahma, 1986). It contains phytoestrogens which are of great interest because of their estrogenic (Mazur *et al*., 1998). Fenugreek seeds have also been recognized as a potential source of diosgenin a basic compound in the hemisynthesis of steroidal sapogenins such as cortison and sex hormones (Brenac and sauvaire, 1996 a and b). Moreover, Rao and sharma (1987) found that the seeds of fenugreek contained 4.8% saponins. Fenugreek seeds are considered as an appetizer and helps in digestion. Fenugreek has antioxidant, antifungal, antiviral and anticarcinogenic activities, (Mazur *et al*., 1998).

Chamomile (*Matricaria Chamomilla L.*) is an plant from the family compositase. It contains chemicals as flavones opigenin, essential oil such as bisaboloxide B,α – bisabolol, chamazulene and bisababoloxide A (Ayad 1998). Chamomile flowers inhibit the excessive growth of intestinal harmful microorganism, thus counteracting inflammation, (Kolacz *et al*., 1997).

Abaza *et al*. (2003) reported that the addition of chamomile flowers at level of 2.5 kg / ton of broiler diet improved growth performance and feed conversion.

Radish (*Armoracia rusticana*) is plant from the family brassicacea. The pungent principle of radish is allyl isothiocyanate, which is enzymatically produced from sinigrin is used roosted. The fresh root of radish has been considered an antiseptic, diaphoretic, diuretic, rubefacient, stimulant, stomachic, and vermifuge. The material has also been used as a remedy for asthma, coughs, colic, rheumatism, scurvy, ulcers and venereal diseases. Peroxidase enzyme is extracted from the radish root is used as an oxidizer in chemical tests such as blood glucose determinations. The volatiles of radish root are reported to have herbicidal and microbial activities as reported by (Simon *et al*. 1984). Jeong *et al*. (2005) demonstrated that extract of radish roots exhibits an increase in gastrointestinal motility through the activation of muscarinic acetylcholine (ACh) receptors. Methylisogermabullone MIGB isolated from radish roots stimulates the small bowel motility through the activation of ACh receptors. These findings suggest that MIGB may become a potential regulatory agent for therapeutic intervention in dysfunction of gastrointestinal motility. Pedrero *et al*. (2006) suggested that radish enriched in selenite could be a good source as an organoselenium supplement for the human diet and animal feed.

The main target of this study was to investigate the effectiveness of some medicinal plants such as fenugreek seed (*Trigonella foenum graecum L*), chamomile flower (*Matricaria chamomilla L*.) and radish root (*Armoracia rusticana*) as feed supplements versus kemzyme dry product as growth promoters on productive performance, egg quality traits, digestibility coefficients, blood constituents and economical efficiency of laying hens.

MATERIALS AND METHODS

This investigation was carried out at Bourg El-Arab Station, Animal Production Research Institute, Agriculture Research Center. A total number of 150 Matrouh laying hens (a local strain) 32 weeks of age of nearly similar initial live body weight were housed in individual cages and were randomly divided into five equal treatments (30 hens each) in open system house. Birds were exposed to 17 hrs. light daily. The experimental diets were formulated to be iso-nitrogenous (16.05% CP) and iso-caloric (2711.0 kcal/kg diet). The experimental diets were supplied to meet the layers requirements of the Agriculture Ministry Decree (1996). Ingredients and

calculated analysis of the basal diet and tested feed additives are presented in Tables (1, 2 and 3). The five experimental treatments were as follows:

1- Basal diet (control).

2- Basal diet + 0.5% Fenugreek seed powder (F.S).

3- Basal diet + 0.5% Chamomile flower powder (CH. F)

4- Basal diet + 0.5% Radish Roots (R. R)

5- Basal diet + 0.1% Kemzyme dry (K.M)

The tested materials were purchased from local market, fenugreek seeds and chamomile flower were grinded by a hammer mill, radish roots were minced by a mincer. Kemzyme dry is a commercial enzyme preparation which contains alfa amylase (540 u/g), protease (450u/g), beta – glucanase (3000 u/g) and cellulase (5000 u/g).The basal diet contained 5 Kg of sand / ton (0.5%) to be replaced with the test materials in the experimental diets. Feed and water were supplied *ad libitum*. Body weight of each hen was recorded at the start and the end of the experiment. Feed consumption per hen per day was recorded and feed conversion (g feed intake / g egg mass) were calculated through the experimental period.

Egg number and egg weight for each hen were recorded daily then egg mass was calculated. Blood samples were collected after three months from the start of the experiment to evaluate some blood constituents. A number of 5 blood samples were obtained from 5 hens from each treatment which were taken randomly. Blood samples were collected from wing vein using heparin as an anticoagulant and plasma was separated centrifugation to determine plasma total protein, albumin, cholesterol, glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase activity (GPT) by kits from Bio Merieux (France) according to the procedure outlined by the manufacturer. Globulin determined by calculation. Egg quality was measured at the end of experimental period. Ten eggs from each treatment were collected, weighed, broken and separated into shells, yolks and albumen. The weights of yolk, albumen and shell (with membranes) were recorded and calculated as percentages of egg weight. Shape Index and Haugh unit were calculated.

At the end of the experimental period a digestion trial was designed to estimate the digestion coefficients of dry matter (DM.), organic matter (OM.), crude protein (CP.), ether extract (EE.) and nitrogen free extract (NFE) of the experimental diets. Three hens from each treatment were randomly chosen and put in individual cages , which enabled a complete separation and collection of excreta. Diets and water were offered *ad-*

libitum during three days collection period. The feed consumption was recorded, and the excreta, which fall on polyethylene sheets, were collected quantitatively every 24 hours, feathers and scattered feed were taken out of the excreta. The excreta from each hen were pooled together, then dried at 60^0C till constant weight. Then, weighed, ground, well mixed and stored in screw top glass jars for analysis. Materials were analyzed for moisture, ash, crude protein (CP) , either extract (E.E), crude fiber (CF) and nitrogen free extract (NFE) according to A.O.A.C (1990). Economical evaluation for all the experimental diets was made. Economical efficiency is defined as the net revenue per unit feed cost calculated from input output analysis as described by Hassan *et al*. (1996). Data were analyzed using one-way analysis of variance [General liner Models (GLM) procedure, SAS Institute, 1996] significant differences among treatment means were separated using Duncan's multiple range procedure (Duncan , 1955).

RESULTS AND DISCUSSION

Productive performance:

Results of the studied productive performance are presented in Table (4). Treatments did not have any significant effects on hen body weight change at the end of the experiment and each of egg number, egg weight, egg mass and feed conversion throughout the deferent periods except that egg mass throughout 32-35 weeks. The addition of R.R at level of 0.5% numerically increased egg number and egg mass by 12.42 and 12.43 %, respectively, compared to the control. Hens fed basal diet supplemented by R.R, K.M, CH.F and F.S numerically increased egg number than those fed the basal diet (control) by 12.42, 7.31, 5.42 and 2.23%, respectively, meaning that all dietary treatments had positive effect on egg production and revealed higher values than the control, specially those received R.R and K.M supplementation. These results agreed with the findings of Abdel-Ghany, *et al*., (1997) and Shehata, (2000) who demonstrated that K.M preparation at a level 0.5% in laying diet had insignificant better value of egg production during the whole experimental period. Abaza *et. al*. (2004) found that addition of kemzyme and radish roots did not affect either egg number or egg weight. Also, El-Kaiaty *et al*. (2002) and Tollba *et al*. (2005) reported that using F.S in diets at level of 2% had no effect on egg production, egg weight and egg mass. On the other hand F.S my improve the productive performance, health and immunity in poultry (Mohamed *et al*., 2004; Osman, 2002 and El-Ghamry *et al*., 2002). However, Hattaba *et. al*. (1994) indicated that K.M supplementation at rate of 0.5 kg/ton of feed resulted in a significant increase in egg production. On the other hand Abd El Ghany *et al.* (1997) found insignificant increase in egg production due to

enzyme supplementation. Also, Abd El- Maksoud (2006) found that egg weight improved by K.M supplementation.

Results showed that hens of the control group significantly consumed maximum amounts of diet compared to the other treatments throughout all studied intervals which were approximately equal. In addition F.S, CH.F and K.M supplementation decreased ($P<0.05$) feed consumption compared to control and R.R groups. These results agree with those reported by Abd El– Maksoud (2006) who found that hens fed a diet supplemented with KM showed highly significant decrease in daily feed consumption. Also, Conrod and Cary, (1993) found that feed intake of Leghorn strains decreased with enzyme supplementation. Abd El- Latif *et al*., (2004) found that Japanese quail fed diets contain either 0.3 or 0.5% levels of CH.F recorded the lowest values of feed intake and the best feed conversion efficiency. However, Moustafa (2006) indicated that F.S 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.

The R.R and K.M groups were nearly equal and had the best feed conversion (5.7) compared to the other treatments throughout the first interval (32-35 wks.) of age. Both CH.F and R.R improved feed conversion during the second interval (5.65 and 5.61), respectively. At 40- 43 wks. of age, F.S, CH.F and K.M supplementation improved feed conversion throughout the later interval, all treatments improved feed conversion compared to that of control group (6.45). These results agree with the result obtained by Graham and Pettersson (1992) who found with broilers that enzyme supplementation from 1 to 21 days in broiler chick's improved feed conversion. Ali (2002) found that the addition of radish to diet containing enzyme improved broilers feed conversion and indicating that radish may raise the activity of exogenous enzyme through affecting the phenolic compound which act as enzyme inhibitors (Fahey *et.al*., 1993). Also, Yakout *et. al*. (2003) found that enzyme supplementation to layer diets improved feed conversion. This improvement my be attributed to that F.S can inhibit 85-90% of formation of aflatoxins (El-Shayeb and Mabrouk, 1984), which lead to improved feed conversion of hens. The positive effect of using F.S on feed conversion may also be due to the composition of fenugreek from crude protein, crude fat and total carbohydrates (Abd El-Aal and Rahma, 1986). Mazur *et al*., (1998) demonstrated that the presence of phytoestrogens in F.S may also have a great value because of its antifungal and antioxidant activities. In other words, the positive response of

F.S on feed conversion may be due to the effective role of trigonelline content of the essential oil in fenugreek. Also, it has anti carcinogenic, antiviral, antifungal and antioxidant activities. In the same connection Zhao *et al*., (2003) also, found that trigonelline has a positive role on a middle rate of absorption and fast rate of elimination. In this regards, Abaza (2001) found that the best feed conversion was recorded with the chicks fed diet which included 2.5 kg chamomile / ton for broiler diet while Radwan (2003) observed that the addition of chamomile at level of 0.5% in broiler diet gave better feed utilization. Also, Moustafa (2006) found that fenugreek at the level of 0.05% improved feed conversion.

Egg quality traits:

Results of egg quality traits are presented in Table (5). Feed additives used had insignificant effect on egg quality traits. Group of hens fed diet supplemented with F.S had numerically highest values of shell thickness (0.358) and albumen weight percentage (49.65%). Eggs of CH.F group had the highest Hough unit (80.20) and shape index (74.32%), while supplementation with R.R improved shell weight percentage (13.86%) and eggs of K.M group had the highest yolk weight percentage (39.29%) compared to the other treated groups. These results agreed generally with those reported by Abd EL-Ghany *et. al*. (1997) who found that K.M supplementation did not have any significant effect on yolk, albumen and shell % and shell thickness. Attia *et al*. (1997) and Abd El- Maksoud (2006) found that egg quality was not affected by the levels of K.M supplementation in laying diets. Also, Abaza *et. al* (2004) noticed that R.R and K.M supplementation in layer diets had insignificant effect on yolk weight %, Albumen weight %, Shell weight % and Haugh unit.

Digestibility coefficient:

Results of digestibility coefficient of laying hens are presented in Table (6). Treatments did not have any significant effect on digestibility values of laying hens. Addition of CH.F to the diet improved DM. and CP., and adding of R.R increased OM., CF. and NFE digestion. Also, K.M supplementation improved NFE compared to treatments of F.S, CH.F and control groups. In this respect Abd El- Maksoud (2006) who found that K.M supplementation in laying diet did not cause any significant change in the digestibility coefficient values of OM % , CP % , E.E %, CF% and NFE%. Increased level of F.S to 2% in diet of turkey chicks cause significant increase in digestibility of NFE% and this may be due to saponin content in F.S that stimulate insulin activity (EL-Mallah *et al*., 2005).

Blood constituents:

Results of blood plasma constituents (total protein, albumen, globulin, total cholesterol, GOT and GPT) are shown in (Table 7). Hens fed the experimental diets showed significant differences among treatments for blood constituents. Addition of K.M significantly increased plasma total protein and globulin values followed by group fed diet included R.R. The lowest values of plasma total protein were recorded by hens fed diet contains CH.F, F.S and control. Similar results were reported by Rashwan (1998) who found that serum total protein decreased with F.S when added to rabbits diets. The highest values of albumin were recorded for hens fed R.R followed by those fed F.S. Addition of CH.F significantly decreased total cholesterol values followed by F.S and R.R, respectively, compared with the control group. These result agree with those of Radwan (2003) who observed that addition of CH.F and F.S to broiler diet increased plasma albumin, while CH.F decreased total cholesterol values compared to control group. Addition of CH.F significantly decreased GOT when compared to the control group or other dietary groups. The highest values of GPT were recorded by hens fed diet containing R.R followed by K.M, F.S, CH.F and control group, respectively. El- Husseiny *et al*. (2002) noticed that addition of F.S to broiler diet decreased significantly total cholesterol and increased GOT and GPT values compared to control group.

Economical efficiency:

The results of economical efficiency (EEF) and relative economical efficiency (REEF) estimated for the experimental diets used during the experiment are shown in Table (8). According to the input –output analysis , the best R.E.E were recorded by the hens fed 5 kg radish / ton diet , followed by hens fed 1 kg kemzyme /ton diet, then hens fed 5 kg chamomile/ ton diet and those fed 5 kg fenugreek /ton diet, respectively. These results indicated that the diets containing feed additives were more economical than the control diet. This improvement could be due to improving the feed conversion or reducing the amount of feed required to produce one unit of egg mass. Moustafa (2006) found that economic evaluation for egg production was improved by using 0.05% fenugreek. Abaza *et al*. (2003) reported that the best relative economical efficiency were recorded by chicks fed 2.5 kg chamomile + 2.5 kg nigella seeds / ton of broiler diet, followed by those fed 2.5 kg chamomile / ton of diet alone. However, Abd El- Maksoud (2006) found that kemzyme supplementation increased cost slightly and decreased relative economical efficiency.

CONCLUSION

The results indicated that feeding laying hens on diets containing feed additives some what improved the productive performance and relative economic efficiency values of laying hen. Further research is needed to get better understanding of the effect of medicinal plants in poultry production and their beneficial impact on human health.

Table (1): Composition and calculated analysis of the basal diet

Ingredient	%
Yellow corn	64.00
Soybean meal (44%)	25.00
Wheat bran	00.57
Limestone	07.77
Dicalcium phosphate	01.50
DL-Methionine	00.06
Premix[1]	00.30
Salt (NaCl)	00.30
Sand	00.50
Total	100.0
Calculated analysis [2]	
Crude protein %	16.05
ME. kcal/kg	2711.0
Crude fiber %	03.36
Ether extract %	02.83
Ca %	03.32
Av. P %	00.40
Methionine %	00.35
Methionine + Cyctin %	00.62
Lysine %	00.89
Sodium %	00.13
Cost (L.E)/100 Kg	96.00

1-Vitamins and minerals premix contain per 3kg Vit A 10 000 000 IU , Vit D3 2000 000 IU,Vit E 10000mg,Vit K3 1000mg, Vit B1 1000mg, Vit B2 5000mg, Vit B6 1500mg, Vit B12 10mg, pantothenic acid 10000mg, Niacin 30000mg, Biotin 50mg, Folic acid1000mg, Choline 250gm, Selenium 100mg, copper 4000mg,iron 30000mg,manganess 60000mg, zinc 50000mg,iodine 1000mg,cobalt 100mg and CaCO3 to 3000g.

2-According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Chemical analysis of fenugreek seeds and chamomile flower

Item	Fenugreek seeds	Chamomile flowers
Crude protein (%)	23.17	16.16
Ether Extract. %	08.24	07.38
Ash %	03.38	10.98
Crude fiber (%)	10.28	14.03
NFE (%)	45.90	42.30
Organic Matter %)	96.62	89.02
GE (Kcal /kg)	3350.46	3419.16
Sodium %	0.04	0.30
Potassium %	1.00	2.00
Calcium %	1.10	1.67
Total phos .%	1.00	1.00
Magnisium mg/kg	2437	2894
Copper mg / kg	04.80	08.40
Zinc mg/kg	41.20	44.50
Iron mg / kg	224.00	1500.00
Manganese mg / kg	03.70	52.90
Aspartic	0.70	0.50
Threonine	0.81	0.56
Serine	1.00	0.63
Glutamic	4.30	2.36
Proline	1.00	1.61
Glycine	1.20	0.70
Alanine	0.93	0.64
Cystine	0.12	0.12
Valine	0.94	0.80
Methionine	0.17	0.00
Isoleucine	1.30	0.58
Leucine	1.57	0.91
Tyrosine	0.70	0.37
Phenyl alanine	0.96	0.51
Histidine	0.51	0.31
Lysine	1.40	0.76
Arginine	1.96	0.12
Total Ess. AA	9.62	4.55

Source: Radwan (2003).

Table (3): The chemical analysis of Radish roots

Item	Per (100g)
Calories	48.00
Protein(g)	01.18
Fat Tatal (g)	00.69
Carbohydrate (g)	11.29
Fiber- Total (g)	03.30
Sugar- Total (g)	07.99
Calcium (mg)	56.00
Iron (mg)	00.42
Magnesium (mg)	27.00
Phosphorus (mg)	31.00
Potassium (mg)	246.00
Sodium (mg)	314.00
Zinc (mg)	00.83
Copper (mg)	00.06
Manganese (mg)	00.13
Selenium (mg)	02.80
Vitamin C (mg)	24.90
Thiamin (mg)	00.01
Riboflavin (mg)	00.02
Niacin (mg)	00.39
Vitamin B6 (mg)	00.07
Vitamin A (IU)	02.00
Vitamin E (mg)	00.01
Vitamin K (mug)	01.30
Fat-saturated (g)	00.09
Fat – Monosaturated (g)	00.13
Fat-polysaturated	00.34

Source: http://www.nutrition analyser.com/food_composition.

Table (4): Productive performance of Matrouh laying hens as affected by different feed additives during the experimental period (mean ± S.E)

Period (wks)	Feed additives				
	Control	Fenugreek	Chamomile	Radish	Kemzyme
	Egg number(egg/hen)				
32-35	13.86±0.46	14.00±0.85	15.43±1.31	17.57± 1.25	17.43±1.76
36-39	15.14±1.01	16.43±1.31	16.43±1.38	17.43±1.77	15.43±1.63
40-43	15.86±2.67	15.43±1.67	15.43±1.49	15.43±3.31	15.29±1.29
32-43 overall	44.86±3.45	45.86±2.74	47.29±3.05	50.43±5.85	48.14±3.66
Period (wks)	**Egg weight (g)**				
32-35	38.85±0.82	40.82±0.35	39.85±0.51	39.23±0.63	40.65±0.70
36-39	42.83±0.75	40.47±2.96	42.34±0.71	42.30±0.59	43.53±0.87
40-43	42.82±1.35	43.99±0.82	42.47±0.93	42.45±0.43	42.77±1.22
32-43 overall	41.50±0.90	41.47±0.99	41.55±0.54	41.33±0.49	42.32±0.82
Period (wks)	**Egg mass (g/hen/day)**				
32-35	17.92^{b}±0.61	19.06^{ab}±1.21	20.48^{ab}±1.74	23.00^{a}±1.68	23.57^{a}±2.32
36-39	21.61 ±1.44	22.28 ±2.58	23.20 ±2.04	24.70 ±2.66	22.50 ±2.64
40-43	22.76 ±1.44	22.76 ±2.71	22.09 ±2.64	22.06 ±4.85	21.93 ±2.24
32-43 overall	20.67 ±1.61	21.36 ±1.55	21.91 ±1.63	23.24 ±2.78	22.75 ±2.05
Period (wks)	**Feed consumption (g/hen/day)**				
32-35	128.04^{a}±0.26	125.51^{bc}±0.51	124.41^{c}±0.59	126.29^{b}±0.83	124.98^{bc}±0.24
36-39	128.11^{a}±0.26	125.61^{bc}±0.52	124.51^{c} ±0.59	126.39^{b}±0.83	125.08^{bc}±0.24
40-43	128.25^{a}±0.26	125.80^{bc}±0.49	124.65^{c} ±0.59	126.53^{b}±0.85	125.21^{bc}±0.24
32-43 overall	128.14^{a}±0.26	125.64^{bc}±0.51	124.53^{c} ±0.59	126.41^{b}±0.83	125.09^{bc}±0.24
Period (wks)	**Feed conversion (g feed intake/g egg mass)**				
32-35	7.20±0.25	6.73±0.38	6.33±0.51	5.72±0.55	5.71±0.70
36-39	6.12±0.48	6.22±0.90	5.65 ±0.54	5.61±0.77	6.15±0.89
40-43	6.88±1.22	5.97±0.64	6.05 ±0.58	6.82±2.33	6.13±0.73
32-43 overall	6.45±0.53	6.08±0.48	5.88 ±0.45	6.05±0.89	5.76±0.50
Body weight change(32-43)	147.14±19.1	148.57±42.2	90.00±13.5	69.29±18.7	127.86±36.8

a, b, c means with different superscripts within rows are significantly different ($p<.05$).

Table (5): Egg quality of Matrouh laying hens as affected by different feed additives during the experimental period (mean ± S.E).

Parameters	Feed additives				
	Control	Fenugreek	Chamomile	Radish	Kemzyme
Shell thickness (mm)	0.322±0.86	0.358±1.46	0.344±1.60	0.318±1.11	0.330±2.00
Yolk weight (%)	38.35±0.87	37.19±0.78	37.83±0.19	37.58±1.09	39.23±1.07
Albumen weight (%)	48.55±1.07	49.65±0.70	49.05±0.35	48.56±1.49	47.23±1.16
Shell weight (%)	13.10±0.37	13.16±0.29	13.12±0.31	13.86±0.55	13.53±0.17
Shape Index	73.34±1.00	65.73±14.18	74.32±0.87	69.22±0.89	72.92±2.47
Haugh unit	78.60±1.29	78.00±0.71	80.20±1.62	79.00±0.84	79.60±0.93

Table (6): Digestibility coefficients of Matrouh laying hens as affected by different feed additives during the experimental period (mean ± S.E).

Parameters	Feed additives				
	Control	Fenugreek	Chamomile	Radish	Kemzyme
DM. %	73.74±0.22	73.52±0.25	73.93±0.19	73.12±0.08	73.41±0.42
OM. %	74.71±0.29	74.55±0.51	74.79±0.59	75.63±0.31	74.71±0.29
CP. %	79.10±0.20	79.63±0.0.59	80.11±0.30	78.82±0.13	79.59±0.74
EE. %	81.41±1.27	80.21±1.06	79.46±0.38	79.75±0.33	80.05±0.99
CF. %	21.21±0.41	21.21±0.43	20.74±0.21	21.60±0.35	21.16±0.56
NFE %	79.26±0.11	79.83±1.29	78.73±1.28	82.19±0.99	80.67±1.10

Table (7): Some blood constituents of Matrouh laying hens as affected by different feed additives during the experimental period (mean± S.E).

Parameters	Feed additives				
	Control	Fenugreek	Chamomile	Radish	Kemzyme
Total protein(mg/100ml)	4.11^{b}±0.34	3.96^{b} ±0.14	3.50^{b} ±0.10	5.17^{a}±0.38	5.67^{a} ±0.19
Albumin(mg/100 ml)	1.88^{c}±0.06	2.19^{ab}±0.12	2.06^{bc}±0.03	2.40^{a}±0.06	1.66^{d}±0.03
Globulin (mg/100 ml)	2.23^{bc}±0.31	1.76^{c} ±0.25	1.44^{c}±0.10	2.77^{b}±0.36	4.01^{a}±0.23
Cholesterol(mg/100ml)	133.40^{a}±0.32	122.50^{c}±0.55	111.96^{d}±1.25	128.72^{b}±0.63	132.50^{a}±0.43
GOT U/I	154.43^{a}±7.85	157.04^{a}±4.83	94.94^{b}±4.45	169.00^{a}±6.11	164.43^{a}±1.95
GPT U/I	6.92^{e}±0.06	8.52^{c}±0.09	7.56^{d}±0.03	10.44^{a}±0.22	9.64^{b}±0.07

a, b, c, d, e means with different superscripts within rows are significantly different ($p<.05$).

Table (8): Input/output analysis and economical efficiency of experimental groups fed different of feed additives.

Item	Feed additives				
	Control	Fenugreek	Chamomile	Radish	Kemzyme
Price/kg feed (L.E.)	0.960	0.975	0.990	0.970	0.987
Total feed intake/hen(Kg)	11.53	11.31	11.21	11.38	11.26
Total feed cost/hen(L.E.)	11.07	11.03	11.10	11.04	11.11
Total number of egg/hen	44.86	45.86	47.29	50.43	48.14
Total price of egg/hen(L.E.)[1]	17.94	18.34	18.92	20.17	19.26
Net revenue/hen(L.E.)	6.87	7.31	7.82	9.13	8.15
Economical efficiency EF[2]	0.62	0.66	0.70	0.83	0.73
Relative REEF[3]	100.00	106.45	112.90	133.87	117.74

1. The price of the egg = 40 P.T. (the common price at the expt. time).
2. Net revenue per unit of total feed cost.
3. Relative economic efficiency, assuming the control treatment = 100%.

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الملخص العربي

تأثير استخدام الحلبة و الشيح و الفجل كإضافات غذائية على الأداء الانتاجى ومعاملات الهضم للدجاج البياض

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تهدف الدراسة إلى بحث تأثير استخدام بذور الحلبة و أزهار الشيح وجذور الفجل (كمنشطات نمو طبيعية) و الكيمزيم (كمنشط نمو تجارى) كإضافات غذائية في العلف على الأداء الانتاجى، جودة البيض ، معاملات الهضم، بعض مكونات بلازما الدم، الكفاءة الاقتصادية لدجاج مطروح المحلى من عمر 32–43 أسبوع . استخدم في هذة الدراسة عدد 150 دجاجة وزعت عشوائيا إلى 5 مجموعات تجريبية متساوية بكل مجموعة 30 دجاجة في أقفاص فردية0 غذيت المجموعة الأولى على عليقة أساسية (كنترول) (بدون إضافات) أما المجموعات الأربعة الأخرى غذيت على العليقة الأساسية مضافا إليها بذورا لحلبة، أزهار الشيح ، جذور الفجل ، الكيمزيم بمستويات 0.5 ، 0.5، 0.5 ، 0.1% على الترتيب.

و يمكن تلخيص النتائج فيما يلي:

1- إضافة جذور الفجل أدت إلى زيادة غير معنوية فى عدد البيض و كتلة البيض عدديا بمعدل 12.42 ، 12.43 % على الترتيب بالمقارنة بمجموعة الكنترول0

2- إضافة كل من جذور الفجل ، الكيمزيم ، ازهار الشيح ، بذور الحلبة أدت إلى زيادة عدد البيض بمعدل 12.42 ، 7.31 ، 5.42 ، 2.23% على الترتيب مقارنة بمجموعة الكنترول0

3- إضافة كل من ازهار الشيح، بذور الحلبة، جذور الفجل ، الكيمزيم خفضت معنويا استهلاك العلف بالمقارنة بمجموعة الكنترول0

4- تحسنت الكفاءة الغذائية عدديا و لكن غير معنويا باستخدام الكيمزيم و تبعة كل من ازهار الشيح، جذور الفجل، بذور الحلبة على الترتيب بالمقارنة بمجموعة الكونترول0

5- لم تؤثر جميع المعاملات معنويا علي كل من صفات جودة البيض و معاملات الهضم 0

6- أثرت جميع الإضافات المستخدمة معنويا على مكونات الدم حيث أدت إضافة كل من الكيمزيم وجذور الفجل إلى ذيادة في قيم البروتين الكلى والجلوبيولين بالمقارنة بإضافة الشيح و الحلبة ومجموعة الكونترول0

7- أدت إضافة جذور الفجل إلى زيادة معنوية في قيمة الالبيومين و بدون معنوية مع بذور الحلبة وتبعهم الكنترول ثم الكيمزيم0

8- إضافة ازهار الشيح قلل معنويا مستوى الكولسترول و تبعة جذور الفجل، بذور الحلبة على الترتيب بالمقارنة بمجموعة الكونترول0

9- إضافة ازهار الشيح قلل معنويا قيمة GOT بالمقارنة بباقي المعاملات و مجموعة الكنترول كما سجلت إضافة جذور الفجل أعلى قيمة من GPT وتبعها الكيمزيم، بذور الحلبة، ازهار الشيح، الكنترول على الترتيب0

10- أفضل كفاءة اقتصادية سجلت باستخدام جذور الفجل وتبعها الكيمزيم ، أزهار الشيح ، بذور الحلبة على الترتيب و قد أشارت هذة النتائج أن استخدام الإضافات الطبيعية أو التجارية كان أكثر اقتصادية من الكنترول (بدون إضافة)0