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IMPACT OF GROWTH PROMOTERS ADDITION ON PRODUCTIVE PERFORMANCE AND IMMUNE RESPONSE IN BROILER CHICKENS

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ABSTRACT

The purpose of this work was to study the effect of Fenugreek seeds powder (*Trigonella foenum-gracum L.)* and Camphor leaves powder (*Cinnamomum camphora*) on productive performance and immune response of Ross broiler chicken. A total of 100 day-old unsexed broiler chicks (Ross 308) were randomly allocated to five treatment groups with two replicates of 10 each reared for 42 days. The experimental diets were: Control diet (C), fenugreek seeds powder 1g/1kg (F1), fenugreek seeds powder 1.5g/1kg (F2), camphor leaves powder 1g/1kg (Cph1), camphor leaves powder 1.5g/1kg (Cph2). The F2 trait recorded the best results during most of ages for body weight and body weight gain. Dressing percentage of broilers at five week was significantly higher value for Cph1 group. The percentage of minor and major breast muscles showed a slightly non-significant increase to Cph2 trait. The drum muscle weight percentage showed a higher significant value for (Cph1) trait. The F2 group recorded the lower significant value for Giblets percentage compared to another groups and control group. The highest value for spleen percentage was recorded in F1 group and the lowest value showed in control and Cph2. Bursa gland recorded the highest value for F2 group and the lowest value recorded by Control and Cph2 group. The F1 group recorded the highest value for thymus gland percentage and the lowest value showed in Cph2 group. The Cph2 and F2 treatments had the maximum cutaneous basophilic hypersensitivity swelling response with insignificantly difference at 24 hr after injection, while at 48 hr, the Cph2 trait had significantly higher dermal swelling response compared to other traits and control group. The F1 and F2 groups had significantly hyper responder to sheep red blood cells at seven days post-secondary injection, while at fourteen days post-secondary injection, Cph2 and F2 groups had significantly hyper responses to sheep red blood cells. Therefore, fenugreek seeds and camphor leaves supplementation as a growth promoter at 1.5g / 1kg might be acceptable for achieving better performance under environmental conditions of Egypt.

Keywords: Fenugreek, Camphor, Productive, Immune, Broiler

INTRODUCTION

Antibiotics as growth promoter in chicken diets are considered serious health risks to human health, because of their residual effects in meat result pathogens develop resistance to antibiotics. Scientists of poultry today are challenged to find out new alternatives to antibiotic growth promoters with no side effects for poultry that could be more or as effective against harmful micro-organisms and to stimulate the growth by increasing the efficiency of feed utilization and to enhance the immunity **(Farman et al 2009)**. The development of resistance to certain antibiotics poses real problems to the animal and public health **(Barton, 2000).** Consequently, many additives (prebiotics, probiotics, symbiotic….) raise a particular interest as products of substitution to antibiotics in order to improve the production performances and the health of animals **(Bach, 2001).**

Fenugreek leaves and seeds have been used extensively to prepare extracts and powders for medicinal **(Basch et al 2003).** Fenugreek has been used for over two thousand years as a medicinal plant in various parts of the world (**Srinivasan, 2006**). Use of fenugreek is associated with a wide range of therapeutic applications including a carminative (prevents flatulence) and as an aphrodisiac. Fenugreek seeds are considered as an appetizer and helps indigestion. The seed has antioxidant, antiviral and anticarcinogenic activities **(Mazur et al 1998).** The plant is often used for over two thousand years as a medicinal plant in various parts of the world.

Camphor, a natural product derived from the wood of the tree Cinnamomum camphora, has a longhistory use as antiseptic, analgesic, antipruritic, counterirritant and rubefacient **(Ellenhorn and barceloux, 1998)**. It success and wide medical use, especially in topical preparations, is connected to its mild local an esthesizing effect and to the production of a circum scribed sensation of heat, together with its characteristic and penetrating odour that is by most of people associated to the idea of a strong and effective medicine **(Gibson et al 1989).** Then, we study the effect of fenugreek seeds and camphor leaves powder on productive performance and immune response of Ross broiler chicken.

MATERIALS AND METHODS

Study area

The experimental work of this study was carried out at the poultry-Breeding farm, Poultry Production Department, Faculty of Agriculture, Ain-Shams University, during the period from August to September 2015. One-day old chicks from Ross commercial broiler strain has been reared to 6 weeks-old of age.

Preparation of the Experimental Diets

Two medicinal plants, namely *Trigonella foenum-graecum L*. (fenugreek) and Camphor (*Cinnamomum camphora*) was purchased from the local area of Giza governorate, Egypt. The medicinal plants were washed with cold water and dried under shade. The dried leaves of Camphor and fenugreek seeds were coarsely powdered. The samples were further ground into powder. The obtained powder was packed and preserved in the feed storage room until used for feed formulation. Based on the chemical analysis result, two treatment rations containing fenugreek at levels of (1% and 1.5%) and another two treatment rations containing camphor at levels of (1% and 1.5%) of the total ration were formulated in addition to control diet with two replicates for every treatment as: Control diet (C), fenugreek seeds powder 1g/kg diet (F1), fenugreek seeds powder 1.5g/1kg (F2), camphor leaves powder 1g/1kg (C1), camphor leaves powder 1.5g/1kg (C2). The rations were formulated to be with Metabolizable Energy (ME) content of 3000 kcal/kg Dry Matter (DM) and Crude Protein (CP) content of 23% during the starter phase of 1 to 17 days of age, ME content of 3050 kcal/kg DM and CP content of 21% for grower phase of 18 to 29 days of age and ME content of 3100 kcal/kg DM and CP content of 19% for finisher phase of 30 to 42 days of age. The diets introduced for chickens ad libitum.

Measurements

All birds have been individually weighed weekly intervals (at 0, 1, 2, 3, 4 and 5 wk of ages). Also, body weight gain was estimated weekly from 0-1, 1-2, 2-3, 3-4 and 4-5 week of age and calculated for accumulative period of 0-5 week of age.

At 6^{th} week of age, 5 birds from each treatment were slaughtered for carcass evaluation. Edible and inedible parts were extracted and weighed. The lymphoid organs (Bursa of Fabricius, Spleen and Thymus) of these slaughtered birds have been extracted and weighed also.

Response induced in vivo by mitogen was evaluated by injection of phytohemagglutinin-P (PHA-P) into the toe webs between the second and the third digits of chicks. Five birds from each treatment at 4 weeks of age were used. Each bird was intradermally injected in the toe web of the left foot with 100 µg phytohemagglutinin-P (Sigma Chemical Co., St. Louis, MO 63178) in 0.1 ml of sterile saline measured with a constant tension caliper before injection and at 24, 48 and 72 hr after PHA-P injection. The toe web swelling was calculated as the difference between the thickness of the toe web before and after injection.

Sheep red blood cells (SRBCs) were used as T-dependent antigens to quantify the antibody response. Five birds from each trait were injected intramuscular with SRBCs (3% suspension in PBS, 1 ml/bird) at 2 weeks of age followed by a booster injection of SRBC suspension at 4 weeks (after 14 days of the first injection). Blood samples were collected at 7 and 14 days after the first injection and again at 7 and 14 days post booster. The plasma from each sample was collected; heat inactivated at 56 °C for 30 min and then analyzed for

total immunoglobulin, mercaptoethanol-sensitive (MES) and mercaptoethanolresistant (MER) IgG anti-SRBC antibodies as previously described (**Yamamoto and Glick, 1982**). Briefly, 50 µL of plasma was added in an equal amount of PBS in the first column of a 96-well V-shaped bottom plate, and the solution was incubated for 30 min at 37°C. A serial dilution was then made (1:2) and 50 µL of 2% SRBC suspension was added to each well. Total antibody titers were then read after 30 min. of incubation at 37°C. The well immediately preceding a well with a distinct SRBC button was considered as the endpoint titer for agglutination. For MES (IgM) response, 50 µL of 0.01 M mercaptoethanol in PBC was used instead of PBS alone, followed by the aforementioned procedure. The difference between the total and the IgG response was considered to be equal to the IgM antibody level.

Statistical analysis

Data were subjected to a one-way analysis of variance with treatments effect using the General Linear Model (GLM) procedure of **(SAS User's Guide 9.1.3, 2004)** using the following model**:**

$$Yij = \mu + Si + eij$$

Where; Yij = Trait measured, µ = Overall means, Si = Additional of growth promoters, eij = Experimental error.

Duncan's multiple range test **(Duncan, 1955)** was used to separate means when the dietary treatments effect was significant.

RESULTS AND DISCUSSION

1. Productive performance

1.1. Body weight

Data presented in **Table (1)** showed a significant difference between traits at 4 week of age. Chicks which fed on (Camphor 2) showed increase in body weight at 4 week (1351.73 g) compared to other traits. While (F1 & F2) traits recorded non-significant increase in body weight (1628.55 & 1631.25 g) respectively, compared to other groups. The (F2) trait recorded the best body weight during most of ages.

In contrast to our findings, **Weerasingha et al (2013)** concluded that 1% dietary fenugreek seed powder has some growth promoting effects in broilers, while higher than 1% dietary fenugreek has negative effects on feed intake and growth performance. **Mamoun et al (2014)** investigated chicks fed on 1% fenugreek seed powder recorded significantly the higher body weight compared to all tested groups, while those fed on control diet recorded significantly the lowest body weight value.

1.2. Body weight gain

The presented data in **Table (2)** illustrated that there is no effect to camphor and fenugreek addition into dietary on body weight gain. The control group recorded a higher significant value than traits which fed on dietary containing camphor and fenugreek additives. A cumulative value of body weight gain during the age between 0-5 weeks recorded higher value (1556.06 g) to control group than other groups. The (F2) group showed the higher value (1388.89 g) for cumulative body weight gain after the control group. While, **Khadr and Abdel-Fattah (2007)** indicated that addition of fenugreek seeds during the growing period had slightly increased body weight gain for chicks fed diets containing 1% fenugreek seeds followed by those fed 2% level, especially in the last week of the experimental period.

1.3. Edible parts

In the current study, **Table (3)** showed that dressing percentage of broilers at 5 week was significantly higher value for Cph1 group (75.14%) than control (73.20%) and other groups. The percentage of minor and major breast muscles showed a non-significant increase to Cph2 trait (2.44% & 9.18% subsequently) compared to control and other treatments F2 group recorded the lower significant value for Giblets percentage (3.43%) compared to another groups and control group. Drum muscle weight percentage showed a higher significant value for (Cph1) trait which recorded (5.05%), followed by (F1) treatment which recorded (4.80%). While, control recorded (4.29%) for drum weight percentage. The (F2) treatment had a lower value of both drum and thigh muscles percentages as follow (4.21 g and 6.55 g) subsequently compared to control group.

Khadr and Abdel-Fattah (2007) showed that broilers fed diets supplemented with 1% or 2% fenugreek seeds decreased percentages of dressing, heart and edible organs but the differences were insignificant compared to the control group. Feeding 3g/kg of fenugreek seeds insignificantly affected all slaughters parameters (**Rabia, 2010).**

Table 1. Weekly body weight of Ross broiler hybrids affected by Camphor and Fenugreek

Age (wk.)	Control	Cph1	Cph2	F1	F2	Pr.
0	42.01±1.37	41.89±2.11	40.88±1.88	43.24±1.97	42.36±0.94	NS
1	152.00±2.98	155.59±3.27	154.74±3.17	152.88±3.42	152.80±2.92	NS
2	397.52±14.61	401.83±16.18	414.87±9.64	404.06±7.83	423.06±11.16	NS
3	768.80±20	806.81±27.42	806.58±16.51	831.05±16.30	836.87±15.60	NS
4	1270.67^{ab}±15.76	1204.92^{b}±34.23	1351.73^{a}±39.52	1263.40^{ab}±33.02	1284.64^{ab}±22.95	0.031
5	1611.25^{a}±47.86	1567.82^{b}±61.43	1583.33^{b}±18.42	1628.55^{a}±33.03	1631.25^{a}±34.93	0.048

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant.

Table 2. Weekly and cumulative body weight gain of Ross broiler hybrids affected by Camphor and Fenugreek

Age (wk.)	Control	Cph1	Cph2	F1	F2	Pr.
0-1	109.99±6.88	113.70±8.39	113.86±8.17	109.64±6.74	110.44±7.45	NS
1-2	229.95±14.75	260.78±9.70	248.95±12.35	246.60±8.75	257.90±14.35	NS
2-3	406.10±34.28	391.00±23.28	364.41±27.90	425.40±20.00	406.42±2.14	NS
3-4	514.05^{a}±34.74	351.95^{b}±37.42	466.52^{ab}±49.97	406.80^{ab}±35.05	420.36^{ab}±34.63	0.0419
4-5	422.47±48.20	439.50±59.85	376.33±67.25	334.61±47.58	355.75±31.17	NS
0-5	1556.06^{a}±47.51	1361.93^{b}±53.46	1257.31^{b}±39.18	1374.45^{b}±46.95	1388.89^{b}±37.72	0.0005

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant.

Hind et al (2013) showed that treatment differences only affected dressing %, breast and abdominal fat. Breast cut reported high weights in group (Cinnamon), (Fenugreek), (Ginger), (control+ antibiotic) (97.4-152.65g) and reported the lowest weight in control (78.85 g). Estimated dressing percentages in study of **(Hind et al 2013)** were comparable with the results depicted by **(Zomrawi et al 2013)** who found (71.10 – 73.70 %) is slightly lower than those reported by (**Zomrawi et al 2012)** who found (75.15 – 76.26%).

1.3.2. Inedible parts

Abdominal fat percentage at 5 wk of age recorded highly significant differences between treatments, (Fenugreek 2, Camphor 1 and Fenugreek 1) recorded (0.83%, 1.03% and 1.07%) respectively compared to the control **(Table 4)**. Blood percentage showed the lower significant value (1.37%) compared to all treatments. It was shown that the percentage of feathers recorded the highest proportion in F2 group (7.03%) and then less in control (6.15%).

Table 3. Edible parts as affected by Camphor and Fenugreek for Ross broiler hybrid

Trait	Control	Cph1	Cph2	F1	F2	Prob.
Live body wt., g.	2119.00^{a} ±37.53	1889.75^{c} ±18.20	1979.25^{bc} ±45.11	1996.5^{bc} ±47.31	2084.3^{ab} ±31.88	0.0012
Dressing wt. g.	1552.00^{a} ±33.73	1420.50^{b} ±19.44	1411.08^{b} ±33.54	1482.7^{ab} ±38.62	1480.2^{ab} ±41.31	0.0477
Dressing wt. %	73.20^{ab} ±0.42	75.14^{a} ±0.44	71.32^{b} ±0.33	73.47^{ab} ±0.65	66.62^{c} ±1.46	<0.0001
Liver wt. g.	49.40^{a} ±1.18	40.12^{bc} ±2.53	38.63^{c} ±2.62	45.19^{ab} ±1.85	39.46^{bc} ±0.37	0.0042
Liver wt. %	2. 43^{ab} ±0.09	2.13^{bc} ±0.11	1.99^{c} ±0.09	2.43^{a} ±0.06	1.88^{c} ±0.03	0.0002
Gizzard wt. g.	29.27 ±0.74	26.99 ±1.55	31.32 ±2.86	29.57 ±1.93	27.42 ±2.19	NS
Gizzard wt. %	1.44^{ab} ±0.02	1.37^{b} ±0.09	1.73^{a} ±0.15	1.43^{ab} ±0.09	1.23^{b} ±0.12	0.0388
Heart wt. g.	9.05^{a} ±0.31	7.37^{b} ±0.25	7.47^{b} ±0.12	8.07^{b} ±0.26	7.60^{b} ±0.14	<0.0001
Heart wt. %	0.42^{a} ±0.01	0.39^{ab} ±0.01	0.39^{ab} ±0.009	0.41^{ab} ±0.01	0.37^{b} ±0.006	0.0154
Giblets wt. g.	89.07^{a} ±1.02	74.50^{b} ±2.53	77.43^{b} ±5.01	82.84^{ab} ±2.51	74.49^{b} ±2.22	0.0184
Giblets wt.%	4.20^{a} ±0.13	3.90^{a} ±0.12	4.12^{a} ±0.21	4.27^{a} ±0.09	3.43^{b} ±0.19	0.0048
Minor pectoralis wt. g.	45.28 ±2.18	42.16 ±2.39	44.81 ±6.77	40.99 ±1.03	40.99 ±2.21	NS
Minor pectoralis wt. %	2.23 ±0.07	2.01 ±0.05	2.44 ±0.44	2.10 ±0.04	1.78 ±0.05	NS
Major pectoralis wt. g.	191.12^{a} ±7.84	168.26^{b} ±4.87	173.81^{ab} ±7.13	179.83^{ab} ±8.11	185.28^{ab} ±5.63	0.0195
Major pectoralis wt. %	8.98 ±0.20	8.56 ±0.20	9.18 ±0.20	8.55 ±0.25	8.48 ±0.28	NS
Drum muscle wt. g.	91.08^{a} ±2.35	93.99^{a} ±1.55	81.21^{b} ±2.25	94.38^{a} ±2.89	89.56^{a} ±2.46	0.0008
Drum muscle wt. %	4.29^{b} ±0.06	5.05^{a} ±0.05	4.16^{b} ±0.09	4.80^{a} ±0.11	4.21^{b} ±0.15	<0.0001
Thigh muscle wt. g.	188.36^{a} ±6.61	157.45^{b} ±5.68	166.16^{b} ±7.76	167.77^{b} ±4.24	136.12^{c} ±7.07	0.0003
Thigh muscle wt. %	8.87^{a} ±0.15	8.21^{a} ±0.33	8.25^{a} ±0.41	8.13^{a} ±0.10	6.55^{b} ±0.36	0.0004

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant

Table 4. Inedible parts as affected by Camphor and Fenugreek traits for Ross broiler hybrid

Trait	Control	Cph1	Cph2	F1	F2	Prob.
Live body wt., g.	2119.00^{a} ±37.53	1889.75^{c} ±18.20	1979.25^{bc} ±45.11	1996.50^{bc} ±47.31	2084.33^{ab} ±31.88	0.0012
Abdominal fat wt. g.	29.72^{a} ±2.97	20.19^{b} ±1.20	22.19^{b} ±2.22	18.58^{b} ±2.59	18.62^{b} ±1.48	0.0044
Abdominal fat wt. %	1.43^{a} ±0.15	1.03^{b} ±0.07	1.19^{ab} ±0.10	1.07^{b} ±0.15	0.83^{b} ±0.08	0.0187
Blood wt. g.	42.00^{b} ±6.50	69.33^{a} ±12.25	73.75^{a} ±8.20	70.50^{a} ±2.63	57.00^{ab} ±5.06	0.024
Blood wt. %	1.37^{b} ±0.06	3.66^{a} ±0.66	3.65^{a} ±0.32	3.52^{a} ±0.05	2.77^{a} ±0.25	0.0007
Feathers wt. g.	130.66^{ab} ±13.54	118.75^{b} ±5.22	148.25^{a} ±9.90	153.00^{a} ±10.51	145.00^{ab} ±7.98	0.0707
Feathers wt. %	6.15^{b} ±0.62	6.31^{ab} ±0.33	7.46^{ab} ±0.40	7.68^{a} ±0.55	7.03^{ab} ±0.40	0.096

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant

For abdominal fat, only group (control+ antibiotic) and (Fenugreek) were significantly different from each other, while (control), (Cumin), (Ginger) and F (Cinnamon) were not different from group (control+ antibiotic) or (Fenugreek). These findings agreed with **(Zhang et al 2009** and **Javed et al 2009)** who observed that dressing percentage, breast weight and leg weight increased significantly when certain spices were added to the ration.

2. Immunocompetence measurements

In this study, **Table (5)** showed that the highest value for spleen percentage was recorded in F1 group (0.12%) and the lowest value showed in control and Cph2 (0.08%). **Rabia (2010)** concluded that there is an insignificant difference for spleen weight percentage between control group (0.20%) and the group which fed on (3 g fenugreek /kg diet) (0.19%) for broiler at 42 days of age.

Bursa gland recorded the highest value for F2 group (0.06%) and the lowest Value was recorded by Control and Cph2 group (0.02%), followed by control (0.02%). **Rabia (2010)** concluded that there is an insignificant difference for bursa of fabriciuos weight percentage between control group (0.14%) and the group which fed on 3 g fenugreek/kg (0.11%). **Khadr and Abdel-Fattah (2007)** showed that the bursa weight was not affected by addition of fenugreek with (1% and 2%) levels compared to the control.

Thymus gland showed significant differences between traits. The F1 group recorded the highest value (0.12%) and the lowest value showed in Cph2 group (0.02%). **Khadr and Abdel-Fattah (2007)** showed that fenugreek seed at level of 1% increased thymus weight which was higher than control and the 2% treatment.

Hind et al (2013) reported that the weight of the immunological organs (thymus and spleen) was not significantly affected by the treatment differences, while the third organ, bursa weight was significantly affected by treatment differences. (Cumin) and (ginger) showed the highest bursa weight (2.72 and 1.84 g), respectively, while (control), (control+ antibiotic), (Fenugreek), (Cinnamon) were not significantly different. On the other hand, **(Bin et al 2003)** reported that the addition of Fenugreek to boiler feeds lead to increased bursa weight.

Injection of phytohemagglutinin-P at a selected site in chickens considered as an inducer of localized in vivo lymphoproliferative response **(Cheema et al 2003).** The response was measured in this study at 24, 48 and 72 hr post PHA-P injection into the toe-web and the results showed in **Table (6)**. At 24 hr after injection chickens which fed diet with Camphor 2 and Fenugreek 2 addition had the maximum cutaneous basophilic hypersensitivity swelling response with insignificantly difference compared to the other treatments and control. Swelling response decreased by 48 and 72 hour.

Table 5. lymphoid organs as affected by Camphor and Fenugreek treatments for Ross broiler hybrid

Trait	Control	Cph1	Cph2	F1	F2	Prob.
Spleen wt (g.)	1.82^{b}±0.20	1.89^{b}±0.14	1.57^{b}±0.14	2.45^{a}±0.21	2.01^{ab}±0.12	0.0071
Spleen wt %	0.08^{b}±0.008	0.10^{ab}±0.007	0.08^{b}±0.009	0.12^{a}±0.01	0.10^{ab}±0.006	0.0159
Bursa wt (g.)	0.61^{b}±0.07	0.62^{b}±0.05	0.52^{b}±0.01	0.89^{ab}±0.09	1.18^{a}±0.23	0.0023
Bursa wt %	0.02^{b}±0.002	0.03^{b}±0.002	0.02^{b}±0.001	0.04^{ab}±0.005	0.06^{a}±0.01	0.0028
Thymus wt (g.)	2.45^{a}±0.36	1.98^{ab}±0.25	1.47±0.12	2.45^{a}±0.25	1.89^{ab}±0.36	0.0063
Thymus wt %	0.11^{ab}±0.01	0.10^{ab}±0.01	0.07^{b}±0.004	0.12^{a}±0.01	0.09^{ab}±0.01	0.0086

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant

Table 6. Toe web dermal swelling response (difference) to phytohemagglutinin-P injection as affected by Camphor and Fenugreek treatments for Ross broiler hybrid

Time (hr.)	Trait					Prob.
	C	Cph1	Cph2	F1	F2	
	Toe web dermal swelling (mm.)					
24 hr.	0.0188±0.0064	0.0277±0.0045	0.0295±0.0049	0.0258±0.0054	0.0303±0.0036	NS
48 hr.	0.0097^{b}±0.0027	0.0140^{ab}±0.0045	0.0258^{a}±0.0075	0.0125^{ab}±0.0040	0.0115^{ab}±0.0037	0.0163
72 hr.	0.0117±0.0045	0.0115±0.0037	0.0066±0.0028	0.0051±0.0047	0.0100±0.0028	NS

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant

The Cph2 treatment had significantly higher dermal swelling response at 48 hr compared to another treatments and control group. **Motamedi and Taklimi (2014)** reported that the treatment containing 0.5% fenugreek had the maximum value of lymphocytes percentage (69.00) and control treatment had the minimum value (67.75).

Sheep red blood cells (SRBCs) have been chosen in this study as a non-pathogenic antigen for virus. Total anti-SRBCs antibody presented in **(Table 7)** speculated that the birds which fed on F1 and F2 groups had significantly hyper responder to SRBCs at 7 days post-secondary injection, while at 14 days post-secondary injection Cph2 and F2 groups had significantly hyper responses to SRBCs. **Motamedi and Taklimi (2014)** reported that the mean SRBC in the group of 0.5% fenugreek has a significant difference with the control group. They showed that there is no significant difference between treatments, but 1% fenugreek group had an increase compared to the control group.

With respect to Immunoglobulin-M, results showed that F1 and F2 groups had significantly hyper responder to SRBCs at 7 days post-secondary injection, while at 14 days post-secondary injection F2 group had significantly hyper response to SRBCs compared to the another groups. **Motamedi and Taklimi (2014)** reported that the effect of various treatments did not become significant on the data of immunoglobulin M. the control treatment and 0.5% fenugreek had the

Table 7. Total anti-SRBCs antibody, immunoglobulin-M and immunoglobulin-G of Ross broiler hybrids affected by Camphor and Fenugreek treatments

Total anti-SRBCs antibody titer				
Trait	**7PPI**	**14PPI**	**7PSI**	**14PSI**
C	4.66±1.20	3.00±0.40	7.50^{ab}±1.20	2.00^{b}±0.40
Cph1	4.50±0.50	2.50±0.65	6.75^{ab}±0.85	2.25^{b}±0.47
Cph2	3.33±2.33	2.75±0.25	4.75^{b}±0.85	4.75^{a}±0.62
F1	4.33±0.66	2.25±0.62	9.00^{a}±1.00	2.25^{b}±0.25
F2	4.00±0.00	2.75±0.25	9.00^{a}±1.08	5.00^{a}±0.70
Prob.	NS	NS	0.009	0.001
Immunoglobulin-M				
Trait	**7PPI**	**14PPI**	**7PSI**	**14PSI**
C	1.66±1.20	2.25±0.25	5.25^{ab}±1.31	1.25^{b}±0.25
Cph1	1.25±0.75	1.00±0.57	4.25^{ab}±1.08	1.25^{b}±0.47
Cph2	2.00±3.00	2.00±0.00	2.00^{b}±0.00	1.66^{b}±0.33
F1	1.33±0.66	1.25±0.47	5.66^{ab}±0.66	1.25^{b}±0.47
F2	0.25±0.25	1.50±0.65	7.00^{a}±0.91	3.50^{a}±0.65
Prob.	NS	NS	0.004	0.003
Immunoglobulin-G				
Trait	**7PPI**	**14PPI**	**7PSI**	**14PSI**
C	3.00a±0.00	1.00±0.00	3.00^{ab}±0.00	1.75^{b}±0.00
Cph1	2.00b±0.00	1.50±0.28	3.33^{ab}±0.88	1.33^{b}±0.33
Cph2	2.00b±0.00	1.00±0.00	4.50^{a}±0.50	3.75^{a}±0.25
F1	3.00a±0.00	1.33±0.33	3.33^{ab}±0.33	1.33^{b}±0.33
F2	3.50a±0.50	1.66±0.33	2.66^{b}±0.33	2.00^{b}±0.00
Prob.	0.006	NS	0.04	0.001

a and b Means within the same row with different letters are significantly differed, C=Control, Cph1=Camphor 1, Cph2=Camphor 2, F1=Fenugreek 1, F2=Fenugreek 2, Pr.= probability, NS = non-significant

minimum value (1.48). Concerning to Immunoglobulin-G, F2 group showed a significantly hyper responder to SRBCs at 7 days post primary injection, while Cph2 group showed a significantly hyper responder to SRBCs at 7 and 14 days post-secondary injection. **Motamedi and Taklimi (2014)** reported that the effect of various treatments has been significant on immunoglobulin G so that, the mean of group containing 1% fenugreek have a significant difference. Also, there is no significant difference between treatment containing 1% fenugreek and control group.

CONCLUSION

Considering the results obtained from the current study it could be concluded that the fenugreek seeds powder and camphor leaves powder may increase body weight, with additive (1.5 g/1 kg diet) carcass characteristics and also improving the cellular and humeral immunity for broiler chickens under environmental conditions of Egypt.

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تأثير إضافة محفزات النمو علي الأداء الانتاجي والاستجابة المناعية لدجاج اللحم

[210]

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الموجـــــــز

الغرض من هذه الدراسة هو معرفة تأثير إضافة مسحوق بذور الحلبة ومسحوق ورق الكافور علي الآداء الانتاجي والاستجابة المناعية لدجاج اللحم (سلالة الروس). تم التوزيع العشوائي لعدد 100 كتكوت غير مجنس عمر يوم (سلالة روس 308) الي 5 مجاميع ولكل معاملة مكررتان، داخل كل مكررة 10 كتاكيت تم تربيتهم حتي عمر 42 يوم. وزعت العلائق التجريبية كالتالي: عليقة مقارنة، عليقة مزودة بمسحوق بذور الحلبة "1جم/كجم عليقة" (حلبة 1)، عليقة مزودة بمسحوق بذور الحلبة "1.5جم/كجم عليقة" (حلبة2)، عليقة مزودة بمسحوق ورق الكافور "1 جم/كجم عليقة" (كافور1) وعليقة مزودة بمسحوق ورق الكافور "1.5 جم/كجم عليقة" (كافور2). ظهر من هذه الدراسة أن معاملة حلبة 2 هي الافضل بين المعاملات خلال مختلف الاعمار من حيث وزن الجسم ووزن الجسم المكتسب. سجلت النسبة المئوية لتصافي اللحم عند عمر 5 أسابيع أعلي زيادة معنوية لمجموعة كافور 1. أظهرت النسبة المئوية لعضلة الصدر العظمي والصغري زيادة طفيفة غير معنوية لمعاملة كافور2. وسجلت معاملة كافور1 قيمة مرتفعة معنوية للنسبة المئوية لوزن عضلة الدبوس. بينما سجلت مجموعة حلبة 2 أقل قيمة للنسبة المئوية للحوائج مقارنة ببقية المجاميع. سجل وزن الطحال القيمة الأعلي من بين المعاملات لصالح مجموعة حلبة 1، بينما ظهرت أقل قيمة في المعاملة كافور2 والمقارنة. سجل وزن غدة البرسا أعلي قيمة لصالح مجموعة حلبة 2، بينما سجلت بؤمجموعة المقارنة وكافور2 أقل قيمة. أظهرت المجموعة حلبة 1 القيمة الأعلي للنسبة المئوية لوزن الغدة الثيموسية فيما سجلت مجموعة كافور 2 أقل قيمة. أظهرت مجاميع حلبة 2 وكافور 2 استجابة مناعية مرتفعة للحقن بمادة PHA–P. وكذلك أظهرت مجاميع حلبة 1 وحلبة 2 استجابة معنوية عالية ضد خلايا دم الغنم الحمراء عند اليوم السابع بعد الحقن الثانوي، بينما أظهرت مجاميع كافور2 وحلبة 2 استجابة معنوية مرتفعة ضد خلايا دم الغنم الحمراء عند اليوم 14 من الحقن الثانوي. وكان المضمون العام للدراسة هو أن إضافة الحلبة والكافور بمعدل 1.5 جرام لكل 1 كجم عليقة هي النسبة الأفضل خلال هذه الدراسة لتحقيق آداء أفضل تحت الظروف البيئية المصرية.

الكلمات الدالة: الحلبة، الكافور، الإنتاج، المناعه، دجاج اللحم

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