Effect of Feeding Antibiotic - Free Rations Supplemented with Some Selected Herbals Oil Mixture on Vaccinated and Non-Vaccinated Female Broilers Performance, Hematological Profile and Antibody Titer

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ABSTRACT

The effect of feeding antibiotics-free ration supplemented with *Pimpinella anisum, Nigella sativa* and *Thymus vulgaris* oil mixture on vaccinated and non-vaccinated female broilers was studied. An experiment of 4 dietary treatments of 4 replicates x 25 chicks each was conducted on Lohman female broilers from 1 to 42 days of age. Dietary treatments consisted of the same starter and finisher antibiotic-free rations, supplemented or not with 0.2% oils mixture of *Pimpinella anisum, Nigella sativa and Thymus vulgaris* (1:1:1) throughout the experiment period. The statistical findings of this study proved that, the addition of oil mixture to antibiotics-free ration improved significantly live body weight, body weight gain and feed conversion ratio of un-vaccinated and vaccinated female broilers at 21- and 42- days of age. Moreover, oil mixture improved (P< 0.5) antibody titer of vaccinated female broilers at 21-days of age against ND, IBD and IB. Meanwhile, at 21-days of age the addition of oil mixture to the vaccinated female broilers didn't reflect an additional significant improvement in antibody titer against studied diseases. But addition of oil mixture to un-vaccinated female broilers ration improved (P<0.05) antibody titer against ND, IB and IBD compared with un-vaccinated female broiler fed the un-supplemented ration. The present study showed that at 21-days of age, addition of oil mixture to vaccinated female broilers increased significantly WBCs, heterophils and lymphocytes, while, addition of oil mixture to unvaccinated female broilers antibiotics-free ration increased significantly Hct and thrombocytes counts compared with other dietary treatments. On the other hand, at 42-days of age vaccinated female broilers fed antibiotics-free ration recorded the highest (P<0.05) WBCs and Hct counts compared with other dietary treatments. Meanwhile, the use of oil mixture of PA, NS and NS did not resulted significantly in any positive effects on other measured parameters.

Keywords: Antibiotics, Female broilers, Growth performance, Oil mixture, antibody titer.

INTRODUCTION

Poultry industry is the world's fastest growing sources of meat. The modern production system can produce market ready broiler chicks in less than 6 week. This development arose from genetic selection, improved nutrition and health management practices involving the use of antibiotics and / or vaccines for the treatment and prevention of diseases (Perez-carbajal et al., 2010; Redwond et al., 2009). Antibiotics may also be used as growth promoters at sub- therapeutic concentration in feeds. In fact, it has been reported to phase out these antibiotics from European Union market since January 2006. However, prevention against

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diseases become of priority in broiler industry. Therefore, scientists have searched for alternatives to antibiotics. In this view, medicinal plants and essential oils extracted from these plants are becoming more important due to their wide range of activities on digestive, immune and endocrine system and anti-microbial activities (Elgayyar et al.2001; Jang et al., 2004; Nasir and Grashorn, 2010a). It has been reported that the essential oils extracted from thyme, particularly the phenolic components (including carcavarol and thymol) were responsible for antioxidant activity observed in lipids system (Farag et al., 1989; Deighton et al., 1993). Hertrampf (2001) reported antibacterial, antifungal anticocidial and antioxidant effects for thyme oil. Antibacterial activity of thyme poly phenolic components against *Bacillus subtilis*, *S.entric*, *Clostridium perfringensf* , *Escherichia coli* and *Bacillus cerus* have been reported in previous literature(Cross et al., 2007). In addition, anise oil has anothole (85%) as active ingredient and also it has contained eugenol, methylchavicol, anisaldehyde and estragol (Ciftci et al., 2005). Previous literature showed that essential oil of anise increased the digestion of protein, cellulose and fats (Jamroz and Kamel, 2002) and improved apparent whole tract and ileal digestibility of nutrients (Hernandez et al., 2004). Moreover, anise oil has been used for treatment of some of the diseases like rhinitis, cough and other symptoms of the common cold (Schilcher, 2000). On the other hand, recent studies have shown that dietary Nigella sativa and its various extracts were found to possess antibacterial activity against gram positive and gram- negative bacteria, and they caused inhibition of aflatoxin production (Nasir and Grashorn, 2006). Several studies were conducted on the effect of medicinal plants and/or their extracts on broiler chicks (Al- Homidan et al., 2002; Al- Beitawi et al., 2009; Nasir and Grashorn, 2010a) However, no oil from a single source has found to be suitable for all purpose, simply because oils from different sources are generally differ in their composition. So far, a large number of medicinal plants have been analyzed (Bruits and Burcar, 2000; Ramadan and Morsel, 2002). Masada, (1976) cited that the main components of oil extracted from thyme is thymol (5- methyl- 2-isopropyl phenol) with small quantities of 1.8- cineol and linalool. Meanwhile, Nigella sativa seeds are rich source of fatty acids particularly the unsaturated linoleic and linoleic fatty acids. It has been reported that volatile oil of anise seeds consists of trans- anethol (70-90%) with estragol, ansealdehyde and the polymer of anethol (Ciftci et al., 2005). Therefore, the present syudy was designed to study the effect of feeding unvaccinated and vaccinated female broilers free- antibiotics rations supplemented with *Pimpinella anisum*, *Nigella sativa* and *Thymus vulgaris oil* on growth performance, blood hematological profile, and antibodies titer of some selected diseases.

MATERIALS AND METHODS

Birds and Rearing conditions

Four hundred on day old Lohman female broiler (FM) chicks were purchased from a commercial local hatchery and raised in an open sided house at Animal Research center at Jordan University of science and Technology. The average weight of chick was 35.70g. Upon arrival, Chicks were randomly allocated into 16 pens (1.15m×2.10m each). Water and feeds were offered ad libitum. No antibiotics were used through all the experimental period (42-day). Half of the chicks were vaccinated against Newcastle (ND) disease (Hitchner B1 strain) at 9-days of age and (Lasota strain) at 22-days of age, infectious bronchitis (IB) strain H120 diseases at the same age and infectious bursal disease (IBD) at 13 days of age. The other half was not vaccinated against any disease.

Experimental rations

Chicks were fed a starter ration from one to 21-days of age and a finisher ration from 22 to 42-days of age (Table 1). All rations were formulated based on yellow corn and soybean meal to meet the requirements according to NRC (1994). Randomized samples from each starter and finisher rations were collected for proximate analysis using the procedure described by AOAC (1994). Dietary treatments consisted of the same starter and finisher antibiotics-free rations, supplemented or not with 0.2% oils mixture of *Pimpinella anisum, Nigella sativa* seeds and *Thymus vulgaris* leaves (1:1:1) throughout the experimental period.

Measurements

Live body weight, body weight gain, feed intake and feed conversion ratio

Immediately after arrival chicks were weighed, and the average weight per chick was recorded and considered as initial body weight (35.7g). Live body weight (BW) and cumulative feed intake (CFI) were measured at 21 and 42-days of age. Body weight gain (BWG) and feed conversion ratio (FCR) were calculated at the same ages.

Selected antibodytiter (Abs)

At 21 and 42-days of age, Ab's titer against Newcastle disease (ND), infectious bronchitis (IB) and infectious bursal (IBD) diseases were quantified from 5 randomly selected birds from each replicate within each treatment. Antibody titer was assayed by link immunosorbent assay (ELISA) for IB and IBD and haemaglutination inhibition (HI) test for ND as described by Thayer and Beard (1998).

Blood hematology

At 21 and 42-days of age, five chicks from each replicate within each treatment were randomly selected for blood assay. Half of the blood collected in EDTA anticoagulant tubes for the determination of hematological parameters using the method described by Wintrobe (1976). The second half of the blood was collected in non-heparinized tubes and centrifuged at 4000 rpm for 15 minutes. Clear serum was used for the determination of selected antibodies titer (Ab's).

Statistical analysis

Collected data were statistically analyzed.Pen means were used as experimental units. A completely randomized statistical design was used. Data were subjected to ANOVA using the General linear model (GLM) procedure of SAS (1990). The level of significance was set at $P<0.05$ or less depending upon the F-values generated. Differences among treatments were found, means were separated by the Least Significant Differences (LSD) method following the procedure of SAS (1990).

Table 1. Composition of experimental ration

Ingredient	Starter %	Finisher %
Yellow corn	60.75	69
Soybean meal (48% CP)	34	26
*Broiler concentrate (54% CP)	2	1.75
Limestone	1.25	1.25
Dicalcium phosphate	0.75	0.75
*Vitamin: mineral premix	1	1
NaCl	0.25	0.25

Calculated feeding value		
CP (%)	22.62	19.36
ME (MJ/kg diet)	12.46	12.7
EE (%)	2.96	3.17
CF (%)	2.59	2.56
Lysine (%)	1.24	1
Methionin + Cystine (%)	0.73	0.63
Analyzed feeding value		
CP (%)	22.57	19.3
DM (%)	91.95	91.87
EE (%)	2.87	3.1
CF (%)	2.5	2.52

*Broiler concentrate provided the following: CP 54%; EE 24%; ME 16.25/Kg diet; Methionine+Cystine 2.05% and Lysine 1.5%.

*Vitamin: mineral premix provided the following: 2,000,000 IU Vitamin A; 400,000 IU Vitamin D3; 400 mg Vitamin E; 200 mg Vitamin B1; 800 mg Vitamin B2; 4,000 mg Nicotinc acid; 2,00 mg pantothenic acid; 300 mg Vitamin K; 200 mg folic acid; 300 mg Vitamin B6; 50 mg Co; 1.600 mg Cu; 6.421 mg Fe; 156 mg I; 12,800 mg Se; 9,000 mg Zn and 100 mg Choline Chloride.

RESULTS

Growth performance

The effect of 0.2% dietary oil mixture of *Pimpinella anisum*, *Nigella sativa* and *Thymus vulgaris* on growth performance of (VFB) and (UVFB) at 21- and 42- day of age are presented in table (2). Results showed that the addition of oil mixture to antibiotics-free rations of VFB and UVFB improved (P<0.05) their growth performance in terms of BW, BWG and FCR at 21- and 42- days of age compared with other dietary treatments.

Table 2. Means ± ES growth performance of female broilers at 21- and 42-days of age.

	Live body weight (g)		Body weight gain (g)		Cumulative feed intake (g)		Feed conversion ratio	
	21-d	42-d	21-d	42-d	21-d	42-d	21-d	42-d
Antibiotics-free ration (T1)	541.61^{b}	1836.17^{c}	505.91^{b}	1800.47^{c}	862.23^{ab}	3675.35^{a}	1.70^{a}	2.00^{a}
Antibiotics-free ration+ vaccines (T2)	564.02^{b}	1943.12^{b}	528.32^{b}	1907.42^{b}	829.15^{b}	3540.38^{b}	1.65^{a}	1.82^{b}
Antibiotics-free ration+ oil (T3)	600.11^{a}	1990.65^{ab}	564.41^{a}	1954.95^{ab}	880.27^{a}	3700.25^{a}	1.56^{b}	1.86^{b}
Antibiotics-free ration+ vaccines + oil (T4)	606.83^{a}	2027.45^{a}	571.13^{a}	1991.75^{a}	827.10^{b}	3528.30^{b}	1.45^{c}	1.74^{c}
± SE	12.98	32.40	12.55	30.52	0.03	37.50	0.01	0.02

[a-c] Means with different superscripts in the same column are significantly different at *P<0.05*.

Selected antibodytiter (Abs)

Table (3) presents the means ± SE values of antibody titer (Abs) against Newcastle disease (ND), infectious bronchitis (IB) and infectious bursal disease (IBD) of VFB and UVFB at 21- and 42- days of age. Results demonstrated that VFB fed antibiotics-free ration supplemented with oil mixture had the highest (P<0.05) Abs against the most infectious diseases (ND, IB and IBD) at 21- days of age. Meanwhile, the lowest (P<0.05) Abs was recorded for UVFB fed the antibiotics –free ration with oil mixture addition. On the other hand, at 42-days of age VFB fed the antibiotics free ration had significantly the same Abs against ND as VFB fed the antibiotics free ration supplemented with oil mixture. With respect to IB and IBD diseases VFB fed antibiotics free ration supplemented with medicinal plants oil mixture had the highest (P<0.05) Abs among all treatments

Table 3. Means ± ES of antibody titer against ND, IBD and IB of female broilers at 21- and 42- days of age.

Treatments	Newcastle disease (ND) HI		Infectious bronchitis disease (IB) ELIZA		Infectious bursal disease (IBD) ELIZA	
	21-d	42-d	21-d	42-d	21-d	42-d
Antibiotics-free ration (Basal nation) T1	1.78 ^{c}	0.90 ^{c}	95.71 ^{d}	105.70 ^{c}	47.05 ^{d}	81.86 ^{c}
Antibiotics-free ration + vaccines T2	4.43 ^{b}	4.00 ^{a}	135.43 ^{b}	221.43 ^{a}	129.15 ^{b}	275.86 ^{a}
Antibiotics-free ration + oil mixture T3	2.56 ^{c}	2.30 ^{b}	113.17 ^{c}	169.17 ^{b}	75.18 ^{c}	147.05 ^{b}
Antibiotics-free ration +vaccine + oil mixture T4	8.93 ^{a}	4.85 ^{a}	220.43 ^{a}	220.43 ^{a}	176.86 ^{a}	270.14 ^{a}
± SE	0.71	0.71	3.83	3.67	3.34	3.34

a-d Means with different superscripts in the same column are significantly different at *P*<0.05

Blood hematological profile

Table (4) showed that at 21-days of age addition of oil mixture to the antibiotics-free ration of VFB increased (P<0.05) their total WBCs, heterophils and lymphocytes counts compared with other dietary treatments. No significant were detected in RBCs count and Hb concentration. In addition, UVFB fed antibiotics-free rations recorded the highest (P<0.05) Hct and thrombocytes compared with other treatments. However, at 42-days of age VFB fed antibiotics-free ration supplemented with 0.2% mixture recorded significantly the highest (P<0.05) WBCs and Hct counts. Meanwhile, no significant effects were observed in other parameters.

Table 4.Means ± ES of blood hematological profile of female broilers at 21-days of age.

treatment	WBC's (×103/µL)		RBC's (×106/µL)		Hb (g/dl)		Hct (×103/µL)		Thrombocytes (×103/µL)		Heterophillis (×103/µL)		lymphocytes	
	21-d	42-d	21-d	42-d	21-d	42-d	21-d	42-d	21-d	42-d	21-d	42-d	21-d	42-d
Antibiotics-free ration (T1)	2.3c	8.26^{b}	*2.85	*3.02	*12.5	*12.06	35.68^{b}	33.00^{c}	66.67^{b}	*49.05	1.85^{b}	*62.60	0.45^{d}	*33.20
Antibiotics-free ration + vaccines (T2)	8.15^{b}	9.11^{b}	2.76	2.61	12.70	12.30	33.15^{c}	33.40^{c}	41.05^{d}	65.40	1.75^{b}	64.85	6.40^{b}	36.60
Antibiotics-free ration + oil (T3)	7.85^{b}	8.96^{ab}	2.60	2.70	12.80	12.70	37.00^{a}	35.60^{b}	77.15^{a}	52.60	2.00^{b}	64.08	5.85^{b}	33.45
Antibiotics-free ration + vaccines + oil (T4)	10.5a	11.06^{a}	2.93	2.79	12.86	12.96	32.00^{c}	37.17^{a}	49.80^{c}	56.20	2.95^{a}	65.20	7.55^{a}	32.00
± SE	0.46	0.64	0.28	0.48	0.36	0.44	0.61	0.24	0.41	0.24	0.25	0.65	0.36	0.72

* Not significant
$^{a-c}$Means with different superscripts in the same column are significantly different at *P<0.05*.

DISCUSSION

The aim of the present study was to evaluate the effect of oil mixture extracted from *Pimpinella anisum* (PA), *Nigella sativa* (NS) and *Thymus vulgaris* (TV) on growth performance, antibody titer against the most infectious diseases in broiler production (*ND*, *IBD* and *IB* and blood hematology of vaccinated and un-vaccinated female broilers (VFB and UVFB) fed antibiotics- free rations. The obtained results of this study extend the previous findings on growth performance of female broiler chickens. Our results showed that At 21- and 42-days of age, UVFB and VFB fed antibiotics- free ration supplemented with oil mixture of PA, NS and TV oil mixture had the highest (P< 0.05) BW, BWG and the best FCR compared with VFB and UVFB fed antibiotics -free ration without oil mixture addition. We assumed that the favorable effects of oil mixture could be due to the active and valuable component that such oil mixture contains. The essential oils of such medicinal plants have a wide range of anticoccidial, pharmacological, antifungal, antioxidant, antibacterial, activities (Jamroz and Kamel, 2002; Lewis et al., 2003; Jantan et al., 2003; Botsoglou et al., 2004; Mitsh et al., 2004). The previous finding in this regards has been reported that the major components of *Thymus vulgaris* oil are thymol and carvacrol which can improved growth performance of animal (Masda, 1976; Hertrampf, 2001; Alcick et al., 2003). Previously reported observations on the effect of essential oils mixture of PA, NS and TV revealed that these oils stimulate digestive system particularly the digestion of proteins, fats and cellulose (Langhout, 2000; Hertrampf, 2001; Williams and losa, 2001; Jamroz and kamel, 2002; Alcicek et al., 2003; Rammakrishna et al., 2003) These authors postulated that this effect is may be due to the digestive improve nutrients utilization through enhanced choleric effects, which produce a definite increase in bile flow (Mahfouz et al., 1960). However, the improvement in BW, BWG and FCR may also be related to the presence of fat soluble unidentified factors and vitamin F group (a mixture of fatty acids including linoleic, linolenic and archidonic acids) which are essential for growth performance (Murray et al., 1993). Moreover, another factor that could be considered as a major factor in improving BW, BWG and FCR of vaccinated and un-vaccinated female broilers fed antibiotics free ration supplemented with oil mixture in the presence of different active components of PA oil such as anothol, anisaldehyde, estragol, eugenol and methylchavicol that have stimulating effects on growth performance of

female broilers (Giannenas et al., 2003; Ciftci et al., 2005; Bayram et al., 2007). Based on the results, reported herein and reports in the literature, we believed that specific components of essential oil mixture affected positively the performance of VFB and UVFB fed antibiotics-free ration. Our present findings are in harmony with previous findings of (Abu-Egla et al., 2001; El-Ghammary et al., 2002; Hassan et al., 2004). These authours cited that BW, BWG and FCR significantly improved at 7 weeks of age as a result of PA, NS and TV addition either individually or as a mixture to the basal ration of broiler chicken. Concerning antibody titer against the most infectious diseases (ND, IB and IBD) in broiler production, the present findings proved that the addition of PA, NS and TV oil mixture to the antibiotics-free ration of VFB increased ($P<0.05$) their Abs at 21-days of age. Meanwhile, at 42-days of age no additional effects in Abs production against ND, IB and IBD disease were noticed as a result of PA, NS and TV oil mixture. Recently, several authors have isolated and identified many active components of NSS oil that have beneficial effects (Karawya et al., 1994; Atta-ur-Rehman and Malik, 1995; Ramadan and Morsal, 2002; Vatansev et al., 2013). These authors indicated that linleic acid (C18:2n-6) was the dominate fatty acid, followed by oleic acid (C18:1n-9) and linolenic acid (C18:2n-3) which are considered as essential fatty acids and cannot be synthesized inside the body of the chicken, and thus must be taken as supplement or through high fatty acids food (HFA) in order to sustain health. In this trend, Friedman and Sklan (1995) reported that Abs production developed more rapidly and reached higher level in chicks fed lower level of linoleic acid and concluded that dietary fatty acids composition can influence immune response in broiler chickens. Previous studies indicated that volatile oil of NSS contain a variety of pharmacologically active substances such as nigellicine-N-oxide, nigellidene, thymoquinone and alphahedrin (Al-Homidan et al., 2002; Nassir et al., 2005). These components could be another factor that explains the positive effect of oil mixture on Abs production. Our present results are in agreement with Stef et al. (2009) who reported that essential oils extracted from medicinal plants improve the immune response of broilers, and Abulkarimi (2011) who also concluded that the composition of *Thymus vulgaris* extract increased infectious bronchitis Abs at 21-days of age as compared to control birds. But no significant differences were detected in ND antibody titer at 42-days of age. On the other hand, our present findings disagree with Toghyani et al. (2010) who reported that there was no significant impact for feeding NS on Abs titer against ND virus. Recently, Butcher (2003) demonstrated that immune system of birds can be influenced by nutrition in several ways such as synthesis of immunologically active substances and development of lymphoid tissues. The same author reported that omega 3 and 6 fatty acids are of benefit to the immune system at higher than normal concentration in the diet. Based on many interpretation of resistance to infectious diseases into 7 categories, of these mechanisms are the effects on the development of the immune system (linoleic acid, iron and vitamin A) and the supply of substrates to the immune system (all nutrients). However, based on the results, reported herein and reports in the literature, we assume that the relationship between oils extracted from medicinal plants and Abs against the studied infectious diseases is highly positively correlated. Nevertheless, the present findings are in agreement with previous findings of El-Kaiaty et al. (2002) who concluded that medicinal plants or their extracts have highly significant effect on the immune response of broiler chickens. Unfortunately, there are few studies which have revealed the

mechanism of action of the immunostimulatory compounds of medicinal plants and their extracts, but the exact mechanism are not already known. An understanding of the mechanism through which phytochemicals affects the immune system is seriously needed. Therefore, more researches are requested in this field. With respect to hematological profile, our present results prove the addition of PA, NS and TV oil mixture to VFB ration significantly increased WBCs, heterophils and lymphocytes counts. Meanwhile, addition of oil mixture to antibiotics-free ration of UVFB increased significantly Hct and thrombocytes counts compared with other dietary treatments at 21-days of age. On the other hand, at 42-days of age the addition of oil mixture of PA,NS and TV to VFB ration increased ($P<0.05$) WBCs and Hct counts. We assume that the significant increase in WBCs, heterophiles and lymphocytes of VFB at 42-days of age as a result of using medicinal plants oil mixture could be attributed to valuable and active components founded in these oils. Mahfouz and El-Dakhakhany (1960) reported that the essential oils of *Nigella sativa* contain crystalline compounds called nigellone or thymoquinone, which has protective effect against diseases. Furthermore, Zaker et al. (2008) postulated that crushed *Nigella sativa* seeds and its extracts has an immunostimulant effect and used it as remedies for diseases. On the other hand, several researchers (Farag et al., 1989a; Hertrampf, 2001) reported that thyme oil has antibacterial, anticoccidal and antioxidant effects. Smith palmer et al., (1998) demonstrated that the essential oil showed a wide range of antibacterial activity against some food born pathogens such as *Salmonella enteritidis*, *Escherichia coli* and *Staphylococcus aureus*. Previous researchers discovered the effects of various feeds on hematological profile of livestock's and concluded that unconventional sources affect animal physiology (Emenalon and Mdebibie, 1998). In this trend Esonu et al. (2001) reported that hematological profile reflects the physiological responsiveness of the animal to its internal and external environments including feed and feeding. Unfortunately, very few researches in this field are available, therefore more researches and studies are needed to explain the working mechanism of the oils. Further studies are also required to evaluate the effect of such oils on a particular disease.

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تأثير التغذية على عليقة خالية من المضادات الحيوية مضافا لها خليط من زيت حبة البركة واليانسون والزعتر على أداء ومكونات الدم والأجسام المناعية لإناث دجاج اللحم لقحت أو لم تلقح لقاحات

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ملخص

تم دراسة تأثير التغذية على عليقة خالية من المضادات الحيوية مضافا لها خليط من زيت حبة البركة واليانسون والزعتر على أداء إناث دجاج لحم نوع لوهمان أعطيت أو لم تعط لقاحات. أجريت تجربة مكونة من أربع معاملات تغذوية على إناث دجاج لحم لمدة 42 يوم. أظهرت النتائج تحسنا معنويا ($P<0.05$) على وزن الجسم الحي ووزن الجسم المكتسب وكفاءة تحويل الغذاء على عمر 21 و 42 يوم للمجموعات التي غذيت على عليقة الشاهد مضاف لها زيت سواء تلك التي لقحت أو لم تلقح. كما أظهرت النتائج تحسنا معنويا على إنتاج الأجسام المناعية ضد أمراض ND و IB و IBD على عمر 21 يوم في حين لم يظهر أي تحسن معنوي على عمر 42 يوم بالنسبة لإناث دجاج اللحم التي أعطيت اللقاحات ولكنه لوحظ وجود فروق معنوية في الأجسام المضادة لإناث دجاج اللحم التي لم تلقح وغذيت عليقة مضافا لها أو لم يضف خليط الزيت. أما بالنسبة لمكونات الدم فقد أظهرت نتائج نفس التجربة أنه على عمر 21 يوم كان هناك زيادة معنوية ($P< 0.05$) في عدد كريات الدم البيضاء و heterophils و lymphocytes في حين أن إضافة خليط الزيت لعلائق إناث دجاج اللحم غير الملقحة زاد تعداد Hct و thrombocytes مقارنة بالمعاملات الأخرى. في المقابل على عمر 42 يوم سجلت إناث دجاج اللحم الملقحة والتي غذيت على عليقة خالية من المضادات الحيوية سجلت أعلى ($P<0.05$) عدد لكريات الدم البيضاء وال Hct وفي نفس الوقت إضافة الزيت للعليقة الخالية من المضادات الحيوية لم تظهر أي تحسن معنوي في القياسات الأخرى. وعليه فإنه يوصى بإجراء المزيد من التجارب لتأكيد هذه النتائج أو نفيها.

الكلمات الدالة: مضادات حيوية، إناث دجاج لحم، مظهر النمو، خليط زيت، لقاحات.

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