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EFFECT OF DIETARY OREGANO SUPPLEMENTATION ON PRODUCTIVE, PHYSIOLOGICAL AND IMMUNOLOGICAL PERFORMANCE OF BROILER CHICKS.

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ABSTRACT: A total number of 225 unsexed-one-day old Starbro broiler chicks were randomly distributed into 5 equal experimental groups with three replicates of 15 chicks each. The first group was fed the basal diet and served as control group. The second and third groups were fed the basal diet supplemented with 0.25 and 0.50g Robadiar/kg diet, respectively. The fourth and fifth groups were fed the basal diet supplemented with 0.30 and 0.60g Orego-Stim/kg diet, respectively. The effect of these feed additives on performance of broilers were evaluated. The results obtained could be summarized as follows: broiler chicks of the fifth group recorded the best values for live body weight, body weight gain and feed conversion ratio followed by fourth, third and second treatment groups compared with the control diet. Relative weight of eviscerated carcass, heart and edible organs were significantly (P≤0.05) increased by dietary oregano groups (except the second group) compared with the control group. Also, relative weights of thymus and bursa significantly (P≤0.05) increased for the fifth group compared to the control one, while, abdominal fat (%) was significantly (P≤0.05) reduced by dietary treatments. All dietary additives significantly reduced the total counts of anaerobic and *E. coli* bacteria, at the same time, they increased the beneficial bacteria counts (*lactobacillus)*, moreover, birds of fifth group recorded the lowest counts of both anaerobic and *E. coli* bacteria, and the highest count of *lactobacillus* compared to other treatment groups and untreated control group. Chicks fed the fifth diet significantly (P≤0.05) had high plasma total protein, globulin and glucose concentrations compared to control diet. Each of plasma total lipids, total cholesterol and triglycerides concentration was significantly (P≤0.05) decreased in all supplemented diet groups comparing to the control group. However, plasma concentrations of aspartate amino transaminase and alanine transaminase activities as well as albumin/globulin ratio were not significantly affected. There were significant (P≤0.05) increases in the counts of erythrocytes and total counts of leukocytic, but no in lymphocytes, heterophil and heterophil/lymphocytes ratio due to tested supplements compared to the control. Economic efficiency values increased by about 7.43, 10.00, 15.14 and 16.71% for second, third, fourth and fifth groups, respectively over the control group. Supplementing diet with 0.60g Orego-Stim/kg diet significantly improved the growth performance, carcass characteristic and some physiological and immunological parameters of broiler chicks.

Keywords: Oregano, broiler, productive performance, carcass, physiological parameters.

INTRODUCTION

Essential oils are complex mixtures of different organic molecules- terpenes, alcohols, esters, aldehydes, ketones and phenols (Fletcher et al., 2001). They are obtained by extraction, fermentation, and pressing, but steam distillation method is the most method commonly used for commercial production of essential oils. As plant material can be used flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots (Burt, 2004). Their mode of action is more indirect, rather based on a comprehensive approach that can support internal defense mechanisms of animals and can therefore be considered sustainable, long-term solution (Gwendolyn, 2002). Essential oil from oregano (*Origanum vulgare)* contains mainly carvacrol (86.9 %), a lesser extent, y-terpinene, p-cymene and myrcene.

Oregano is an aromatic plant with a wide distribution throughout the mediterranean area and Asia (Vokou et al., 1993). The essential oil obtained from oregano subsp. *hirtum* plant by a steam distillation process comprises more than 20 ingredients, most of which are phenolic antioxidants (Vekiari et al., 1993). Major components are carvacrol and thymol that constitute about 78 to 82% of the total oil (Adam et al., 1998).

Carvacrol inhibits the growth of several bacteria strains, e.g. *Escherichia coli* and *Bacillus cereus* (Du et al., 2008). Its low toxicity together with its pleasant taste and smell suggests its use as a feed additive to prevent bacterial contamination (Ultee and Smid, 2001).

It has been suggested that the essential oil derived from oregano possess *in vitro* antimicrobial (Lambert et al., 2001), antifungal (Thompson, 1989), insecticidal (Karpouhtsis et al., 1998) and antioxidant (Botsoglou et al., 2002) properties. These properties are mainly attributed to carvacrol and thymol. However, the oregano plants, apart from these volatile phenolic antioxidant compounds occurring in the essential oil (Adam et al., 1998). Also, it contain a variety of glycosidically bound volatile and non-volatile constituents that also exhibit biological activity after enzymatic or acid hydrolysis (Milos et al., 2000). Therefore, oregano plants might be more biologically active than their essential oil when incorporated in poultry diets.

Roofchaee et al. (2011) found that supplementation of broiler diets with 600 and 1200 mg/kg diet oregano essential oil significantly improved feed conversion ratio compared with the control diet. Penalver et al. (2005) showed that essential oil of oregano incredibly exerted antibacterial effect against poultry origin strains of E. coli. Navid (2011) found that the highest body weight gain and the lowest feed conversion ratio of broiler chicks were observed in the chicks received 200 ppm of oregano oil. Moreover, the lowest percent of abdominal fat was observed in chicks received 150 ppm of oregano oil, and the highest percent of breast was in chicks received 200 ppm of oregano oil. Abdel-Wareth (2011) showed that use of oregano at different levels (10, 15, 20, 25 or 30 g/kg diet) improved body weight gain and feed conversion ratio. Furthermore, increasing levels of oregano supplementation to broiler diets improved gut health and nutrient digestibility of the birds. The phenolic compounds of carvacrol and thymol present in the essential oil from oregano has a good antioxidant capacity and also,

antimicrobial activity against pathogenic microorganisms like Salmonella typhimurium, *Escherichia coli*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. (Arcila-Lozano et al., 2004). The present study was carried out to determine the effect of oregano on productive performance and some physiological parameters of broiler chicks.

MATERIALS AND METHODS

This growth experiment was carried out at El-Fayom Poultry Breeding Station, Animal Production Research Institute, Agricultural Research Center.

Chicks and experimental design

A total number of 225 unsexed-one-day old Starbro broiler chicks were used in this experiment up to 6 wks of age. Starbro strain resulted by crossing between Cobb breed as a male x Hubbard breed as a female. All chicks were randomly divided into 5 equal experimental groups (45 chicks, each) with three replicates of 15 birds each, with almost similar initial average body weight. Replicates were randomly housed in floor pens. The first group was fed the basal diet without supplementation and served as control. The second and third groups were fed the basal diet supplemented with 0.25 **(**Recommended levels of manufacturer) and 0.50g Robadiar®/kg diet, respectively. The fourth and fifth groups were fed the basal diet supplemented with 0.30 **(**Recommended levels of manufacturer) and 0.60g Orego-Stim®/kg diet, respectively. Robadiar® produced by Ropapharm International Co., Newzeland, and Orego-Stim® produced by Meriden-Animal Health Co., UK.

Managements and feeding:

All experimental birds were maintained under similar hygienic and managerial conditions and received continuous light. Feed and water were provided for *ad libitum* consumption. The ingredients and calculated analysis of the experimental diets are shown in Table 1. Diet was formulated to cover the nutrient requirements of broiler chickens as urged by the (NRC, 1994).

Measurements:-

Performance traits:-

Individual live body weight (LBW) was recorded at hatch day and at the end of each growth period. Body weight gain (BWG) was then calculated. Feed intake (FI) was recorded and feed conversion ratio (FCR) was calculated during the same previous intervals.

Carcass traits:-

At the end of the experimental period (6 wks of age), 5 birds from each treatment group were randomly chosen, weighted and slaughtered until complete bleeding, feathers were removed. The birds were weighed after removing heads, legs, feathers, blood and viscera to determine the percentage of carcass weight included wings and necks. The heart, liver, empty gizzard, and lymphoid organs (thymus, bursa and spleen) were separated, weighed and their percentages to live body weight were calculated.

Microbiological analysis:-

Cecum contents were separately collected for each treatment under aseptic conditions to determine the total count of anaerobic bacteria and *Escherichia coli* (E.Coli) in their selective media as described by Collins et al. (1995) and lactobacilli bacteria count in their selective media as described by Kim and Goepfert (1971).

Blood biochemical analysis and hematological picture:-

At six weeks of age (end of experiment), blood samples (about 6 ml) were collected from each slaughtered bird during exsanguinations in heparinized test tubes. Each sample was divided into two parts. The first part was used to evaluate the total count of red and white blood cells as well as the differential counts of leucocytes (lymphocyte and heterophil). However, heterophil/lymphocyte ratio was calculated. The other part was centrifuged at 3000 rpm for 20 minutes. The separated plasma was stored in a deep freezer at -20°C until assayed for total protein (TP), albumen (Al), total lipids (TL), total cholesterol (Tch), high density lipoproteins (HDL-ch), low density lipoproteins (LDL-ch), Triglycerides (TG), Glucose (Glu), aspartate amino transamiase (AST) and alanine transamiase (ALT) according to the manufacture recommendations of commercial kits. Globulin (Gl) and Al/Gl ratio were calculated.

Economical efficiency (EEF):

The economic parameters of production including feeding and additives costs, income and returns per bird were calculated, while the other productive factors were disregarded since they were constant.

Statistical analysis:

Data were subjected to one-way analysis of variance using SAS (2001). Differences between means were detected by using Duncan's multiple range test (Duncan, 1955). For carcass traits, the percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis, and then actual means are presented. The following model was used:

$Y_{ij} = \mu + T_i + e_{ij}$.

Where, Y_{ij} = observation for each dependent variable; μ = overall mean; T_i = Treatment effects (i = 1, 2... and 5); e_{ij} = Random error.

RESULTE AND DISCUSSION

Growth Performance

Parameters of broiler chicks as influenced by dietary oregano (R and OS) are illustrated in Table 2. At the end of starter and grower periods, body weight of birds fed 0.60g OS/kg diet (T5) was significantly ($P \leq 0.05$) heavier, followed by group fed 0.30g OS/kg diet (T4), followed by birds fed 0.50 and 0.25g R/kg diet (T3 and T2, respectively), compared to the control birds. In this experiment, adding each of R or OS as (oregano) to broiler diets may play important role in live body weight throughout the experimental period from 0 to 42 day of age. Body weight gain of broiler chicks fed different levels of dietary oregano significantly ($P \leq 0.5$) increased as compared to that of the control group during the whole experimental period, where birds fed 0.60g OS/kg diet significantly ($P \leq 0.05$) showed the highest body weight gain, while those fed 0.25g R/kg diet showed the lowest body weight gain, but had almost significantly ($P \leq 0.05$) higher gain than the control. Data presented in Table 2 show that there were no significant differences in the amounts of feed consumed could be observed between tested treatments and control group at all studied periods. However, the T5 birds consumed insignificantly higher amounts of feed than those of all the dietary treatments and control. The data of feed conversion ratio are presented in Table 2, it was observed that there were significant ($P \leq 0.05$) differences in feed

conversion ratio values during starter and finisher periods due to supplementation of oregano (either R or OS). Birds fed T5 diet had significantly better (P≤0.05) feed conversion ratio for the whole period (0-42 d), as compared to control group. While, group fed T2 diet recorded intermediate value of FCR between the control and other treatments. In this respect, Roofchaee et al. (2011) found that broiler diets supplemented with 600 mg/kg of oregano in the grower period significantly (P≤0.05) increased body weight gain compared with the control group. Moreover, feed conversion ratio was not affected by dietary supplementation of oregano essential oil in starter period, but inclusion of 600 and 1200 mg/kg of oregano in grower period significantly (P≤0.05) improved feed conversion ratio compared with control group. Abdel-Wareth (2011) showed that feed conversion ratio was positively affected by adding 15 or 20 g oregano/kg of broiler chicks. However, when 30 g/kg oregano were added the feed conversion ratio increased by approximately 5%. A blend derived from oregano supplemented at a level of 200 mg/kg resulted in an increased body weight gain by 16% as well as an feed conversion ratio improved by 12%. It was concluded that these positive findings may be due to the positive digestive stimulating effects of thymol and carvacrol (Ertas et al., 2005). In agreement with this study, Lee et al. (2003a) found that some bioactive components of carvacrol, improved feed conversion ratio in broiler chickens. They proposed that the effect of carvacrol on feed conversion ratio could be related to increase efficiency of feed utilization. There is evidence which suggests that herbal essential oils have appetite and digestion stimulating properties (Hernandez et al., 2004). Mansoub (2011) found that the highest (P≤0.05) body weight gain and the lowest (P≤0.05) feed conversion ratio were observed in the group received 200ppm of oregano, but, the best (P≤0.05) result for daily feed intake was in the group received 150ppm of oregano. The beneficial effect of growth promoting feed additives on animals arises from stabilizing feed hygiene and beneficially modulating the gut ecosystem by controlling potential pathogens. Phytogenic compounds have a number of active ingredients and pharmacologically active substances that are beneficial for maintaining health and improving performance of poultry. They are reported to stimulate secretion of digestive enzymes (lipase and amylase) and intestinal mucous in broilers, to stimulate feed digestion, to impair adhesion of pathogens and to stabilize microbial balance in the gut (Lee et al., 2003a). On the other hand, Lewis et al. (2003) and Cross et al. (2007) reported that dietary inclusion of oregano in broiler diets could not affect broiler performance. Similarly, Botsoglou et al. (2002) reported that inclusion of 50 and 100 mg/kg oregano in the form of Orego-Stim could not exert any growth promoting action in broilers.

Carcass traits and lymphoid organs:-

Data presented in Table 3 show that relative weight of eviscerated carcass, heart and edible organs were significantly (P≤0.05) increased in dietary oregano groups (except T2 group) compared to the control group. The significant (P≤0.05) improvement of relative carcass weight and edible

organs may be related to increasing live body weight of treated groups compared to the control group. It is worthy to note that relative abdominal fat percentage was significantly (P≤0.05) reduced by dietary oregano supplementation (Table 3). Regarding the lymphoid organs, the relative percentage of thymus and bursa were significantly (P≤0.05) higher for T5 group compared with the control (Table 3). However, chicks fed OS (T5 and T4 groups) had significantly (P≤0.05) high percentage of bursa compared to those fed R (T2 and T3 groups) and control group. Moreover, chicks of T5 group had significantly (P≤0.05) high percentage of thymus compared to T2 and T1 (control) groups, while, there were no significant differences in spleen percentage between groups. These results are partially in agreement with results of Mansoub (2011) who found that there are significant (P≤0.05) differences in the carcass traits due to adding oregano to broiler diets. The lowest percent of abdominal fat was observed in experimental group received 150 ppm of oregano, and the highest percent of breast was in experimental group received 200 ppm of oregano. Essential oil extracted from aromatic plants has been used as alternatives to antibiotics. For this reason, these plants are becoming more important due to their antimicrobial effects and the stimulating effect on animal digestive system (Osman et al., 2005).The active principles of essential oils act as a digestibility enhancer, balancing the gut microbial ecosystem and stimulating the secretion of endogenous digestive enzymes and thus improving growth performance in poultry (Lovkova et al., 2001).

Microbiological analyses:-

Results indicate that both total anaerobic and *E. coli* counts were significantly (P≤0.05) decreased, while *lactobacillus* count was significantly (P≤0.05) increased by adding different sources of oregano when compared to untreated control group. However, no significant (P≤0.05) differences were found between different sources of oregano treatments on *E. coli* count. Generally, birds of T5 group had the lowest counts of both anaerobic and *E. coli* bacteria, and the highest count of *lactobacillus* compared to other treatments and untreated control group. These results are almost in agreement with the results of Roofchaee et al. (2011) who studied the effect of supplementing broiler diets with oregano at levels of 300, 600 and1200 mg/kg and found non-significant improvement in lactic acid bacteria, while levels of 300 and 600 mg/kg recorded significantly lower cecal *E. coli* than control. Moreover, Cross et al. (2007) came to the same conclusion with addition of 1 g oregano/kg for broiler's diet. Generally, there are limited numbers of *in vivo* studies about the effects of oregano on the intestinal microflora of broiler chickens. Abdel-Wareth (2011) indicated that oregano increased *lactobacillus* population in crop and small intestine of broilers. Nevertheless, Penalver et al. (2005) showed that essential oil of oregano incredibly exerted antibacterial effect against poultry origin strains of *E. coli*. They suggested that this potent antibacterial activity can widely be attributed to the presence of two major active components of oregano essential oils that are thymol and carvacrol. Helander et al. (1998) investigated the antibacterial mechanism of two major components of oregano essential oil,

carvacrol and thymol on *E. coli* and reported both of them do the same mechanism, which is disintegrate the membrane of bacteria, leading to the release of membrane associated materials to the external medium. They suggested that thymol and carvacrol are able to penetrate the bacteria and may thus, be able to influence their proliferation. As thyme has been reported to have antibacterial antioxidant and antifungicidal activities (Basilico and Basilico, 1999; Vincent, 2002).

Blood biochemical analysis:-

As shown in Table 5, adding the oregano (except 0.25g R/kg diet) to broiler chicks diets significantly ($P \leq 0.05$) increased concentration of plasma total protein comparing to control diet. Chicks fed T5 diet had recorded significantly ($P \leq 0.05$) high plasma total protein and globulin concentrations compared to control diet. On the other hand, adding the oregano (R or OS) to broiler diets did not alter albumin/globulin ratio, aspartate amino transamiase and alanine transamiase enzymes activities comparing to untreated control group. Results in Table 5 indicate that adding 0.60g OS/kg to broiler diets increased ($P \leq 0.05$) concentration of glucose compared to control group. While, adding the oregano (R or OS) to broiler diets significantly ($P \leq 0.05$) decreased plasma concentration of total lipids, total cholesterol and triglycerides comparing to untreated control group. Adding the oregano to broiler diets did not alter plasma high density lipoproteins and low density lipoproteins. However, there were no significant differences in total lipids and total cholesterol between R and OS treatments. The results arepartially supported by Toghyani et al (2010) who found that supplementing broiler diets with 10 g thyme/kg diet resulted in an increment for HDL-cholesterol value compared to control and other levels of thyme. Also, Radwan et al. (2008) found that the addition of 1% thyme to hen's diet resulted in a marked decrease in plasma total lipids. Ali et al. (2007) found that adding thyme to hen's diet significantly ($P \leq 0.05$) decreased plasma HDL, total cholesterol, triglycerides and total lipids. The reduction of triglycerides and total cholesterol noticed with thyme in animal studies was attributed to the lowering effect of thymol or carvacrol on HMG-CoA reductase the rate-limiting enzyme of cholesterol synthesis (Case et al., 1995). Lee et al. (2003b) indicated that dietary carvacrol, reduces plasma triglycerides and phospholipids and suggested that carvacrol may have more impact on lipogenesis than on cholesterol biosynthesis. On the other hand, Bolukbası et al. (2006) reported that dietary thyme oil increased plasma concentration of triglycerides, LDL-cholesterol and HDL-cholesterol in broilers.

Hematological picture:

Table 6 show a significant ($P \leq 0.05$) increase in the counts of erythrocytes and total counts of leukocytic, but no significant differences were detected in each of lymphocytes, heterophil and heterophil/lymphocytes ratio due to adding the oregano to broiler diets. In this respect, heterophils (H) are parts of natural immunity and cellular defense against microbial infections and lymphocytes (L) are cells that produce antibodies. The increases in H/L ratio in challenged chicks may be attributed to increased corticosterone secretion (Vleck and Bucher, 2000), which finally

resulted in decrease of the antibody titers. Stress-induced bursal atrophy has been suggested to be caused by increased corticosteroid production (Khansari et al. 1990). In this respect, Toghyani et al (2010) showed that the red and white blood cell counts, hemoglobin concentration, hematocrit percentage and heterophil to lymphocyte ratio did not differ significantly among treatments. However, hematological parameters are usually related to health status and are of diagnostic importance in clinical evaluation of the state of health. Also, hematological parameters are good indicators of physiological, pathological and nutritional status of an animal and changes in hematological parameters have the potential of being used to elucidate the impact of nutritional factors and additives supplied in diet on any living creature. Leucocytes are known to increase sharply when infection occurs, as they are one of the first lines of defense of the body (Ganong, 1999). Al-Kassie (2009) showed that feeding broiler on diets supplemented with oil extract derived from thyme and cinnamon significantly increased red and white blood cell, hematocrit and hemoglobin values compared with the control group.

Economical efficiency (EEF):

The effect of supplementing oregano with two types (Robadiar or Orego-Stim) on EEF is shown in Table 7. From economic viewpoint, it is clear that all dietary oregano supplemented groups had better EEF values compared to control. The improvement in EFF ranged between 7.43 and 16.71%. However, the T5 treatment recorded the superiority value for net revenue and EEF, as it increased EEF by 16.71% as compared by control group. The increase in EEF which was exhibited by the rest of the experimental treatments valued about 7.43, 10.00 and 15.14 % for T2, T3 and T4 dietary treatments, respectively.

From the present study it can be concluded that superiority of the Orego-Stim® product to the Robadiar® product of performance may be represent the purity of the Orego-Stim® product higher than the Robadiar® product.

IN CONCLUSION,

Orego-Stim as oregano at level of 0.60g/kg diet to broiler chicks was efficient in improving the growth performance traits, carcass characteristic and had beneficial effects on some immunological and physiological responses during growth period.

Table (1): Composition and calculated analysis of experimental diets offered to broiler chicks from 1 to 42 days of age.

Ingredients	**Starter diet (1 to 21 days of age)**	**Growing diet (22 to 42 days of age)**
Yellow corn	53.90	59.26
Soya bean meal (44%)	30.38	25.12
Corn gluten meal (60%)	8.50	8.00
Soya oil	2.85	3.50
Mono calcium phosphate	1.50	1.35
Lime stone	1.65	1.52
L-Lysine	0.32	0.32
DL-Methionine	0.10	0.13
Salt (NaCl)	0.30	0.30
Sodium bicarbonate	0.20	0.20
Broiler Premix*	0.30	0.30
Total %	100	100
Calculated analysis		
Crude Protein %	22	20
ME (Kcal/kg)**	3050	3150
Ether extract, %	6.30	7.15
Calcium, %	0.92	0.84
Phosphorus available %	0.45	0.42
Methionine %	0.51	0.51
Lysine %	1.32	1.19
Methionine + Cystine %	0.98	0.89

*Each 3 kg of vitamin and mineral premix contain: vitamin A 12000000 IU, vitamin D3 5000000 IU, vitamin E 50000 mg, vitamin K3 3000 mg, vitamin B1 2000 mg, vitamin B2 8000 mg, vitamin B6 3000 mg, vitamin B12 15 mg, biotin 120 mg, Choline Chloride 400000 mg; folic acid 2000 mg, pantothenic acid 12000 mg, manganese 100000 mg, zinc 100000 mg, iron 40000 mg, copper10000 mg, iodine 1000 mg, selenium 200 mg and cobalt 100 mg.
**ME= Metabolic Energy

Table (2): Effect of dietary supplementation of oregano on the performance of broiler chicks during the experimental periods.

Item	T1	T2	T3	T4	T5	SE
Live body weight:						
Initial body weight (g)	40.80	40.29	40.50	40.89	40.74	0.235
Body weight (g) at 21 day of age	587 [c]	623 [abc]	594 [bc]	645 [ab]	651 [a]	16.825
Final body weight (g)	1690 [c]	1763 [b]	1790 [ab]	1811 [ab]	1856 [a]	20.281
Body weight gain:						
Body weight gain (g) at 21 day of age	546 [b]	583 [ab]	554 [ab]	604 [ab]	610 [a]	16.982
Body weight gain (g) at 42 day of age	1103 [c]	1140 [bc]	1196 [a]	1166 [ab]	1205 [a]	13.241
Total body weight gain (g)	1649 [c]	1723 [b]	1750 [ab]	1770 [ab]	1815 [a]	20.380
Feed intake (g/bird):						
During starter period (1-21 day)	911	914	906	909	919	5.145
During grower period (22-42 day)	2701	2708	2697	2703	2723	50.817
Total feed intake	3612	3622	3603	3612	3642	48.299
Feed conversion ratio (feed intake, g/weight gain, g):						
During starter period (1-21 day)	1.670 [a]	1.570 [ab]	1.643 [ab]	1.510 [b]	1.507 [b]	0.046
During grower period (22-42 day)	2.453 [a]	2.377 [ab]	2.257 [c]	2.320 [bc]	2.260 [c]	0.035
Total feed conversion ratio	2.190 [a]	2.103 [ab]	2.060 [b]	2.040 [b]	2.010 [b]	0.028

[a, b....] Means within each row have no similar letter(s) are significantly different ($P \leq 0.05$)

T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

Table (3): Effect of dietary supplementation of oregano on carcass characteristics and lymphoid organs (% of body weight) of broiler chicks at 42 day of age.

Item	T1	T2	T3	T4	T5	SE
Carcass characteristics (% of BW)						
Eviscerated carcass	61.57 [b]	62.86 [ab]	63.74 [a]	63.98 [a]	64.05 [a]	0.287
Liver	2.379	2.393	2.394	2.409	2.389	0.133
Empty gizzard	2.521	2.487	2.514	2.522	2.542	0.086
Heart	0.583 [c]	0.613 [b]	0.621 [ab]	0.644 [a]	0.638 [ab]	0.009
Giblets	5.483	5.493	5.529	5.575	5.569	0.191
Edible organs	67.054 [b]	68.352 [ab]	69.268 [a]	69.560 [a]	69.620 [a]	0.467
Abdominal fat	2.901 [a]	2.695 [b]	2.681 [b]	2.664 [b]	2.642 [b]	0.069
Lymphoid organs (% of BW)						
Thymus	0.495 [b]	0.508 [b]	0.533 [ab]	0.538 [ab]	0.555 [a]	0.014
Bursa	0.195 [b]	0.205 [b]	0.206 [b]	0.233 [a]	0.243 [a]	0.0083
Spleen	0.144	0.149	0.150	0.151	0.152	0.0086

[a, b....] Means within each row have no similar letter(s) are significantly different ($P \leq 0.05$)
T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

Table (4): Effect of dietary supplementation of oregano on cecal bacteria count of broiler chicks at 42 day of age.

Item	T1	T2	T3	T4	T5	SE
Total anaerobic bacteria (x 10^6)	9.020 [a]	8.130 [b]	7.730 [bc]	7.230 [cd]	7.080 [d]	0.180
Lactobacilli (x 10^6)	3.710 [c]	4.630 [b]	4.870 [ab]	4.990 [ab]	5.130 [a]	0.135
Escherichia coli (x 10^2)	921.214 [a]	813.159 [b]	788.449 [b]	774.620 [b]	749.970 [b]	31.461

[a, b....] Means within each row have no similar letter(s) are significantly different ($P \leq 0.05$)
T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

Table (5): Effect of dietary supplementation of oregano on blood plasma proteins, glucose, lipids and enzymes concentrations of broiler chicks at 42 day of age.

Item	T1	T2	T3	T4	T5	SE
Plasma proteins:						
Total protein (g/dl)	4.860 [c]	5.270 [bc]	5.350 [b]	5.670 [b]	6.290 [a]	0.152
Albumin (A) (g/dl)	2.780 [ab]	2.850 [ab]	2.670 [b]	2.910 [ab]	3.180 [a]	0.132
Globulin (G) (g/dl)	2.080 [b]	2.420 [ab]	2.680 [ab]	2.760 [ab]	3.110 [a]	0.221
A/G Ratio	1.337	1.178	0.996	1.054	1.023	0.139
Plasma glucose (mg/dl)	187.70 [b]	207.71[ab]	209.99 [ab]	210.51 [ab]	219.99 [a]	8.204
Plasma lipids:						
Total lipids (mg/dl)	397.67 [a]	363.62 [b]	361.47 [b]	350.71 [b]	344.45 [b]	10.914
Total cholesterol (mg/dl)	154.76 [a]	120.85 [b]	117.31 [b]	116.42 [b]	108.67 [b]	5.135
Triglycerides (mg/dl)	97.51 [a]	69.82 [b]	64.68 [bc]	60.58 [bc]	56.43 [c]	3.103
HDL-ch (mg/dl)	77.48	81.11	74.40	80.62	81.00	3.236
LDL-ch (mg/dl)	33.71	35.36	34.54	33.21	35.03	2.510
Enzymes activities:						
AST (IU/L)	52.08	52.42	52.01	52.62	52.00	1.298
ALT (IU/L)	26.50	25.43	26.84	24.78	24.17	1.647

[a, b....] Means within each row have no similar letter(s) are significantly different ($P \leq 0.05$)
T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

Table (6): Effect of dietary supplementation of oregano on hematological picture of broiler chicks at 42 day of age.

Item	T1	T2	T3	T4	T5	SE
Red blood cells (x 10^6/mm^3)	2.690 [b]	3.170 [a]	3.140 [a]	3.270 [a]	3.410 [a]	0.068
White blood cells (x 10^3/mm^3)	27.900 [b]	33.370 [a]	31.830 [a]	33.740 [a]	34.630 [a]	1.219
Lymphocyte (%)	60.160	61.930	62.240	62.250	62.790	1.636
Heterophil (%)	29.380	28.860	29.260	27.130	28.080	1.931
Heterophil/Lymphocyte ratio	0.490	0.466	0.475	0.437	0.450	0.036

[a, b....] Means within each row have no similar letter(s) are significantly different ($P \leq 0.05$)
T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

Table (7): Effect of experimental treatments on the economic efficiency (EEF) of meat production

Items	**Treatment**				
	T1	**T2**	**T3**	**T4**	**T5**
Fixed price/chick (L.E)	3.25	3.25	3.25	3.25	3.25
Average feed consumed g/bird starter	911	914	906	909	919
Average feed consumed g/bird finisher	2701	2708	2697	2703	2723
Price kg feed (L.E) starter	3.11	3.15	3.19	3.15	3.19
Price kg feed (L.E) finisher	2.90	2.94	2.98	2.93	2.98
Price/feed (L.E) starter	2.83	2.88	2.89	2.86	2.93
Price/feed (L.E) finisher	7.83	7.96	8.03	7.92	8.11
Total feed cost/chick (L.E) [1]	10.66	10.84	10.92	10.78	11.04
Total cost/chick (L.E)	13.91	14.09	14.17	14.03	14.29
Average live body weight (kg/bird)	1689.68	1762.92	1790.02	1811.14	1855.59
Price/ kg live body weight/(L.E) [2]	14.00	14.00	14.00	14.00	14.00
Total revenue (L.E)/chick	23.65	24.68	25.06	25.35	25.97
Net revenue (L.E)/chick	9.74	10.59	10.89	11.32	11.68
Economical efficiency (EEF) *	0.700	0.752	0.770	0.806	0.817
Relative economical efficincy[4]	100.00	107.43	110.00	115.14	116.71

T1:Control T2:Robadiar (0.25g/kg) T3:Robadiar (0.50g/kg) T4:Orego-Stim (0.30g/kg) T5**:**Orego-Stim (0.60g/kg).

1-According to the price of different ingredients available in ARE.

2-According to the price at the experimental time (2015).

3-Net revenue per unit total cost.

4-Assuming that the relative EEF of the control group equal 100.

* Economic efficiency=Net revenue/total cost x 100.

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الملخص العربى

تأثير إضافة الأورجانو فى العليقة على الآداء الإنتاجى والفسيولوجى والمناعي لكتاكيت اللحم

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إستخدم فى هذه الدراسة عدد 225 كتكوت لحم من سلالة ستاربرو عمر يوم وقسمت عشوائيا الى خمس مجموعات متساوية العدد (45 كتكوت/ مجموعة) وكل مجموعة تم تقسيمها الى ثلاث مكررات متساوية العدد (15 كتكوت/مكررة) وتم تغذية المجموعات الخمس كالتالى:
1- المجموعة الأولى:- تم تغذيتها على العليقة الأساسية (مقارنة) بدون أى اضافات.
2- المجموعة الثانية :- تم تغذيتها على العليقة الأساسية مضاف اليها الروباديار بمعدل 25و0جم/كجم علف.
3- المجموعة الثالثة:- تم تغذيتها على العليقة الأساسية مضاف اليها الروباديار بمعدل50و0جم/كجم علف.
4- المجموعة الرابعة:- تم تغذيتها على العليقة الأساسية مضاف اليها الأوريجوستيم بمعدل 30و0جم/كجم علف.
5- المجموعة الخامسة:- تم تغذيتها على العليقة الأساسية مضاف اليها الأوريجوستيم بمعدل 60و0جم/كجم علف.
وتتلخص أهم النتائج المتحصل عليها فيما يلى:
-سجلت كتاكيت المجموعة الخامسة زيادة فى وزن الجسم والوزن المكتسب وتحسن فى معامل التحويل الغذائى مقارنة بالمجاميع التجريبية الأخرى أو مجموعة المقارنه
-وجد أن النسبة المئوية لكل من الذبيحة، القلب، الأجزاء المأكولة زادت زيادة معنوية فى المجاميع المغذاه على علائق مضاف اليها الأورجانو (باستثناء المجموعة الثانية) مقارنة بمجموعة المقارنة.
-سجلت كتاكيت المجموعة الخامسة زيادة معنوية فى النسبة المئوية لكل من الغدة الثيموسية والبرسا مقارنة بمجموعة المقارنة، بينما كانت نسبة دهن البطن أقل معنويا بزيادة مستويات إضافة الأورجانو للعليقة.
-إرتفع العدد الكلى للميكروبات النافعة ارتفاعا معنويا بينما انخفض العدد الكلى للميكروبات الضارة انخفاضا معنويا فى الأعورين نتيجة التغذية على كل من الروباديار أو الأوريجوستيم مقارنة بمجموعة المقارنة، وقد سجلت طيور المجموعة الخامسة أعلى القيم بالنسبة للعدد الكلى للميكروبات النافعة وأقل القيم بالنسبة للعدد الكلى للميكروبات الضارة مقارنة بالمجاميع التجريبية الأخرى أو مجموعة المقارنة.
-سجلت كتاكيت المجموعة الخامسة زيادة معنوية فى تركيز كلا من البروتينات الكلية، الجلوبيولين والجلوكوز فى بلازما الدم وكذلك العدد الكلى لكل من كرات الدم الحمراء والبيضاء مقارنة بمجموعة المقارنة.
-كما أدت التغذية على علائق مضاف اليها الأورجانو الى إنخفاض معنوى فى تركيز الدهون الكلية، الكوليسترول الكلى وكذلك الجلسريدات الثلاثية فى بلازما الدم وذلك مقارنة بمجموعة المقارنة ، بينما لم تتأثر انزيمات الكبد ونسبة الألبيومين الى الجلوبيولين بهذه الاضافات.
-سجلت المجموعة الخامسة أعلى كفاءة اقتصادية (71و16%) مقارنة بمجموعة المقارنة.
يتضح من هذه النتائج أن اضافة الأوريجوستيم بمعدل 60و0جم/كجم علف كأحد مصادر الأورجانو إلى عليقة كتاكيت اللحم (من عمر يوم حتى عمر 42 يوم) أدى الى تحسين الأداء الانتاجى وصفات الذبيحة وأظهر تأثيرا ايجابيا على بعض الاستجابات المناعية وبعض الصفات الفسيولوجية فى كتاكيت اللحم.