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Performance and Carcass Characteristics of Broiler Chicks Fed Diets Supplemented with Some Medicinal and Aromatic Plants

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Abstract: *This study was conducted to investigate the effects of using Eucalyptus , Pamegranate , Tilia and Thyme as natural biological feed additives on growth performance, carcass traits, blood constituents and economical efficiency of broiler chicks. Two hundred and seventy unsexed Arbor-Acres broiler chicks at one week of age were divided into nine treatments (30 bird each); each treatment contained 3 replicates of 10 birds each. The experimental treatments were:*

Treatment 1 the control diet (free from medicinal and aromatic plants).
Treatments 2 and 3 the control diet + 0.1 and 0.2% Eucalyptus(E).
Treatments 4 and 5 the control diet + 0.1 and0.2 % Pamegranate(P).
Treatments 6 and 7 the control diet + 0.1 and 0.2% Tilia(T).
Treatments 8 and 9 the control diet + 0.1 and 0.2% Thyme(Th).

Chicks fed the diet supplemented with E at the level of 0.1% had the highest values of LBW at 28 and 42 days of age. In general, adding medicinal aromatic plants (MAP) to the control diets improved live body weight gain (LBWG). Chicks fed the diet supplemented with E at the level of 0.1% had the highest values of LBWG at starteing and total period. Chicks fed the diets supplemented with Th at the level of 0.2% and 0.1% had the lowest feed intake (FI) during the periods from 7 to 28 and 7 to 42 days of age. Feeding MAP had no significant effects on feed conversion (FC), carcass characteristics or plasma constituents. Feeding MAP significantly affected moisture ($P\leq0.05$) and ash ($P\leq0.01$)% of broiler meat. However, insignificant differences were observed in protein, fat and NFE% of meat. Carcass part significantly influenced ($P\leq0.01$) protein, fat and ash % of broiler meat. Chicks fed diet supplement with E at the level of 0.1% had higher growth rate (GR) at the two periods. Obtained results indicated that mortality % decreased in chicks fed starter and finsher diets supplemented with MAP additives. Economical efficiency: EEF values at 6 weeks of age improved in chicks fed the diets supplemented with MAP additives (except T 0.1 % and Th 0.1 %) as compared with unsupplemented one. It *was concluded that 0.1% E can be used as a natural feed additive in broiler diets to obtain best performance and highest income per chicken.*

INTRODUCTION

The history of herbs is as long as the story of mankind, for people have used these plants since earliest times. Wars have been fought and lands conquered for the sake of plants, and even today we continue to depend on exotic species for many of our newest medicines and chemicals **(Richmond and Mackley, 2000)**. Recently, many countries tended to minimize or prohibit the chemical components for their deleterious side effects on both animals and human. So, it is important to use natural promoters.

Huang et al.(1992) concluded that the Chinese medicinal herbs have a stimulating effect on growth of broilers. In addition, some plants were found to have natural effects, e.g., tonics, antiparasitic, anti-bacterial, stimulant, carminative, anti-fungial, anti-microbial and antiseptic **(Boulos,1983a, El-Emary,1993 and Soliman *et al*., 1995)**, in addition, *Acacia nilotica* has been used in controlling diseases caused by *Clostridium perfringens* (**Schragle and Muller, 1990**)**.**

In this respect, vegetable, herbs, spices and edible plants were suggested an non-traditional feed additive or growth promoters in broiler diets to improve the growth feed conversion efficiency and reduce the cost of feed (**Boulos, 1983b ; Ali *et al.*, 1992 ; Gill, 1999 ; Dickens *et al.*, 2000** ; **Abaza, 2001 ;Al-Harthi, 2002 and Hassan, *et al.*, 2004**). Also, **Sabra and Mehta, (1990)** applied herbal plants as growth promoters in broiler diets and observed a pronounced improvement in their body weight gain, mortality rate and feed conversion. **Vogt and Rauch (1991)** fed broiler diets with extracted oils from thyme, mace and caraway or coriander, garlic and onion at 0, 20, 40 and 80 mg/Kg diet, and found that daily gain, FC, flavor and smell of meat were not affected by the extracted oils. **Abd El- Latif *et al.*, (2002)** indicated that adding thyme, black cumin, dianthus or fennel in Japanese quail diet improved body weight, body weight gain and feed conversion.

Therefore, MAP are preferable as feed additives and growth promoters. It was necessary to throw some more light on these plants concerning their effects on broiler performance. So, the objective of the present study was to investigate the impacts of different types and levels of MAP i.e., Eucalyptus (*Eucalyptus globulus*); Pamegranate (*punica granatum*); Tilia (*Tilia ulmtfolia*) and Thyme (*Thymus vulgaris*) as natural biological feed additives in starter and finisher diets of broiler chicks.

MATERIALS AND METHODS

This work was carried out at El Takamoly Poultry Project, Fayoum, Egypt, to study the effect of four MAP, Eucalyptus (*Eucalyptus globulus*); Pamegranate (*Punica granatum*); Tilia (*Tilia ulmtfolia*) and Thyme (*Thymus vulgaris*) as natural biological feed additives in starter and finisher diets of broiler chicks. Chemical analyses were performed in the laboratories of the Poultry Production Department, Faculty of Agriculture, Fayoum, Cairo University, according to the procedures outlined by **AOAC (1990).**

Two hundred and seventy unsexed Arbor-Acres broiler chicks at one week of age were divided into nine treatments (30 bird each), each treatment contained 3 replicates of 10 birds. **The experimental treatments were as follows:**

Treatment 1 chicks were fed the control diet (free from MAP).
Treatment 2 chicks were fed the control diet + 0.1 % Eucalyptus(E)
Treatment 3 chicks were fed the control diet + 0.2 % Eucalyptus(E)
Treatment 4 chicks were fed the control diet + 0.1 % Pamegranate(P)
Treatment 5 chicks were fed the control diet + 0.2 % Pamegranate(P)
Treatment 6 chicks were fed the control diet + 0.1 % Tilia(T)
Treatment 7 chicks were fed the control diet + 0.2 % Tilia(T)
Treatment 8 chicks were fed the control diet + 0.1 % Thyme(Th)
Treatment 9 chicks were fed the control diet + 0.2 % Thyme(Th)

The experimental diets were supplemented with a minerals and vitamins mixture along with L-lysine and DL-methionine to cover the recommended requirements according to **NRC, (1994)** and were formulated to be isonitrogenous and iso-caloric (Table 1). Then, chicks were individually weighed, wing-banded and randomly allotted to dietary treatments. Chicks were raised in electrically heated batteries with raised wire mesh floors and had free access to feed and water. Batteries were placed into a room provided with continuous light and fans for ventilation. The birds were reared under similar managerial conditions, and were given the experimental diets from the end of the first week until 28 days (starter diets) and from 29 to 42 days of age (finisher diets).

Birds were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed consumption was recorded and feed conversion (g feed / g gain) and body weight gain were calculated. Crude protein conversion (CPC) and caloric efficiency ratio (CER) were also calculated **(Ragab, 2001)**.Growth rate (GR), was calculated using the following formula according to the equation of **Larner and Asundson (1932):**

$$GR = ((LBW_2 - LBW_1) / 0.5 (LBW_2 + LBW_1)) \times 100$$

Where: LBW_1 and LBW_2 are body weights at early and late ages studied.

Cumulative mortality % were calculated during the starting and finishing periods. At the end of the experiment (42 days), a slaughter test was performed using four chicks (2 males and 2 females) around the average LBW of each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the carotid artery and jugular veins (islamic method). After four minutes of bleeding, each bird was dipped in a water bath for two minutes and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass traits, dressing% (eviscerated carcass without head, neck and legs) and total giblets % (gizzard, liver, spleen and heart). The eviscerated weight included the front part with wing and hind part. The abdominal fat was removed from the parts around the viscera and gizzard, and was weighed to the nearest gram. The bone of front and rear were separated and weighed to calculate meat percentage. The meat from each part was weighed and blended using a kitchen blender. Chemical analyses of representative samples of the experimental diets and carcass meat (including the skin) were carried out to determine percentages of

DM, CP (N x 6.25), EE, CF and ash contents according to the methods of **A.O.A.C (1990).** Nitrogen free extract (NFE) was calculated by difference.

Individual blood samples were collected during exsanguinations, immediately centrifuged at 3500 rpm for 15 min. Serum were harvest after centrifugation of the clotted blood, stored at–20Ċ in the deep freezer until the time of chemical determinations. The biochemical characteristics of blood were determined colorimetrically, using commercial Kits as previously described **(Ragab, 2001)**.

To determine the economical efficiency for meat production, the amount of feed consumed during the entire experimental period was obtained and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time. Analysis of variance was conducted according to **Steel and Torrie (1980).** Significant differences among treatment means were determined using Duncan's multiple range test **(Duncan, 1955).**

RESULTS AND DISCUSSION

Productive performance:

Live body weight (LBW):

Data presented in Table 2 showed that MAP significantly affected LBW ($P \leq 0.05$ or $P \leq 0.01$) at 14, 28 and 42 days of age. Chicks fed the diet supplemented with E at the level of 0.1% had the highest values of LBW at 28 and 42days of age (828.17 and 1580.7 g, respectively), and at the level of 0.2% E at 14 days of age (233.32g). However, insignificant effects were observed in LBW at other periods (7, 21 and 36 days of age).

Live body weight gain (LBWG) :

Data presented in Table 2 showed that MAP significantly affected LBWG ($P \leq 0.05$ or $P \leq 0.01$) during all periods studied. Chicks fed the diet supplemented with E at the level of 0.1% had the heaviest LBWG during the periods from 7 to 28 and 7 to 42 days of age (731.85 and 1484.3 g respectively), while chicks fed the diets supplemented with P at the level of 0.1% had heavier LBWG during the period from 29 to 42 days of age

(766.87g), followed by those fed the diets supplemented with E at the level of 0.2% as compared with the control and the other supplements at the some periods. This is in accordance with the previous data on LBW. In general, adding MAP to the control diet improved body weight gain. The improvement in body gain may be due to the presence of fat soluble unidentified factors and essential fatty acids including linoleic, linolenic and arachidonic acids in MAP for growth **(Murray *et al.*, 1991).** These results agree with the finding of **Abd El- Latif *et al.*, (2002)** who observed that adding Th to the conrol diet at a level of 0.1% improved (P≤0.05) body weight and weight gain. Also, **Saad (1994) ; El-Gammal 1994 and Dorman *et al.*, *(*2000)** reported that Th leaves had a consideration as a stomachtic, digestive stomic stimulant anti-oxidant ant anti-septic. They also showed that the MAP possess the useful or beneficial microbial activities in the digestive system. Moreover, Th promotes the obsorption of fat which leads to more gain when compared with the control group **(El- Shenawi,1992).**

Feed intake (FI):

Data presented in Table 2 showed that MAP significantly affected FI (P≤0.01) during all periods studied. Chicks fed the diets supplemented with Th at the level of 0.1% had the lowest FI during the periods from 7 to 28, 29 to 42 and 7 to 42 days of age (1159.5, 782.69 and 2758.9g, respectively).

Feed conversion, crude protein conversion and caloric efficiency ratio (FC, CPC and CER):

Results presented in Table 2 indicated that MAP insignificantly affected FC, CPC and CER during all periods studied. These results are in agreement with those reported by **Abdel-Malak *et al.*, (1995)** who reported that increasing Bio-Tonic level up to 1000 g/ton, as a supplementation in broiler chicken diets improved body weight, however, FC was not significantly affected. On the other hand, these results disagree with those reported by **Abd El- Latif *et al.*, (2002)** who found that the birds fed dietary Th diet resulted in the worst (P≤0.01) FC efficiency compared with other dietary herbal feed additives. Also, **Hassan *et al.* (2004)** reported an improvement in FC by the addition of herbal feed additives in the diets.

Growth rate (GR): -

Data presented in Table 3 showed that MAP significantly affected GR during the starting and total periods. Chicks fed the diet supplement with E at the level of 0.1% had higher GR values at the two periods (being 15.8 and 17.7, respectively) as compared with the control or the other groups. This supports the previous finding that chicks fed the diet supplement with E at the level of 0.1 % had the highest values of LBW and LBWG (Table 2). However, insignificant effects were observed in GR during the finishing period.

Mortality percentage:

Cumulative mortality % were calculated during the starting and finishing periods are presented in Table 3. Obtained results indicated that the percentage of mortality was zero % in chicks fed the starter diets supplemented with herbal feed additives as compared to those fed the unsupplemented diet (control). During the finishing period, it is worth noting that mortality % of chicks fed on the diet supplemented with 0.1 or 0.2% P was zero %. However chicks fed the diet supplemented with 0.1% Th the mortality rate was the highest being 6.667%. The improvement in mortality rate by feeding diets supplemented with P may not be due only to the increased level of active material in diets which has a protective action against diseases **(Mahfouz and El-Dakhakhny,1960),** but also to the reduction of mold growth which inhibit the formation of aflatoxins **(Rao *el al.*, 1985 and Ghazalah and Ibrahim, 1996)**. Recently, **Hassan, *et al.* (2004)** reported that mortality rate decreased in chicks fed diets supplemented with herbal preparations as compared with those fed unsupplemented one.

Carcass characteristics :

Results presented in Table 4 revealed no significant difference among dietary treatments in the carcass traits. It was clearly noted that chicks fed the diets supplenented with Th at levels of 0.2 and 0.1 gave the best values for dressing and total giblets percentages (73.01 and 5.41 %, respectively). These results agree with the finding of **Abd El- Latif *et al.*, (2002)** who stated that the highest values of dressing and edible giblets were noticed in Japanese quail fed dietary Th compared with the control. Also, **Abd El- Malak (1995)** reported that birds fed 1000g/ton Bio-Tonic, as a feed supplement, gave the greatest values of carcass and giblets compared with other dietary treatments. The enhancement in these parameters give proof to the metabolic role of essential and volatile oils included in Th and Fennel (**Evans and Pharm, 1975).** Also, it may be attributed to the incorporation of poly- unsaturated fatty acids into tissues. Recently, **Hassan *et al.* (2004)** reported a significant ($P \leq 0.05$) increase in dressing and liver percentages for broiler chicks fed the supplemented herbal feed additives as compared to those fed the control.

Plasma constituents: -

Data of plasma constituents analyses are summarized in Table 4. The results indicated insignificant effects of MAP on plasma constituents. Supplemental herbs caused an insignificant decrease in cholesterol, albumin and albumin/globulin ratio, with an insignificant increase in globulin. The same trend was obtained with Th by **Ibrahim *et al.* (2000)** in growing rabbits.

Chemical composition of broiler meat: (on dry matter basis)

Data presented in Table 5 showed that the MAP significantly affected moisture % ($P \leq 0.05$) and ash % ($P \leq 0.01$) of broiler meat. The highest moisture and ash % values were observed for the group fed Th at a level of 0.2% supplement, while the lowest moisture and ash % values were observed for the group fed E at levels of 0.2 and 0.1 %, respectively. However, insignificant differences were observed in protein, fat and NFE% of meat. Carcass part significantly influenced ($P \leq 0.01$) protein, fat and ash %. Front part had higher protein and ash % than rear part (60.35 and 2.73 vs 49.89 and 2.27%), rear part had higher fat % than front part (41.57 vs 31.35%). However, moisture and NFE% of meat were insignificantly affected by carcass part.

Economical efficiency (EEF) :-

Results in Table 6 showed that EEF value at 6 weeks of age was improved in chicks fed the diets supplemented with MAP (except T and Th at the 0.1 %) as compared with the unsupplemented one. Supplement 0.1%E gave the best economical and relative efficiency being 2.3812 and 110.336 %, respectively then 0.2% E (2.3595 and 109.327%, respectively) when compared with the other treatments or the control. Whereas, the birds fed 0.1% T had the worst values, being 1.9317 and 89.504%, respectively. The relative efficiency varied between – 10.496 to + 10.336 % which is of minor importance considering the other factors of production. It can be concluded that 0.1% E can be used as a natural feed additive in broiler diets to get best performance and highest income per chicken. These results agree with those of **Abd El-Latif, *et al.* (2002)** who reported that the inclusion of herbal feed additives in Japanese quail diet resulted in the least feed cost/Kg gain and the highest percentage of economical efficiency compared with the control diet. Also, **Hassan, *et al.* (2004)** reported that EEF value at 7 weeks of age was improved in chicks fed diets supplemented with the herbal feed additives as compared with the unsupplemented one.

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الأداء وصفات الذبيحة لبداري التسمين المغذاة علي علائق مضاف إليها بعض النباتات الطبية والعطرية

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أجريت هذه الدراسة لبحث تأثير استخدام الكافور وقشر الرمان والتليو والزعتر كإضافات غذائية بيولوجية علي معدل النمو وصفات الذبيحة ومكونات الدم والكفاءة الاقتصادية لبداري التسمين. استخدم عدد ٢٧٠ كتكوت أربور أيكرز غير مجنس عمر أسبوع ، قسمت الكتاكيت إلي تسع معاملات (٣٠ طائر/معاملة) ، كل معاملة اشتملت علي ٣ مكررات (١٠ طيور/مكرر). والمعاملات التجريبية كما يلي:-

معاملة ١ مجموعة المقارنة (خالية من أي نباتات طبية أو عطرية)

معاملة٢ و٣ عليقة المقارنة بالإضافة إلي ٠,١ و ٠,٢ % أوراق الكافور.

معاملة٤ و٥ عليقة المقارنة بالإضافة إلي ٠,١ و ٠,٢ % قشر الرمان.

معاملة٦ و٧ عليقة المقارنة بالإضافة إلي ٠,١ و ٠,٢ % تليو.

معاملة٨ و٩ عليقة المقارنة بالإضافة إلي ٠,١ و ٠,٢ % زعتر.

والنتائج المتحصل عليها يمكن تلخيصها في الأتي:

كان أعلي وزن للدجاج المغذي علي العليقة المحتوية علي أوراق الكافور بنسبة ٠,١ % علي عمر ٢٨ و ٤٢ يوم من العمر وعلي مستوي ٠,٢ % علي عمر ١٤ يوم. عموما أدت إضافة النباتات الطبية والعطرية إلي عليقة الكنترول لتحسين وزن الجسم الحي. وكان أعلي زيادة في وزن الجسم الحي للدجاج المغذي علي العليقة المحتوية علي أوراق الكافور بنسبة ٠,١ % خلال فترة النامي والفترة الكلية. كانت الكتاكيت المغذاة علي العلائق المحتوية علي الزعتر بنسبة ٠,٢ و ٠,١ و٠,١ أقل في استهلاك الغذاء خلال الفترات من ٧-٢٨ و٢٧-٤٢ و٧-٤٢ يوم من العمر. لم يكن لتغذية النباتات الطبية والعطرية أي تأثير معنوي علي كلا من معدل تحويل الغذاء و كفاءة تحويل البروتين والطاقة وصفات الذبيحة وقياسات البلازما. تأثر التركيب الكيمائي للحم الدجاج معنوياً بالنسبة للرطوبة والرماد. بينما لم يتأثر كلا من البروتين والدهن والكربوهيدرات الذائبة % . أثر إضافة النباتات الطبية والعطرية علي كلا من بروتين ودهن ورماد أجزاء الذبيحة. كان أعلي معدل نمو للدجاج المغذي علي العليقة المحتوية علي أوراق الكافور بنسبة ٠,١ % خلال فترة النامي والفترة الكلية. انخفضت نسبة النفوق للكتاكيت المغذاة علي علائق البادي والناهي المضاف إليها النباتات الطبية والعطرية. تحسنت قيمة الكفاءة الاقتصادية علي عمر ٦ أسبوع للطيور المغذاة علي العلائق المحتوية علي النباتات الطبية والعطرية (ما عدا التليو والزعتر علي مستوي ٠,١ %) بالمقارنة بمجموعة الكنترول. ومن هنا يمكن إضافة ٠,١ % أوراق الكافور كإضافة غذائية لعلائق بداري التسمين للحصول علي أعلي أداء إنتاجي وأعلي كفاءة اقتصادية .

Table 1: Composition and analyses of the experimental diets.

Item, %	Starter diet	Finisher diet
Yellow corn, ground	56.0	64.80
Soybean meal (44 %CP)	29.0	23.65
Corn gluten meal (60%CP)	8.20	5.80
Vegetable oil	3.40	2.40
Di – calcium phosphate	1.80	1.30
Calcium carbonate	0.90	1.30
Sodium chloride	0.30	0.30
Vit. and Min. premix *	0.30	0.30
DL – Methionine	0.10	0.05
L-Lysine	0.00	0.10
Total	100	100
Calculated analysis (%) :**		
CP	22.51	19.53
EE	2.620	2.840
CF	2.470	2.420
Ca	0.869	0.906
Available P	0.444	0.346
Methionine	0.515	0.411
Methionine +Cystine	0.944	0.781
Lysine	1.088	1.010
ME, K cal/Kg	3109	3150

*Each 3.0 Kg of the Vit. and Min. premix contains : Vit. A, 12000000 IU ; Vit. D_3 2500000 IU ; Vit. E, 10 g ; Vit. K, 2.5 g ; Vit. B1, 1.5 g ; Vit. B2, 5 g ; Vit. B6, 1.5 g; Vit. B12,10 mg ; Choline chloride, 1050 g ; Biotin, 50 mg ; Folic acid, 1 g ; Nicotinic acid , 30 g ; Ca pantothenate, 10 g ; Zn, 55 g ; Cu,10 g ; Fe, 35 g ; Co, 250 mg ; Se, 150 mg ; I, 1 g ; Mn, 60 g and anti-oxidant, 10 g.

** According to NRC, 1994.

Table (2): Growth performance (Mean ± SE) of broiler chicks as affected by dietary Eucalyptus, Pamegranate, Tilia and Thyme supplementation.

Item	Treatments								
	Control	Eucalyptus (E)		Pamegranate (P)		Tilia (T)		Thyme (Th)	
		0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%
Live Body Weight (g) :									
At 7 days	96.85 ±2.21	96.32 ±2.25	96.67 ±2.17	96.71 ±2.18	97.90 ±2.36	95.60 ±2.18	97.10 ±2.17	95.32 ±2.17	97.49 ±2.18
At 14 days	215.89 ±6.9^{abcd}	226.34±6.99^{ab}	233.32±6.76^{a}	225.95±6.81^{abc}	210.69±7.36^{abcd}	202.79±6.81^{d}	206.61±6.76^{cd}	204.02 ±6.76^{cd}	213.41 ±6.81^{bcd}
At 21 days	425.71 ±14.19	464.86±14.43	445.66±13.94	410.55±14.03	407.78±15.17	423.30±14.03	449.00±13.94	412.76 ±13.94	437.69 ±14.03
At 28 days	744.45 ±22.69^{BC}	828.17±22.5^{A}	797.22±21.69^{AB}	738.62±21.84^{BC}	757.64±23.62^{BC}	732.18±21.84^{BC}	770.66±21.69^{BC}	713.25 ±21.69^{C}	731.53 ±21.84^{C}
At 36 days	1131.81±30.9	1247.46±30.6	1189.8±29.56	1169.7±29.76	1171.2±32.18	1134.8±29.76	1203.2±29.56	1118.6±29.56	1152.4 ±29.76
At 42 days	1452.4 ±35.5^{bc}	1580.7±35.2^{a}	1550.5±34.5 ^{ab}	1505.5±34.2 ^{abc}	1493.9±36.9 ^{bc}	1411.3±34.9 ^{c}	1521.0 ±33.9 ^{abc}	1439.7±35.2 ^{bc}	1480.4 ±34.9 ^{bc}
Live Body Weight gain (g) :									
From (7 to 28)	636.98 ±21.2^{BC}	731.85±21.5^{A}	700.46±21.11^{AB}	641.91±20.93^{BC}	662.75±22.63^{BC}	636.58 ±20.9^{BC}	673.56±20.8^{BC}	617.93 ±20.8 ^{C}	634.04 ±20.9 ^{C}
From (29 to 42)	707.98 ±21.2 ^{ab}	752.49±21.0 ^{a}	753.46±20.6 ^{a}	766.87±20.4 ^{a}	736.33±22.1 ^{ab}	672.41 ±20.4 ^{b}	750.38±20.3 ^{a}	709.55 ±20.3 ^{ab}	751.05 ±20.9 ^{ab}
From (7 to 42)	1354.88±34.5^{BC}	1484.3±34.1^{A}	1453.91±33.4^{AB}	1408.8±33.2^{ABC}	1399.08±35.9^{BC}	1315.59±33.9^{C}	1423.9±32.9^{ABC}	1344.39±34.1^{BC}	1382.87±33.9^{BC}
Feed intake (g) :									
During 7-28 days	1188.0±5.9 ^{D}	1347.6±5.9 ^{A}	1246.3±5.8 ^{B}	1254.4±5.8 ^{B}	1193.0±6.3 ^{D}	1179.9±5.8 ^{D}	1209.4±5.8 ^{C}	1159.5±5.8 ^{E}	1158.0±5.8 ^{E}
During 29-42 days	858.14±9.48^{ABC}	871.21±9.6^{AB}	843.17±9.46^{BC}	864.48±9.38^{AB}	835.49±10.1^{CD}	813.35±9.38^{DE}	797.12±9.31^{EF}	782.69±9.31 ^{F}	872.44±9.38 ^{A}
During 7-42 days	2867.6±11.5^{E}	3130.5±11.7^{A}	2954.9±11.5 ^{C}	3050.4±11.4 ^{B}	2856.1±12.3 ^{E}	2844.5±11.4 ^{E}	2922.0±11.3 ^{D}	2758.9±11.3 ^{F}	2863.4±11.4 ^{E}
Feed conversion :									
During 7-28 days	1.943±0.078	1.916±0.079	1.818±0.079	2.082±0.077	1.832±0.083	1.949±0.077	1.838±0.077	1.990±0.077	1.878±0.077
During 29-42 days	1.242±0.042	1.185±0.041	1.157±0.040	1.164±0.040	1.163±0.043	1.238±0.040	1.086±0.40	1.150±0.040	1.206±0.041
During 7-42 days	2.161±0.059	2.154±0.059	2.070±0.058	2.236±0.057	2.071±0.062	2.200±0.058	2.083±0.057	2.151±0.059	2.102±0.058
Crude protein conversion :									
During 7-28 days	1.070±0.051	1.114±0.052	1.015±0.51	1.188±0.050	1.049±0.055	1.043±0.050	0.988±0.050	1.112±0.050	0.963±0.050
During 29-42 days	0.971±0.043	0.969±0.042	0.926±0.042	0.963±0.041	0.925±0.045	1.047±0.041	0.940±0.041	0.881±0.041	0.946±0.041
During 7-42 days	0.412±0.014	0.417±0.014	0.388±0.014	0.430±0.014	0.395±0.015	0.418±0.014	0.386±0.013	0.405±0.014	0.382±0.014
Caloric efficiency ratio :									
During 7-28 days	15.071±0.716	15.628±0.728	14.251±0.714	16.671±0.708	14.727±0.766	14.644±0.708	13.873±0.703	15.604±0.703	13.519±0.708
During 29-42 days	16.657±0.736	16.631±0.728	15.887±0.714	16.528±0.708	15.875±0.766	17.969±0.708	16.133±0.703	15.124±0.703	16.225±0.708
During 7-42 days	6.386 ±0.216	6.452 ±0.213	6.028 ±0.209	6.640 ±0.208	6.120 ±0.224	6.523 ±0.208	6.001 ±0.206	6.256 ±0.213	5.949 ±0.208

a, …d, and A,… F, values in the same row within the same item followed by different superscripts are significantly different (at $P \le 0.05$ for a to d ; $P \le 0.01$ for A to F).

Table (4) : Carcass characteristics and serum constituents (Mean ± SE) of broiler chicks as affected by dietary Eucalyptus, Pamegranate, Tilia and Thyme supplementation.

Item	Treatments								
	Control	Eucalyptus (E)		Pamegranate (P)		Tilia (T)		Thyme (Th)	
		0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%
Carcass traits									
Dressing %	70.75±1.63	70.58±1.63	70.70±1.63	70.23±1.63	71.68±1.63	70.94±1.63	72.46±1.63	71.92±1.63	73.01±1.63
Liver %	2.12±0.15	2.23±0.15	2.32±0.15	2.24±0.15	2.18±0.15	2.34±0.15	2.232±0.15	2.34±0.15	1.89±0.15
Gizzard %	2.43±0.17	2.28±0.17	2.11±0.17	2.37±0.17	2.20±0.17	1.96±0.17	1.94±0.17	2.29±0.17	2.42±0.17
Spleen %	0.14±0.02	0.13±0.02	0.15±0.02	0.19±0.02	0.16±0.02	0.17±0.02	0.13±0.02	0.16±0.02	0.12±0.02
Heart %	0.59±0.06	0.55±0.06	0.55±0.06	0.56±0.06	0.56±0.06	0.55±0.06	0.60±0.06	0.62±0.06	0.55±0.06
Total giblets %	5.27±0.24	5.18±0.24	5.13±0.24	5.37±0.24	5.10±0.24	5.01±0.24	4.99±0.24	5.41±0.24	4.98±0.24
Abdominal fat%	1.70±0.30	1.74±0.30	1.33±0.30	2.08±0.30	1.28±0.30	1.36±0.30	1.39±0.30	1.63±0.30	1.51±0.30
Whole front %	15.97±0.76	17.30±0.76	17.40±0.76	18.45±0.93	17.32±0.93	17.18±0.76	18.06±0.93	16.37±0.76	17.01±0.76
Whole rear %	14.15±0.45	14.62±0.45	14.39±0.45	15.47±0.55	15.20±0.55	14.48±0.45	16.13±0.55	14.85±0.45	15.63±0.45
Front Meat %	75.35±1.79	76.71±1.79	76.46±1.79	76.65±2.19	72.15±2.19	74.16±1.79	78.45±3.10	73.61±1.79	77.56±1.79
Rear Meat %	75.90±1.25	76.33±1.25	75.34±1.25	76.10±1.53	70.46±1.53	74.38±1.25	76.66±2.16	75.47±1.25	74.66±1.25
Serum constituents									
Calcium mg/dl	9.80±1.99	10.03±2.44	5.82±2.44	9.23±2.44	7.79±2.44	12.68±2.44	10.35±2.44	8.23±2.44	13.8±2.44
Phosphorus mg/dl	90.91±15.24	98.18±15.24	78.18±15.24	100.0±15.24	121.82±15.24	160.00±15.24	110.41±15.24	101.82±15.24	138.18±15.24
Triglycerides mg/dl	89.02±16.94	62.60±13.83	59.15±16.94	99.39±16.94	90.24±16.94	105.49±16.94	136.58±16.94	69.51±16.94	70.73±16.94
Cholesterol g/l	163.50±62.6	94.00±51.13	111.0±51.13	106.33±51.13	138.67±51.13	146.00±51.13	159.00±51.13	117.0±51.13	150.33±51.13
GOT mmol/L	28.75±1.12	28.05±1.12	28.25±1.12	28.95±1.12	30.20±1.12	32.70±1.12	29.10±1.12	29.95±1.12	28.0±1.12
GPT mmol/L	47.75±2.59	50.40±2.59	40.70±2.59	45.00±2.59	47.20±2.59	44.60±2.59	43.60±2.59	43.80±2.59	40.80±2.59
Total protein g/dl	2.25±0.36	2.27±0.36	1.56±0.36	2.48±0.36	2.90±0.36	2.39±0.36	3.47±0.36	2.22±0.36	2.22±0.36
Albumin g/dl	1.73±0.29	1.13±0.29	0.83±0.29	1.03±0.29	1.34±0.29	1.48±0.29	1.50±0.29	1.09±0.29	1.19±0.29
Globulin g/dl	0.512±0.37	1.142±0.37	0.724±0.37	1.452±0.37	1.560±0.37	0.917±0.37	1.973±0.37	1.127±0.37	1.087±0.37
Albumin/Globulin ratio	6.099±1.72	0.993±1.72	2.061±1.72	0.712±1.72	0.896±1.72	2.901±1.72	0.799±1.72	1.137±1.72	1.406±1.72
Glucose mg/dl	60.07±37.31	57.19±37.31	53.96±37.31	62.59±37.31	55.40±37.31	53.24±37.31	138.49±37.31	65.83±37.31	60.07±37.31

Table (5): Chemical analysis of carcass meat % (Mean ± SE) of broiler chicks (on dry matter basis) as affected by dietary Eucalyptus, Pamegranate, Tilia and Thyme supplementation.

Item	Moisture	Protein	Fat	Ash	NFE
Control	3.88±0.57[ab]	53.83±1.79	38.27±1.73	2.38±1.95[AB]	1.63±0.18
Eucalyptus 0.1 %	4.82±0.57[ab]	54.53±1.79	37.20±1.73	1.69±1.95[C]	1.76±0.18
Eucalyptus 0.2 %	3.42±0.57[b]	54.55±1.79	37.83±1.73	2.85±1.95[A]	1.35±0.18
Pamegranate 0.1 %	4.73±0.57[ab]	55.12±1.79	36.22±1.73	2.11±1.95[BC]	1.82±0.18
Pamegranate 0.2 %	3.53±0.57[b]	55.73±1.79	36.57±1.73	2.77±1.95[A]	1.40±0.18
Tilia 0.1 %	4.56±0.57[ab]	56.37±1.79	35.02±1.73	2.53±1.95[AB]	1.50±0.18
Tilia 0.2 %	4.23±0.57[ab]	56.52±1.79	34.62±1.73	2.80±1.95[A]	1.80±0.18
Thyme 0.1 %	4.65±0.57[ab]	54.58±1.79	36.92±1.73	2.48±1.95[AB]	1.37±0.18
Thyme 0.2 %	5.15±0.57[a]	54.85±1.79	35.65±1.73	2.87±0.22[A]	2.03±0.18
Carcass Part :					
Front Part	4.09±0.27	60.35±0.84[A]	31.35±0.82[B]	2.73±0.09[A]	1.57±0.08
Rear Part	4.58±0.27	49.89±0.84[B]	41.57±0.82[A]	2.27±0.09[B]	1.69±0.08

a, b, A, B and C, values in the same column within the same item followed by different superscripts are significantly different at ($P \leq 0.05$ for a, and b ; $P \leq 0.01$ for A, B and C)

Table (3):Growth rate and mortality % of broiler chicks as affected by dietary Eucalyptus , Pamegranate, Tilia and Thyme supplementation.

Treat / Item	Control	Eucalyptus(E)		Pamegranate(P)		Tilia (T)		Thyme (Th)	
		0.1 %	0.2 %	0.1 %	0.2 %	0.1 %	0.2 %	0.1 %	0.2 %
Growth rate									
From (7 to 28 days of age)	1.53±0.01[1] BC	1.58±0.01 A	1.56±0.01 AB	1.53±0.01BC	1.55±0.01BC	1.53±0.01BC	1.55±0.01BC	1.52±0.01 C	1.52±0.01C
From (27 to 42 days of age)	0.25±0.01	0.24±0.01	0.25±0.01	0.26±0.01	0.24±0.01	0.23±0.01	0.23±0.01	0.23±0.01	0.26±0.01
Total (7 to 42 days of age)	1.75±0.01b	1.77±0.01a	1.76±0.01ab	1.76±0.01ab	1.76±0.01ab	1.74±0.01b	1.76±0.01ab	1.75±0.01b	1.75±0.01b
Mortality %									
Starter (7 to 28 days of age)	3.333	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Finisher (27 to 42 days of age)	0.000	0.000	3.333	0.000	0.000	3.333	0.000	6.667	3.333
Total (7 to 42 days of age)	3.333	0.000	3.333	0.000	0.000	3.333	0.000	6.667	3.333

[1] Mean ± standard error of the mean.

a, and b, values in the same row followed by different superscripts are significantly different (at $P \leq 0.05$ for a and b and $P \leq 0.01$for A,B, and C.

Table (6) : Economical efficiency of broiler chicks as affected by dietary Eucalyptus , Pamegranate, Tilia and Thyme supplementation.

Treat / Item	Control	Eucalyptus (E)		Pamegranate (P)		Tilia (T)		Thyme (Th)	
		0.1 %	0.2 %	0.1 %	0.2 %	0.1 %	0.2 %	0.1 %	0.2 %
Average feed intake (Kg/bird) a	2.161	2.154	2.07	2.236	2.071	2.2	2.083	2.151	2.102
Price / Kg feed (P.T.) * b	109.19	112.09	114.99	110.19	111.19	112.19	115.19	110.59	111.99
Total feed cost (P.T.) = a x b = c	235.95	241.44	238.02	246.38	230.27	246.81	239.94	237.88	235.40
Average LBWG (Kg/ bird) d	1.3549	1.4843	1.4539	1.4088	1.3991	1.3156	1.4239	1.3444	1.3829
Price / Kg live weight (P.T.) ** e	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00	550.00
Total revenue (P.T.) = d x e = f	745.195	816.365	799.645	774.84	769.505	723.58	783.145	739.42	760.595
Net revenue (P.T.) = f - c = g	509.239	574.927	561.620	528.459	539.235	476.766	543.206	501.545	525.196
Economical efficiency =(g /c) ***	2.1582	2.3812	2.3595	2.1449	2.3417	1.9317	2.2639	2.1084	2.2311
Relative efficiency ****	100	110.336	109.327	99.383	108.504	89.504	104.899	97.694	103.377

*Based on average price of both starter and finisher diets during the experimental time. ** According to the local market price at the experimental time.
*** Net revenue per unit feed cost. **** Assuming economical efficiency of control group equals 100.