

Effect of adding rosemary leaves (*Rosmarinus officinalis* L.) powder to feed on growth performance and some blood parameters of broiler in hot climate region

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Abstract

The study was conducted at Poultry Research Station of Agriculture Faculty - University of Tripoli, Libya. The aim of this study was to investigate the effect of adding different levels of rosemary leaves powder to broilers' feed on growth performance, carcass quality and some blood parameters. A total of four hundred one day old Ross 308 unsexed broiler chicks were used. The experiment lasted to 42 days. The chicks were divided to five treatment groups according to the percentages of rosemary leaves powder added to feed; 0.00%, 0.25, 0.50, 0.75 and 1.00%. The treatments were distributed on replicates by using complete random design. Each treatment was applied in four replicates with 20 chicks each. The results showed that the birds consumed rosemary leaves powder at 0.25, 0.50, and 0.75 achieved highly significant reduction in averages of daily feed intake, feed conversion ratio and mortality% compared with the birds in control treatment. Moreover, groups on 0.50 or 0.75% rosemary powder have shown a significant reduction in proportion of abdomen lipid layer comparing to control group. On the other hand, the results showed no significant differences between the five groups in body weight, body weight gain, carcass characteristics, parameters, notably, of glucose, cholesterol, T3 and T4.

Key words: Broiler, Rosemary powder, Growth performance and Biochemical blood parameters.

Introduction

The rapid development and steady growth of poultry industry around the world has been accompanied with many challenges, such as outbreaks of bacterial and viral diseases and heat stress in hot climate regions. This led to the use of medication antibiotics to face these challenges and to improve growth and

nutritional efficiency. However, the use of such antibiotics has been subjected to many investigations and criticism due to their residues in animal products and the emergence of bacterial strains resistant to them. Therefore, its use has been banned in European Union since 2006 (Castanon, 2007). Attention has recently

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turned to the use of medicinal herbs as an alternative to antibiotics. Medicinal herbs contain active compounds that are antibacterial (Chowlu *et al.*, 2019, Alwan and Abdaljaleel, 2022), immune-stimulating (El-Sabrout *et al.*, 2023), improve digestion and enhance growth rate (Shohe *et al.*, 2019) and are antioxidants (Chowlu *et al.*, 2019). Rosemary (*Rosmarinus officinalis* L.) belongs to the Lamiacea family. In Libya, rosemary grown naturally as a part of the native vegetation in Nafusa Mountain, Meslata, and the Green mountain (Saleem *et al.*, 1985). Inclusion of rosemary leaves powder to broiler feed increases body weight and growth rate (Spernakova *et al.*, 2007, Ghazalah and Ali, 2008), improved feed intake and feed efficiency (Ghazalah and Ali, 2008; Al-Mansouri *et al.*, 2023). Osman *et al.*, (2010) showed that rosemary leaves powder improved carcass characteristics and immune response. It caused a reduction in blood glucose and triglycerides (Ghazalah and Ali, 2008) and blood cholesterol (Belenli *et al.*, 2015). Moreover, Ghazalah and

Ali (2008) indicated that adding rosemary leaves powder to broiler feed increase plasma level of triiodothyronine (T3) and thyroxin (T4). This experiment aimed to investigate the effect of adding rosemary leaves powder at different levels in feed on growth performance and some blood parameters of broiler in hot climate region.

Materials and Methods

This study was conducted at the Poultry Research Station of Faculty of Agriculture - University of Tripoli, Tripoli, Libya. Four hundred one-day old unsexed broiler chicks (Ross 308) were used. The study lasted 42 days started in May 8 and ended in June 19, 2016. The chicks were raised on the ground where fed starter feed (from day one to 21 days), followed by finisher feed (from 22 to 42 days). Feed and water were provided adlibitum. Table (1) shows nutrient content of diets that were used. The ambient temperature (°C) inside the house was recorded (Table, 2).

Table 1. Nutrient specification of the experimental diets.

Nutrient	Starter diet	Finisher diet
Metabolisable Energy (Kcal/kg)	2940	3004
Protein (%)	21.5	19
Linoleic Acid (%)	1.563	1.667
Crude Fiber (%)	2.532	2.653
Calcium (%)	0.986	0.993
Avail. Phosphorus (%)	0.457	0.453
Lys (%)	1.275	1.047
Met (%)	0.911	0.738
Salt (%)	0.349	0.323

Table 2. Averages of housing temperature during the experiment.

Week	Average temp.
1 – 3 days	°م 35
4 – 7 days	°م 33
2nd week	°م 31
3rd week	°م 29
4th week	°م 27.5
5th week	°م 29
6th week	°م 31

Rosemary leaves were collected from Tarhuna region. Table (3) shows the approximate analysis of rosemary leaves powder. According to adding level of rosemary leaves powder to feed, five treatments were assigned; 0.00% (control), 0.25%, 0.50%, 0.75% and 1.00%. Complete Random Design (CRD) was used to allocate the treatments randomly in the replicates. Each treatment was applied in 4 replicates, with 20 chicks/replicate.

Live body weight, body weight gain, feed intake, feed conversion ratio, mortality% were measured weekly for each replicate. While, blood parameters and carcass characteristics were recorded at the end of the experiment; these included glucose and cholesterol levels, T3 and T4 levels, dressing%, breast muscle weight %, abdomen lipid layer% and viscera organs%. The data were statistically analyzed by Statistical Analysis System (SAS, 2002). Duncan's multiple range test was used to determine the significant differences between the averages of all traits (Duncan, 1955).

Table 3. The approximate analysis of dried rosemary leaves powder.

Nutrient	%
Moisture	8.89
Protein	8.7
Crude Fiber	23.5
Ether Extract	4.37
Free nitrogen Extract	48.19
Ash	6.35

Results and discussion

The results in table (4) show a highly significant reduction ($P < 0.009$) in daily feed intake due to the inclusion of different levels of rosemary leaves powder in the diet. It was clear; that the increasing level of the rosemary leaves powder caused more reduction in daily feed intake; whereas the birds received 1.00% of rosemary leaves powder recorded the highest reduction. These results agree with those reported by Windisch *et al.*, (2008), Rostami *et al.*, (2015), Elnaggar *et al.*, (2016), Yildirim *et al.*, (2018) and kadhim (2018). Dealing with body weight at 42 days and daily body weight gain the results showed no significant differences ($P > 0.05$)

between all treatment groups, these findings agree with those published by Fotea *et al.*, (2009), Ciftci *et al.*, (2013), Yesilbag *et al.*, (2011) and Norouzi *et al.*, (2015).

According to the relationship between feed intake and body weight gain, the results in table (4) show highly significant differences in feed conversion ratio between the groups which consumed rosemary leaves powder and control group. It was obvious, that the chicks received 1.00% rosemary leaves powder recorded the best feed conversion ratio (1.74) compared to 1.81 for the control group. The improvement in feed conversion ratio may be attributed to inclusion of rosemary leaves powder which was found previously by Ghazalah and Ali (2008), Fotea *et al.*, (2009), Norouzi *et al.*, (2015), Elnaggar *et al.*, (2016) and kadhimi (2018).

The results in Table (4) obviously show that, there was a highly significant effect ($P < 0.01$) of rosemary leaves powder on mortality % during 42 days. All chicks in the house were exposed to natural heat stress during the 6th week of age between 33°C and 40.5°C. This natural condition caused high mortality% in control group (57.5%), but did not have such effect on mortality% in the rosemary groups, whereas the group of 1% rosemary leaves powder recorded the lowest mortality% (10%). This finding was in agreement with that found by Tollba (2010) and kadhimi (2018).

The results in table (5) show that there are no significant differences ($P > 0.05$) between all groups in dressing %, breast muscle % and viscera organs%. This finding agrees with that

found by Gharejanloo *et al.*, (2017) On the other hand, adding rosemary leaves powder to feed with 0.5% or 0.75% caused a highly significant reduction ($P < 0.01$) in abdomen lipid layer compared to the control group. This finding agrees with those found by Ashan (2011) and Zeweil *et al.*, (2015).

The results in Table (6) show effect of adding different levels of rosemary leaves powder to feed on some blood parameters at 42 days of age. The results showed that there were no significant differences ($P > 0.05$) between all treatment groups in blood concentrations of glucose, cholesterol, (T3) and (T4). These results agree with those found by Belenli *et al.*, (2015) and Al-Mansouri *et al.*, (2023).

According to the results, adding rosemary leaves powder to feed caused a highly significant decrease in feed intake. Windisch *et al.*, (2008) noticed that rosemary leaves had strong flavor which may decrease broiler appetite to consume feed. Also, Lee *et al.*, (2003) indicated that Carvacrol has a suppressive and anti-appetizing effect on feed intake. Jeon *et al.*, (2011) and Daly *et al.*, (2013) reported that there are taste receptors in the gut similar to taste buds on tongue which may regulate feed intake. Moreover, Furness *et al.*, (2013) noticed that the digestive system might serve as a site of the chemosensory system, and this may confirm the finding of Mace and Marshall (2013) who stated that the chemosensory system regulates development and functions of the digestive system and health.

Table 4. Effect of adding different levels of rosemary to feed on growth performance of broiler during 42 days period.

Treatment (gm powder per 100 gm feed)	Daily Feed intake (gm/bird/day)	Body Weight gr	Daily Weight Gain (gm/bird/day)	Feed Conversion Rate (gm feed /gm meat)	Mortality (%)
%0.0	110.98 ^a	2614.6 ^a	61.10 ^a	1.81 ^a	57.50 ^a
%0.25	104.05 ^b	2527.9 ^a	59.06 ^a	1.76 ^b	20.00 ^b
%0.50	105.27 ^b	2570.1 ^a	60.06 ^a	1.75 ^b	20.00 ^b
%0.75	103.44 ^b	2530.8 ^a	59.14 ^a	1.74 ^b	13.75 ^b
%1	101.69 ^b	2504.8 ^a	58.45 ^a	1.74 ^b	10.00 ^b
SEM	1.58	41.94	0.99	0.01	8.31
P _r	0.009	0.40	0.40	0.001	0.0075

a, b, c: Means with different superscripts in the same column are significantly different.

Table 5. Effect of adding different levels of rosemary to feed on Carcass characteristics of broiler at during 42 days period.

Treatment (gm powder/100 gm feed)	Dressing %	Breast meat %	abdomen lipid layer %	viscera organs %
%0.0	77.59 ^a	32.45 ^a	2.3 ^a	4.97 ^a
%0.25	77.96 ^a	32.44 ^a	2.1 ^a	5.24 ^a
%0.50	77.67 ^a	32.75 ^a	1.58 ^b	4.97 ^a
%0.75	77.32 ^a	33.4 ^a	1.67 ^b	4.82 ^a
%1	76.85 ^a	32.90 ^a	2.27 ^a	5.02 ^a
SEM	0.44	0.69	0.1	0.16
Pr	0.49	0.86	0.0002	0.5

a, b, c: Means with different superscripts in the same column are significantly different.

Table 6. Effect of adding different levels of rosemary to feed on Carcass characteristics of broiler during 42 days period.

Treatment (gm powder/100 gm feed)	Glucose mg/dL	Cholesterol mg/dL	T3 ng/ml	T4 ng/ml
%0.0	248.2 ^a	179.58 ^a	2.4 ^a	19.0 ^a
%0.25	239.5 ^a	180.64 ^a	1.70 ^a	16.25 ^a
%0.50	239.4 ^a	204.50 ^a	1.97 ^a	17.25 ^a
%0.75	240.8 ^a	216.10 ^a	2.25 ^a	17.25 ^a
%1	201.6 ^a	185.28 ^a	2.1 ^a	17.75 ^a
SEM	0.84	0.29	0.19	0.08
Pr	0.26	0.13	0.16	0.28

On the other hand, the results show no significant differences in body weight gain between all groups of the experiment, although there was significant reduction in feed intake due to adding rosemary leaves powder to feed. This can be justified by what Windisch *et al.*, (2008) who pointed out that volatile oils of herbs and spices increase the efficiency of digestive system to utilize the ingredients, which

was confirmed by Lee *et al.*, (2003) and Cross *et al.*, (2007) that rosemary and various herbs have active compounds stimulate secretion of bile and activity and secretion of pancreatic enzymes, and what Yang *et al.*, (2022) and Gümüş *et al.*, (2023) pointed out that rosemary increased the length of the villi of the small intestine. Additionally, rosemary stimulates Lactobacilli growth (Franciosi *et al.*, 2015;

Norouzi *et al.*, 2015) and inhibit *E. coli* activity (Norouzi *et al.*, 2015) and *Staphylococcus* ssp (Franciosi *et al.*, 2015).

Due to the effect of rosemary leaves powder on feed intake and body weight gain, the birds consumed rosemary leaves powder in feed showed a highly significant improvement in feed efficiency compared to control group.

Heat stress is one of the most important reason causes heavy economic losses in poultry farms in hot regions such as Libya. The results of the current study showed that rosemary leaves powder significantly reduced mortality %. It might be an indication that inclusion of herbs and spices in broilers diets have a role in alleviation of the negative effects of heat stress (Lee *et al.*, 2003; Alcicek *et al.*, 2004; Jang *et al.*, 2007). Çabuk *et al.*, (2006) and Engida *et al.*, (2023) stated that the essential oils of rosemary leaves powder have an anti-stress and stimulant effect on the immune system which is seen through low mortality%. Moreover, each 100 grams of rosemary contains 21.8 mg of vitamin C (Hedges and Lister, 2007), which reduces negative effects of heat stress by reducing the manufacture and secretion of corticosterone (Kutlu, 1980).

Moreover, rosemary contains antioxidants that reduce the effects of heat stress in hot weather through high activity of glutathione peroxidase and catalase enzymes in plasma and a decrease in the level of malon dialdehyde and peroxide value in liver tissue (Mohammed *et al.*, 2013) and in breast and thigh tissue (Hosseinzadeh *et al.*, 2023).

Results reported in this study showed that adding rosemary leaf powder to feed in 0.5% and 0.75% caused a significant decrease ($P < 0.01$) in proportion of abdomen lipid layer. This may be due to the fact that active rosemary compounds (carvacrol, carnosol and carnosol acid) have an anti-obesity effect. These compounds may prevent accumulation of fat between cells, also inhibit or restrict fat differentiation and reduce the gene expression of fat manufacturing in visceral fat tissue (Takahashi *et al.*, 2006 and Umayya and Manpal, 2013).

Conclusion

Aromatic or medicinal plants have important effects on the performance and immunity of broiler chickens. The results of this study showed that adding rosemary leaf powder at 1% to broiler feed had an important effect on growth performance under heat stress conditions. Whereas adding the powder at a rate of 1% resulted in a highly significant reduction in feed intake, improving nutritional efficiency and reducing the mortality percent compared to control birds. Despite there was a significant decrease in feed intake due to consuming rosemary leaf powder (1%), the results of this study showed no changes in body weight and weight gain in the treated birds compared to the control ones.

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تأثير إضافة مسحوق أوراق إكليل الجبل (*Rosmarinus officinalis* L.) إلى

العلف على الأداء الإنتاجي وبعض قياسات الدم لدجاج اللحم

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2- كلية التربية طرابلس - جامعة طرابلس

المستخلص

أجريت الدراسة بمحطة أبحاث الدواجن التابعة لكلية الزراعة - جامعة طرابلس - ليبيا. هدفت هذه الدراسة إلى التحقق من تأثير إضافة مستويات مختلفة من مسحوق أوراق إكليل الجبل إلى علف دجاج اللحم على الأداء الإنتاجي وخصائص الذبيحة وبعض مقاييس الدم تحت ظروف الإدارة العادية. استخدمت أربع مائة كتكوت من سلالة Ross 308 عمر يوم واحد، واستمرت التجربة حتى عمر 42 يوماً. قسمت الكتاكيت إلى خمس معاملات مختلفة حسب نسبة مسحوق أوراق إكليل الجبل المضافة إلى العلف: مجموعة التحكم (0.00 %)، 0.25 %، 0.50 %، 0.75 % و 1.00 %. وزعت الكتاكيت عشوائياً على 4 مكررات/معاملة باستخدام التصميم العشوائي الكامل، واحتوى كل مكرر على 20 كتكوتاً. قيست صفات استهلاك العلف ووزن الجسم والزيادة الوزنية والكفاءة الغذائية ونسبة النافق وخصائص الذبيحة وبعض مقاييس الدم شملت مستويات الجلوكوز والكوليسترول وهرموني T3 و T4. أظهرت النتائج انخفاض عالي المعنوية في متوسطات استهلاك العلف ومعدل الكفاءة الغذائية ونسبة النافق في المجموعات التي تناولت مسحوق أوراق إكليل الجبل مقارنة بمجموعة التحكم. علاوة على ذلك، سجلت مجموعتا المعاملة 0.50 % و 0.75 % انخفاض عالي المعنوية مقارنة بمجموعة التحكم في نسبة طبقة الشحوم حول منطقة البطن. ومن جهة أخرى أظهرت النتائج عدم وجود فروق معنوية بين مجاميع المعاملات الخمسة بالتجربة في متوسطات وزن الجسم والزيادة الوزنية في الجسم وخصائص الذبيحة ومقاييس الدم المتمثلة في مستويات الجلوكوز والكوليسترول وهرموني T3 و T4. الكلمات الدالة: دجاج اللحم، مسحوق أوراق إكليل الجبل، الأداء، مقاييس الدم.