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First Screening of *Thymus algeriensis* (*Lamiaceae*) as Feed Additives on Growth Performance, Carcass Traits and Some Blood Parameters of Broiler Chickens

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ABSTRACT

Background: The aim of the present study is to evaluate the effects of thyme powder (*Thymus algeriensis*), as feed additive, on some zootechnical performances as well as hematobiochemical parameters of broilers.

Methods: A total of 96 Cobb 500 broilers of one day of age, were randomly divided into four dietary treatment groups and 4 replicates with 6 birds per pen were reared till 48 days of age. Treatments were: T1 fed witha basal diet without thyme powder (control group), T2, T3 and T4 were fed a basal diet supplement with 1%, 2% and 3% of thyme powder respectively. Weekly measurements were made of body weight and weight gain. On the forty-fifth day of the study, blood samples were collected in order to evaluate the blood profile and calculate the white blood cell percentage.

Result: The inclusion of 3% thyme powder increased significantly broiler body weight, feed intake and feed conversion ratio. Birds of T4 increased significantly ($P<0.05$) their heart and thigh weight. Hematobiochemical parameters in broilers, particularly on levels of various white blood cell subtypes and uric acid levels.The use of this plant endemic to arid and semi-arid regions as a feed additive is considered an alternative to the use of antibiotic.

Key words: Endemic aromatic plant, Feed additive, Growth, Poultry nutrition.

INTRODUCTION

Poultry is a popular and widely consumed meat worldwide and it plays a very important role in global food production (Gul *et al.,* 2016; Bist *et al.,* 2024; Ashour *et al.,* 2025). In Algeria, poultry occupy a prominent place in the national economy, contributing significantly to nutritional security (Cherifi and Abdelli, 2023), domestic poultry production has recently experienced a significant expansion thanks to various support policies launched by the government over the past twenty years.

On the other hand, several authors indicated that the poultry industry is constantly seeking to improve the health and productivity of chickens without the use of antibiotics to meet the growing demand for chicken products (Atay, 2023; Prakash *et al.,* 2024; Ashour *et al.,* 2025). Current research is attempting to replace chemical antibiotics with powders and extracts from medicinal and aromatic plants (Atay, 2023; Ashour *et al.,* 2025). Because of their many beneficial health effects (Jin *et al.,* 2020), including increased appetite and feed intake, improved digestive enzyme secretion, immune response activation (Rahimi *et al.,* 2011; Jin *et al.,* 2020), antibacterial properties (Sambasivaraju and Fazeel, 2016) and antioxidant activity (Jin *et al.,* 2020), aromatic plants have been used to achieve modern intensive poultry production (Ghazanfari *et al.,* 2015; Adam *et al.,* 2020; Puvaca *et al.,* 2022; Atay, 2023).

Specific compounds from aromatic medicinal plants could help improve feed utilization efficiency and offer economic benefits in broiler production (Jin *et al.,* 2020; Atay, 2023).

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The genus *Thymus* L. which has antibacterial, antifungal and anticoccidiotic properties attributed to thymol and carvacrol, is practically widespread around the Mediterranean (Zouari *et al.,* 2012; Perrino and Wagensommer, 2022; Mahdi *et al.,* 2022). In Algeria it is represented by 17 species and subspecies, three of which are endemic (Tamma *et al.,* 2024). *Thymus algeriensis* is one of the three thymuses endemic to Algeria (Zouari *et al.,* 2012). Indeed, several studies which have focused on the effects of different species belonging to the genus Thymus

as feed additive on growth performance, carcass characteristics and certain blood parameters of broiler chickens (Adam *et al.,* 2020; Sigolo *et al.,* 2021). Nevertheless and according to the best of our knowledge, no study has been carried out on the effect of *Thymus algeriensis* on the aforementioned parameters.

In this context, the aim of this study is determining the impact of varying dosages of *Thymus algeriensis* powder on broiler zootechnical and haemato-biochemical properties.

MATERIALS AND METHODS

Chickens and experimental models

The study was conducted from September to November 2024 at a farm in the El-Ogla region (province of Tebessa, Northeastern Algeria), characterized by a semi-arid climate with cold winters.

A total of 96 one day-old Cobb 500 broilers of different sexes were randomly divided into four feed treatment groups: One control group (T1) and three groups fed a basal diet supplemented with 1% (T2), 2% (T3) and finally 3% (T4), respectively.

Four replicates of six chicks each made up each experimental group. The chicks were reared for 48 days in hygienic circumstances with deep litter.

Diet and breeding

Three experimental diets (starter, grower and finisher) were used in this trial. They were developed to meet the daily requirements of broilers. The ingredients and chemical composition of the experimental diets are presented in (Table 1).

For the first 18 days of the trial, the chickens were fed a starter diet; after that, they were fed a grower diet for 18-35 days and finally, a finisher diet for the remaining weeks. *T. algeriensis* was combined with the basal diets after being run through a 2 mm sieve hammer mill and placed in plastic bags with labels, at 0% (T1: as a without-supplement control), 1% (T2: 100 g Thyme powder plus 9.9 kg basal diet total of 10 kg), 2% (T3: 200 g Thyme powder plus 9.8 kg basal diet in a total 10 kg mixture) and 3% (T4: 300 g Thyme plus 9.7 kg basal diet in a total 10 kg mixture). Each time the preparation was repeated according to the phases of broiler rearing.

Simultaneously, a tiny amount of the unrefined *T. algeriensis* powder was kept for chemical analysis in a dark glass container that was labeled and hermetically sealed.

The chemical composition of *T. algeriensis* powder was identified at the agricultural sciences department of the University of Khenchela, Algeria.

Dry matter (DM), organic matter (OM) and crude protein (CP) were determined according to the methods of AOAC, (1990). Due to the importance of lignin as an anti-nutritive value in poultry feed, acid detergent fibre (ADF), neutral detergent fibre (NDF) and acid detergent lignin (ADL) were analysed according to the method described by Van Soest *et al.* (1991) (Table 2).

In accordance with treatment levels and replicates, the birds were kept in an experimental aviary that was divided into 16 pens of identical size (1×1,2 m), using by plasterboard partitions. Following the density regulation of 10 chickens/m^2, six hens were kept in each pen. sawdust were utilized as bedding and each pen had a feeder and waterer. *Ad-libitum* access to feed and water was provided to the chicks. For the first seven days, the ambient temperature was initially fixed at 32°C. It was progressively lowered until 24°C on day 21 and then maintained for the remaining investigation.

Chickens were vaccinated against Newcastle disease (7^{th} and 14^{th} day of age), infectious bronchitis (16^{th} day of age) and infectious bursal disease (Gumboro).

Performance parameters

Weekly body weight increases for each pen were tracked during the rearing phase. Body weight gain (BWG) and feed conversion ratio (FCR) were also calculated. At the end of the experiment, three chickens from each treatment group were weighed. recorded and sacrificed following the Islamic manner. The edible giblets (heart and liver), thighs and fat were collected and weighed.

Table 1: Ingredients, chemical analyses and composition of diets.

Ingredients (g/kg)	Starter				Grower				Finisher			
Thymus powder	0	10	20	30	0	10	20	30	0	10	20	30
Corn	580	570	560	550	620	610	600	590	640	630	620	610
Wheat bran	70				50				50			
Soyabean (44%)	310				290				270			
Salt	2				2				2			
CMV	38				38				38			
Calculated chemical analysis												
ME (kcal/kg)	2987	3051	3029	2974	3122	3086	3083	3092	3098	3112	3117	3150
DM (%)	92	92	91	91	92	92	91	91	92	92	92	91
CP (% DM)	21	21	21	21	21	21	20	20	20	21	20	21
Ash (% DM)	8.8	8.0	7.8	8.9	8.2	8.5	8.0	8.5	8.5	8.0	8.0	7.5

DM: Dry matter; CP: Crude protein; CMV: Complex mineral vitamin; ME: Metabolizable energy.

Blood sampling

Three chickens in each group had their blood samples collected. Twelve chickens in all were selected at random for sampling and then labeled for additional treatment. Blood samples were kept in two different kinds of test tubes, with half of the samples being put in anticoagulant tubes (EDTA tubes) for the measurement of the white blood cell and the heterophil /lymphocyte ratio (H/L) (Shoukary *et al.,* 2015).

Statistical analysis

Statistica and Microsoft Excel were used for statistical analysis. The data was first analyzed using ANOVA. Then, the mean values of the variables were compared using the Tukey test. Besides, all residual data were subjected to the normality test.

RESULTS AND DISCUSSION

Growth performance

In the Table 3 showsthat thyme powder supplementation, at different levels, had no significant effect (P<0.05) on body weight of birds at 7 day and 28 day. However, body weight at 48 day was significantly increased as diet was supplemented with 3% of thyme powder. Feed intake of thyme powder supplemented group T3 and T4 was significantly higher than those of other groups T1 and T2 for all the trial period except starter phase.

Dietary supplementation of Thyme powder (T3 and T4) raised significantly FCR (P<0.05) when compared to the other groups (T1 and T2) among all trial period of broiler.In overall, thyme powder supplementation had comparable performances to control group. Except at 48 day of age where T4 showed a higher body weight, feed intake and average daily gain than T1. However, Deeb *et al.* (2024) found that a basal diet with thyme leaves powder added at 1, 2 or 3 g/kg of diet enhanced significantly body weight and feed intake of broiler chickens throughout study period of 38 days.

Besides, Mehboob *et al.* (2025) reported that supplementation of broiler diets with the fed herb Urtica dioica as a feed additive at 2% improved significantly the performance of broiler chickens (body weight and FCR).

Anti-nutritional factors may be the cause of these outcomes. Additionally, these improvements may be attributed to the antibacterial and antioxidant properties of the thyme powder employed, which may enhance gut health and boost the absorption of nutrients by stimulating digestive enzymes (Du *et al.,* 2016). Thyme increases the amount of feed consumed by enhancing absorption through intestinal villi and causing the release of digestive enzymes including chymotrypsin and amylase (Denli *et al.,* 2004). On the other hand, more undesirable FCR was recorded for the group T4 compared to control group T1 (1,66 vs 1,59). Similarly, numerous authors (Ashour *et al.,* 2025; Golshahi *et al.,* 2025) have already reported that the addition of thyme for broiler raise significantly FCR. Other studies, such as Vlaicu *et al.* (2023), which investigated the effect of thyme oil addition on broiler production, also stated that a diet containing 0.05% thyme oil had a more favorable feed conversion ratio. These contradictions

Table 2: Chemical composition of *Thymus algeriensis* powder.

Chemical composition	Values
DM (%) Dry matter	85.93±2.13
OM (% DM) Organic matter	88.39±2.31
Ash (% DM)	11.63±2.31
CP (% DM) (Crude protein)	9.41±1.11
ADF (% DM) Acid detergent fiber	43.20±2.00
NDF (% DM) Neutral detergent fiber	55.45±4.53
ADL (% DM) Acid detergent lignin	17.91±0.66

Values are given as mean ± standard deviation (SD) (n=3).

Table 3: Effects of *Thymus* powder at different levels on growth performance of broilers.

Parameters	Age (day)	Levels of *Thymus* powder				p
		0%	1%	2%	3%	
Body weight (g/bird/week)	7	170.32±1.94	170.82±2.01	170.47±2.62	172.73±0.87	NS
	28	1670.02±1.02	1670.57±2.12	1669.60±1.23	1676.40±9.43	NS
	48	3502.35^{b}±6.75	3493.41^{b}±5.62	3501.42^{b}±5.53	3523.45^{a}±10.4	0.000
Average daily gain(ADG) (g)	7-14	47.27±0.28	46.66±0.61	46.88±0.49	47.15±0.18	NS
	1-28	57.99±0.05	57.97±0.12	57.94±0.06	58.22±0.33	NS
	29-48	91.62^{ab}±0.33	91.14^{b}±0.22	91.59^{ab}±0.25	92.35^{a}±0.79	0.020
	1-48	72b±0.15	71.79^{b}±0.14	71.96^{b}±0.13	72.44^{a}±0.24	0.001
Average daily feed intake (g)	1-7	22.85±0.30	22.60±0.71	22.50±1.08	23.05±0.62	NS
	21-28	140.78^{b}±1.90	138.93^{b}±3.15	142.48^{ab}±0.91	146.56^{a}±1.68	0.001
	42-48	174.96^{b}±1.41	174.35^{b}±1.65	178.77^{a}±1.28	181.72^{a}±1.69	0.000
Total feed intake (g)	1-48	5483.91^{c}±61	5486.18^{c}±47	5590.57^{b}±39	5760.63^{a}±21	0.000
Feed conversion ratio (FCR)	1-28	1.38^{ab}±0.01	1.37^{b}±0.02	1.38^{ab}±0.01	1.40^{a}±0.02	0.008
	29-48	1.77^{c}±0.02	1.79^{c}±0.01	1.83^{b}±0.01	1.88^{a}±0.01	0.000
	1-48	1.59^{c}±0.02	1.59^{c}±0.01	1.62^{b}±0.01	1.66^{a}±0.01	0.000

could be attributed to different thyme products (powder, oil or extracts), maturity of plant at harvest and storage conditions which affect chemical composition of plant (Brenes and Roura, 2010).

Carcass yield

In the Table 4 revealed how various level of thyme powder concentration on broiler's diet affect different carcass traits. A significance decrease in carcass weight before evisceration was observed at 2% of thyme powder inclusion ($P<0.05$). However, this difference don't persist till evisceration ($P>0.05$). It can be noted that the addition of 3% of thyme powder to broiler diet improved significantly thigh's mean weight of broiler ($P<0.05$) compared to other treatments. Weights of the heart and thighs augmented considerably ($P<0.05$) for treated groups, with the highest results recorded at 3% comparatively with the control. Whereas, no effects occurred of thyme powder inclusion ($P>0.05$) for liver and abdominal fat weights.

Our results were in line with those of Adam *et al.* (2020), who found that different levels of thyme powder or essential oils of thyme had non-significant effect on weight of gastric tracts and their parts. Also, previous studies found that enriching broiler's diet with 5 g/kg feed (Ibrahim *et al.,* 2024) of thyme powder had not improved significantly carcass, liver, gizzard, heart and abdominal fat weight.

Additionally, Ashour *et al.* (2025) found that supplementing 2 g/kg feed of thyme powder in broiler diet had no effect on liver, gizzard weight and thigh meat, while noting a decrease in heart weight compared to the control group.

Furthermore, Rathor *et al.* (2025) revealed that chickens fed the diet with Ajwain (Trachyspermum ammi) seeds at 1.5% level recorded significantly ($P<0.05$) higher carcass weight, heart and liver weight compared to control group.

Incorporation of herbs and their products in the diets of poultry are known to stimulate and promote the effective use of feed nutrients which subsequently results in rapid body weight gain, higher production rates and improved performance (Vargas *et al.,* 2022; Ajaykumar *et al.,* 2024).

Blood analysis

The results of the Table 5 detail the effect of supplementation with different levels of thyme powder on the biochemical and haematological blood parameters of

Table 4: Carcass and internal organ yields for different doses.

Parameters	Levels of *Thymus* powder				p
	0%	1%	2%	3%	
Body weight (g)	$3510.75^{ab}\pm6.75$	$3495.50^{b}\pm10.21$	$3490.25^{b}\pm12.69$	$3524.25^{a}\pm10.44$	0.002
Carcass weight before evisceration (g)	$3100^{a}\pm18.26$	$3074.25^{a}\pm56.97$	$2980.75^{b}\pm22.56$	$3124.75^{a}\pm13.57$	0.000
Carcass weight after evisceration (g)	2773.75±13.77	2756.25±39.02	277.25±9.25	2797.25±18.37	0.150
Eviscerated carcass weight/ Uneviscerated carcass weight	89.48	89.66	93.21	89.52	/
Thigh (g)	$357.50^{ab}\pm4.20$	$344^{c}\pm2.94$	$348.50^{bc}\pm2.65$	$364.50^{a}\pm8.74$	0.000
Heart (g)	$17.75^{ab}\pm0.96$	$17^{b}\pm0.82$	$17.50^{ab}\pm0.58$	$20.25^{a}\pm2.63$	0.039
Liver (g)	74±1.83	72.75±3.77	76.75±3.40	78.50±3.87	0.112
Abdominal fat (g)	50±2.94	48±3.16	48.75±2.99	52.25±3.59	0.300

Table 5: Biochemical and hematological analysis of blood.

Parameters	Levels of *Thymus* powder			
	0%	1%	2%	3%
Blood biochemical parameters				
Glucose (g/l)	$2.18^{a}\pm0.04$	$2.22^{a}\pm0.51$	$2.28^{a}\pm0.26$	$2.50^{a}\pm0.50$
Cholesterol (g/l)	$0.88^{a}\pm0.02$	$0.80^{a}\pm0.13$	$0.70^{a}\pm0.13$	$0.62^{a}\pm0.10$
Total serum protein (g/l)	$46.74^{b}\pm2.70$	$38.94^{c}\pm0.93$	$53.74^{a}\pm0.65$	$32.90^{d}\pm0.66$
Uric acids (mg/l)	$25.12^{c}\pm2.16$	$39.98^{b}\pm0.65$	$48.69^{a}\pm1.14$	$24.19^{c}\pm0.73$
Creatinine (mg/l)	$1.73^{b}\pm0.21$	$2.76^{a}\pm0.15$	$2.75^{a}\pm0.22$	$2.30^{a}\pm0.30$
Globulin (g/l)	$20.45^{b}\pm2.20$	$29.75^{a}\pm0.25$	$28.87^{a}\pm1.03$	$19.45^{b}\pm0.51$
Albumin (g/l)	$14.40^{a}\pm2.19$	$12.20^{a}\pm0.26$	$15.40^{a}\pm0.53$	$14.00^{a}\pm1$
Albumin/Globulin	0.70	0.41	0.53	0.72
Hematological parameters				
Red blood cells (mm^3)	$3.84\times10^{6}\pm0.94^{a}$	$3.17\times10^{6}\pm0.21^{a}$	$3.27\times10^{6}\pm0.21^{a}$	$2.80\times10^{6}\pm0.26^{a}$
Platelets (mm^3)	$45.6\times10^{3}\pm1.51^{ab}$	$43.5\times10^{3}\pm1.25^{b}$	$47.7\times10^{3}\pm1.47^{a}$	$36.2\times10^{3}\pm0.72^{c}$
Lymphocytes (µl)	$73\times10^{3}\pm2^{c}$	$71\times10^{3}\pm1^{c}$	$84\times10^{3}\pm1.32^{b}$	$92\times10^{3}\pm0.87^{a}$
Monocytes (µl)	$53\times10^{3}\pm1^{b}$	$47\times10^{3}\pm1.32^{c}$	$62\times10^{3}\pm1.73^{a}$	$60\times10^{3}\pm1.73^{a}$
Granulocytes (µl)	$78\times10^{3}\pm2^{d}$	$84\times10^{3}\pm1.15^{c}$	$92\times10^{3}\pm1.80^{b}$	$105\times10^{3}\pm2.65^{a}$

broilers. They showed that glucose and cholesterol concentrations were higher while birds were fed a finisher diet supplemented with 3% thyme powder compared to other groups.However, the concentrations of uric acids, creatinine and globulin were increased in both T2 and T3 groups, while albumin concentration increased for broiler of T3 only. Moreover, the percentage of red blood cells and platelets were higher in broiler of T3 comparatively with T2 and T4 groups. In addition, the percentage of lymphocyte, monocyte and granulocyte cells was higher in chickens fed a diet supplemented with 3% thyme powder (T4) in comparison with the other groups. Ali, (2014) found that supplementing broiler diets with 0.5%, 1% or 1.5% thyme leaf powder decreased cholesterol levels. On the other hand, our findings are in agreement with Larbaoui *et al.* (2024) concerning the amount of blood (Glucose), reporting the same value by the addition of 5% of olive pomace on the growth of broiler chickens.

The antioxidant properties of thyme seem to reduce the destructive oxidative effect of the toxin on the liver and reduce cholesterol, triglycerides and liver enzymes due to the inhibitory effect of these extracts on key enzymes.

CONCLUSION

Based on the results, it was shown that adding 3% *T. algeriensis* powder to broiler feed improved the broiler's body weight, carcass weight and haemato-biochemical profile. Consequently, the improvement in the overall health and well-being of broilers may be a sign that this plant species can constitute a promising substitute to antibiotics as a growth booster.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal Care and Handling Techniques were approved by the University of Animal Care Committee.

Conflict of interest

The authors declare that they have no competing interests.

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