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Oregano (*Origanum vulgare* L.) essential oil as a natural growth promoter in broiler chickens

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Abstract Broiler chickens were supplemented with oregano essential oil showed better early growth performance compared to those fed a standard diet or the antibiotic salinomycin. During the first 10 days, the chickens receiving oregano essential oil had a highly significantly higher feed intake ($P<0.01$) than the group which received 1,000 ppm. It showed the highest average daily feed intake of 26.62 g/bird, followed by the 2,000 ppm and 4,000 ppm groups, which had averaged intakes of 25.9 and 25.81 g/bird, respectively. However, the differences among the oregano-supplemented groups were not statistically significant ($P > 0.05$). In contrast, the control and antibiotic groups had lower feed intakes of 23.26 g/bird and 23.23 g/bird, respectively, but there were not significantly differed among the oregano-supplemented groups ($P>0.05$). Additionally, body weights and daily growth rates in all groups receiving oregano were similar to those in the antibiotics group and were significantly higher ($P<0.01$) as compared to the control group. However, no significant differences were observed among the various levels of oregano ($P>0.05$). Notably, during the same period, the group supplemented with 2,000 ppm of oregano essential oil exhibited a feed conversion ratio (FCR) that was statistically compared ($P > 0.05$) to the group receiving salinomycin. After the initial 10 days, there were not significant differed in growth performance or carcass traits across all treatment groups ($P>0.05$). The feed cost per kilogram of meat produced during the starter period for the 1,000 ppm oregano group was 25.76 Baht/kg, as compared to the control group at 25.96 Baht/kg and the antibiotic group at 23.85 Baht/kg. These findings suggested that oregano essential oil, particularly at 1,000 ppm, can serve as a cost-effective alternative to antibiotics for enhancing early-stage growth in broiler chickens without negatively impacting overall production costs or carcass quality.

Keywords: Antibiotic alternatives, Feed efficiency, Phytogenic feed additive

Introduction

Consumers are increasingly concerned about product safety, especially regarding residues from livestock farms and the use of antibiotics. Antimicrobial

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drug residues in animal products often arise from treatments and animal feed, contributing to developing drug-resistant pathogens in humans.

Antibiotic-resistant bacteria can develop the ability to withstand commonly used medications. This resistance may occur naturally, or bacteria may develop mechanisms to survive. Moreover, the misuse of antibiotics in both humans and animals significantly contributes to the proliferation and spread of antibiotic resistance. Such misuse includes inappropriate usage, lack of knowledge, and incorrect application, all of which can lead to resistance, contamination, and residual effects.

In the past, antibiotics were utilised as growth promoters to enhance animal weight. However, the World Health Organisation (WHO) and the European Union now enforce regulations banning antibiotics for growth promotion in livestock.

The poultry industry has pursued alternative methods in response to growing consumer demand for safe and healthy food free from antibiotic-resistant bacteria. These include using natural extracts like essential oils, known for their antimicrobial properties, as replacements for antibiotics. Studies involving essential oils in broiler chickens have shown that supplementation can promote growth, improve feed conversion rates, and enhance carcass quality (Kim *et al*., 2016).

Oregano (*Origanum vulgare* L.) is an aromatic plant commonly found in the Mediterranean. Its essential oil contains key components, the most notable being thymol, a naturally occurring phenolic compound recognised for its antimicrobial properties effective against Gram-positive and Gram-negative bacteria (Dorman and Deans, 2000). Another important component is carvacrol, which helps eliminate pathogenic bacteria without disrupting beneficial bacteria in the body. Carvacrol also acts as an antiviral and antifungal agent, without promoting antibiotic resistance. Additionally, oregano contains γ-terpinene and P-cymene, which offer antioxidant, antimicrobial, and anti-inflammatory effects. Due to its antimicrobial properties, Oregano has several health benefits, including stimulating appetite, enhancing digestion, alleviating vomiting, and soothing intestinal ulcers (Sivropoulou *et al*., 1996).

Previous studies indicate that oregano supplementation may enhance growth performance, improve feed efficiency, and positively influence carcass characteristics in broilers. However, the effectiveness of oregano essential oil can vary based on concentration, the bird's age, and environmental factors. Therefore, it is essential to evaluate the dose-dependent effects of oregano essential oil on broiler chickens, particularly in comparison to traditional antibiotic growth promoters (AGPs), to validate its practical application in commercial poultry production.

The study aimed to evaluate the effects of varying levels of oregano essential oil supplementation on the growth performance, feed intake, carcass yield, and production costs of broiler chickens during their rearing period, and to assess its potential as a cost-effective natural alternative to conventional feed additives, contributing to a more sustainable future in poultry farming.

Materials and methods

Ethical approval

The Animal Care and Use Committee of King Mongkut's Institute of Technology, Ladkrabang, approved the study (Approval number: ACUC-KMITL-RES/2024/010).

Experimental animals, diets, treatments, and management practices

A total of 750 one-day-old male Cobb 500 broiler chicks were obtained from a commercial hatchery and randomly assigned to five dietary treatment groups, each consisting of five replicates with 30 birds per replicate. The five treatments included a basal diet supplemented with 60 ppm/kg of salinomycin (antibiotic group), a basal diet without any additives (control group), and basal diets supplemented with oregano essential oil at concentrations of 1000, 2000, and 4000 ppm/kg, respectively. All diets were formulated to meet or exceed the nutrient requirements recommended by the National Research Council (1994) and were provided in mash form.

The feeding program was divided into three phases: Starter (1-10 days old) with 22% protein, grower (11-21 days old) with 21% protein, and finisher (22-35 days old) with 19% protein. Details of the diet formulation and calculated analysis of the experimental basal diet are provided in Tables 1 and 2.

The broilers were raised for 35 days at the Animal Research and Innovation Centre (ARIC) within the Department of Animal Production Technology and Fisheries at the School of Agricultural Technology, King Mongkut's Institute of Technology, Ladkrabang. The chicks were housed in pens measuring 2.0 m x 1.5 m in a facility equipped with evaporative cooling, and they had access to water and feed ad libitum.

Table 1. Nutritional composition and ingredients used in broiler feed

Ingredient (%)	Starter	Grower	Finisher
Corn	54.72	59.48	64.3
Soybean oil	1.92	1.72	1.5
Soybean Meal (48% CP)	30.63	24.47	18.25
Full-fat Soybean	8	10	12
Calcium carbonate	1.45	1.33	1.22
Mono-dicalcium phosphate 22 %	1.79	1.6	1.44
Salt	0.36	0.36	0.36
DL-Methionine	0.34	0.3	0.26
L-Lysine	0.25	0.23	0.23
Threonine	0.09	0.07	0.04
Choline Chloride 60%	0.06	0.06	0.05
Premix	0.18	0.18	0.18

Table 2. Proximate composition of experimental basal diet

Ingredient (%)	Starter	Grower	Finisher
Metabolizable energy (kcal/kg)	3100	3150	3200
Crude protein	23	21	19
Moisture	10.92	10.97	11.03
Fat	5.93	6.24	6.53
Fiber	3.15	3.2	3.26
Ash	5.8	5.31	4.86
Calcium carbonate	0.96	0.87	0.79
Total phosphorus	0.77	0.71	0.65
Available phosphorus	0.48	0.44	0.4
Salt	0.36	0.35	0.35
Lysine	1.44	1.29	1.16
Methionine	0.67	0.61	0.55
Methionine+Cystein	1.08	0.99	0.91
Typtophane	0.28	0.25	0.22
Arginine	1.54	1.39	1.24

Data collection

Performance measurement

To evaluate growth performance, the data were collected on feed intake and chicken weights on days 1, 10, 24, and 35 of the trial. The data was used to calculate body weight gain, feed conversion ratio (FCR), and feed cost per unit of weight gain.

Carcass sampling and processing

At the end of the 35-day feeding trial, three birds with body weights closest to the group mean were selected from each replicate, resulting in 15 birds per treatment group for carcass evaluation. Feed was withdrawn for 12 hours prior to slaughter to minimize gut contents. The birds were humanely slaughtered following standard ethical guidelines. After slaughter, the carcasses were defeathered, eviscerated, and processed using commercial practices.

Carcass weight was recorded after the removal of feathers, blood, head, feet, and internal organs. The eviscerated carcasses were then further dissected to evaluate the relative weights of breast meat, thighs, drumsticks, liver, heart, and abdominal fat. All parts were weighed using a digital scale with a precision of 0.01 g. Carcass yield and individual part percentages were calculated based on live body weight. All procedures were conducted under hygienic conditions to ensure the integrity of the samples.

Statistical analysis

The growth performance data were analysed using SAS statistics (SAS Institute, Cary, NC). Each individual replicate pen of broilers was treated as the experimental unit for statistical analysis. We assessed statistical variances in the results between the control group and the oregano-supplemented group using a one-way ANOVA. The significance of mean differences was evaluated using Duncan's New Multiple Range Test (DMRT), with a significance level set at $p < 0.05$.

Results

Effect of supplementing oregano essential oil on growth performance

The effects of oregano essential oil on broiler production performance were evaluated and compared chickens fed in different concentrations of oregano oil (1000, 2000, and 4000 ppm) against those receiving salinomycin (60 ppm) and a

non-supplemented control group. Feed intake and body weight were measured across three feeding phases.

During the starter phase, chickens supplemented with oregano essential oil significantly increased their feed intake as compared to the control and salinomycin groups ($P < 0.01$, Table 3). The group receiving 1,000 ppm of oregano oil had the highest feed intake at 265.13 g and an average daily feed intake (ADFI) of 26.51 g/day, followed closely by the 2,000 ppm and 4,000 ppm groups. However, the differences among the oregano-supplemented groups were not significantly differed ($P > 0.05$).

Table 3. Feed intake and average daily feed intake of broilers fed control (CON), Salinomycin (SAL), or oregano oil diets (mean ± SD) over 35 days

Item	SAL	CON	Oregano essential oil (ppm.)			P-value
			1,000	2,000	4,000	
Feed intake (g)						
starter	232.58^{B}±2.49	232.27^{B}±2.29	265.13^{A}±10.06	258.97^{A}±18.48	258.10^{A} ±19.93	0.0001
grower	1348.56±33.95	1327.96±7.05	1327.95±12.76	1364.86±31.20	1336.31±8.99	0.120
finisher	1794.26±84.68	1834.59±38.45	1801.65±75.01	1830.51±90.83	1834.24±60.67	0.845
overall	3375.40±128.16	3394.83±42.98	3394.73±82.69	3454.34±80.26	3428.65±56.69	0.542
Average daily feed intake (g/day)						
starter	23.26^{B}±0.25	23.23^{B}±0.23	26.51^{A}±1.01	25.90^{A}±1.85	25.81^{A}±1.99	<0.0001
grower	89.91±2.26	88.53±0.47	88.53±0.85	90.99±2.08	89.09±0.60	0.120
finisher	179.43±8.47	183.46±3.85	180.16±7.50	183.05±9.08	183.42±6.07	0.845
overall	96.44±3.66	97.00±1.23	96.99±2.36	98.69±2.29	97.96±1.62	0.543

^{AB} Different letters within the same row indicate statistically significant differences.

The control and antibiotic-supplemented groups had significantly lower feed intakes and ADFI, with 232.58 g (23.26 g/day) and 232.27 g (23.23 g/day), respectively. These results indicated that supplementation with oregano essential oil, especially at a concentration of 1,000 ppm, effectively enhances feed intake during the starter phase as compared to both the control and antibiotic groups.

Higher feed intake resulted in significantly greater body weight on day 10 and an increased daily growth rate during the starter phase for chickens supplemented with oregano essential oil, compared to the control and antibiotic-supplemented groups ($P < 0.01$, Table 4). Chickens receiving 2,000 ppm of oregano essential oil demonstrated the highest average daily growth rate at 19.78 g/bird/day and followed by those supplemented with 1,000 ppm and 4,000 ppm of oregano essential oil, yielding average daily growth rates of 19.32 g/bird/day

and 18.52 g/bird/day, respectively. However, the differences among these groups were not statistically significant differed and ADFI (26.51 g/day), followed by the 2,000 ppm and 4,000 ppm groups. Differences among the oregano-supplemented groupswere not statistically significant differed. In contrast, the control group exhibited a significantly lower average daily growth rate of only 16.61 g/bird/day. These findings indicated that oregano essential oil supplementation, especially at 2,000 ppm, enhanced growth performance during the starter phase.

Feed conversion efficiency was evaluated by comparing the ratio of feed intake to body weight, chickens supplemented with 2,000 ppm of oregano essential oil showed the best feed conversion ratio (FCR). This ratio was similar to that of the group treated with antibiotics, which recorded the lowest FCR. However, the difference between these two groups was not statistically significant differed with FCR values of 1.31 for the oregano group and 1.29 for the antibiotic group (Table 4). Both groups had significantly lower FCRs as compared to the others. The differences in body weight, growth rate, and feed conversion efficiency among all groups were not statistically significant differed.

Table 4. Body weight, average daily gain and feed conversion ratio of broiler (mean ± SD) fed control (CON), salinomycin (SAL), or oregano oil diets over 35 days

Item	SAL	CON	Oregano essential oil (ppm)			P-value
			1,000	2,000	4,000	
Body weight (g)						
D 0	41.90±3.27	42.07±3.32	42.00±3.19	42.00±3.35	41.93±3.17	0.395
D 10	223.30^{B}±15.65	208.13^{C}±14.68	235.23^{AB}±15.17	239.83^{A}±23.50	227.10^{AB}±25.19	0.001
D 24	1253.60±44.12	1208.03±29.89	1202.25±47.45	1234.94±56.58	1184.01±28.06	0.191
D 35	2379.70±84.36	2381.78±59.82	2363.45±81.14	2388.83±62.25	2359.66±29.43	0.947
Average daily gain (g/bird/day)						
0-10	18.14^{B}±1.33	16.61^{C}±1.24	19.32^{AB}±1.28	19.78^{A}±2.03	18.52^{AB}±2.29	0.001
11-24	68.59^{A}±2.28	66.66^{AB}±2.38	64.47^{AB}±4.09	66.34^{AB}±3.54	63.79^{B}±2.68	0.171
25-35	111.76±8.13	116.53±5.18	116.12±8.11	114.52±4.59	116.75±5.29	0.703
0-35	66.80±2.47	66.85±1.70	66.33±2.31	67.05±1.72	66.22±0.78	0.947
Feed conversion ratio						
0-10	1.29^{C}±0.10	1.40^{A}±0.01	1.37^{AB}±0.01	1.31^{CB}±0.01	1.41^{A}±0.03	0.011
11-24	1.31±0.06	1.33±0.05	1.38±0.09	1.38±0.05	1.40±0.07	0.209
25-35	1.61±0.06	1.58±0.02	1.55±0.05	1.60±0.05	1.57±0.05	0.425
0-35	1.44±0.06	1.45±0.03	1.46±0.03	1.47±0.03	1.48±0.03	0.580

^{AB} Different letters within the same row indicate statistically significant differences.

Survival rate and feed cost efficiency

The dietary treatments were not significantly affected in broiler chickens' survival rate throughout the 35-day feeding period (Table 5). All groups achieved a 100% survival rate during the starter phase (0–10 days), with only minor mortality observed during the grower (11–24 days) and finisher (25–35 days)

phases. The consistently high survival rates indicated that oregano essential oil, even at concentrations up to 4000 ppm which it is found to be safe and did not show a negatively impact the viability of the birds.

Table 5. Survival rate and feed cost per kg of meat in broilers fed oregano oil or salinomycin (SAL) compared to the control group (CON) over 35 days

Item	SAL	CON	Oregano essential oil (ppm)			P -value
			1000	2000	4000	
Survival rate (%)						
starter	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00	1.000
grower	99.33±0.00	100.00±0.00	99.33±1.49	99.33±1.49	98.00±2.98	0.394
finisher	99.33±0.00	99.33±0.00	99.33±1.49	100.00±1.54	100.00±1.54	0.436
overall	98.67±1.83	99.33±1.49	98.67±1.83	98.67±2.98	97.33±3.65	0.801
Feed Cost per Gain (Bath/Kg)						
starter	23.85^{B}±1.63	25.96^{A}±1.90	25.76^{A}±1.30	25.57^{A}±1.08	26.72^{A}±5.25	0.009
grower	23.66^{B}±0.99	23.91^{B}±0.97	25.12^{AB}±1.64	25.85^{A}±1.25	26.07^{A}±0.93	0.013
finisher	25.20^{B}±0.98	24.68^{B}±0.35	24.74^{B}±0.79	25.41^{B}±0.77	26.66^{A}±0.89	0.005
overall	24.29^{C}±0.76	24.33^{C}±0.53	24.93^{CB}±0.54	25.56^{AB}±0.42	26.09^{A}±0.57	0.001

^{AB} Different letters within the same row indicate statistically significant differences.

However, the feed cost per kilogram of body weight gain was varied significantly among the groups during all study phases ($P < 0.05$). The group supplemented with salinomycin consistently had the lowest feed costs across all periods, particularly during the starter phase, costing 23.85 Baht per kilogram. Although the groups supplemented with oregano had slightly higher feed costs than the salinomycin group, the group receiving 1000 ppm of oregano demonstrated a favourable balance. This group is maintained feed cost efficiency comparable to the control group, with costs of 24.93 Baht per kilogram as compared to 24.33 Baht per kilogram for the control group ($P > 0.05$), while also supporting improved growth performance during the early phase.

A similar trend was observed during the grower and finisher phases. The group supplemented with 4000 ppm of oregano consistently incurred the highest feed costs per kilogram gained, which were significantly higher than those of both the salinomycin and control groups ($P < 0.01$). Throughout the entire 35-day period, the salinomycin group maintained the lowest feed cost per kilogram gained at 24.29 Baht. Meanwhile, feed costs are progressively increased with higher levels of oregano oil supplementation, reaching 26.09 Baht per kilogram

in the 4,000 ppm group. Notably, the 1,000 ppm oregano group exhibited feed cost efficiency comparable to the control group, which was not statistically significant differed.

Carcass characteristics

There were not statistically significant differed which observed in slaugter weight, hot carcass weight, or carcass yield among all treatment groups (Table 6). The average slaugter weights ranged from 2,240.67 to 2,272.33 g/bird, while hot carcass weights varied between 2,019.33 and 2,081.00 g./bird. Carcass yield percentages were similar across treatments, with values ranging from 81.66% to 82.54%.

Table 6. Carcass traits of 35-day-old broilers fed control (CON), salinomycin (SAL), or oregano oil diets

Traits (%)	SAL	CON	Oregano essential oil (ppm)			P - value
			1000	2000	4000	
Slaugter wt. (g)	2250.00±69	2244.67±81	2240.67±90	2272.33±70	2252.33±89	0.958
Carcass wt (g)	2081.00±62	2025.00±78	2019.33±86	2041.33±74	2042.34±74	0.792
Cacass	82.54±0.89	82.46±0.75	81.66±0.91	81.67±1.36	82.48±1.08	0.118
Breast	27.05±1.66	27.96±1.63	27.73±1.80	27.48±2.04	28.17±2.41	0.542
Fillet	4.09±0.44	4.29±1.39	4.28±0.04	4.17±0.43	4.51±0.39	0.122
Wing	9.43±0.48	10.04±1.63	9.69±0.45	9.52±0.31	9.47±0.51	0.377
Thing	15.39±0.97	15.17±1.21	14.81±0.97	14.91±1.03	15.09±1.25	0.698
Drumstick	11.85±0.57	11.92±0.55	11.70±0.54	12.00±1.56	11.56±0.50	0.636
Giblet	9.17±0.82	9.25±0.46	9.46±0.57	9.25±0.97	8.93±0.75	0.563
Liver	1.90±0.24	1.93±0.22	1.94±0.26	1.87±0.35	1.98±0.28	0.905
Heart	0.57±0.15	0.56±0.10	0.55±0.10	0.56±0.11	0.60±0.12	0.782
Gizzard	2.64±0.6	2.52±5.59	2.78±0.50	2.87±5.86	2.37±0.47	0.235

Likewise, the proportions of significant carcass cuts, including breast, fillet, wings, thighs, and drumsticks, expressed as a percentage of hot carcass weight, was not significantly differed between groups. Breast yield ranged from 27.05% to 28.17%, and fillet ranged from 4.09% to 4.51%. Other parts, such as

wings (9.43–10.04%), thighs (14.81–15.39%), and drumsticks (11.56–12.00%) which were not significant treatment affected.

Additionally, there were not significant differed in the relative weights of by-products, including the liver, heart, gizzard or total internal organs. These results suggested that oregano essential oil supplementation was not negatively affected the carcass composition or organ development when compared to antibiotic or control diets.

Overall, the inclusion of oregano essential oil in broiler diets up to 4000 ppm maintained carcass yield and cut proportions comparable to those of chickens fed with salinomycin or a standard diet, indicating its potential as a natural growth-promoting feed additive without adverse effects on carcass quality.

Discussion

The findings of this study indicated that supplementing broiler chickens with oregano essential oil which significantly enhanced their early growth performance, particularly during the first 10 days post-hatching. The group that received 1,000 ppm of oregano essential oil exhibited the highest feed intake during this period, with performance resulted to compare those of the group that received the antibiotic salinomycin. Moreover, body weight and average daily gain were higher in the oregano oil group compared to both the control and antibiotic-treated groups. Earlier research involving chickens indicated that adding oregano to their diet could promote growth (Chen *et al*., 2007; Malayoglu *et al*., 2010; Roofchaee *et al*., 2011). This highlights the bioactivity of the phytogenic compounds found in oregano, such as carvacrol and thymol, which are known to enhance palatability, stimulate digestive secretions, and possess antimicrobial properties (Windisch *et al*., 2008; Hashemi and Davoodi, 2010; Zeng *et al.*, 2015). The antimicrobial mechanism of oregano extract *in vitro* has already been investigated and reported (Krishan and Narang, 2014).

The first ten days after hatching are crucial for broiler management, as chicks' gastrointestinal and immune systems are still developing while facing significant environmental and nutritional stress. This is why the benefits of oregano are most noticeable during the starter phase. The enhanced palatability and appetite stimulation which significantly increased feed intake ($P<0.01$), which is found to be essential for encouraging small, inexperienced chicks to consume the necessary nutrients. Additionally, the potent antimicrobial and antioxidant properties of carvacrol and thymol provided a protective barrier for the immature gut during the initial stages of microbial colonization. By effectively reducing the growth of harmful bacteria, the essential oil ensures that

the energy and nutrients consumed are primarily directed toward maintenance and growth, rather than being diverted to immune responses and inflammation. Furthermore, the compounds' ability to improve digestive enzyme secretion and to reduce intestinal inflammation contributes to superior intestinal integrity, resulting in enhanced nutrient absorption and a feed conversion ratio comparable to the antibiotic group. These mechanistic advantages are found to be highly specific to the early, vulnerable phase of the chick's life, which is why the significant differences diminished as the birds transitioned into the grower phase, where their gut health stabilized and matured.

Additionally, raising the dosage of oregano essential oil past 4,000 ppm did not provide any further advantages, indicating a biological threshold and highlighting the cost-effectiveness of using lower inclusion rates. Roofchaee *et al.* (2011) explored the impact of oregano on the growth performance of broilers at varying concentrations ranging from 300 mg/kg to 1200 mg/kg. Their findings showed that the optimal effect was observed at 600 mg/kg, rather than at 1200 mg/kg.

While the effects of oregano essential oil were mostly pronounced during the starter phase, the maintenance of similar performance across all groups during the grower-finisher phase indicates that early supplementation can provide strategic advantages in broiler management. This approach can improve early growth metrics without the need for extended application, helping to reduce additive costs and simplify feed formulation.

From a sustainability perspective, oregano essential oil, derived from a renewable plant source, supports environmentally responsible production systems. It could contribute to reduce the ecological footprint by minimising reliance on synthetic compounds, promoting the development of circular, and plant-based feed additives.

These results closely aligned with recent research conducted by Ruan *et al*. (2021), which found that supplementing the diet with oregano essential oil at 150 or 300 mg/kg significantly improved average daily feed intake($P=0.059$), average daily gain ($P<0.05$), enhanced gut morphology, and positively influenced the cecal microflora in yellow-feathered broilers, particularly during the starter phase. Their study also emphasised the beneficial effects of oregano essential oil on intestinal health and antioxidant status, supporting the notion that phytogenic additives can enhance nutrient absorption and promote early growth in antibiotic-free broilers.

When examining multiple studies, a consistent trend showed that the starter phase was exceptionally responsive to supplementation with oregano essential oil. The study is supported by demonstrating notable benefits within the first 10 days of growth. Previous research by Roofchaee *et al*. (2011) highlighted

advantages during the grower phase (days 11-24), finding that supplementing with 600 mg/kg of oregano essential oil in Ross 308 broilers significantly improved growth and body weight compared to a control group ($P < 0.05$). Additionally, the 600 mg/kg and 1200 mg/kg oregano essential oil groups significantly enhanced feed conversion efficiency throughout the trial period ($P < 0.05$).

The accumulation of evidence highlights the promise of using oregano essential oil in early life as a focused approach to enhance appetite, aid gut development, and foster a beneficial microbial environment during this crucial phase of physiological change. In this study, the observed enhancement in the growth performance of chicks given oregano oil may be attributed to improve the health status, as indicated by an increase in systemic antioxidative capacity, even though all the birds were raised under standard conditions.

These results aligned with the conclusions drawn by Alagawany *et al*. (2020), who emphasised the multifaceted role of oregano essential oil in poultry health and production. Their review highlighted that the bioactive constituents of oregano essential oil, such as carvacrol and thymol, possess strong antimicrobial, antioxidant, and anti-inflammatory properties. These qualities are contributed not only to improve gut health and nutrient utilisation but also to enhance immunity and overall performance. Their works are emphasized how oregano essential oil can effectively reduce antibiotic usage without compromising productivity, aligning with current trends in sustainable and consumer-friendly poultry production.

Recent research by Tiyaprasertkul *et al.* (2025) highlighted the significant roles of the primary active components of oregano essential oil, thymol and carvacrol, in enhancing broiler performance during the starter and grower phases. Their study demonstrated that supplementing with thymol and carvacrol markedly improved growth performance in the grower phase, influenced blood biomarkers related to oxidative stress and inflammation, and enhanced intestinal morphology and microbial balance. These improvements in physiological and gut health are explained the observed growth-promoting effects, supporting the scientific rationale for using oregano essential oil in poultry production and indicating a shift towards more sustainable, antibiotic-free practices in the industry.

From a commercial perspective, these results showed a position oregano essential oil as a viable alternative to in-feed antibiotics, aligning with global trends toward antibiotic-free poultry production. Growing consumer awareness and regulatory restrictions have increased the demand for sustainable and health-conscious animal products (Haque *et al*., 2020). Unlike antibiotics, which may contribute to antimicrobial resistance and raise public health concerns,

phytogenic additives, such as oregano essential oil which provided a natural, residue-free solution that did not compromised the animal performance.

In conclusion, this study is significantly contributed to the expanding body of literature that firmly establishes oregano essential oil as a functional feed additive. When strategically incorporated during the early growth phase, oregano essential oil is found to be an effective alternative to antibiotics, enhancing broiler performance while maintaining production efficiency and keeping feed costs in check. The prominent results during the starter phase underscored the essential oil's ability to provide a "strong start" for chicks by boosting early feed intake and protecting the immature gut during this critical period of development. These findings underscored the potential of phytogenics in commercial broiler systems and is advocated for the widespread adoption of oregano essential oil as a cost-effective and health-promoting substitute for conventional antibiotics. Future research should decisively focus on long-term health outcomes, gut microbiota modulation, and immune responses, as well as practical on-farm implementation under diverse management conditions, to ensure the broader adoption of this promising alternative within the industry.

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Conflicts of interest

The authors declare no conflict of interest.

References

Alagawany, M., Abd El-Hack, M. E., Tiwari, R. and Farag, M. R. (2020). Oregano essential oil as a natural alternative to antibiotics in poultry production: A review. Journal of Applied Poultry Research, 29:602-612.

Chen, L. H., Yuan, Y., Leng, Y. F. and Cui, L. (2007). Effects of oregano oil on growth performance and carcass quality of broilers. China Poultry, 29:9-11.

Dorman, H. J. and Deans, S. G. (2000) Antimicrobial agents from plants: antibacterial activity of plant volatile oils. Journal of Applied Microbiology, 88:308-316

Hashemi, S. R. and Davoodi, H. (2010). Phytogenics as new class of feed additive in poultry industry. Journal of Animal Veterinary advances, 9:2295-2304.

Haque, M. H., Sarker, S., Islam, M. S., Islam, M. A., Karim, M. R., Kayesh, M. E. H., Shiddiky, M. J. A. and Anwer, M. S. (2020). Sustainable Antibiotic-Free Broiler Meat Production: Current Trends, Challenges, and Possibilities in a Developing Country Perspective. Biology, 9:411.

Kim, S. J., Lee, K. W., Kang, C. W. and An, B. K. (2016). Growth Performance, Relative Meat and Organ Weights, Cecal Microflora, and Blood Characteristics in Broiler Chickens Fed Diets Containing Different Nutrient Density with or without Essential Oils. Asian-Australasian Journal of Animal Sciences, 29:549-54.

Krishan, G. and Narang, A. (2014). Use of essential oils in poultry nutrition: a new approach. Journal of Advanced Veterinary and Animal Research, 1:156-162.

Malayoglu, H. B., Baysal, S., Misirlioğlu, Z., Polat, M., Yilmaz, H. and Turan, N. (2010.) Effects of oregano essential oil with or without feed enzymes on growth performance, digestive enzymes, nutrient digestibility, lipid metabolism and immune response of broilers fed on wheat-soybean meal diets. British Poultry Science, 51:67-80.

National Research Council. (1994). Nutrient requirements of poultry. 9th Rev. Edition. National Academy Press. Washington, DC.

Ruan, D., Fan, Q., Fouad, A. M., Sun, Y., Huang, S., Wu, A., Lin, C., Kuang, Z., Zhang, C. and Jiang, S. (2021). Effects of dietary oregano essential oil supplementation on growth performance, intestinal antioxidative capacity, immunity, and intestinal microbiota in yellow-feathered chickens. Journal of animal science, 99:skab033.

Roofchaee, A., Irani, M., Ebrahimzadeh, M. A. and Akbari, M. R. (2011). Effect of dietary oregano (*Origanum vulgare* L.) essential oil on growth performance, cecal microflora and serum antioxidant activity of broiler chickens. African Journal of Biotechnology, 10:6177-6183.

Sivropoulou, A., Papanikolaou, E., Nikolaou, C., Kokkini, S., Lanaras, T. and Arsenakis, M. (1996). Antimicrobial and cytotoxic activities of Origanum essential oils. Journal of Agricultural and Food Chemistry, 44:1202-1205.

Tiyaprasertkul, P., Phungkeha, P., Srikijkasemwat, K., Philatha, A., Rassmidatta, K., Ruangpanit, Y., Siwapirunthep, P., Yan, F., Romero-Sanchez. and Chaosap, C. (2025). Thymol-carvacrol supplementation in broilers: impact on performance, blood biomarkers, and gut health. International Journal of Agricultural Technology, 21:741-752.

Windisch, W., Shedle, K., Plitzner, C. and Kroismayr, A. (2008). Use of Phytogenic Products as Feed Additives for Swine and Poultry. Journal of Animal Science, 86:E140-E148.

Zeng, Z., Zhang, S., Wang, H. and Piao, X. (2015). Essential oil and aromatic plants as feed additives in non-ruminant nutrition: a review. Journal of Animal Science and Biotechnology, 6:7.

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