Zagazig J. Agric. Res., Vol. 52 No. (4) 2025 885- 896

Animal, Poultry and Fish Production Research

Available online at http://zjar.journals.ekb.eg
http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

EFFECT OF DIETARY SUPPLEMENTATION OF EQUAL MIXES OF CINNAMON AND OREGANO ESSENTIAL OILS ON THE EARLY GROWTH PERFORMANCE OF PEKIN DUCKS

Nada A. Mansour, Zenat A. Ibrahim, M.M. Alagawany and M.S. El-Kholy*

Poult. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 24/07/2025; Accepted: 31/08/2025

ABSTRACT: Our trial aimed to investigate whether different dietary levels of equal mixes of cinnamon and oregano essential oils can affect the early growth performance of Pekin duck during 0-2 weeks of age. A total of 200 healthy one- day-old Pekin ducks were randomly distributed into 4 experimental groups. Each group contained 5 replicates with 10 birds each. The 1st group received the standard diet with no supplementation, while the 2nd, 3rd, and 4th groups received the standard diet supplemented with 50, 100, and 150 mg of equal mix of cinnamon and oregano oil per kg diet, respectively. By the end of the first week, ducks supplemented with 100 mg or 150 mg/kg of the oil mixture exhibited significantly higher live body weight (LBW) and body weight gain (BWG) compared to the control group, while the 50 mg group showed intermediate values. This trend became more pronounced in the second week, where birds receiving 100 and 150 mg/kg had significantly greater LBW than the control. Across all measured intervals (week 0–1, week 1–2, and week 0–2) no significant differences were observed in feed intake (FI) and feed conversion ratio (FCR) among the control group and the groups receiving 50 mg, 100 mg, or 150 mg of the essential oil mix per kg of diet. However, FI and FCR were numerically improved by dietary treatments with essential oils, compared to the control. These findings indicate that the inclusion of essential oil mixtures at 100–150 mg/kg in duck diets may enhance growth performance without adversely affecting feed utilization.

Key words: Cinnamon, oregano, pekin ducks, early growth performance

INTRODUCTION

The poultry production industry is a major sector of global agriculture, playing a crucial role in food production **(Alagawany *et al.*, 2019a)**. The inclusion of natural feed additives with bioactive compounds in poultry diets has demonstrated promising results in enhancing growth performance and health **(Alagawany *et al.*, 2018; Hussein *et al.*, 2019; Alagawany *et al.*, 2019b, c; Gado *et al.*, 2019; Reda *et al.*, 2020; Zhang *et al.*, 2024)**. Among these alternatives, essential oils (EOs) that obtained from aromatic plants have gained attention as eco-friendly and cost-effective substitutes for antibiotics in poultry nutrition. Essential oils have long been utilized in various industries, including skincare **(Gutiérrez *et al.*, 2008)**, aromatherapy, cosmetics **(Price, 2003)**, herbal medicine **(Lau *et al.*, 1998)**, and perfumery **(Nielsen and Rios, 2000)**. They are recognized for their antimicrobial and insecticidal properties, which make them valuable in agricultural applications **(Singh *et al.*, 2005; Abd El-Hack *et al.*, 2020)**. Additionally, some plant extracts have been found to enhance digestion and improve nutrient absorption **(Ertas *et al.*, 2005)**. Also, EOs can enhance digestion and alleviate heat stress, along with acting against pathogens **(Mahmoud *et al.*, 2025)**. Due to their natural origin, easy availability, and lack of toxic residues, herbs and their essential oils are being considered as alternatives to antibiotic as growth promoters (AGPs) in poultry production **(Al-**

*** Corresponding author: Tel. :**+201069446858
E-mail address: elkolymohamed1980@gmail.com

Abdullatif *et al*., 2023; Khan and Ahmad, 2023).

Cinnamomum zeylanicum, a member of the Lauraceae family, is one of the oldest medicinal herbs. Its essential oil contains bioactive compounds like cinnamaldehyde and eugenol, making it a valuable plant-based additive with significant potential **(Ali *et al*., 2025)**. These compounds exhibit strong antibacterial activity against pathogens such as *Vibrio parahaemolyticus*, *Staphylococcus aureus*, *Salmonella* spp., and *Escherichia coli* **(Chang *et al*., 2001)**. Additionally, cinnamon oil possesses hypocholesterolemic, antioxidant, analgesic, antiulcer, and antifungal properties **(Mastura *et al*., 1999; Lin *et al*., 2003; Entana and Alejandro, 2024).** According to **Wenk (2000)**, plant-based feed additives can inhibit the growth of harmful bacteria while supporting beneficial gut microbiota, ultimately improving poultry health and productivity.

Oregano essential oil (EOO) is among the widely explored plant-derived additives in poultry nutrition. Various oregano species are distributed globally, particularly in regions such as Greece and Turkey **(Leyva-López *et al*., 2017)**. The oil's primary bioactive components, carvacrol and thymol, are present in differing concentrations depending on the plant species **(Leyva-López *et al*., 2017)**. When incorporated into poultry diets, oregano oil has demonstrated a broad spectrum of biological activities, including antimicrobial, antioxidant, antiviral, antiparasitic, and immune-enhancing properties **(Alagawany *et al*., 2018)**.

Owing to such advantages of these essential oils, the present study aimed to investigate whether different dietary levels of equal mixes of cinnamon and oregano essential oils can affect the early growth performance of Pekin duck during 0-2 weeks of age.

MATERIALS AND METHODS

Experimental Design, Ducklings, And Managerial Conditions

The present study was carried out in a private duck farm, Sharkia governorate, Egypt. A total number of 200 one-day-old Pekin ducks were randomly distributed to 4 equal groups in a one way completely randomized design. Each group contained 50 ducklings with 5 replications (10 birds each). The 1st group received the standard diet with no supplementation, while the 2nd, 3rd, and 4th groups received the standard diet supplemented with 50, 100, and 150 mg of equal mix of cinnamon and oregano oil per kg diet, respectively. Birds in each replicate were placed in a separate litter floor pen (150 × 100 cm). Birds in all treatment groups were fed on the same basal diets (Table 1) which were formulated to meet or exceed Pekin duck requirements during the starter period according to **NRC (1994)**.

All birds were reared in an open-sided duck farm. The indoor temperature was around 33°C through the first three days of age, after that the temperature was gradually reduced to 27°C at the end of the trial (14th day of age). The standard management and husbandry procedure was applied during the experimental period. Feed and water were introduced *ad libitum* through the experimental period.

Data Collection

Live body weight (LBW) and body weight gain (BWG)

Ducklings were weighed post-hatch on the first day of age (LBW 0) and were equally distributed among the replicates (10 birds each) to ensure that the average body weight was approximately equal across all replicates. Birds were weighed again at the end of the first (LBW 1) and second (LBW 2) week of age. Body weight gain (g/day) was calculated by subtracting the average live body weight of each replicate between two successive weights (BWG 0-1 and BWG 1-2). Also, body weight gain was calculated for the whole period (BWG 0-2) by subtracting the average initial live body weight (LBW 0) from the average final live body weight (LBW 2) of each replicate.

Feed intake (FI) and feed conversion ratio (FCR)

At the beginning of each experimental period, a certain amount of each experimental diet was weighed for each replicate within each treatment group. At the end of the certain period, the remaining diet was weighed and subtracted from that offered to obtain the total FI per replicate

Table 1. Ingredients and calculated nutrients' content of the control diet

Ingredients	%
Yellow corn (8.5%)	56.5
Soybean meal (44%)	37.0
Corn gluten meal (62%)	1.50
Soybean oil	2.00
Limestone	0.59
Dicalcium phosphate	1.41
Salt	0.20
Premix[1]	0.30
Choline-chloride (50%)	0.30
Dl-Methionine	0.03
Sodium bicarbonate	0.17
Total	**100**
[2]Calculated nutrients' content	
Crude protein %	22.03
Calcium %	0.65
Available phosphorus %	0.40
Lysine %	1.16
Methionine %	0.41
Total sulfur amino acids %	0.75
Metabolizable energy (kcal/kg diet)	2951

[1] Provides per kg of diet: Vitamin A, 12,000 I.U; Vitamin D3, 5000 I.U; Vitamin E, 130.0 mg; Vitamin K3, 3.605 mg; Vitamin B1 (thiamin), 3.0 mg; Vitamin B2 (riboflavin), 8.0 mg; Vitamin B6, 4.950 mg; Vitamin B12, 17.0 mg; Niacin, 60.0 mg; D-Biotin, 200.0 mg; Calcium D-pantothenate, 18.333 mg; Folic acid, 2.083 mg; manganese, 100.0 mg; iron, 80.0 mg; zinc, 80.0 mg; copper, 8.0 mg; iodine, 2.0 mg; cobalt, 500.0 mg; and selenium, 150.0 mg.

[2] Calculated according to **NRC (1994).**

during the certain period. The previous amount was divided by number of chicks in the replicate to obtain average amount of feed intake per chick. The previous amount was divided by period length (day) to obtain the average amount of FI per chick per day (FI 0-1, 1-2, and 0-2). Feed conversion ratio (FCR) was calculated as grams of feed required to produce one gram of body gain during each experimental period (FCR 0-1, 1-2, and 0-2). The calculation of FCR was achieved by determining the ratio between average daily FI and average daily BWG.

Statistical Analysis

Analysis of variance for data was accomplished using the SAS General Liner Models Procedure **(SAS Institute, 2004).** The model was assessed for different traits according to **Snedecor and Cochran (1982).** The statistical fixed model used was:

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

Where:

Y_{ij} = An observation.

μ = Overall mean.

Ti = The fixed effect of treatments with equal mixtures of cinnamon and oregano oil at 50, 100, 150 mg/kg diets.

eij = Random error.

Duncan's new multiple range test was used to test the differences among the means according to **Duncan (1955)**. Statistical significance was accepted at a probability level of 0.05 ($P < 0.05$).

RESULTS

Live Body Weight

Table 2 demonstrates the effects of dietary supplementation with equal mixtures of cinnamon and oregano essential oils on the LBW of Pekin ducks. At the start of the experiment (LBW 0), there were no significant differences among the groups, indicating uniform initial weights (P = 0.960). However, by the end of the first week (LBW 1), ducks supplemented with 100 mg or 150 mg/kg of the oil mixture exhibited significantly (P= 0.044) higher body weights compared to the control group, while the 50 mg group showed intermediate values. This trend became more pronounced in the second week (LBW 2), where birds receiving 100 and 150 mg/kg had significantly (P = 0.012) greater weights than the control, and the 50 mg group again showed intermediate values.

Body Weight Gain

Table 3 illustrates the effects of dietary supplementation with equal mixtures of cinnamon and oregano essential oils on the BWG of Pekin ducks. During the first week (BWG 0–1), ducks supplemented with 100 and 150 mg/kg of the oil mixture showed significantly (P = 0.032) higher weight gains compared to the control group, while the 50 mg group displayed intermediate values. Although weight gain from week 1 to 2 (BWG 1–2) numerically increased with higher supplementation levels, the differences were not statistically significant (P = 0.061). Over the entire two-week period (BWG 0–2), birds receiving 100 and 150 mg/kg of the essential oil mix exhibited significantly (P=0.014) greater cumulative weight gains compared to the control group, with the 50 mg group again showing intermediate results.

Feed Intake

The data in Table 4 illustrates the effect of dietary supplementation with equal mixes of cinnamon and oregano essential oils on FI of Pekin ducks during different growth phases. Across all measured intervals (week 0–1, week 1–2, and week 0–2) no significant differences (P = 0.318, 0.730, and 0.661, respectively) were observed among the control group and the groups receiving 50 mg, 100 mg, or 150 mg of the essential oil mix per kg of diet. Although slight numerical increases in FI were noted in the 50 mg and 100 mg groups compared to control, particularly during the first week (27.76 ± 1.074 and 27.06 ± 1.178 g vs. 26.72 ± 0.998 g), these differences were not statistically significant. Similarly, FI during week 1–2 and over the entire two-week period (week 0-2) remained comparable across all treatments.

Feed Conversion Ratio

Table 5 presents the effects of dietary supplementation with equal mixes of cinnamon and oregano essential oils on the FCR of Pekin ducks during different growth intervals. While no statistically significant differences were observed among the treatment groups throughout the experimental periods ($P > 0.05$), a numerical improvement in FCR was noted with increasing levels of supplementation. During the first week (0–1), the FCR decreased (P = 0.069) progressively from 1.419 in the control group to 1.302 in the group receiving 150 mg/kg, approaching statistical significance. Similarly, during week 1–2 and over the entire 2-week period, ducks fed 100 mg and 150 mg/kg diets exhibited better (P = 0.348 and 0.208, respectively) FCR values (1.462 and 1.474; 1.427 and 1.417, respectively) compared to the control (1.594 and 1.536, respectively).

DISCUSSION

In the present study, our findings in Tables 2 and 3 indicated that supplementation with 100–150 mg/kg of cinnamon and oregano essential oils can effectively enhance early growth performance in terms of LBW and BWG of Pekin ducks during first two weeks of age. Likewise, **Mehdipour *et al*. (2013)** noted a significant increase (P=0.003) in BWG of quails aged 21–35 days when supplemented with 200 mg/kg of

Table 2. Effect of dietary supplementation of equal mixes of cinnamon and oregano essential oils on live body weight (LBW) of Pekin ducks

Items	Control	Cinnamon and oregano oil mix/kg of diet			Sig.
		50 mg	100 mg	150 mg	
LBW 0	47.38 ± 1.385	47.26 ± 1.412	47.10 ± 1.409	47.56 ± 1.365	0.960
LBW 1	179.4 ± 5.442[b]	184.3 ± 3.434[ab]	187.1 ± 6.141[a]	189.6 ± 5.682[a]	0.044
LBW 2	451.3 ± 20.040[b]	471.0 ± 21.177[ab]	485.8 ± 7.944[a]	490.2 ± 17.365[a]	0.012

Means in the same row bearing different letters are significantly different (P≤0.05).

Table 3. Effect of dietary supplementation of equal mixes of cinnamon and oregano essential oils on body weight gain (BWG) of Pekin ducks

Items	Control	Cinnamon and oregano oil mix/kg of diet			Sig.
		50 mg	100 mg	150 mg	
BWG 0-1	18.86 ± 0.796[b]	19.58 ± 0.303[ab]	20.00 ± 0.857[a]	20.28 ± 0.746[a]	0.032
BWG 1-2	38.84 ± 2.441	40.98 ± 3.114	42.66 ± 0.850	42.94 ± 2.686	0.061
BWG 0-2	28.86 ± 1.506[b]	30.28 ± 1.499[ab]	31.34 ± 0.467[a]	31.64 ± 1.335[a]	0.014

Means in the same row bearing different letters are significantly different (P≤0.05).

Table 4. Effect of dietary supplementation of equal mixes of cinnamon and oregano essential oils on feed intake (FI) of Pekin ducks

Items	Control	Cinnamon and oregano oil mix/kg of diet			Sig.
		50 mg	100 mg	150 mg	
FI 0-1	26.72 ± 0.998	27.76 ± 1.074	27.06 ± 1.178	26.40 ± 1.345	0.318
FI 1-2	61.68 ± 2.812	63.86 ± 2.579	62.38 ± 2.823	62.94 ± 4.036	0.730
FI 0-2	44.22 ± 1.886	45.84 ± 1.762	44.72 ± 1.993	44.70 ± 2.603	0.661

Table 5. Effect of dietary supplementation of equal mixes of cinnamon and oregano essential oils on feed conversion ratio (FCR) of Pekin ducks

Items	Control	Cinnamon and oregano oil mix/kg of diet			Sig.
		50 mg	100 mg	150 mg	
FCR 0-1	1.419 ± 0.094	1.418 ± 0.047	1.355 ± 0.087	1.302 ± 0.059	0.069
FCR 1-2	1.594 ± 0.143	1.567 ± 0.145	1.462 ± 0.056	1.474 ± 0.173	0.348
FCR 0-2	1.536 ± 0.121	1.517 ± 0.096	1.427 ± 0.057	1.417 ± 0.130	0.208

cinnamon oil, outperforming groups receiving cinnamon powder, antibiotics (virginiamycin), and symbiotics. **Shirzadegan (2014)** further confirmed that broiler chickens fed diets containing various concentrations of cinnamon powder, particularly at a 0.5% inclusion level, exhibited notable improvements in final body weight. **Devi *et al*. (2018)** also reported a significant (P<0.01) increase in broiler body weight at 42 days when diets were supplemented with cinnamon oil. Conversely, some studies have indicated no significant impact of cinnamon oil on poultry growth. **Lee *et al*. (2003)** found no changes in broiler weight gain as affected by cinnamaldehyde administration, though it significantly reduced water intake. **Muhl and Liebert (2007)** recorded insignificant changes in performance of broiler fed diets containing cinnamaldehyde and other bioactive phytogenic compounds. Similarly, **Koochaksaraie *et al*. (2011)** found that cinnamon treatment (0.50–2.00 g/kg diet) exerted insignificant effect on broiler growth. Further research by **Tonbak and Çiftçi (2012)** revealed that adding cinnamon oil (*Cinnamomum zeylanicum L.*) at doses of 250 or 500 ppm to quail diets, whether under heat stress or normal conditions, did not significantly impact live weight or weight gain. **Symeon *et al*. (2014)** also found no substantial differences in broiler body weight at market age when cinnamon oil was included at 0.5 or 1.0 ml per kg of feed. Despite these mixed findings, alternative strategies have focused on improving poultry health by modulating intestinal microflora and preventing pathogenic bacterial spread. Essential oils, including cinnamon oil, enhance feed efficiency and growth performance by boosting immune function, regulating gut microbiota, stimulating the secretion of digestive enzymes, and exerting antioxidant, and antimicrobial effects **(Saeed *et al*., 2018; Kishawy *et al*., 2019; Mahgoub *et al*., 2019; Abo Ghanima *et al*., 2020)**.

Oregano essential oil has been suggested to enhance nutrient digestibility, potentially by stimulating digestive enzyme activity in the gastrointestinal tract, as proposed by **Ghazi *et al*. (2015)** in their study on broilers exposed to heat stress. Another plausible mechanism is the enhancement of nutrient metabolism, as observed by **Reyer *et al*. (2017)**, who administered a blend of essential oils (including oregano, thyme, rosemary, and star anise) to day-old broiler chicks. Our findings revealed that ducks supplemented with oregano essential oil exhibited a significant increase in average BWG compared to the un-supplemented ducks. This improvement may be attributed to enhanced gut function and more efficient nutrient absorption, echoing the findings of **Zhang *et al*. (2021)**, who reported improved growth performance in broilers fed oregano essential oil from hatch to 21 days, without affecting feed intake. Similar growth-promoting effects of oregano oil have been documented in earlier studies as well (**Hashemipour *et al*., 2013; Ghazi *et al*., 2015; Tzora *et al*., 2017; Amer *et al*., 2021; Zhang *et al*., 2021)**, supporting the beneficial role of oregano essential oil in poultry nutrition.

Our findings in Tables 3 and 4 suggest that the inclusion of equal mixes of cinnamon and oregano essential oils at the tested levels (50, 100, and 150 mg/kg diet) did not affect FI or FCR in Pekin ducks during the early growth phase. **Zhang *et al*. (2021)** reported improved growth performance in broilers fed essential oils from hatch to 21 days, without affecting feed intake, indicating that the improvements in LBW and BWG may be attributed to enhanced gut function and more efficient nutrient absorption. The influence of cinnamon and oregano essential oil on FI and FCR in poultry has been the subject of numerous investigations, with outcomes varying considerably. Several studies (e.g., **Al-Kassie, 2009; Ciftci *et al*., 2009; Mehdipour *et al*., 2013; Şimşek *et al*., 2015; Torki *et al*., 2015; Pathak *et al*., 2017; Mehdipour and Afsharmanesh, 2018)** have reported beneficial effects. For instance, **Al-Kassie (2009)** noted that broilers receiving 200 ppm of a thyme-cinnamon essential oil mixture exhibited improved feed intake and utilization. Likewise, **Ciftci *et al*. (2009)** observed enhanced FCR in broiler chicks fed diets containing 0.5 g/kg of cinnamon essential oil, surpassing those given avilamycin antibiotic or un-supplemented diets. Furthermore, **Mehdipour and Afsharmanesh (2018)** demonstrated that quail diets enriched with either cinnamon essential oil or virginiamycin (200 mg/kg) led to comparable gains in FCR by day 35, although FI remained unchanged.

Conversely, in accordance with our findings in the present work, several other investigations have failed to detect any significant impact of cinnamon and oregano essential oil on FI and FCR. Research by **Lee *et al*. (2003), Hernandez *et al*. (2004), Sarica *et al*. (2009), Tonbak and Çiftçi (2012), Symeon *et al*. (2014) and Pathak *et al*. (2017),** reported no notable changes in FI or FCR following cinnamon oil or powder supplementation. Notably, **Lee *et al*. (2003)** found that while cinnamaldehyde inclusion did not influence FI or FCR in broilers, it did reduce water intake. **Tonbak and Çiftçi (2012)** also concluded that the addition of cinnamon essential oil (250 or 500 ppm) did not significantly affect FCR in quail, regardless of exposure to heat stress. Similarly, **Hernandez *et al*. (2004)** observed minimal effects on performance when a blend of cinnamon, oregano, and pepper essential oils (200 ppm) was added to the diet. Also, **Cufadar (2018), Karadagoglu *et al*. (2018), Feng *et al*. (2021), and Zhao *et al*. (2021)** reported no significant effects on FI in chickens receiving diets containing oregano essential oil.

Conclusion

The supplementation of a dietary mixture of cinnamon and oregano essential oils at levels of 100 or 150 mg/kg significantly improved live body weight and body weight gain of Pekin ducks during the early growth phase. Although feed intake and feed conversion ratio were not statistically affected, the numerical enhancements observed suggest potential benefits in feed efficiency. These findings indicate that the inclusion of essential oil mixtures at 100–150 mg/kg in duck diets may enhance growth performance without adversely affecting feed utilization.

REFERENCES

Abd El-Hack, M. E., Abdelnour, S. A., Taha, A. E., Khafaga, A. F., Arif, M., Ayasan, T., Swelum, A. A., Abukhalil, M. H., Alkahtani, S., Aleya, L. and Abdel-Daim, M. M. (2020). Herbs as thermoregulatory agents in poultry: An overview. Science of the Total Environment, 703. https://doi.org/10.1016/ j. scitotenv. 2019. 134399

Abo Ghanima, M. M., Elsadek, M. F., Taha, A. E., Abd El-Hack, M. E., Alagawany, M., Ahmed, B.M., Elshafie, M.M. and El-Sabrout, K. (2020). Effect of Housing System and Rosemary and Cinnamon Essential Oils on Layers Performance, Egg Quality, Haematological Traits, Blood Chemistry, Immunity, and Antioxidant. Animals, 10 (2), 245. https://doi.org/10.3390/ ani10020245

Al-Abdullatif, A. A., Qaid, M. M., Al-Mufarrej, S. I., Al-Garadi, M. A., Murshed, M. A. and Alhotan, R. A. (2023). Impact of dietary supplementation with cinnamon bark powder on broiler growth and carcass indices, small intestinal measurements, physico-chemical properties of meat and economics of production. Cogent Food and Agriculture, 9 (2). https://doi.org/10.1080/23311932.2023. 2284686

Alagawany, M., Abd El-Hack, M. E., Farag, M. R., Elnesr, S. S., El-Kholy, M. S., Saadeldin, I. M. and Swelum, A. A. (2018). Dietary supplementation of Yucca schidigera extract enhances productive and reproductive performances, blood profile, immune function, and antioxidant status in laying Japanese quails exposed to lead in the diet. Poultry Science, 97 (9), 3126–3137. https:// doi.org/10.3382/ps/pey186

Alagawany, M., Elnesr, S. S. and Farag, M. R. (2019b). Use of liquorice (*Glycyrrhiza glabra*) in poultry nutrition: Global impacts on performance, carcass and meat quality. World's Poultry Science Journal, 75(2), 293–303. https://doi.org/10.1017/S004393391900 0059

Alagawany, Mahmoud, Elnesr, S. S., Farag, M. R., Abd El-Hack, M. E., Khafaga, A. F., Taha, A. E., Tiwari, R., Iqbal Yatoo, M., Bhatt, P., Khurana, S.K. and Dhama, K. (2019c). Omega-3 and omega-6 fatty acids in poultry nutrition: Effect on production performance and health. Animals, 9 (8), 573. https://doi.org/10.3390/ani9080573

Alagawany, Mahmoud, Elnesr, S. S., Farag, M. R., El-Hack, M. E. A., Khafaga, A. F., Taha, A. E., Tiwari, R., Yatoo, M. I., Bhatt, P., Marappan, G. and Dhama, K. (2019a). Use of licorice (Glycyrrhiza glabra) herb as a feed additive in poultry: Current knowledge and prospects. Animals, 9(8), 536.

ALi, G. I. ., Tahoon, A. Y., Naena, NEHAL, A. A., El-Keredy, A. M. S., Al-Sokary, E. T., Elbaz, S. and Abou ASA, S. (2025). Cinnamon nano particles (CNPS) as feed additives on rabbit growth performance, immunity, antioxidant capacity, and resistance to Escherichia coli. Assiut Veterinary Medical Journal, 71(184), 608–634. . 21608/ avmj.2025.320513.1399

Al-Kassie, G.A.M. (2009). Influence of two plant extracts derived from thyme and cinnamon on broiler performance. Pakistan Veterinary Journal, 29(4), 169–173.

Amer S.A., Tolba S.A., Al Sadek D.M.M., Abdel Fattah D.M., Hassan A.M. and Metwally A. E. (2021). Effect of supplemental glycerol monolaurate and oregano essential oil blend on the growth performance, intestinal morphology, and amino acid digestibility of broiler chickens. BMC Veterinary Res. 17 (1), 312. doi: 10.1186/s12917-021-03022-5

Chang, S. T., Chen, P. F. and Chang, S. C. (2001). Antibacterial activity of leaf essential oils and their constituents from Cinnamomum osmophloeum. Journal of Ethnopharmacology, 77 (1), 123–127. https:// doi.org /10.1016/S0378-8741(01)00273-2

Ciftci, M., Dalkilic, B., Cerci, I. H., Guler, T., Ertas, O. N. and Arslan, O. (2009). Influence of dietary cinnamon oil supplementation on performance and carcass characteristics in broilers. Journal of Applied Animal Research, 36(1), 125–128. https://doi.org/10.1080/ 097 12119 .2009.9707045

Cufadar, Y. (2018). Effects of dietary oregano essential oil supplementation on performance and eggshell quality in laying hens. Selcuk J. Agric. Food Sci. 32 (2), 158–161. doi: 10.15316/SJAFS.2018.79

Devi, P. C., Samanta, A. K., Das, B., Kalita, G., Behera, P. S., and Barman, S. (2018). Effect of Plant Extracts and Essential Oil Blend as Alternatives to Antibiotic Growth Promoters on Growth Performance, Nutrient Utilization and Carcass Characteristics of Broiler Chicken. Indian Journal of Animal Nutrition, 35 (4), 421. https://doi.org/10.5958/2231-6744. 2018.00064.6

Duncan, D. B. (1955). Multiple range and multiple “F” test. Biometrics, 11: 1–42.

Entana Jr, R. B. and Alejandro, M. A. (2024). Growth Performance of Broiler Chicken (*Gallus gallus* domesticus) in Response to Cinnamon Powder as Feed Additives. Turkish Journal of Agriculture - Food Science and Technology, 12(12), 2497–2500. https://doi.org/10.24925/turjaf.v12i12.2497-2500.6948

Ertas, O. N., Güler, T., Çiftçi, M., Dalkiliç, B. and Gülcihan Simsek, Ü. (2005). The effect of an essential oil mix derived from oregano, clove and anise on broiler performance. International Journal of Poultry Science, 4 (11), 879–884. https://doi.org/10.3923/ijps. 2005.879.884

Feng J., Lu M., Wang J., Zhang H., Qiu K. and Qi G. (2021). Dietary oregano essential oil supplementation improves intestinal functions and alters gut microbiota in late-phase laying hens. J. Anim. Sci. Biotechnol. 12 (1), 72. doi: 10.1186/s40104-021-00600-3

Gado, A.R., Ellakany, H.F., Elbestawy, A.R., El-Hack, M.E.A., Khafaga, A.F., Taha, A.E., Arif, M. and Mahgoub, S.A. (2019). Herbal medicine additives as powerful agents to control and prevent avian influenza virus in poultry – a review. Annals of Animal Science, 19 (4), 905–935. https://doi.org/ 10. 2478/aoas-2019-0043

Ghazi S., Amjadian T. and Norouzi S. (2015). Single and combined effects of vitamin C and oregano essential oil in diet, on growth performance, and blood parameters of broiler chicks reared under heat stress condition. Int. J. Biometeorol 59 (8), 1019–1024. Doi: 10. 1007/ s00484-014-0915-4

Gutiérrez, R. M. P., Mitchell, S. and Solis, R. V. (2008). Psidium guajava: A review of its traditional uses, phytochemistry and pharmacology. Journal of Ethnopharmacology, 117 (1), 1–27. https://doi.org/10.1016/j.jep. 2008. 01.025

Hashemipour H., Kermanshahi H., Golian A.

and Veldkamp T. (2013). Effect of thymol and carvacrol feed supplementation on performance, antioxidant enzyme activities, fatty acid composition, digestive enzyme activities, and immune response in broiler chickens. Poultry Sci., 92 (8), 2059–2069. doi: 10.3382/ps.2012-02685

Hernández, F., Madrid, J., García, V., Orengo, J., and Megías, M. D. (2004). Influence of two plant extracts on broilers performance, digestibility, and digestive organ size. Poultry Science, 83(2), 169–174. https://doi.org/10. 1093/ ps/83.2.169

Hussein, M.M.A., Abd El-Hack, M.E., Mahgoub, S.A., Saadeldin, I.M. and Swelum, A. A. (2019). Effects of clove (*Syzygium aromaticum*) oil on quail growth, carcass traits, blood components, meat quality, and intestinal microbiota. Poultry Science, 98(1), 319–329. https://doi.org/10.3382/ps/pey348

Karadagoglu O., Ozsoy B., Olmez M., Aydin O. D. and Sahin T. (2018). The Effects of Drinking Water Supplemented with Essential Oils on Performance, Egg Quality and Egg Yolk Fatty Acid Composition in Laying Hens. İstanbul Üniversitesi Veteriner Fakültesi dergisi 44 (2), 85. doi: 10.26650/ actavet.2018.410397

Khan, K. and Ahmad, N. (2023). Using cinnamon (*Cinnamomum zeylanicum*) and turmeric (Curcuma longa L) powders as an antibiotic growth promoter substitutions in broiler chicken's diets. Animal Biotechnology, 34(9), 4466–4473. https://doi.org/10.1080/ 10495398. 2022.2157282

Kishawy, A. T. Y., Amer, S. A., Abd El-Hack, M. E., Saadeldin, I.M. and Swelum, A. A. (2019). The impact of dietary linseed oil and pomegranate peel extract on broiler growth, carcass traits, serum lipid profile, and meat fatty acid, phenol, and flavonoid contents. Asian-Australasian Journal of Animal Sciences, 32 (8), 1161–1171. https://doi.org/ 10.5713/ajas.18.0522

Koochaksaraie, R. R., Irani, M. and Gharavysi, S. (2011). The effects of cinnamon powder feeding on some blood metabolites in broiler chicks. Revista Brasileira de Ciencia Avicola / Brazilian Journal of Poultry Science, 13 (3), 197–201. Lau, B. H. S. (1998). Rational Phytotherapy: A Physicians' Guide to Herbal Medicine. In *Annals of Internal Medicine* (Vol. 128, Issue 10). Springer. https://doi.org/10.7326/0003-4819-128-10-199805150-00036

Lee, K. W., Everts, H., Kappert, H. J., Frehner, M., Losa, R., and Beynen, A. C. (2003). Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. British Poultry Science, 44 (3), 450–457. https://doi.org/10.1080/00071660310000855 08

Leyva-López N., Gutiérrez-Grijalva E., Vazquez -Olivo G. and Heredia J. B. (2017). Essential Oils of Oregano: Biological Activity beyond Their Antimicrobial Properties. Molecules (Basel Switzerland) 22 (6), 989. doi: 10.3390 /molecules22060989

Lin, C. C., Wu, S. J., Chang, C.H. and Ng, L. T. (2003). Antioxidant activity of *Cinnamomum cassia*. In Phytotherapy Research (Vol. 17, Issue 7, pp. 726–730). https://doi.org/10.1002 /ptr.1190

Mahgoub, S.A.M., El-Hack, M.E.A., Saadeldin, I. M., Hussein, M. A., Swelum, A.A. and Alagawany, M. (2019). Impact of Rosmarinus officinalis cold-pressed oil on health, growth performance, intestinal bacterial populations, and immunocompetence of Japanese quail. Poultry Science, 98(5), 2139–2149.

Mahmoud, H. A., Afiffy, O. S., El-Hamady, H. Y. and Mohamed, N. G. (2025). Effects of Dietary Anise, Lemon and Mint Oils Supplementation on Growth Performance, Carcass Traits and Blood Biochemical Parameters of Broiler Chickens. Assiut Veterinary Medical Journal (Egypt), 71(184), 335–349. https://doi.org/10.21608/avmj. 2025. 336405.1469

Mastura, M., Nor Azah, M. A., Khozirah, S., Mawardi, R., and Abd. Manaf, A. (1999). Anticandidal and antidermatophytic activity of *Cinnamomum* species essential oils. *Cytobios*, *1999*(387), 17–23.

Mehdipour, Z. andAfsharmanesh, M. (2018). Evaluation of synbiotic and cinnamon (*Cinnamomum verum*) as antibiotic growth promoter substitutions on growth performance, intestinal microbial populations and blood parameters in Japanese quail. Journal of Livestock Science and Technologies, 6(2), 1–8. https://doi.org/10. 22103 /jlst.2018.10558.1200

Mehdipour, Zohreh, Afsharmanesh, M. and Sami, M. (2013). Effects of dietary synbiotic and cinnamon (*Cinnamomum verum*) supplementation on growth performance and meat quality in Japanese quail. Livestock Science, 154(1–3), 152–157. https://doi.org/ 10.1016/j.livsci.2013.03.014

Muhl, A. and Liebert, F.(2007). Growth, nutrient utilization and threonine requirement of growing chicken fed threonine limiting diets with commercial blends of phytogenic feed additives. Journal of Poultry Science, 44(3), 297–304. https://doi.org/10.2141/jpsa.44.297

Nielsen, P.V. and Rios, R. (2000). Inhibition of fungal growth on bread by volatile components from spices and herbs, and the possible application in active packaging, with special emphasis on mustard essential oil. International Journal of Food Microbiology, 60 (2–3), 219–229.

NRC (1994). Nutrient Requirements of Poultry. 9th rev. e. Natl. Acad. Press, Washington, DC, USA.

Pathak, M., Mandal, G.P., Patra, A.K., Samanta, I., Pradhan, S. and Haldar, S. (2017). Effects of dietary supplementation of cinnamaldehyde and formic acid on growth performance, intestinal microbiota and immune response in broiler chickens. Animal Production Science, 57(5), 821–827. https:// doi.org/10.1071/AN15816

Price, S. (2003). Aromatherapy for Common Ailments: How to Use Essential Oils--Such as Rosemary, Chamomile, and Lavender--To Prevent and Treat More Than 40 Common Ailments. Simon and Schuster.

Reda, F. M., Alagawany, M., Mahmoud, H. K., Mahgoub, S. A. and Elnesr, S. S. (2020). Use of red pepper oil in quail diets and its effect on performance, carcass measurements, intestinal microbiota, antioxidant indices, immunity and blood constituents. In *Animal* (Vol. 14, Issue 5, pp. 1025–1033). https: // doi.org/10.1017/S1751731119002891

Reyer H., Zentek J., Männer K., Youssef I. M. I., Aumiller T. and Weghuber J. (2017). Possible Molecular Mechanisms by Which an Essential Oil Blend from Star Anise, Rosemary, Thyme, and Oregano and Saponins Increase the Performance and Ileal Protein Digestibility of Growing Broilers. J. Agric. Food Chem. 65 (32), 6821–6830. doi: 10.1021/acs.jafc.7b01925

Saeed, M., Kamboh, A.A., Syed, S.F., Babazadeh, D., Suheryani, I., Shah, Q. A., Umar, M., Kakar, I., Naveed, M., El-Hack, M. E. A., Alagawany, M. and Chao, S. (2018). Phytochemistry and beneficial impacts of cinnamon (*Cinnamomum zeylanicum*) as a dietary supplement in poultry diets. World's Poultry Science Journal, 74 (2), 331–345. . 1017/S0043933918000235

Sarica, S., Corduk, M., Yarim, G. F., Yenisehirli, G. and Karatas, U. (2009). Effects of novel feed additives in wheat based diets on performance, carcass and intestinal tract characteristics of quail. South African Journal of Animal Science, 39(2), 144–157. https://doi.org/10.4314/sajas.v39i2.44388

SAS (2004). Statistical Analysis System, User's Guide. Statistical. Version 7th ed. SAS. Inst. Inc. Cary. N.C. USA. Stat. Version.

Shirzadegan, K. (2014). Reactions of modern broiler chickens to administration of the cinnamon powder in diet Administration of Cinnamon Powder in the Diet. Iranian Journal of Applied Animal Science, 4(2), 367–371. https://www.researchgate.net/ publication /273380695

Şimşek, Ü. G., Ciftci, M., Özçelik, M., Azman, M. A., Tonbak, F. and Özhan, N. (2015). Effects of cinnamon and rosemary oils on egg production, egg quality, hatchability traits and blood serum mineral contents in laying quails (*Coturnix coturnix* Japonica).

Ankara Üniversitesi Veteriner Fakültesi Dergisi, 62(3), 229–236. https://doi.org/ 10. 1501/vetfak_0000002685

Singh, G., Maurya, S., Catalan, C. and de Lampasona, M. P. (2005). Studies on essential oils, part 42: Chemical, antifungal, antioxidant and sprout suppressant studies on ginger essential oil and its oleoresin. Flavour and Fragrance Journal, 20 (1), 1–6. https: // doi.org/10.1002/ffj.1373

Snedecor, G. W. and W. G. Cochran (1982). Statistical Methods 6th ed. Iowa State University Press, Ames. Iowa.

Symeon, G. K., Athanasiou, A., Lykos, N., Charismiadou, M. A., Goliomytis, M., Demiris, N., Ayoutanti, A., Simitzis, P. E. and Deligeorgis, S. G. (2014). The effects of dietary cinnamon (*Cinnamomum Zeylanicum*) oil supplementation on broiler feeding behaviour, growth performance, carcass traits and meat quality characteristics. Annals of Animal Science, 14(4), 883–895. https://doi. org /10.2478/aoas-2014-0047

Tonbak, F. and Çiftçi, M. (2012). Effects of Cinnamon Oil (*Cinnamomum Zeylanicum L.*) Supplemented to Ration on Growth Performance and Carcass Characteristics in Heat–Stressed Japanese Quails. Fırat University Veterinary Journal of Health Sciences, 26 (3), 157–164.

Torki, M., Akbari, M. and Kaviani, K. (2015). Single and combined effects of zinc and cinnamon essential oil in diet on productive performance, egg quality traits, and blood parameters of laying hens reared under cold stress condition. International Journal of Biometeorology, 59(9), 1169–1177. https:// doi. org/ 10.1007/s00484-014-0928-z

Tzora A., Giannenas I., Karamoutsios A., Papaioannou N., Papanastasiou D. and Bonos E. (2017). Effects of Oregano, Attapulgite, Benzoic Acid and their Blend on Chicken Performance, Intestinal Microbiology and Intestinal Morphology. J. Poultry Sci., 54 (3), 218–227. doi: 10.2141/jpsa.0160071

Wenk, C. (2000). Why all the discussion about herbs? In Ed. (Ed.), Proc. Alltech's 16th Ann. Symp. Biotechnol. in the Feed Industry. Ed. Lyons, T.P., Alltech Tech. Publ., Nottingham University Pres, Nicholasville, KY (79–96). Alltech Tech. Publ., Nottingham University Pres.

Zhang L. Y., Peng Q. Y., Liu Y. R., Ma Q. G., Zhang J. Y. and Guo Y. P. (2021). Effects of oregano essential oil as an antibiotic growth promoter alternative on growth performance, antioxidant status, and intestinal health of broilers. Poultry Sci., 100 (7), 101163. doi: 10.1016/j.psj.2021.101163

Zhang, K., Li, Y., Lin, X., Daneshar, M., Karamian, F. and Li, M. (2024). Effect of cinnamon supplementation on blood pressure, oxidative stress, and inflammatory biomarkers in adults: An umbrella review of the meta-analyses of randomized controlled trials. Nutrition, Metabolism and Cardiovascular Diseases, Dec., 34 (12).

Zhao P., Yan L., Zhang T., Yin H., Liu ,. J., and Wang, J. (2021). Effect of 25-hydroxyvitamin D and essential oil complex on productive performance, egg quality, and uterus antioxidant capacity of laying hens. Poultry Sci. , 100 (11), 101410. doi: 10.1016/j.psj.2021.10141

تأثير الإضافة الغذائية من المخاليط المتساوية من الزيوت الأساسية للقرفة والأوريجانو على أداء النمو المبكر للبط البكيني

ندا عدلي منصور - زينات عبد الجواد إبراهيم - محمود محمد العجواني - محمد سليمان الخولي

قسم الدواجن – كلية الزراعة – جامعة الزقازيق – الزقازيق - مصر

استهدفنا في هذه التجربة دراسة ما إذا كانت المستويات الغذائية المختلفة من مزيج متساوٍ من الزيوت العطرية للقرفة والأوريجانو يمكن أن تؤثر على أداء النمو المبكر للبط البكيني خلال الفترة من عمر يوم حتى أسبوعين، حيث تم توزيع 200 بطة بكيني سليمة بعمر يوم واحد بشكل عشوائي إلى 4 مجموعات تجريبية، احتوت كل مجموعة على 5 مكررات بواقع 10 بطات لكل مكرر. تلقت المجموعة الأولى العليقة القياسية دون أي إضافات، في حين تلقت المجموعات الثانية والثالثة والرابعة العليقة القياسية مضافًا إليها 50، و100، و150 مجم من مزيج متساوٍ من زيت القرفة وزيت الأوريجانو وذلك لكل كجم عليقة على التوالي. بنهاية الأسبوع الأول، أظهرت الطيور التي تم تغذيتها على 100 أو 150 مجم/كجم من مزيج الزيوت العطرية وزن جسم حي ووزن جسم مكتسب أعلى معنوياً مقارنة بالمجموعة الضابطة، بينما أظهرت مجموعة 50 ملغم قيماً متوسطة. وقد أصبح هذا الاتجاه أكثر وضوحاً في الأسبوع الثاني، حيث سجلت الطيور التي تغذت على 100 و150 مجم من الزيوت العطرية /كجم عليقة وزن جسم حي أعلى معنوياً مقارنة بالمجموعة الضابطة، وعبر جميع الفترات التجريبية (الأسبوع 0–1، الأسبوع 1–2، والأسبوع 0–2)، لم تُلاحظ فروق معنوية في الغذاء المأكول ومعامل التحويل الغذائي بين المجموعة الضابطة والمجموعات التي تلقت 50 أو 100 أو 150 مجم من مزيج الزيوت العطرية لكل كجم من العليقة، ومع ذلك، فقد لوحظ تحسن غير معنوي في الغذاء المأكول ومعدل التحويل الغذائي في المجموعات المُعاملة مقارنة بالمجموعة الضابطة، وتشير هذه النتائج إلى أن إضافة مزيج الزيوت العطرية بمعدل 100–150 ملغم/كجم في علائق البط النامي قد يساهم في تحسين أداء النمو دون التأثير السلبي على كفاءة الاستفادة من العلف.

الكمات الإسترشادية: القرفة، الأوريجانو، البط البكيني، أداء النمو المبكر.

المحكمـــون:

1- أ.د. شـــعبان سعد النسرأستاذ فسيولوجي الدواجن – قسم إنتاج الدواجن – كلية الزراعة – جامعة الفيوم.

2- د. محمد ممدوح المكاوي أستاذ مساعد رعاية الدواجن – كلية الزراعة – جامعة الزقازيق.