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Basil Leaf Extract (*Ocimum americanum*) as A Natural Anticoccidial Agent : Inpacts on Body Weight and Cecal Histopathology in Chikens

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ABSTRACT

This study aimed to evaluate the effectiveness of basil leaf extract (*Ocimum americanum* L.) on body weight and cecal histopathology in native chickens infected with *Eimeria tenella*. *Eimeria tenella* is recognized as one of the most pathogenic *Eimeria* species in poultry and is responsible for coccidiosis characterized by severe cecal lesions, including hemorrhage, necrosis, and inflammatory cell infiltration. Basil leaves were selected because they contain phytochemical compounds such as flavonoids, tannins, and essential oils with potential antibacterial, antioxidant, and immunomodulatory activities. The experiment employed a completely randomized design consisting of five treatment groups: a negative control, a positive control, and three basil extract treatments at concentrations of 0.05%, 0.10%, and 0.20%. Parameters observed included body weight and cecal histopathological changes. The results demonstrated that basil extract administration influenced the cecal condition of infected chickens, with the 0.10% dose producing the most favorable outcomes compared with the other doses. Histopathological examination revealed the presence of oocysts, necrosis, macrophage infiltration, inflammation, and hemorrhage in infected chickens; however, the severity of lesions varied among treatments. These findings indicate that basil leaf extract has potential as a natural supplement to support the health of native chickens

Introduction

Native chickens are among the most commonly raised poultry species under traditional farming systems in Indonesia. However, simple management practices often increase susceptibility to diseases, stress, and reduced productivity (Tugiyanti et al., 2025). One of the most important diseases affecting chickens is coccidiosis caused by the protozoan parasite *Eimeria tenella* (Attia et al., 2025). This disease primarily affects the ceca, resulting in mucosal damage, hemorrhage, and impaired growth performance (Graham et al., 2023).

Coccidiosis remains a major challenge in the poultry industry because it causes substantial economic losses and

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negatively affects animal growth and productivity (Gómez-Osorio et al., 2024). Clinical manifestations include lethargy, bloody diarrhea, reduced feed intae, and decreased body weight (Li et al., 2023). In severe cases, extensive cecal tissue damage accompanied by necrosis and inflammatory cell infiltration may occur (Jawad & Jasim, 2025). Consequently, alternative natural products are increasingly explored to enhance host resistance against infection (El-Saadony et al., 2025)

Basil (*Ocimum americanum* L.) has attracted scientific interest because it contains flavonoids, tannins, alkaloids, saponins, and essential oils with diverse biological activities (Wirtu et al., 2024). Previous studies have reported that species within the genus *Ocimum* possess immunomodulatory properties capable of influencing both humoral and cellular immune responses (Kamelnia et al., 2023). Therefore, this study investigated the effectiveness of basil leaf extract on body weight and cecal histopathology in native chickens experimentally infected with *E. tenella* (Badar et al., 2025)

Ocimum americanum belongs to the family Lamiaceae and is widely recognized as a medicinal plant (Vineesh et al., 2023). Phytochemical analyses have demonstrated the presence of essential oils, flavonoids, tannins, phytosterols, carbohydrates, and other phenolic compounds, which contribute to antioxidant, antimicrobial, and immunomodulatory activities (Kazemi & Ariapour, 2025).

From an immunological perspective, *Ocimum* species have been reported to modulate immune responses in experimental animal models(Naseer & Adil, 2025). Enhanced immune function may improve resistance against parasitic infections and reduce tissue damage (Alsulami & El-Saadony, 2024). These findings support the potential use of basil as a natural feed additive for poultry health (Oni & Oke, 2025)

Eimeria tenella is considered one of the most pathogenic *Eimeria* species in chickens because it specifically targets the cecal epithelium (Tu et al., 2025). During parasite development, cellular invasion and multiplication cause tissue destruction, resulting in necrosis, hemorrhage, and inflammatory cell infiltration (Odosamamwen & Benin, 2025). Histopathological lesions typically include congestion, hemorrhage, epithelial necrosis, schizonts, microgametes, macrogametes, and inflammatory infiltrates (Ibrahim et al., 2020; Murshed et al., 2024). Infection also adversely affects production performance, particularly body weight gain and growth (El-Shall et al., 2023). Therefore, body weight and cecal histopathology are relevant indicators for evaluating both disease severity and the effectiveness of herbal treatments

Materials and Methods

This study was conducted using an experimental approach with a completely randomized design (Herrera-Reyes et al., 2024). Twenty-five native chickens were randomly assigned into five treatment groups, each consisting of five replicates. The groups included a negative control, a positive control, and three basil extract treatments at concentrations of 0.05%, 0.10%, and 0.20% (Tok et al., 2025).

Basil leaf extract was prepared through sorting, washing, drying, and ethanol maceration. The extract was administered through feed from week 3 to week 8 of rearing. At eight weeks of age, chickens were orally challenged with *E. tenella* at a dose of 1×10^4 oocysts per bird. The parameters observed were body weight and cecal histopathology. Five days post-infection, chickens were euthanized and cecal tissues were collected for histopathological examination. Samples were fixed in 10% buffered neutral formalin, dehydrated in graded alcohol solutions, cleared in xylene, embedded in paraffin, sectioned using a microtome, and

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stained with hematoxylin and eosin (H&E). Histopathological observations were analyzed descriptively by comparing tissue alterations among treatment groups (Alblihd et al., 2023).

Results and Discussion

The results showed that *E. tenella* infection induced both gross pathological and histopathological changes in the ceca of native chickens. More severe lesions were observed in the positive control group than in chickens receiving basil extract. Histopathological examination revealed oocysts, necrosis, macrophage infiltration, inflammation, microgametocytes, macrogametocytes, schizonts, and hemorrhage. Cecal damage was categorized into mild, moderate, and severe lesions. Mild lesions were characterized by oocysts and epithelial necrosis in several villi. Moderate lesions consisted of necrosis, macrophage infiltration, and inflammation. Severe lesions included oocysts, macrophage infiltration, necrosis, inflammation, and hemorrhage. The 0.10% basil extract treatment exhibited the lowest lesion severity among all treatment groups.

Table 1. Cecal Histopathological Findings

Histopathological Parameter	Main Characteristics	Negative Control	Positive Control	EO 0.05%	EO 0.10%	EO 0.20%
Mild lesions	Oocysts + epithelial necrosis	0	5	3	1	3
Moderate lesions	Necrosis + macrophage infiltration + inflammation	0	3	3	1	2
Severe lesions	Oocysts + macrophage infiltration + necrosis + inflammation + hemorrhage	0	5	4	0	4

Discussion

Eimeria tenella infection causes cecal damage through epithelial invasion followed by schizogony and gametogony. These developmental stages result in cell destruction, hemorrhage, and inflammatory infiltration, ultimately disrupting cecal mucosal integrity (Nie et al., 2024)The histopathological findings observed in the present study are consistent with previous reports describing hemorrhage, necrosis, schizonts, and inflammatory cell infiltration in chickens affected by coccidiosis (Santiani et al., 2023).

Basil extract may function as an immunomodulatory agent due to its flavonoid and phenolic constituents. These compounds are commonly associated with enhanced antioxidant defense mechanisms and improved immune responses (Azam et al., 2023). Under parasitic infection conditions, improved immune function may reduce tissue damage and maintain physiological performance.

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Table 2. Interpretation of Basil Extract Effects

Basil Extract Dose	Interpretation	Biological Explanation
0.05%	Limited protection	Protective effect present but not optimal
0.10%	Best outcome	Presumed effective dose
0.20%	Not superior to 0.10%	Response may be non-linear

The observed dose-response pattern is consistent with reports indicating that herbal products often exhibit optimal biological activity at intermediate rather than maximum doses (Randa et al., 2025). From a pathological perspective, macrophage infiltration indicates active inflammatory processes. Macrophages serve as major phagocytic cells involved in antigen recognition and removal of tissue debris generated during infection (Zhao et al., 2024).

Body weight reduction in infected chickens may result from impaired digestion, decreased feed intake, and increased metabolic demands associated with infection. Severe cecal lesions interfere with nutrient absorption, thereby reducing growth performance. Consequently, body weight and cecal histopathology provide complementary indicators for assessing the effectiveness of basil extract treatment.

The findings suggest that basil leaf extract has potential as a natural health-supporting agent for native chickens. Nevertheless, further studies incorporating broader immunological parameters, including phagocytic activity, leukocyte counts, cytokine concentrations, and oocyst shedding, are required before field application can be recommended (Alsayeqh & Abbas, 2023)

Conclusion

Basil leaf extract (*Ocimum americanum* L.) affected body weight and cecal histopathology in native chickens infected with *Eimeria tenella*. The 0.10% dose produced the most favorable results in reducing cecal damage compared with the other doses. Therefore, basil leaf extract shows promise as a natural immunomodulatory agent for native chickens.

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References

Alblihd, M. A., Alsharif, K. F., Hamad, A. A., Ali, F. A. Z., Hussein, M. T., Alhegaili, A. S., Hassan, M. A., Al-Amer, O. M., Albezrah, N. K. A., & Almalki, A. A. (2023). Okra [Abelmoschus esculentus (L.) Moench] improved blood glucose and restored histopathological alterations in splenic tissues in a rat model with streptozotocin-induced type 1 diabetes through CD8+ T cells and NF-kβ expression. *Frontiers in Veterinary Science*, *10*, 1268968.

Alsayeqh, A. F., & Abbas, R. Z. (2023). Nutritional supplements for the control of avian coccidiosis–a review. *Annals of Animal Science*, *23*(4), 993–1007.

Alsulami, M. N., & El-Saadony, M. T. (2024). The Enhancing Effect of Bacterial Zinc Nanoparticles on Performance, Immune Response, and Microbial Load of Nile Tilapia (Oreochromis niloticus) by Reducing the Infection by Trichodina heterodentata. *Pakistan Veterinary Journal*, *44*(3).

Attia, M. M., Mahmoud, M. A., Abdelsalam, M., Almutairi, L. A.,

ISSN 2443-1230 (print)
ISSN 2460-6804 (online)
DOI: https://doi.org/10.24114/tz0v8w96

Alqahtani, M. A., Areshi, S. M., El-Saadony, M. T., El-Tarabily, K. A., & Salem, H. M. (2025). Molecular and histopathological characterization of Ascaridia galli and Eimeria tenella co-infection in Numida meleagris. *Frontiers in Veterinary Science*, *12*, 1622170.

Azam, M. S., Islam, M. N., Wahiduzzaman, M., Alam, M., & Dhrubo, A. A. K. (2023). Antiviral foods in the battle against viral infections: Understanding the molecular mechanism. *Food Science & Nutrition*, *11*(8), 4444–4459.

Badar, S., Saleem, G., Aslam, A., & Ashraf, K. (2025). Rosmarinus officinalis Essential Oils as an Alternative to Anticoccidial Drugs in Broiler Chicken against E. maxima and E. tenella Infection. *Egyptian Journal of Veterinary Sciences*, 1–14.

El-Saadony, M. T., Saad, A. M., Mohammed, D. M., Korma, S. A., Alshahrani, M. Y., Ahmed, A. E., Ibrahim, E. H., Salem, H. M., Alkafaas, S. S., & Saif, A. M. (2025). Medicinal plants: bioactive compounds, biological activities, combating multidrug-resistant microorganisms, and human health benefits-a comprehensive review. *Frontiers in Immunology*, *16*, 1491777.

El-Shall, N. A., Jiang, S., Farag, M. R., Azzam, M., Al-Abdullatif, A. A., Alhotan, R., Dhama, K., Hassan, F., & Alagawany, M. (2023). Potential of Spirulina platensis as a feed supplement for poultry to enhance growth performance and immune modulation. *Frontiers in Immunology*, *14*, 1072787.

Gómez-Osorio, L.-M., Vasiljevic, M., Raj, J., Chaparro-Gutierréz, J. J., & López-Osorio, S. (2024). Mycotoxins and coccidiosis in poultry–co-occurrence, interaction, and effects. *Frontiers in Veterinary Science*, *11*, 1387856.

Graham, D., Petrone-Garcia, V. M., Hernandez-Velasco, X., Coles, M. E., Juarez-Estrada, M. A., Latorre, J. D., Chai, J., Shouse, S., Zhao, J., & Forga, A. J. (2023). Assessing the effects of a mixed Eimeria spp. challenge on performance, intestinal integrity, and the gut microbiome of broiler chickens. *Frontiers in Veterinary Science*, *10*, 1224647.

Herrera-Reyes, G. S., Martínez-Reyes, M. Á., Perez-Rodriguez, P., Romero-Padilla, J. M., Luna-Espinoza, I., & Suarez-Espinosa, J. (2024). Analysis for multiple responses in a completely randomized experimental design. *Agrociencia*.

Jawad, T. I., & Jasim, G. A. (2025). Molecular detection and histopathological changes caused by Eimeria tenella in broilers in Al-Diwaniyah Province, Iraq. *Open Veterinary Journal*, *15*(2), 714.

Kamelnia, E., Mohebbati, R., Kamelnia, R., El-Seedi, H. R., & Boskabady, M. H. (2023). Anti-inflammatory, immunomodulatory and anti-oxidant effects of Ocimum basilicum L. and its main constituents: A review. *Iranian Journal of Basic Medical Sciences*, *26*(6), 617.

Kazemi, M., & Ariapour, A. (2025). Nutritional dynamics of Iranian pasture flora: implications for animal health and productivity. *Grass and Forage Science*, *80*(2), e12718.

Li, X., Zhu, J., Wu, Y., & Tan, Z. (2023). Correlation between kidney function and intestinal biological characteristics of adenine and folium sennae-induced diarrhea model in mice. *The Turkish Journal of Gastroenterology*, *34*(1), 4.

ISSN 2443-1230 (print)
ISSN 2460-6804 (online)
DOI: https://doi.org/10.24114/tz0v8w96

Naseer, M., & Adil, M. (2025). Phytochemical profiling, HPLC analysis, and antimicrobial potential of Curio radicans (L. f.) PV Heath. *Scientific Reports*, *15*(1), 34753.

Nie, H.-Y., Ge, J., Huang, G.-X., Liu, K.-G., Yue, Y., Li, H., Lin, H.-G., Zhang, T., Yan, H.-F., & Xu, B.-X. (2024). New insights into the intestinal barrier through "gut-organ" axes and a glimpse of the microgravity's effects on intestinal barrier. *Frontiers in Physiology*, *15*, 1465649.

Odosamamwen, I. D., & Benin, C. (2025). *Effects Of Malaria Parasite On The Heart Of Albino Wistar Rats*.

Oni, A. I., & Oke, O. E. (2025). Gut health modulation through phytogenics in poultry: mechanisms, benefits, and applications. *Frontiers in Veterinary Science*, *12*, 1616734.

Randa, V. D., Trisnadi, S., & Sumarawati, T. (2025). Dose-dependent modulatory effects of Pimpinella alpina (Purwoceng) root extract on TNF-α and CRP in a CCl_4-induced hepatic injury model. *Jurnal Teknologi Laboratorium*, *14*(2), 335–345.

Santiani, F., Silva, R. O. S., Oliveira, C. A. de, Withoeft, J. A., Cristo, T. G., Costa, L. S., Gaspar, T., & Casagrande, R. A. (2023). Characterization of coccidiosis and evaluation of suggestive cases of subclinical necrotic enteritis in broilers. *Pesquisa Veterinária Brasileira*, *43*, e07090.

Tok, S., Öz, M., & Dikel, S. (2025). Effects of Dietary Anise (Pimpinella anisum L.) Oil on Growth Performance, Blood Parameters and Muscle Nutrient Content of Nile Tilapia (Oreochromis niloticus). *Veterinary Medicine and Science*, *11*(4), e70443.

Tu, J.-H., Liu, B.-G., Lin, B.-J., Liu, H.-C., Guo, S.-C., Ouyang, Q.-Y., Fang, L.-Z., He, X., Song, Z.-H., & Zhang, H.-H. (2025). Single-cell transcriptomic atlas of the chicken cecum reveals cellular responses and state shifts during Eimeria tenella infection. *BMC Genomics*, *26*(1), 141.

Tugiyanti, E., Nurnaningsih, W., & Sukmaningsih, T. (2025). Sustainable Development of Indonesia's Native Chicken Sector: Opportunities and Constraints. *Journal of Sustainable Livestock*, *1*(1), 27–43.

Vineesh, S., Balaji, R., Tanuja, & Parani, M. (2023). The complete chloroplast genome of Ocimum americanum Linnaeus 1755 and phylogenetic analysis among the Lamiaceae family. *Mitochondrial DNA Part B*, *8*(10), 1077–1081.

Wirtu, S. F., Mishra, A. K., Jule, L. T., & Ramaswamy, K. (2024). Ocimum basilicum and Ocimum americanum: A Systematic Literature Review on Chemical Compositions and Antimicrobial Properties. *Natural Product Communications*, *19*(4), 1934578X241247640.

Zhao, Y., Li, M., Mao, J., Su, Y., Huang, X., Xia, W., Leng, X., & Zan, T. (2024). Immunomodulation of wound healing leading to efferocytosis. *Smart Medicine*, *3*(1), e20230036.