

Phytochemical Solutions for Infectious Bursal Disease: A Sustainable Approach to Poultry Health

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ABSTRACT

IBD is a virus that can cause difficulties for young chicks because of its variable strains and insufficient vaccinations. Phytochemicals, derived from plants, have antiviral properties against IBDV. However, before exploring phytochemical therapies, one must understand the pathophysiology of IBD, hygienic guidelines, and challenges associated with immunization. Some plants rich in phytochemicals that may benefit chicken health include turmeric, green tea, garlic, licorice, neem, and ginger. The article analyzes the mechanisms of action, showing how phytochemicals reduce inflammation, strengthen immune responses, and inhibit the growth of viruses.

Introduction

A serious concern to the global poultry industry is Infectious Bursal Disease (IBD), a highly infectious viral virus that affects young chickens [1]. Emerging virus strains and the requirement for ongoing vaccine updates have presented difficulties for conventional methods. Phytochemicals, or plant-based medicines, which present a viable way to treat IBD while upholding sustainable chicken-raising methods. The naturally occurring substances present in plants called phytochemicals have drawn interest due to a variety of their biological functions, such as their antiviral, anti-inflammatory, and antioxidant capabilities [2]. The article explores the emerging subject of using phytochemicals as a novel and sustainable means of managing IBD. The ability of these substances derived from plants to strengthen immunity, reduce virus replication, and improve poultry health in general, opens the door for a more healthy and sustainable poultry business.

Pathology of IBD

The IBDV virus travels to the Fabricius bursa through infected macrophages. The bursa of Fabricius is a lymphoid organ found in birds that is vital to the growth of the immune system. After transmission, the virus replicates intracytoplasmic ally in IgM+ B cells [3]. This process increases the replication and growth of the disease. In the bursa of Fabricius, activation of macrophages leads to an increase in interferon (IFN-) production. Signaling proteins called interferons are essential for the immune system's defense against viral infections. The growth of bursal lesions is caused by the production of pro-inflammatory cytokines [4]. Additionally, the interferon-gamma (IFN- γ) produced during the infection may cause the healthy B-cells surrounding IBDV-infected cells to undergo apoptosis or programmed cell death.

Hygiene Standards and Vaccination Strategies

Strict cleaning regulations must be followed in order to prevent IBDV. Vaccination is the primary strategy, employing standard live, attenuated, and inactivated viral vaccines [5]. The main tactic is vaccination, which uses conventional live, attenuated, and inactivated viral vaccines. IBDV particles can survive up to 122 days in the environment of a chicken farm and 52 days in feed and water. The challenging difficulties of eliminating persistent viral particles makes controlling the condition harder. The financial challenges in managing the disease are highlighted by the high expense of controlling IBDV in afflicted chickens and preventing it from spreading to other flocks [6]. Because of the virus's ongoing development, vaccination failures can happen even with stringent protocols. This emphasizes the

necessity of further research and development to improve vaccination efficacy against IBDV strains that are changing. Failures to vaccinate can still happen even with strict methods, especially with the way IBDV strains are still evolving [7]. This emphasizes the necessity of ongoing research and development to improve vaccine efficacy against IBDV strains that are changing.

Phytochemicals

Phytochemicals derived from several plants that have antiviral properties against IBDV. By boosting the host immune system, these compounds may have indirect antiviral effects or direct antiviral effects by preventing the spread of viruses [8]. It has been discovered that some phytochemicals alter the immune system, strengthening the body's fight against IBDV. These substances may lessen the severity of the disease or stop infection by strengthening the host immune response. The particular active ingredients in a plant determine how well it works against IBD. Numerous phytochemicals with distinct qualities, including flavonoids, alkaloids, tannins, and essential oils, are found in various plants [9]. For the purpose of creating tailored therapies, it is essential to recognize and comprehend the active ingredients that provide antiviral actions.

Mechanisms of Action

In poultry, phytochemicals exhibit a variety of methods that prevent IBD. Their antiviral effect is significant because substances like polyphenols and flavonoids directly prevent the IBDV from replicating, impacting many phases of the viral life cycle [10]. Furthermore, phytochemicals boost the hosts defense systems against IBDV by inducing the formation of immune cells and the release of cytokines, which further contributes to the immunological response. These substances have anti-inflammatory properties which play a critical role in reducing the inflammatory reaction that the virus has caused. Phytochemicals guard cells against oxidative stress brought on by IBDV infection by acting as antioxidants. In addition, they could prevent the entry of viruses, stop the formation of proteins, cause infected cells to die, and strengthen mucosal immunity. phytochemicals can increase the synthesis of interferon, which is essential for antiviral defense [11]. When combined with other phytochemicals, these activities within plant extracts may provide a complete strategy by simultaneously targeting several elements of the viral life cycle. This comprehensive strategy emphasizes the potential of phytochemicals in the fight against IBD and emphasizes the significance of continued research to identify particular compounds and ideal dosages for efficient disease control.

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Promising Plant Sources for Controlling IBD

Plants rich in phytochemicals that are promising for managing IBD in chicken include a variety of plants, each with its special advantages. Curcumin, the main ingredient in turmeric, has antiviral and anti-inflammatory qualities [12]. Rich in polyphenols such as epigallocatechin gallate (EGCG), green tea exhibits immunomodulatory and antiviral properties. Alkamides and flavonoids found in echinacea have immunostimulant properties. Allicin and diallyl sulfide, found in garlic, have antiviral and immune-boosting properties [13]. Glycyrrhizin and flavonoids abound in licorice, which has antiviral, anti-inflammatory, and immunomodulatory properties. Nimbin and azadirachtin, two of neem's constituents, may have antiviral effects. Aloe Vera may have immunomodulatory and anti-inflammatory properties because it contains polysaccharides and anthraquinones. Ginger possesses antiviral and anti-inflammatory properties thanks to gingerol and shogaol. Oregano has antibacterial and anti-inflammatory qualities. It is high in carvacrol and thymol. Due to the presence of ginsenosides, ginseng has antioxidant and immunomodulatory properties [14]. These plant sources offer a natural and comprehensive solution to the problems presented by IBDV in poultry health management.

Challenges and Future prospective

There are several issues and concerns when using phytochemicals to treat IBD in chicken. It is challenging to achieve phytochemical content uniformity since different plant sources have varied compositions. Extensive study is required to determine the ideal dosages for controlling IBD while minimizing potential harm [15]. The practical use of phytochemicals in chicken farms needs to be in line with current agricultural techniques, necessitating farmer-friendly techniques appropriate for large-scale production. An in-depth knowledge of the effects of environmental elements including soil conditions and climate on phytochemical efficacy is required. To properly utilize the combined benefits of plant extracts, interactions between their constituents whether antagonistic or synergistic need to be carefully considered. It is essential to address the possibility of phytochemical residues in poultry products in order to adhere to food safety regulations. For phytochemicals to be successfully incorporated into workable and long-lasting IBD control measures, regulations and safety requirements must be followed in conjunction with educational programs to promote awareness and adoption among chicken producers.

Conclusion

Phytochemicals is one promising approach to resolve the issues caused by IBD in the poultry business. Phytochemicals have several mechanisms of action, which include antiviral, immunomodulatory, and anti-inflammatory effects, and provide a comprehensive strategy for managing IBD. Promising plant sources, like garlic, green tea, and turmeric, provide herbal medicines validated by research and conventional knowledge.

References

- [1] Li K, Niu X, Jiang N, Zhang W, Wang G, Li K, Huang M, Gao Y, Qi X, Wang X. Comparative Pathogenicity of Three Strains of Infectious Bursal Disease Virus Closely Related to Poultry Industry. *Viruses*. 2023 May 26;15(6):1257.
- [2] Gonfa YH, Tessema FB, Bachheti A, Rai N, Tadesse MG, Singab AN, Chaubey KK, KumarBachheti R. Anti-inflammatory activity of phytochemicals from medicinal plants and their nanoparticles: A review. *Current Research in Biotechnology*. 2023 Nov 7:100152.
- [3] Schat KA. The Importance of the Bursa of Fabricius, B Cells and T Cells for the Pathogenesis of Marek's Disease: A Review. *Viruses*. 2022 Sep 12;14(9):2015.
- [4] Rojas JM, Alejo A, Martín V, Sevilla N. Viral pathogen-induced mechanisms to antagonize mammalian interferon (IFN) signaling pathway. *Cellular and Molecular Life Sciences*. 2021 Feb;78:1423-44.
- [5] Trovato M, Sartorius R, D'Apice L, Manco R, De Berardinis P. Viral emerging diseases: challenges in developing vaccination strategies. *Frontiers in immunology*. 2020 Sep 3;11:2130.

- [6] Arega AM. Review on infectious bursal disease: threat for Ethiopian poultry industry. *Int J Appl Life Sci*. 2018 Feb 17;11:52-65.
- [7] Lawal N, Bello MB. Six decades of infectious bursal disease in poultry: The journey so far and challenges ahead. *Sokoto Journal of Veterinary Sciences*. 2021 Nov 4;19(3):150-73.
- [8] Ahmadi B, Naghib SM, Bakhshi M, Bakhshi A. Biopolymers as Antibacterial and Antiviral Agents. In *Antibacterial and Antiviral Functional Materials*, Volume 1 2023 (pp. 65-109). American Chemical Society.
- [9] Gebremariam A, Gebrezgabher BG, Desta KT, Sbhathu DB, Berhe GG, Abdirkadir M, Tsegay E. Aloe adigratana Reynolds: Preliminary Phytochemical Screening, Proximate Content, Essential Oil Analysis, and In Vitro Antifungal Activity Studies of Its Leaf Peels and Gel. *Journal of Experimental Pharmacology*. 2023 Dec 31:321-32.
- [10] Yasmin AR, Sohaimi MN, Azaman SN, Nur-Fazila SH, Amirul FM. Feed Additives as Antiviral Agents. In *Sustainable Use of Feed Additives in Livestock: Novel Ways for Animal Production 2023* Dec 29 (pp. 327-350). Cham: Springer International Publishing.
- [11] Haq Z, Ahmad SM, Bashir I, Dar MA, Saleem A, Khan AA, Yattoo MI, Mir S, Rastogi A, Hussain MI, Shah RA. Pathogenesis-Related Gene Expression in Response to Trachyspermum ammi Supplementation Along With Probiotics in Chicken Salmonellosis and Insights in Drug Therapeutics. *Frontiers in Veterinary Science*. 2022 Jun 29:866614.
- [12] Peng Y, Ao M, Dong B, Jiang Y, Yu L, Chen Z, Hu C, Xu R. Anti-inflammatory effects of curcumin in the inflammatory diseases: Status, limitations and countermeasures. *Drug design, development and therapy*. 2021 Nov 2:4503-25.
- [13] Rouf R, Uddin SJ, Sarker DK, Islam MT, Ali ES, Shilpi JA, Nahar L, Tiralongo E, Sarker SD. Antiviral potential of garlic (*Allium sativum*) and its organosulfur compounds: A systematic update of pre-clinical and clinical data. *Trends in food science & technology*. 2020 Oct 1;104:219-34.
- [14] He M, Huang X, Liu S, Guo C, Xie Y, Meijer AH, Wang M. The difference between white and red ginseng: variations in ginsenosides and immunomodulation. *Planta Medica*. 2018 Aug;84(12/13):845-54.
- [15] Pant P, Pandey S, Dall'Acqua S. The influence of environmental conditions on secondary metabolites in medicinal plants: A literature review. *Chemistry & Biodiversity*. 2021 Nov;18(11):e2100345.