



Aqueous ginkgo biloba leaf extract and oxytetracycline and their effect on the intestinal parameters of broiler

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Abstract:

This study was conducted in the poultry field of the Agricultural Research and Experiment Station, College of Agriculture, Al-Muthanna University, from November 17, 2024 to December 21, 2024. Two hundred twenty-five, one-day-old, 42 gm, broiler chicks were used. The chicks were randomly distributed into five treatments, each with three replicates (15 chicks per replicate). The experimental treatments were as follows: T1: Control treatment (no addition), T2, T3 and T4 were add of 2, 4 and 6 ml of aqueous extract of Ginkgo biloba leaf powder to drinking water, T5: Add of 1 gm of the antibiotic oxytetracycline to drinking water. The results indicated that a significant ($P \leq 0.05$) improvement on the relative weight and length of the small intestine (duodenum, jejunum, ileum, and cecum) of broiler chickens when using an aqueous extract of Ginkgo biloba leaves compared to T5 and control treatments. Significant improvement ($P \leq 0.05$) in immunological and histological parameters. The use of high levels of aqueous extract of Ginkgo biloba leaves resulted in a significant increase in the villus height, crypt depth, and villus height-to-crypt depth ratio of broiler chickens from a histological perspective.

Keywords: Ginkgo biloba, aqueous extract, oxytetracycline, intestinal parameters, broiler.

Introduction:

Therapeutic nutrients, also known as phytochemicals or functional foods, a naturally occurring bioactive chemical

compounds with beneficial properties, such as health promotion, disease prevention, or other medicinal effects.

Therapeutic nutrients are used in a wide range of products produced by the pharmaceutical industry (Kaushik *et al.*, 2003; Al-Zamili *et al.*, 2019; Abdul-Sada *et al.*, 2023; Al Salman and Al-Gharawi, 2019; Abdal Sada, 2019). Ginkgo biloba medicinal products have been among the most widely sold medicinal products in the world (Wang and Zhang, 2019).

Ginkgo biloba leaves contain good levels of vitamin C, carbohydrates, riboflavin, proteins, and many other nutrients, which have health benefits, such as cancer prevention and the treatment of neurological diseases (Youdim and Joseph, 2001;).

Studies have shown that Ginkgo biloba is a traditional herbal medicinal plant with numerous therapeutic properties, it contains numerous active organic compounds, most notably flavonoids, terpenes, bioflavonoids, organic acids, and polyphenols. Its historical use dates back approximately 5,000 years to the ancient Chinese, its use dates back to the treatment of heart and lung diseases by inhaling its steam or drinking it as a tea (Belwal *et al.*, 2019; Eivsand *et al.*, 2020).

Wan *et al.* (2016) noted that Ginkgo biloba is widely used to treat headaches, tinnitus (caused by a blood vessel problem), dizziness, inattention, mood disorders, cardiovascular disease, and coronary heart disease. Das *et al.* (2022) indicated that Ginkgo biloba leaves are effective in treating

early-stage Alzheimer's disease, vascular dementia (impaired mental function resulting from damage to brain tissue due to poor or interrupted blood flow), epilepsy, cerebrovascular disease, stroke, and peripheral vascular disease.

Studies have shown that Ginkgo biloba leaves have an impact on the productive characteristics of broiler chickens. Cao *et al.* (2012) observed improved body weight in broiler chickens when fermented Ginkgo biloba was added at concentrations of 0.2 and 0.35% to the starter feed and 0.4 and 7% to the grower feed, compared to the control treatment. Zhang *et al.* (2012) indicated that adding Ginkgo biloba fermented with *Aspergillus niger* at concentrations of 0.5% to the starter feed and 1.0% to the grower feed did not significantly affect body weight gain compared to the control treatment. Adding Ginkgo biloba leaf powder with dried mint leaves at 0.1% to the feed significantly improved body weight gain, weight gain, and feed conversion ratio compared to the control treatment (El-Iraqi *et al.*, 2013).

The present study aims to demonstrate the effect of using different levels of Ginkgo biloba leaf extract and antibiotics on the intestinal parameters of broiler chickens.

Materials and methods:

This study was conducted at the poultry farm of the Agricultural

Research and Experiment Station at the College of Agriculture, Al-Muthanna University, from November 17, 2024 to December 21, 2024, to investigate the effect of ginkgo leaf extract and antibiotics on some intestinal parameters traits of Ross 308 broiler chickens.

A total of 225 Ross 308 broiler chicks, one-day-old, 43gm, were used, where the chicks were randomly distributed into five treatments, each containing three replicates (15 birds per replicate). The experimental treatments were as follows:

T1: (control treatment) without supplementation.

T2: 2 ml of ginkgo leaf aqueous extract was added to the drinking water.

T3: 4 ml of ginkgo leaf aqueous extract was added to the drinking water.

T4: 6 ml of ginkgo leaf aqueous extract was added to the drinking water.

T5: 1 gm of oxytetracycline powder was added to the drinking water.

Ginkgo biloba leaves (Chinese variety) were obtained from local markets in the quantities required for use in the experiment. The ginkgo biloba leaves were ground in a grinder using a National laboratory grinder (made in China).

The aqueous extract was prepared according to the method of Hernandez *et al.* (1994), which involves mixing a quantity of ginkgo biloba leaves with a

quantity of distilled water at a ratio of 1 gm to 2 ml of distilled water and placing it in a water bath at 60°C for one hour. The solution was left to stand for 24 hours at room temperature. The resulting mixture was then filtered through several layers of sterile medical gauze. The concentrated liquid was then ready and used in the experiment.

Results and Discussion

Relative Intestine Weight

Table (1) indicates the effect of using different levels of aqueous extract of ginkgo leaves on the relative weight of the intestine of broiler carcasses. A significant ($P \leq 0.05$) increase on the relative weight of the small intestine, duodenum, jejunum, and cecum was observed for treatment T4, which significantly ($P \leq 0.05$) outperformed T3, compared to T2, which also significantly ($P \leq 0.05$) outperformed T5, which significantly ($P \leq 0.05$) outperformed to T1, on the relative weight of the duodenum, jejunum, cecum, and small intestine. The relative weight of the duodenum was 0.669, 0.861, 0.904, and 1.008, 0.721. Relative weight of the jejunum: 2.046, 2.628, 2.814, 2.951, 2.101. Relative weight of the cecum: 0.420, 0.623, 0.6710, 0.701, 0.492. Relative weight of the small intestine: 4.902, 6.233, 6.597, 6.910, 5.133. Regarding the relative weight of the ileum, T3 and T4 significantly outperformed T2 and T5 ($P \leq 0.05$). T5 also outperformed to T1. No significant differences were

observed between treatments T4 and T3. The relative weight of the ileum

was 2.185, 2.742, 2.878, 2.951, 2.310, for T1, T2, T3, T4, T5 respectively.

Table (1) Effect of of Ginkgo biloba leaf extract and antibiotic on the relative weight of the small intestine and cecum (%) of broiler chickens (mean± standard error).

Treatments	Relative weight				
	Duodenum	Jejunum	Ileum	Cecum	Small intestine
T1	0.669±0.011 e	2.046±0.016 e	2.185±0.036 d	0.420±0.0004 e	4.902±0.048 e
T2	0.861±0.003 c	2.628±0.025 c	2.742±0.023 b	0.623± 0.016 c	6.233±0.040 c
T3	0.904±0.006 b	2.814±0.038 b	2.878±0.024 a	0.671±0.004 b	6.597±0.051 b
T4	1.008±0.005 a	2.951±0.016 a	2.951±0.017 a	0.701±0.002 a	6.910±0.028 a
T5	0.721±0.017 d	2.101±0.001 d	2.310±0.005 c	0.492±0.012 d	5.133±0.022 d
Sig.	*	*	*	*	*

Relative Intestinal Length:

Table (2) indicates the effect of aqueous extract of ginkgo leaves and antibiotics on the relative intestinal length (%) of broiler. A significant ($P \leq 0.05$) difference on the relative length of the small intestine, cecum, and ileum was observed for T4, which significantly ($P \leq 0.05$) outperformed to T3, compared T2, which in turn significantly ($P \leq 0.05$) outperformed to T5, which significantly ($P \leq 0.05$) outperformed to T1, on the relative length of the small intestine, cecum, and ileum. The relative length of the ileum was 3.607, 3.892, 4.097, 4.233, and 3.812. Relative Length For the cecum: 0.693, 0.745, 0.788, 0.802, and

0.710. The relative length of the small intestine was 7.771, 8.721, 8.909, 9.431, and 8.234. Regarding the relative length of the duodenum and jejunum, T4 was significantly superior ($P \leq 0.05$) to T2 and T3 also outperformed to T5 and T1. No significant differences were observed between T2 and T3. The relative length of the duodenum was 1.151, 1.372, 1.426, 1.572, and 1.253. The relative length of the jejunum was 1.151, 1.372, 1.426, 1.572, 1.253. 3.012, 3.365, 3.386, 3.624, and 3.168, for transactions T1, T2, T3, T4, and T5 respectively.

Table (2) Effect of of Ginkgo biloba leaf extract and antibiotic on the relative length of the small intestine and cecum (%) of broiler chickens (mean± standard error).

Treatments	Relative length				
	Duodenum	Jejunum	Ileum	Cecum	Small intestine
T1	1.151±0.023 d	3.012±0.019 d	3.607±0.004 e	0.693±0.004 e	7.771±0.047 e
T2	1.372±0.029 b	3.365±0.012 b	3.892±0.007 c	0.745±0.004 c	8.721±0.037 c
T3	1.426±0.008 b	3.386±0.011 b	4.097±0.008 b	0.788±0.001 b	8.909±0.023 b
T4	1.572±0.021 a	3.624±0.021 a	4.233±0.042 a	0.802±0.002 a	9.431±0.044 a
T5	1.253±0.005 c	3.168±0.013 c	3.812±0.007 d	0.710±0.001 d	8.234±0.013 d
Sig.	*	*	*	*	*

Histological Parameters of the Intestine:

Table (3) shows the effect of using different levels of aqueous extract of ginkgo leaves and antibiotics on villus height, crypt depth, and the ratio of villus height to crypt depth in the duodenum, jejunum, and ileum of broiler chickens. A significant ($P \leq 0.05$) increase on villus height in the duodenum was observed in T4. A significant increase on crypt depth was observed in T3 and T4. As for the jejunum and ileum, a significant ($P \leq 0.05$) increase on villus height and

crypt depth was observed in T3) and T4, compared to the other treatments. T2 and T5 were significantly superior compared to T1. The results also showed that the ratio of villus height to crypt depth was in the same direction and significantly superior to the aqueous extract of ginkgo leaves. It also showed an increase on villus height and crypt depth in the duodenum, jejunum, and ileum of treated chicks.

Treatments	Duodenum			Jejunum			Ileum		
	villus height (VH)	crypt depth (CD)	VH/ CD ratio	villus height (VH)	crypt depth (CD)	VH/ CD ratio	villus height (VH)	crypt depth (CD)	VH/ CD ratio
T1	75.48±0.38 d	9.63±0.03 b	7.83±0.01 d	78.65±0.64 c	9.76±0.05 c	8.05±0.02 c	79.67±0.54 c	9.84±0.07 c	8.09±0.07 c
T2	78.15±0.30 c	9.67±0.03 b	8.08±0.01 c	80.99±0.55 b	9.96±0.02 b	8.12±0.03 b	83.05±0.64 b	10.13±0.07 b	8.19±0.06 b
T3	79.82±0.10 b	9.79±0.01 a	8.15±0.03 b	83.70±0.43 a	10.19±0.04 a	8.21±0.05 a	85.80±0.43 a	10.35±0.04 a	8.28±0.01 a
T4	80.97±0.23 a	9.80±0.02 a	8.25±0.01 a	84.44±0.44 a	10.25±0.04 a	8.23±0.04 a	87.14±0.45 a	10.46±0.03 a	8.32±0.02 a
T5	75.27±0.22 d	9.59±0.02 b	7.84±0.03 d	77.83±0.72 c	9.67±0.04 c	8.04±0.01 c	78.92±0.49 c	9.76±0.05 c	8.08±0.009 c
Sig.	*	*	*	*	*	*	*	*	*

This increase in villus length, crypt depth, and the ratio between villus height and crypt depth in the duodenum, jejunum, and ileum of chicks given aqueous extract of ginkgo leaves in different ways may be attributed to the superiority observed when the aqueous extract was given in drinking water compared to other treatments. This is due to the activity and function of beneficial bacteria that produce lactic acid, which enters the intestinal cells directly as a source of energy. This aids in their growth, activity, and division, thereby increasing the length and depth of the crypts in the small intestine.

The results obtained showed a significant effect on the studied traits. Adding aqueous extract of ginkgo biloba leaves to the drinking water of broiler chickens affected the length of the villi, thickness of the villi, and depth of the crypts within the jejunum and intestine. Improving the intestinal environment and health may lead to improved growth performance, efficient nutrient absorption, and a stronger defense against pathogenic bacteria (Chee *et al.*, 2010; Al-Gharawi and Ebade, 2020; Alkenany *et al.*, 2021). Ginkgo biloba leaf extract may protect the intestine from potential oxidative damage during digestion due to its antioxidant polyphenol compounds (Brenes *et al.*, 2008). Antioxidant compounds may improve the morphology of the intestine (Zhang *et al.*, 2015). Jazi *et al.* (2017) reported a strong relationship

between intestinal morphology and the microbial community. These results were consistent with Gui *et al.* (2023) when using a mixture of Chinese medicinal plants in powdered form in the feed. The results demonstrated that the supplementation treatments outperformed the control treatment in the number of beneficial bacteria in the intestine. In addition, the supplementation treatments improved the histological characteristics and morphology of the intestine, including villus length and crypt depth, compared to the control treatment.

The increased length, thickness, and depth of the villi may be attributed to phenolic compounds that enter the colon and interact with colonic bacteria. The interactions of these intestinal bacteria with polyphenols play vital roles in modifying the gut microbiota, not only affecting the gut bacterial composition. They also improve the bioavailability of polyphenols by metabolizing them into absorbable metabolites. This affects the altered microbial composition and bacterial-derived polyphenol metabolites. They also affect intestinal development, improving the health and productivity of chickens. The health-promoting properties of these phenolic compounds are attributed to their effect on the gut microflora. The interactions that occur between intestinal microflora and polyphenols

are two-way interactions, with the latter converting polyphenols into metabolites of the active ingredient. This leads to improved bioavailability and health effects. While polyphenols and their metabolites derived from living organisms are not only beneficial to the gut microflora, they are also beneficial to the gut microflora. The small intestine supports the growth of beneficial bacteria and inhibits pathogens (Iqbal *et al.*, 2020; Ashour *et al.*, 2025). This leads to increased villus length, villus thickness, and crypt depth, as we concluded from Table (3), which in turn leads to enhanced growth and improved intestinal health (Aziza *et al.*, 2010). These supplements play a role in ensuring the integrity and development of the intestinal mucosa and also improve bird performance (Lemos *et al.*, 2016). The growth and production of poultry depend on proper digestion and absorption of nutrients, and intestinal health is essential for maintaining efficient and sustainable digestive physiology (Miao *et al.*, 2021).

References:

- Abdul-Sada SAA, Abd Al-Abbas WN, Al-Gharawi JK (2023). Effect of methods of adding red ginseng on some productive traits of laying hens. In *4th International Conference of Modern Technologies in Agricultural Sciences*, IOP Conference Series: Earth and Environmental Science (Vol. 1262). IOP Publishing. <https://doi.org/10.1088/1755-1315/1262/1/012045>
- Al Salman NTS, Al-Gharawi, JKM (2019). Effect of eucalyptus leaves water extract on some productive traits of broilers. *Plant Archives*, 19 (Suppl. 1), 920-923.
- Al-Gharawi JK, Ebade, JA (2020). Effect of different levels of cardamom oil in diet on some productive traits of layer hens. *Plant Archives*, 20(2), 4085-4088.
- Alkenany MH, Al-Ardhi SAA, Al-Gharawi JK (2021). Effect of Chia Seeds Water Extract on Some Physiological Traits of Broiler. *IOP Conference Series. Earth and Environmental Science*; Bristol, 932 (1).
- Al-Zamili IFB, Al-Airdy SAA, Al-Machi ASH (2019). Effect of feed limestone relief early age in productive and immune traits of the broiler. *Biochem. Cell. Arch.* 19(2): 2807-2814.
- Ashour EA, Al-Ardhi S.A, Abd El-Hack ME, Elsherbeni AI, Elolimy AA, Madkour M, Tufarelli V, Swelum AA. (2025). Effects of lactic acid and herbal blend as antibiotic alternatives on growth, carcass traits, blood chemistry, and microbial load in broiler chickens. *Poult Sci.*, 104(5):105050.

- Aziza, A. E., N. Quezada, and G. Cherian. 2010. Antioxidative effect of dietary Camelina meal in fresh, stored, or cooked broiler chicken meat. *Poult. Sci.* 89:2711–2718.
- Belwal, T., L. Giri, A. Bahukhandi, M. Tariq, P. Kewlani, I.D. Bhatt and R.S. Rawal (2019). Ginkgo biloba. In *Nonvitamin and nonmineral nutritional supplements* (pp. 241-250).
- Brenes, A., A. Viveros., I. Goni., C. Centeno., S. Sáyago-Ayerdy., I. Arija., F. Saura-Calixto. 2008. Effect of grape pomace concentrate and vitamin E on digestibility of polyphenols and antioxidant activity in chickens. *Poult. Sci.* 87, 307–316
- Cao, F.L., X.H. Zhang, W.W. Yu, L.G. Zhao and T. Wang (2012). Effect of feeding fermented Ginkgo biloba leaves on growth performance, meat quality, and lipid metabolism in broilers. *Poultry Science*, 91: 1210-1221.
- Das, R., M.S. Lami, A.J. Chakraborty, S. Mitra, T.E. Tallei, R. Idroes and T.B. Emran (2022). Ginkgo biloba: A Treasure of Functional Phytochemicals with Multimedical Applications. *Evidence-Based Complementary and Alternative Medicine*, 2022.
- Eisvand, F., B.M. Razavi and H. Hosseinzadeh (2020). The effects of Ginkgo biloba on metabolic syndrome: A review. *Phytotherapy Research*, 34(8): 1798-1811.
- El-Iraqi, K.G., E.M. Abdelgawad, H.M. Ibrahim and A.E. El-Sawe (2013). Effect of Ginkgo biloba, dry peppermint and vitamin C as anti-stress on broiler welfare during summer heat stress *Glob. Vet.*, 10 (3): 770-778.
- Gui, J., M. A. K. Azad. , W.Lin., C. Meng., X.Hu., Y. Cui., L.J. He., and X. Kong. 2023. Dietary supplementation with Chinese herb ultrafine powder improves intestinal morphology and physical barrier function by altering jejunal microbiota in laying hens. *Frontiers in Microbiology*, 14, 1185806.
- hee, S.H., P. Iji., M. Choct., L.L. Mikkelsen., and A. Kocher., .2010. Characterisation and response of intestinal microflora and mucins to manno-oligosaccharide and antibiotic supplementation in broiler chickens. *Br. Poult. Sci.* 51, 368–380.
- Iqbal Y., J.J. HAR .Cottrell, Suleria, FR Dunshea. 2020. Gut Microbiota-Polyphenol Interactions in Chicken: A Review. *Animals* 10(8): 1391.
- Jazi, V., F. Boldaji., B.Dastar., S. Hashemi., and A. Ashayerizadeh. 2017. Effects of fermented cottonseed meal on the growth

- performance, gastrointestinal microflora population and small intestinal morphology in broiler chickens. *Br. Poult. Sci.*, 58, 402-408.
- Kaushik, D., V. Kumar and H. Dureja (2003). Developments in nutraceuticals. *Indian Journal of Pharmacology*, 35(6): 363-372.
- Lemos, M.J.D., L.F.L. Calixto., K.A.A Torres-Cordido., and T.L. Reis. 2016. so de aditivo alimentar equilibrador da flora intestinal em aves de corte de postura. *Arq. Inst. Biol.* 83.
- Miao, S., W Zhou., H. Li., M .Zhu., X. Dong., and X. Zou. 2021. Effects of coated sodium butyrate on production performance, egg quality, serum biochemistry, digestive enzyme activity, and intestinal health of laying hens. *Italian Journal of Animal Science*, 20(1), 1452-1461.
- Wan, W., C. Zhang, M. Danielsen, Q. Li, W. Chen and Y. Chan (2016). EGb761 improves cognitive function and regulates inflammatory responses in the APP/PS1 mouse. *Exp Gerontol*, 81: 92-100.
- Wang, H.Y. Y.Q. Zhang (2019). The main active constituents and detoxification process of Ginkgo biloba seeds and their potential use in functional health foods. *Journal of Food Composition and Analysis*, 83: 418-422.
- Youdim K.A. and J.A. Joseph (2001). A possible emerging role of phytochemicals in improving age-related neurological dysfunctions: a multiplicity of effects. *Free Radical Biology and Medicine*, 30(6): 583-594.
- Zhang, X., F. Cao, Z. Sun, W. Yu, L. Zhao, G. Wang and T. Wang (2012). Effect of feeding *Aspergillus niger*-fermented Ginkgo biloba-leaves on growth, small intestinal structure and function of broiler chicks. *Livestock Science*, 147: 170-180.
- Zhang, X., Z. Sun, F. Cao, H. Ahmad, X. Yang, L. Zhao and T. Wang (2015). Effects of dietary supplementation with fermented Ginkgo leaves on antioxidant capacity, intestinal morphology and microbial ecology in broiler chicks. *British Poultry Science*, 56: 370-380.