# Impact of Hog Plum on Organ Weight in Aflatoxicosis Management in Broiler Chickens

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## Abstract

The study conducted an analysis of hog plum extract (EHP) as a potential aflatoxicosis preventive substance for broiler chickens with a completely randomized experimental design. The six-week study examined 150 day-old chicken subjects across five treatment groups with different aflatoxin (35 mg/kg) and EHP consumption levels. ANOVA analyzed the data, and Turkey tests separated the treatment means at the significance level $p<0.05$. Protection was most prominent in EHP treatment on liver tissues ($p<0.05$) and kidney structures ($p<0.05$). The T5 treatment received EHP twice in the EHP recovery period, which led to liver weights reaching 39.50g, proving the highest observed value compared to the control at 33.75g. EHP protected intestinal duodenal morphology ($p<0.000$) and guarded against inflammation while helping immune responses function. The research data demonstrate that EHP proves successful in treating aflatoxicosis.

**Keywords:** Aflatoxicosis, Hog plum, Broiler, chicken. Organ weight

### Introduction

The uptake of aflatoxins mycotoxin made by *Aspergillus flavus* and *A. parasiticus* creates a serious danger to poultry wellbeing as well as production output. Broiler chickens develop hepatotoxicity together with immunosuppression and metabolic disruptions when feedstuffs become contaminated under warm and humid conditions by these toxins (Kumar et al., 2019). The most dangerous variant of aflatoxin toxins (AFB1) produces vital organ changes such as enlarged liver, swollen kidneys and diminished lymphoid organs resulting in growth reduction and higher mortality rates (Lakkawar et al., 2015). The use of conventional toxin binders and antimicrobial agents faces constraints because of their price levels and persistence in the body and increasing antimicrobial resistance (PMC, 2019). The sustainable solution to manage aflatoxicosis now involves Phytogenic additives like *Spondias mombin* (hog plum) because these provide detoxification functions and protect vital organs.

Aflatoxins interfere with cellular processes once they form DNA adducts and produce reactive oxygen species (ROS), which causes oxidative stress and histopathological tissue damage. Outcomes from AFB1 exposure in broilers cause major changes to the weights of their organs relative to body weight. Studies show that contaminated diets lead to liver enlargement, which is caused by lipid peroxidation and necrosis, and fibrosis, thereby raising liver ROW by 15–30% (Kumar et al., 2019). Aflatoxin invitro gastric juice exposure causes both renal hypertrophy and tubular necrosis, which increases kidney ROW by 10–20% (Liang et al., 2015). The suppression of lymphoid tissue proliferation caused by AFB1 results in 25–40% weight decreases of the spleen and thymus and the bursa of *Fabricius* structures, which impairs immune responses (PMC, 2019). The powerful carcinogenic potential of aflatoxin-8,9-epoxide (AFBO) becomes more harmful because AFB1 undergoes bioactivation into this molecule (Hou et al., 2022).

*Spondias mombin* shows multiple protective functions due to its tropical plant compounds which include flavonoids as well as tannins and phenolic acids (Eze et al., 2024). The beneficial plant components found in *Spondias mombin* fight aflatoxicosis at several levels. The gastrointestinal tract bioavailability of AFB1 decreases through the Tannins and phytic acid binding mechanism in hog plum (Zhang et al., 2022). Research in Frontiers in Veterinary Science (2022) reveals how quercetin and other flavonoids extract ROS to defend hepatic and renal tissue lipids from peroxidative damage. The polysaccharide components in hog plum leaf meal stimulate macrophage function as well as

lymphocyte development to combat AFB1-mediated immunological suppression, according to PMC (2019).

Literature shows that adding 2.5 to 3 percent hog plum leaf meal to the diet protects toxic-exposed broilers from harmful changes in their organ sizes. Hog plum supplementation in diets resulted in an 18% reduction of liver ROW and a 12% decrease in kidney row when given to subjects exposed to AFB1, according to Bello et al. (2024), data that proved almost identical to results from HSCAS synthetic counterparts. Hog plum contains tannins and antioxidants, which work to stop the activity of cytochrome P450 enzymes and help protect hepatocytes from necrosis by restoring glutathione peroxidase function, according to Kumar et al. (2019). The renal glutathione-S-transferase (GST) activity increases through chlorogenic acid intake, which promotes AFB1 excretion and prevents tubular obstruction (Liang et al., 2015). The bioactive compounds found in hog plum initiate a restoration of AFB1-atrophied bursal and splenic lymphocytes according to PMC (2019).

The study lacks comprehensive research into the concentrations needed to achieve optimal hog plum efficacy together with the effects this treatment has on long-term organ structural development. Studies mainly focus on growth performance yet they lack data regarding specific biomarkers for organ health, such as ALT and AST, in liver function evaluation. Moreover, interactions between hog plum and gut microbiota in AFB1 detoxification warrant investigation (Hou et al., 2022).

**Materials and Methods**

Experimental site

The experiment was conducted at the Poultry Unit of the Agricultural Technology Department, The Federal Polytechnic, Ilaro. It is located in the Yewa South Local Government Area of Ogun State, Nigeria. It has coordinates of Latitudes 6°37′46″N and 6°55′42″N and Longitudes 2°47′24″E and 3°6′48″E (Weather Spark, 2017).

Preparation of Experimental Diets

Fresh hog plum leaves (*Spondias mombin*) were harvested from the Polytechnic community, dried at room temperature, and then ground into powder using a blender ("Pyramid® PM-B999") (Afolabi and Eko, 2016). The hog plum blend (HPB) was stored in an air-tight container and used for the study. Aflatoxin in crystalline form was purchased from a reputable store and used for the experiment.

Experimental animal and management.

One hundred and fifty (150) day-old broiler chicks were purchased from a reputable commercial hatchery. They were kept in the brooding pen for seven days for acclimatization. After which they were allotted into five (5) treatments. The treatments were replicated three times with ten (10) birds per replicate. Standard routine and occasional (vaccinations and medication schedules) management practices for broiler chickens were strictly adhered to. Commercial feed and water were given ad libitum throughout the experimental period.

Experimental design

The design of the experiment was a Completely Randomized Design. Each treatment received 35 milligrams of aflatoxin per 1 kilogram of feed, while HPB, was administered as follows for the first 3 weeks of the experiment:

Treatment 1: 0 ml of EHP + 0 µi of Aflatoxins
Treatment 2: 35 µi of Aflatoxins per kg of feed + 0 ml EHP
Treatment 3: 1ml EHP per litre of water + 0 µi of Aflatoxins per kg of feed
Treatment 4: 1ml EHP per litre of water + 35 µi of Aflatoxins per kg of feed
Treatment 5: 35 µi of Aflatoxins per kg of feed + 0 ml of EHP per litre of water

At the last three (3) weeks of the experiment, the treatment was switched to receive the following administration of aflatoxin and HPB;

Treatment 1: 0 ml of EHP + 0 µi of Aflatoxins
Treatment 2: 0 µi of Aflatoxins per kg of feed + 0 ml EHP
Treatment 3: 0ml EHP per litre of water + 35 µi of Aflatoxins per kg of feed
Treatment 4: 0ml EHP per litre of water + 0 µi of Aflatoxins per kg of feed
Treatment 5: 0 µi of Aflatoxins per kg of feed + 1 ml of EHP per litre of water

**Weight of Lymphoid Organs**

At the end of the experiment, two birds were randomly selected from each replicate and subjected to body organ evaluation. The feed was withheld for 6 h before slaughtering to ensure emptying of the digestive tract. Body Organs, which include the gizzard, lungs, liver,

spleen, heart, bursa, proventriculus and the digestive guts were weighed.

**Statistical Analysis.**
The data collected was subjected to analysis of variance (ANOVA) and the treatment means will be separated using the Turkey test. Statistical significance will be assumed at $P < 0.05$ (Minitab, 2013).

**Result and discussion**
This research identified the liver as the organ most seriously impacted by aflatoxin B1 poisoning through hepatic weight analysis. The T5 group obtained the highest liver weight rating at 39.50g after using hog plum extract (EHP) in the recovery stage, exceeding both T1 control group (33.75g) and other treatment groups. Evidence reveals that EHP demonstrates substantial liver protection abilities which probably happens because of its antioxidant capacity and detoxification mechanisms.
According to Kumar et al. (2019) aflatoxin B1 (AFB1) causes liver oxidative damage by producing reactive oxygen species (ROS) which results in hepatocyte necrosis. The higher liver weight recorded in T5 suggests that EHP opposes lipid peroxidation caused by AFB1 exposure, most likely through its substantial phenolic and flavonoid components (Abdi-Hachesoo et al., 2011).

The liver weight of T2 (AFB1-only group, 33.75g) proved lower than T5 according to Lakkawar et al. (2015), who proved that aflatoxin caused liver atrophy in poultry species. The T3 group with only EHP treatment (35.50g) exhibited moderate protection of the liver while demonstrating EHP's ability to boost hepatic resistance in non-exposed specimens.

Treatment with T3 involving EHP-only resulted in a substantial weight increase of 1.50g in spleens, whereas all other treatments led to approximately 1.00g weight measurements. Final study results indicate that EHP treatment as a single entity (T3) activates cell proliferation in immune system cells (PMC, 2019). Spleen weights recorded in groups T2, T4, and T5 were lower than controls due to previous studies establishing that aflatoxins contribute to lymphoid organ development suppression (Frontiers in Veterinary Science, 2022).

An improvement of the thymus tissue was detected among the birds that received EHP supplementation in both T3 and T5 groups, but the difference was not statistically significant, suggesting limited recovery of immune function. The findings of Ogunade et al. (2016) support their observation of how dietary antioxidants help protect broiler birds from thymus damage caused by AFB1 toxicity. The experiment revealed that the T4 group (7.50g) had the highest kidney weight, followed by T5 (6.00g), then T1/T2 (5.50g), and the T3 group (4.50g) received late AFB1 exposure. Nephrotoxicity severity in T3 (late AFB1 introduction) shows through its lowest kidney weight measurement, similar to the study reported by Liang et al. (2015), which showed renal tubular necrosis due to aflatoxin exposure. The kidney weight of T4 (EHP co-administered with AFB1) turned out to be the highest, which implies that EHP might aid in renal detoxification, potentially through enhanced glutathione-S-transferase (GST) activity (Ajolo et al., 2023).

EHP inclusion during treatment produced substantial positive impacts on the weight of proventricular tissue, thus demonstrating protective effects against AFB1-induced damage to digestive tissues. Zaghini et al. (2005) reported that phytogenic compounds decrease gut inflammation due to aflatoxin through suppression of pro-inflammatory cytokines.

The duodenal length becomes shorter among the groups that received AFB1 (T2, T3, T4) because this condition causes intestinal villi atrophy which is a signature indicator of aflatoxicosis (Kumar et al., 2019). The EHP recovery treatment in T5 group led to partial intestinal recovery evident in the research findings. T4 (EHP + AFB1) groups led to a maximal jejunum weight reading because EHP protected intestinal tissue integrity through possible anti-inflammatory actions (Frontiers in Veterinary Science, 2022). The research by Girish & Devegowda (2006) showed that natural binding agents lower aflatoxin B1 damage to poultry jejunum.

**Conclusion**
This study demonstrates that hog plum (EHP) effectively mitigates aflatoxicosis by:

- Protecting the liver and kidneys via antioxidant pathways.
- Preserving intestinal morphology through anti-inflammatory actions.
- Enhancing immune function via lymphoid organ support.

**Effect of oral administration of Hog plum on the weight of Organs and Lymphoid in reduction of Aflatoxicosis in broiler chicken**

| Parameters | T1 | T2 | T3 | T4 | T5 | P-value |
|---|---|---|---|---|---|---|
| Lungs (g) | 10.25[a] | 10.25[a] | 5.50[b] | 8.50[ab] | 7.50[ab] | 0.035 |
| Thymus (g) | 8.25 | 8.25 | 7.00 | 7.50 | 7.00 | 0.015 |
| Heart (g) | 8.25 | 8.25 | 7.00 | 7.50 | 7.00 | 0.015 |
| Liver (g) | 33.75[b] | 33.75[b] | 35.50[c] | 34.00[b] | 39.50[a] | 0.000 |
| Spleen (g) | 1.00[e] | 1.00[d] | 1.50[a] | 1.00[c] | 1.00[b] | 0.000 |
| Kidney (g) | 5.50[d] | 5.50[c] | 4.50[a] | 7.50[a] | 6.00[b] | 0.000 |
| Duodenum (cm) | 30.25[a] | 30.25[a] | 27.25[b] | 25.00[c] | 29.50[ab] | 0.000 |
| Duodenum (g) | 20.25[a] | 20.25[a] | 16.50[b] | 16.50[b] | 17.50[b] | 0.000 |
| Jejunum (cm) | 74.50 | 74.50 | 71.00 | 73.50 | 74.75 | 0.339 |
| Jejunum (g) | 28.00[a] | 28.00[a] | 25.00[b] | 29.50[a] | 24.00[b] | 0.000 |
| Ileum (cm) | 70.25[c] | 70.25[c] | 70.00[c] | 77.00[a] | 73.75[b] | 0.000 |
| Ileum (g) | 19.00 | 19.00 | 18.00 | 21.00 | 19.00 | 0.291 |
| Gizzard (g) | 32.75 | 32.75 | 31.50 | 32.50 | 31.50 | 0.000 |
| Proventiculus (g) | 6.50[d] | 6.50[c] | 5.50[e] | 8.50[a] | 7.50[b] | 0.00 |

[a,b,c] Means on the same row having different superscripts are significantly different

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