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## **Biochemical and Blood Lipid Parameters of Broiler Chickens Fed Sagebrush (*Artemisia Herba-Alba* Asso)**

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**Abstract:** The use of medicinal plants in animal feed has gained attention due to their pharmacological properties, cost-effectiveness, and availability. This study evaluated the effects of an infusion from *Artemisia herba-alba* (white wormwood) on biochemical and lipid parameters in broiler chickens. Two hundred one-day-old Cobb 500 chicks were divided into a control group (plain water) and an experimental group (*Artemisia* infusion) over 31 days. The infusion was prepared by steeping 60 g of *Artemisia* powder in 1 liter of water for 8 hours, then diluting it in 40 liters. Weekly measurements included live weight, feed intake, water consumption, feed conversion ratio (FCR), and mortality. Blood samples were analyzed for glucose, urea, creatinine, total proteins, cholesterol (total, HDL, LDL), and triglycerides. Results showed significant increases in blood glucose (2.37 g/L vs. 1.61 g/L) and triglycerides (0.65 g/L vs. 0.29 g/L) in the treated group, indicating effects on carbohydrate and lipid metabolism. Total cholesterol also increased (1.17 g/L vs. 1.04 g/L), while HDL

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cholesterol slightly decreased (0.55 g/L vs. 0.59 g/L). LDL cholesterol rose (0.49 g/L vs. 0.39 g/L), suggesting modulation of lipoprotein metabolism. Renal function (urea, creatinine) and total protein levels remained stable, indicating no adverse effects on kidney function or protein synthesis. These effects are attributed to bioactive compounds in *Artemisia herba-alba*, such as flavonoids and terpenoids, known to influence energy and lipid metabolism. The study highlights its potential as a natural feed additive to improve broiler metabolic health. However, further research is needed to fully understand its mechanisms and long-term implications. This work supports the use of medicinal plants as sustainable alternatives to synthetic additives in poultry production.

**Keywords:** Broiler, Blood parameters, Sagebrush

## Introduction

The use of medicinal plants in animal feed has been of increasing interest over the last few decades due to their pharmacological properties, their cost effectiveness and their availability (Acamovic & Brooker, 2005). In the poultry sector, optimising broiler growth performance and health is a major challenge, especially in the face of metabolic diseases, infections and oxidative stress (Diaz-Sanchez et al., 2015). Natural feed additives, such as plant extracts, are increasingly being used to replace antibiotics and chemical additives to promote sustainable and environmentally friendly animal production (Windisch et al., 2008).

Among these medicinal herbs, *Artemisia herba-alba*, commonly known as sagebrush or wormwood, occupies an important place in traditional medicine and modern scientific research. It is known for its multiple therapeutic properties, including antioxidant, anti-inflammatory, antimicrobial, hypoglycaemic and hypolipidemic effects (Bora & Sharma, 2011). These properties are mainly attributed to the presence of bioactive compounds like flavonoids, terpenoids and polyphenols, which have a synergistic effect in modulating different physiological processes (Tariq et al., 2009). This plant is native to the arid and semi-arid regions of the Mediterranean basin and the Middle East.

The species of the genus *Artemisia* have been the subject of extensive research for their pharmacological properties. In particular, *Artemisia herba-alba* has been widely studied for its beneficial effects on animal and human health. According to Boudjelal et al. (2013), extracts of this plant exhibit antidiabetic properties in diabetic rats through regulation of blood glucose levels and improvement of lipid profiles. Also, these studies indicate that *A. herba-alba* may have a beneficial effect on energy and fat metabolism. Thus, *Artemisia herba-alba*, with its rich phytochemical profile, represents a promising option for improving biochemical and lipid parameters in broilers while minimising the risks associated with using synthetic substances (Abdel-Wahhab et al., 2011).

However, in spite of these advances, only a few studies have focused on the effects of *A. herba-alba* on the biochemical and lipid parameters of broiler chickens, especially when it is administered as an infusion. Existing research has mainly focused on the effects of this plant in rodents or *in vitro* models, leaving a gap in the literature regarding its use in poultry nutrition (Abdel-Wahhab et al., 2011). For example, Abdel-Wahhab et al. (2011) showed that extracts of *A. herba-alba* can protect against aflatoxin-induced toxicity in rats, but there is limited data on its effects in poultry.

Biochemical and lipid parameters in the blood are important indicators of the health and metabolism of animals. Blood glucose levels, for example, reflect the energy balance and the ability of the body to regulate glucose (Dibner et al., 2007). Cholesterol and triglyceride levels are important markers of lipid metabolism, while total protein, urea and creatinine provide insight into renal function and nutritional status (Kaneko et al., 2008). In poultry production, perturbations in these parameters can lead to health problems including metabolic dysfunction, reduced growth and increased mortality (Diaz-Sanchez et al., 2015).

The use of medicinal plants, such as *A. herba-alba*, could help to maintain the balance of these parameters, in particular under conditions of stress or disease. For example, Zeggwagh et al., (2007) demonstrated that *A. herba-alba* extract ameliorated lipid profiles in hypertensive rats, while El-Haskoury et al. (2018) showed that the plant has antioxidant properties and protects against kidney toxicity. These findings suggest that *A. herba-alba* may have a similar effect in broiler chickens, improving the metabolic health of the birds and reducing the risk of disease.

This study evaluated the effect of an infusion of *Artemisia herba-alba* aerial parts on biochemical (blood glucose, urea, creatinine and total protein) and lipid (total cholesterol, HDL cholesterol, LDL cholesterol and

triglycerides) parameters in broiler chickens. The aim was to determine whether this infusion could have a positive effect on the energy and lipid metabolism of the animals, while maintaining the health of the kidneys and the liver. The results obtained could contribute to a better understanding of the mechanisms of action of *A. herba-alba*. They could also open up new perspectives for its use in animal nutrition.

This study is part of a broader effort to explore natural alternatives to synthetic feed additives aimed at promoting more sustainable and humane poultry production (Windisch et al., 2008). By investigating the effects of *A. herba-alba* on the biochemical and lipid parameters of broiler chickens, we hope to provide robust scientific data to support its use in animal nutrition, while helping to reduce the risks associated with using chemical substances.

## Material and Method

200 day-old Cobb 500 broiler chicks of mean initial weight of 33.68g were obtained from a local hatchery in the same area. The rearing period was divided into three phases. Three commercial diets were used during the experiment: starter (crumbled), grower (pelleted) and finisher (pelleted). All chicks were reared together during the first 11 days of the starter phase. At 11 days of age, the chicks were individually weighed, marked and randomly divided into three equal groups to ensure uniformity in the number of chicks (100 chicks per group) and the total weight of the group, with four replicates of 25 chicks per group.

The experimental design comprised:

- A control group (T) that was provided with plain drinking water.
- An experimental group (A) given an infusion prepared from the aerial parts of *Artemisia herba-alba* (sagebrush or white wormwood). The infusion was renewed every 24 hours for 31 consecutive days (from 11 to 42 days of age).

The preparation of the infusion was in accordance with the method described by Leila (1977). Aerial parts of *Artemisia herba-alba* were purchased from a local herbalist. The infusion was prepared according to the same protocol every night for the experimental group throughout the study: 60 g *Artemisia* powder was mixed with 1 litre water in a bottle and infused for 8 hours at room temperature. The next morning, the aqueous solution was filtered. It was then diluted in a container with 40 litres of water. During the six weeks of the experiment, the following parameters were monitored: Weekly individual live weight, Feed intake per day, Daily water consumption, Weekly feed conversion ratio (FCR) and Mortality rate.

For comparison of biochemical profiles and lipid metabolism between the two groups, blood samples were taken from one randomly selected chicken per replicate at the end of the experiment. The blood samples were then sent to a specialised laboratory for analysis. The following parameters were determined: Blood glucose, Blood urea, Blood creatinine, Total proteins, Total cholesterol, HDL cholesterol, LDL cholesterol and Triglycerides.

## Results and Discussion

The results of this study show that the infusion prepared from the aerial parts of *Artemisia herba-alba* powder has a significant effect on the biochemical and lipid parameters of broiler chickens. These effects can be attributed to the bioactive compounds present in *Artemisia herba-alba*, such as flavonoids, terpenoids, polyphenols and sesquiterpenes, which are known for their pharmacological properties on energy and lipid metabolism.

### Biochemical Parameters (Table 1)

| Table 1. Biochemical parameters in the blood of chickens from both lots |             |               |
|-------------------------------------------------------------------------|-------------|---------------|
|                                                                         | Control lot | Artemisia Lot |
| Blood glucose (mg/ml)                                                   | 1.61        | 2.37          |
| Blood urea (mg/ml)                                                      | <0.04       | <0.04         |
| Blood creatinine (mg/ml)                                                | 3           | 4             |
| Total protein (mg/ml)                                                   | 31          | 30            |

### Blood Glucose

Blood glucose levels increased significantly in the group treated with Artemisia herba-alba infusion (2.37 g/L) compared with the control group (1.61 g/L). This increase may be related to the effect of the bioactive compounds in Artemisia herba-alba on carbohydrate metabolism. According to Boudjelal et al. (2013), Artemisia herba-alba extracts exhibit hypoglycaemic properties in diabetic animals; however, in our case, the increase in blood glucose may reflect a transient stimulation of energy metabolism. A recent study by Benbott et al. (2020) showed that Artemisia herba-alba extracts can influence blood glucose regulation by modulating hepatic and pancreatic enzyme activity. In addition, El-Masry et al. (2022) reported that flavonoids in Artemisia herba-alba may stimulate hepatic glucose release, which may explain the increase observed in this study.

### Blood Urea and Creatinine

Blood urea levels remained below 0.04 g/L in both groups, indicating that renal function was not affected by the administration of Artemisia herba-alba infusion. Similarly, creatinine levels, although slightly higher in the treated group (4 mg/L versus 3 mg/L in the control group), remained within normal physiological limits. These findings are consistent with those of Zeggwagh et al. (2007), who demonstrated that Artemisia herba-alba does not exhibit renal toxicity at moderate doses. A more recent study by El-Haskoury et al. (2018) confirmed that Artemisia herba-alba extracts do not impair renal function in treated animals. Ait-Ouazzou et al. (2021) also showed that phenolic compounds in Artemisia herba-alba have a protective effect on the kidneys, supporting our findings.

### Total Protein

The level of total protein remained relatively stable between the two groups (31 g of protein/l for the control group and 30 g of protein/l for the treated group). This suggests that the Artemisia herba-alba infusion did not significantly affect protein synthesis or the nutritional status of the chickens. These results are in agreement with those of Abdel-Wahhab et al. (2011), who observed that the extracts of Artemisia herba-alba did not have any effect on the total protein content of the treated animals. Bouhrim et al. (2020) also reported that Artemisia herba-alba extracts did not significantly alter total protein levels in healthy animals.

### Triglycerides

A significant increase in triglycerides was observed in the Artemisia herba-alba infusion group (0.65 g/L) compared with the control group (0.29 g/L). This increase may be related to the effect of bioactive compounds in Artemisia herba-alba on lipid metabolism. According to Tilaoui et al. (2015), Artemisia herba-alba extracts may affect lipid metabolism by modulating hepatic enzyme activity. A recent study by Boukhris et al. (2019) showed that Artemisia herba-alba extracts can stimulate lipolysis, which may explain the observed increase in triglycerides in this study. El Abbouyi et al. (2021) also reported that Artemisia herba-alba extracts may increase triglyceride levels by stimulating the mobilisation of lipid reserves.

### Lipid Parameters (Table 2):

| Table 2. Lipid parameters in the blood of chickens from both lots of chickens |             |               |
|-------------------------------------------------------------------------------|-------------|---------------|
|                                                                               | Control lot | Artemisia Lot |
| Total cholesterol (mg/ml)                                                     | 1.04        | 1.17          |
| HDL cholesterol (mg/ml)                                                       | 0.59        | 0.55          |
| LDL cholesterol (mg/ml)                                                       | 0.39        | 0.49          |
| Triglycerides (mg/ml)                                                         | 0.29        | 0.65          |

### Total Cholesterol

The level of total cholesterol increased in the group treated with the Artemisia herba-alba infusion (1.17 g per litre) compared with the control group (1.04 g per litre). This increase may be related to the effect of the bioactive compounds contained in Artemisia herba-alba on the metabolism of lipids. Artemisia herba-alba

extracts may affect cholesterol synthesis and degradation, according to Tilaoui et al. (2015). A recent study by El Abbouyi et al. (2021) showed that extracts of *Artemisia herba-alba* can modulate the expression of genes that are involved in the metabolism of cholesterol. Khadir et al. (2020) also reported that *Artemisia herba-alba* extracts were able to increase the level of total cholesterol in the treated animals.

#### *HDL Cholesterol*

There was a slight decrease in HDL cholesterol levels in the treated group (0.55 g/L) compared with the control group (0.59 g/L). Although this decrease is small, it may be an indication of a slight effect of the *Artemisia herba-alba* infusion on reverse cholesterol transport. Nevertheless, the change remains within normal physiological limits. According to Eddouks et al. (2005), *Artemisia herba-alba* extracts have variable effects on HDL cholesterol depending on the dose and duration of treatment. *Artemisia herba-alba* extracts were also found to slightly reduce HDL levels in treated animals by Bouhrim et al. (2020).

#### *LDL Cholesterol*

The level of LDL cholesterol was increased in the treated group (0.49 g/L) in comparison with the control group (0.39 g/L). The effect of the bioactive compounds in *Artemisia herba-alba* on lipoprotein metabolism may explain this increase. According to Boudjelal et al. (2013), extracts of *Artemisia herba-alba* may have an effect on the synthesis and degradation of lipoproteins. A recent study by Khadir et al. (2020) showed that *Artemisia herba-alba* extracts can increase LDL levels in treated animals. This is in agreement with our results. El Abbouyi et al. (2021) also reported that *Artemisia herba-alba* extracts may increase LDL levels through modulation of hepatic enzyme activity.

#### *Triglycerides*

Consistent with the biochemical results discussed above, there was a significant increase in triglycerides in the treated group (0.65 g/L) compared with the control group (0.29 g/L). According to Zeggwagh et al. (2007), extracts of *Artemisia herba-alba* are able to stimulate the mobilisation of lipid reserves in order to meet the increased demand for energy. The ability of *Artemisia herba-alba* extracts to influence triglyceride metabolism by modulating hepatic enzyme activity was confirmed by Boukhris et al. (2019). El Abbouyi et al. (2021) also reported that *Artemisia herba-alba* extracts may increase triglyceride levels through stimulation of lipolysis.

### **Conclusion**

The results of this study showed a significant effect of *Artemisia herba* on biochemical and lipid parameters in broilers. The bioactive compounds of *Artemisia herba-alba* seem to have an effect on energy and lipid metabolism, based on the observed effects on blood glucose, triglycerides, total cholesterol and LDL cholesterol. However, these effects vary depending on the parameters studied. Further research is needed to better understand the mechanisms of action and long-term implications.

### **Scientific Ethics Declaration**

\* The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM Journal belongs to the authors.

### **Conflict of Interest**

\* The authors declare that they have no conflicts of interest

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