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COMPARISON OF THE QUALITY OF MEAT CUTS AND INTERNAL VISCERA OF BROILERS FED DIETS CONTAINING VARYING LEVELS OF CYPERUS ROTUNDUS

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Abstract

This study evaluated the impact on various characteristics of broiler chicken meat from adding 2.5, 5, and 7.5 g/kg of *Cyperus rotundus* powder and 300 mg/kg of vitamin E to their feed. The studied traits were the weight of edible and inedible viscera and primary and secondary cuts, as well as various blood parameters such as glucose levels, blood plasma proteins, plasma lipid profile, and liver enzyme activity associated with amino group transfer. The results indicated that adding the powder as a natural additive provided superior results compared to vitamin E and the control in improving the dressing percentage without edible giblets after the end of the feeding period. Adding 7.5 g/kg to the feed produced the best results at 75.69% followed by 5 g/kg (75.36%), and 2.5 g/kg (73. 03%) compared to 72.5% and 70.3% for the diet containing vitamin E and the control, respectively. Furthermore, adding Cyperus powder compared to vitamin E and the control significantly improved the dressing percentage with edible giblets at 78.86%, 78.30%, 76.86%, 76.20%, and 73.76%, respectively. It also led to a significant increase in the percentage of weight the primary carcass parts. The thigh parts reached 29.1%, 28.3%, 25.63, 24.4%, and 21.70%, while it was 38.73%, 38.16%, 34.96%, 34.76%, and 32.56% for the breast, respectively. However, adding Cyperus powder did not lead to any improvement in the weight of secondary parts such as the wings, neck, and back. The results also showed that Cyperus powder supplements in the feed improved blood glucose levels, as they reached 255.3, 257.3, 251.6, 243.3 and 232.3 dl\mg in birds fed diets containing 2.5, 5, and 7.5 g/kg of the powder and 300 mg/kg of vitamin E and the control treatment, respectively. No significant effect was observed in total protein, albumin, globulin, creatinine, and uric acid levels compared to the control group. The results show that adding the powder to bird feed had a significant effect on the blood lipid profile. Cholesterol blood content, triglycerides, and LDL registered decreases in birds fed diets containing all the experimental Cyperus powder and vitamin E levels and the control at 171.3, 175, 183.3, 183.6, and 195.9 mg/100 ml, 112.3, 114.6, 134.6, 135.3, and 155.3 mg/100 ml, and 103.47, 107.73, 112.60, 112.40, 126.40 mg/100 ml, respectively. However, a significant increase was observed in HDL values, at 45.33, 44.33, 43.66, 44.33, and 37.66 mg/100, respectively. ALT and AST enzyme concentrations decreased significantly while that for the ALP enzyme increased in the treatments involving sedge powder additions compared to the control feed.

Keywords: Cyperus plant, Broiler chicken, Vitamin E, Carcass characteristics, Blood plasma, Antioxidants.

المقارنة بين نوعية قطعيات اللحم والاحشاء الداخلية المأكولة لفروج اللحم بإضافة مستويات مخلفة من نبات السعد

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الخلاصة

هدفت الدراسة إلى تقييم تأثير إضافة 2.5 و5 و7.5 غم / كغم من مسحوق نبات السعد *Cyperus rotundus* و300 ملغم/ كغم من فيتامين E إلى علف فروج اللحم على الخصائص النوعية للحوم، مثل أوزان الأحشاء الصالحة للأكل وغير الصالحة للأكل، وأوزان القطعات الأولية والثانوية، بالإضافة إلى معايير الدم المختلفة مثل مستويات الجلوكوز، والبروتينات ومستوى الدهون الكلية، ونشاط إنزيمات الكبد المرتبطة بنقل المجموعة الأمينية. أشارت النتائج إلى تفوق إضافة مسحوق السعد كمضاف طبيعي مقارنةً بفيتامين E والسيطرة في تحسين نسبة التصافي بدون أحشاء صالحة للأكل بعد انتهاء فترة التغذية، وأن إضافة 7.5 غم/ كغم أعطت أفضل النتائج، ثم 5 غم/ كغم، ثم 2.5 غم/ كغم، حيث بلغت 75.69%، و75.36%، و73.03% على التوالي، بينما بلغت في الطيور التي غذت على عليقة تحتوي على فيتامين E والسيطرة 72.5% و70.3% على التوالي. علاوة على ذلك، أدت إضافة مسحوق السعد مقارنةً بفيتامين E والسيطرة إلى تحسين نسبة التصافي مع الأحشاء الصالحة للأكل بشكل ملحوظ، حيث بلغت 78.86%، و78.30%، و76.86%، و76.20%، و73.76% على التوالي. كما أدى إضافة مسحوق السعد إلى زيادة معنوية في نسبة وزن أجزاء الذبيحة الرئيسية حيث بلغت نسبة الزيادة في الفخذ 29.1%، 28.3%، 25.63%، 24.4%، 21.70%على التوالي، بينما بلغت نسبة الزيادة في الصدر 38.73، 38.16، 34.96، 34.76، و32.56% على التوالي. في حين لم يُحدث إضافة مسحوق السعد أي تحسن في وزن الأجزاء الثانوية كالأجنحة والرقبة والظهر. كما أظهرت النتائج أن إضافة نبات السعد إلى العلف حسّن مستوى سكر الدم، حيث وصل إلى 255.3، 257.3، 251.6، 243.3 و232.3 ديسيلتر/ ملغم في دم الطيور التي تغذت على علف يحتوي على 2.5، 5، و7.5 غم/ كغم من مسحوق السعد و300 ملغم/ كغم من فيتامين E، معاملة السيطرة، على التوالي. في حين لم يُلاحظ أي تأثير معنوي في مستويات البروتين الكلي، والألبومين، والغلوبيولين، والكرياتينين، وحمض اليوريك مقارنةً بالسيطرة. أظهرت النتائج أن إضافة السعد إلى علف الطيور خفض محتوى الدم من الكوليسترول والدهون الثلاثية والكوليسترول الضار LDL لدى الطيور التي غذت على علائق تحتوي على2.5 ،5 و7.5 غم من مسحوق السعد/كغم و300 ملغم/ كغم من فيتامين E، بالمقارنة مع مجموعة السيطرة، حيث بلغت القيم 171.3، 175، 183.3، 183.6، 195.9 ملغم/100 مل، و112.3، 114.6، 134.6، 135.3، 155.3 ملغم/100 مل، و103.47، 107.73، 112.60، 112.40، 126.40 ملغم/100 مل، على التوالي. في حين ارتفعت قيم الكوليسترول الجيد HDL، حيث بلغت 45.33، 44.33، 43.66، 44.33، و37.66 ملغم/100 مل، على التوالي. اظهرت النتائج انخفاضا معنويا في تركيز انزيمي ALT و AST لصالح معاملات اضافة مسحوق السعد بالمقارنة مع عليقة السيطرة في حين ارتفع تركيز انزيم ALP لمعاملات السعد مقارنة بمعاملة السيطرة.

كلمات مفتاحية: نبات السعد، فروج لحم، فيتامين E، صفات الذبيحة، بلازما الدم ومضادات الاكسدة.

Introduction

Humans have consistently utilized natural plant-derived substances to enhance meat and meat products due to the presence of antioxidant and antibacterial properties in these extracts (24). The application of extracts from some medical plants and herbs has grown in industrial sectors, either to extend the shelf-life of meat or to enhance its intrinsic value and microbiological characteristics. The enhancement is achieved either by including these extracts into animal or avian diets during the reproductive phase or by applying them to meat cuts post-slaughter (23 and 34). According to reference (14), the incorporation of Cyperus powder into the diet resulted in an increase in the net percentage, while having no impact on that of edible viscera. This was attributable to the rise in live weight, which was evident in the body weight prior to slaughter, the carcass weight, and the net percentage.

In ancient times, human beings employed the Cyperus plant (*Cyperus albostriatus*) for the production of food, flavor, and medicines due to its many characteristics, including antioxidant and antibacterial features, as well as its use for treating various illnesses (5). Cyperus originated in India and northern and eastern Australia, with additional evidence assigning its existence to Africa, Europe, and Asia. Ninety-two countries, including those in tropical and subtropical regions, have distributed Cyperus (6). Observers of cyperus in its native habitat may see it as a harmful plant; yet, it may be distinguished from other noxious grasses by its elongated, slender roots that form a series of tubers (7 and 8). The pharmaceutical industry use Cyperus in the formulation of many drugs, such as diuretics, cough suppressants, asthma therapies, and antipyretics (29). Cyperus is considered particularly beneficial for the digestive and urinary systems. It has the capacity to address conditions like diabetes, rheumatoid arthritis, epilepsy, Alzheimer's disease, and cancer. Furthermore, it assists in weight regulation and the reduction of obesity (21).

Cyperus has been employed to improve digestion and reduce colic, bloating, nausea, vomiting, and diarrhea. It is effective in mitigating diarrhea by suppressing toxin production from Escherichia coli and reducing the incidence of diarrheal episodes in patients (10). Cyperus facilitates the management of irritable bowel syndrome (15). In addition to its diuretic properties, it protects against urinary tract infections by modulating the bacteria responsible for them without eradicating them (11 and 36). Cyperus components can bind to toxins in the body, facilitating their elimination (30). The plant has been utilized in the formulation of cough remedies and for the treatment of asthma, and it includes antipyretic effects (22). The plant contains antimicrobial properties that are effective against several bacteria, including Salmonella, Staphylococcus aureus, Candida, and Escherichia coli, which are implicated in gastrointestinal, dermatological, and urinary tract problems (33).

It is also effective against fungi and tapeworms (31). This plant has been effectively utilized to maintain the characteristics and sensory attributes of fresh and processed meats during storage due to its antibacterial and antioxidant capabilities. Research has demonstrated that the inclusion of Cyperus powder in chicken feed enhances performance during the breeding period, attributable to the plant's antibacterial and antioxidant qualities (9). This study investigated the impact of integrating cyperus powder into chicken feed on the avian blood's biological qualities, the sensory attributes of the meat, and its capacity to extend the meat's shelf life.

Materials and Methods

A total of 180 ROSS-308 chicks were raised over a period of 42 days. They were randomly allocated to five treatments, each consisting of three replicates, with each duplicate containing twelve chicks.

The treatments were as follows:

T1: Control - normal feed without any additives.

T2: Normal feed with vitamin E 300 mg/kg-1 added.

T3: Feed containing 2.5 g/kg-1 Cyperus powder.

T4: Feed containing 5 g/kg-1 Cyperus powder.

T5: Feed containing 7.5 g/kg^{-1} Cyperus powder.

Dressing Percentage: Dressing percentage was estimated according to (2). The live bird was weighed, slaughtered, the feathers and internal organs removed, and the edible internal organs separated. The percentage was calculated according to the following equation:

$$\text{Dressing Percentage without internal organs} = \frac{Weight\ of\ the\ bird\ after\ slaughtering\ and\ cleaning/gram}{Live\ bird\ body\ weight/\ gram} \times 100$$

$$\text{Dressing Percentage with edible internal organs} = \frac{Weight\ of\ the\ bird\ after\ slaughter + weight\ of\ the\ edible\ entrails}{Live\ bird\ body\ weight/\ gram} \times 100$$

The relative weight of all internal organs was assessed using the methodology outlined by (2). The consumable internal organs (heart, liver, gizzard) were detached from the remaining internal organs of each carcass, weighed using a precise balance, and the proportion of each organ computed.

$$\text{Weight ratio of the organs} = \frac{Member\ weight\ /gram}{Live\ bird\ body\ weight/\ gram} \times 100$$

Blood Samples: Blood samples were collected from the birds on day 42 by slaughtering 2 birds from each replicate for all treatments. The blood was collected in a Serum separator tube SST containing a clot activator. The tubes were then centrifuged for 15 min at 3000 rpm to obtain serum. The serum was stored in a freezer at -20 °C until laboratory tests were performed.

Biochemical Tests:

Glucose concentration: Following the manufacturer's instructions, a spectrophotometer set to 505 nm and a kit from the Swiss firm AGAPPE were used to measure blood serum glucose concentrations.

Total protein concentration: Using a kit made by the Swiss business AGAPPE and a spectrophotometer set to 546 nanometers, the protein content in the blood serum was calculated using the producing company's attached technique.

Albumin concentration in blood plasma: The albumin concentration in blood plasma was determined using a kit manufactured by Biosystems-Spain, and a spectrophotometer at a wavelength of 628 nm.

Globulin Concentration: Serum globulin was estimated according to (2).

Globulin concentration (gm\100ml blood) = Total protein - Albumin

Estimation of creatinine: Serum creatinine was measured using AGAPPE kits and the supplier's instructions included in the test kit's handbook, in accordance with the procedure outlined by (18).

Estimation of uric acid: The levels of uric acid in serum were assessed utilizing a kit produced by Biolabo-France. Twenty microliters of serum were distributed into test tubes. One milliliter of the reagent, comprising a buffer solution at pH 4.7, peroxidase, uricase, and 4-Aminophenazo, was added to produce the fluid's full color shift brought on by the enzymes' reaction with uric acid. The measurement was taken at a wavelength of 510 using a spectrophotometer. The following equation (19) was used to calculate uric acid concentration.

$$\text{Uric acid} = \text{spectrophotometer reading} \times 6\ \text{mg/100 ml}^{-1}\ \text{standard reading}$$

Blood Plasma Lipid Profile:

Total cholesterol in blood serum: The enzymatic method mentioned by (26) was followed using a kit prepared by Biolabo-France and a spectrophotometer at a wavelength of 500 nm. The cholesterol concentration was calculated according to the following equation:

$$\text{Cholesterol} = \frac{Absorption\ of\ plasma\ sample}{Absorption\ of\ standard\ \ solution} \times 100\ \text{concentration of standard solution}$$

Triglycerides concentration: Serum triglycerides were measured utilizing a kit from the French company Biolabo. Optical absorbance was assessed with a spectrophotometer at a wavelength of 540 nm, following the manufacturer's protocol.

Determination of high-density lipoproteins (HDL): HDL was estimated in serum using a kit prepared by the French company Biolabo, then the absorbance was measured by spectrophotometer at a wavelength of 500 nanometers according to the method attached by the company.

Determination of low density lipoprotein (LDL): The method of (20), was used to estimate low-density lipoprotein (LDL), according to the following equation.

$$\text{LDL (mg100 ml}^{-1}) = \text{Total cholesterol} - (\text{VLDL} + \text{HDL}),\ \text{where VLDL} = \text{TG}/5$$

Activity of liver transaminase enzymes (ALP, AST, ALT)

Aspartate amino transferase (AST) activity determination: The AST enzyme was evaluated utilizing a kit manufactured by Bio Merieux-France. It involved measuring the enzyme's activity in the conversion of Aspartic acid to Oxaloacetic acid, which is subsequently transformed into Pyruvic acid. The latter then reacts with 2,4-dinitrophenyl hydrazine (DNPH) to produce a reddish-brown complex. The absorbance is measured at a wavelength of 546 nm and expressed as (1-iu L), following the protocol outlined by (2).

Alanine amino transferase (ALT) activity estimation: The colorimetric method is used to estimate the efficiency of converting pyruvic acid from alanine, by reacting pyruvic acid with DNPH to form a red complex measured at a wavelength of 546 nm and estimated in international units of liter-1 (1-iu L) using a kit prepared by Bio Merieux-France and according to the method mentioned by (2).

Assessment of alkaline phosphatase enzyme activity: A reagent comprising para-nitrophenyl phosphate (pNPP) interacted with the ALP enzyme in blood serum, resulting in a colorimetric change to yellow, which facilitates the measurement of light absorption at a certain wavelength (often 405 nm) via a spectrophotometer. The determination of enzyme activity relies on the quantity of the resultant-colored chemical, expressed in international units per liter (IU/L), and is based on the variation in light absorption over time.

Statistical Analysis: A one-way complete randomization (CRD) analysis was conducted to determine the effect of sedge powder levels (2.5, 5, and 7.5 g/kg feed) on the comparative study of meat and offal specifications. This was done using the ready-made SAS statistical program (27).

Results and Discussion

Table 1 shows the effect of adding Cyperus powder and vitamin E in improving broiler meat at the end of the rearing period. All treatments significantly outperformed the control ($P \leq 0.05$) in dressing percentage without edible giblets. T5 had the highest net percentage of 75.96, followed by T4, T3, and T2 at 75.36, 73.03, and 72.5, respectively. T5 also excelled in dressing percentage with edible giblets at 78.86, followed by T4, T3, and T2, which were 78.3, 76.86, and 76.20, respectively, while T1 recorded the lowest at 73.76. The table also indicates that adding Cyperus powder to the feed caused a significant increase ($P \leq 0.05$) in the percentage of heart, which reached the highest in T5 at 0.682 then T4 and T3 at 0.673 and 0.655, compared to T2 and T1, which were 0.645 and 0.637, respectively.

No significant differences ($P \leq 0.05$) were observed between the control and other treatments with regard to edible parts such as the liver and gizzard. Adding *Cyperus rotundus* powder to broiler feed may have contributed to an increase in the net weight percentage due to its content of biologically active compounds. The compounds contributed to improving the bird's health by enhancing the digestion process and absorption of nutrients, which leads to better relative growth of the bird and improving nutritional efficiency (16). The antimicrobial properties of plants also contributed to reducing digestive diseases in poultry, as is the case with all medicinal plants, which helped improve the health of the bird, as positively reflected in the purification rate with or without the edible entrails (3).

Table 1: Impact on the proportion of purified and edible entrails from supplementing broiler diets with Cyperus powder and vitamin E.

Weeks	Treatments					Sig.	Average adjective	Mean standard error
	T1	T2	T3	T4	T5			
Dressing percentage without edible giblets	70.30 c	72.50 b	73.03 b	75.36 a	75.96 a	P≤0.0001	73.43	0.554
Dressing percentage with edible giblets	73.76 c	76.20 b	76.86 b	78.30 a	78.86 a	P≤0.0001	76.8	0.487
Heart %	0.637 c	0.645 c	0.655 bc	0.673 ab	0.682 a	0.0115	0.658	0.005
Liver %	2.85	2.82	2.85	2.83	2.83	na	2.84	0.007
Gizzard %	1.77	1.76	1.73	1.75	1.74	na	1.75	0.005

** na: no discernible changes between the treatments at the P≤0.05 significance level.
Variations between treatments at the P≤0.05 significance level indicated by different letters (a, b, c) within the same row.
T1: No addition (Control); T2, T3, T4, and T5: diets supplemented with 300 mg kg^{-1} of vitamin E, 2.5 g kg^{-1}, 5 g kg^{-1}, and 7.5 g kg^{-1} of powdered Cyperus, respectively.

Relative Weight of the Chicken Cuts: The results indicate that adding Cyperus powder and vitamin E to the birds' diet significantly improved the relative weights of the carcass cuts. This improvement was positively correlated with the increase in the amount of powder added to the diet. The results in Table 2 show that T5, T4, and T3 were significantly (P≤0.05) better than the control in terms of the relative weights of the main carcass cuts. For thigh cuts, the figures were 29.10%, 28.30%, and 25.63%, respectively, while for breast cuts, they were 38.73%, 38.16%, and 34.96%, respectively.

However, no significant differences were observed between any of the treatments for wing cuts, while T1 and T2 recorded significant superiority (P≤0.05) over the other treatments in the average relative weight of secondary carcass cuts (back and neck) at 22.19%, 22.45%, 3.89%, and 3.84%, respectively. Adding Cyperus powder to broiler feed may have improved the weight of the main cuts due to its contribution to bird health. This is due to its compounds that aid digestion and nutrient absorption, which leads to increased metabolism and, consequently, increased thigh and breast weight. The active compounds in Cyperus may also help promote muscle growth, particularly in key areas, leading to increased muscle mass and improved meat quality (1 and 35).

Table 2: Change in average relative weight of the primary and secondary carcass cuts of broiler chickens with the addition of Cyperus powder and vitamin E to their diets.

Weeks	Treatments					Sig.	Average adjective	Mean standard error
	T1	T2	T3	T4	T5			
Thigh %	21.70 d	24.4 c	25.63 b	28.30 a	29.10 a	$P\leq0.05$	25.69	0.753
Breast %	32.56 c	34.76 b	34.96 b	38.16 a	38.73 a	$P\leq0.05$	35.84	0.627
Wings %	8.81	8.62	8.80	8.83	8.95	na	8.80	0.130
Back %	22.19 a	22.45 a	20.72 b	19.92 b	19.73 b	0.0002	21.00	0.323
Neck %	3.89 a	3.84 a	3.63 b	3.58 b	3.52 b	<.0001	3.69	0.041

** na: no discernible changes between the treatments at the $P\leq0.05$ significance level.
Variations between treatments at the $P\leq0.05$ significance level indicated by different letters (a, b, c) within the same row.
T1: No addition (Control); T2, T3, T4, and T5: diets supplemented with 300 mg kg^{-1} of vitamin E, 2.5 g kg^{-1}, 5 g kg^{-1}, and 7.5 g kg^{-1} of powdered Cyperus, respectively.

Blood Tests:

Glucose and total protein: Table 3 shows the effect of adding Cyperus powder and vitamin E to the birds' feed on blood glucose levels, with all treatments showing significant ($P\leq0.05$) improvements compared to the control group. After slaughter, the blood glucose content in the birds was 255.3 dl mg^{-1} for T5, 257.3 dl mg^{-1} for T4, and 251.6 dl mg^{-1} for T3. This was followed by T2, which significantly outperformed the control, at 243.3 dl mg^{-1}. However, no discernible differences were seen in the amount of total protein between the experimental treatments for albumin, globulin, creatinine, and uric acid.

Also, the blood glucose levels for all treatments were within the normal permissible level of 160–250 100 ml g^{-1}. It is important to maintain glucose at the normal levels for the birds, as the brain depends on it as a simple energy source (4). By enhancing insulin sensitivity and lowering oxidative stress, the flavonoids and antioxidants found in *Cyperus rotundus* have been shown by (13) to improve the health of birds and aid in blood glucose regulation. Additionally, Cyperus increased the body's sensitivity to insulin, which enhanced glucose consumption and lowered blood glucose buildup (32).

Table 3: Impact of supplementing feed with Cyperus powder and vitamin E on the blood plasma proteins and glucose levels of broilers.

Component	Treatments					Sig.	Average adjective	Mean standard error
	T1	T2	T3	T4	T5			
Glucose dl mg $^{-1}$	232.3 b	243.3 ab	251.6 a	257.3 a	255.3 a	0.05	248	3.25
Total protein 100 ml g^{-1}	4.86	5.16	5.13	5.43	5.46	na	5.21	0.328
Albumin 100 ml g^{-1}	2.43	2.53	2.56	2.70	2.76	na	2.6	0.100
Globulin 100 ml g $^{-1}$	2.43	2.63	2.56	2.73	2.70	na	2.61	0.362
Creatinine 100 ml g-^{1}	0.316	0.314	0.313	0.314	0.317	na	0.315	0.010
Uric acid 100 ml g $^{-1}$	5.40	5.42	5.41	5.43	5.42	na	5.42	0.033

** na: no discernible changes between the treatments at the P≤0.05 significance level.

Variations between treatments at the P≤0.05 significance level indicated by different letters (a, b, c) within the same row.

T1: No addition (Control); T2, T3, T4, and T5: diets supplemented with 300 mg kg^{-1} of vitamin E, 2.5 g kg^{-1}, 5 g kg^{-1}, and 7.5 g kg^{-1} of powdered Cyperus, respectively.

Blood Lipid Profile: Adding Cyperus powder and vitamin E to the broiler feed led to a reduction in the level of lipids in their blood (Table 4). A significant decrease (P≤0.05) is seen in T5 and T4 at cholesterol levels of 171.3 and 175, respectively, compared to the control of 195.0, while no significant differences were observed for T3 (183.3) and T2 (183.6). Also, all treatments showed a significant decrease (P≤0.05) in blood plasma triglycerides compared to the control, with the T5, T4, and T3 treatments recording the best significant decrease at 112.3, 114.6, and 134.6, respectively, while no significant difference was observed in T2 and T1 at 135.3 and 155.3, respectively. Adding Cyperus to broiler feed is one of the strategies used to improve bird health, which is reflected in improved meat quality. This is due to the plant's role in reducing triglyceride levels in the blood.

The active compounds in the plant stimulate the body's cells to use fat as an energy source instead of storing it, which lowers its levels in the blood (25). Table 4 also shows a significant increase ($p<0.05$) in HDL levels in the blood plasma of birds for all treatments compared with the control. T5, T4, T3, and T2 recorded 45.33, 44.33, 43.66 and 44.33, respectively, while T1 recorded 37.66. However, no significant differences were seen in the LDL levels. Supplementing broiler feed with Cyperus powder may contribute to improving HDL levels in the blood, which improves cardiovascular health due to its antioxidant and antimicrobial activity that contributes to reducing harmful LDL and increasing HDL. This improves the physiological and productive performance of the birds and lowers the chance of artery-clogging fat buildup, all of which positively impact their overall health (12).

Table 4: Impact of supplementing feed with Cyperus powder and vitamin E on the blood plasma lipid profile of broilers.

Component	Treatments					Sig.	Average adjective	Mean standard error
	T1	T2	T3	T4	T5			
Cholesterol 100ml mg^{-1}	195.0 a	183.6 ab	183.3 ab	175 b	171.3 b	0.0378	181.6	4.81
Triglycerides 100ml mg^{-1}	155.3 a	135.3 ab	134.6 b	114.6 b	112.3 b	0.0462	130.4	7.93
HDL 100ml mg^{-1}	37.66 b	44.33 a	43.66 a	44.33 a	45.33 a	0.0443	43.06	1.016
LDL 100ml mg^{-1}	126.40	112.40	112.60	107.73	103.47	0.7568	112.52	5.18

Variations between treatments at the P≤0.05 significance level indicated by different letters (a, b, c) within the same row.
T1: No addition (Control); T2, T3, T4, and T5: diets supplemented with 300 mg kg^{-1} of vitamin E, 2.5 g kg^{-1}, 5 g kg^{-1}, and 7.5 g kg^{-1} of powdered Cyperus, respectively.

Liver Transaminase Activity (ALP, AST, ALT): The additives to the bird feed significantly reduced ALT activity in all treatments (P≤0.05) compared to the control (Table 5) but showed no significant differences in the level of ALT enzyme activity in the chicken blood plasma. T5 recorded the greatest decrease of 15.63, followed by T4 (17.86) and T3 (18.33) compared to T2 at 19.10. The results also recorded the most significant decrease (P≤0.05) in the AST level for T5 and T4 at 43.76 and 47.50, respectively compared to the control, followed by T3 (55.90) and T2 (63.00). From the results it can be concluded that adding the sedge plant as a natural additive produced the largest decrease compared to adding vitamin E as an artificial additive as in T2.

Higher AST and ALT activity in blood plasma provides evidence of an increased breakdown of tissue cells and the entry of these enzymes into the bloodstream, meaning that a malfunction has occurred due to disease, bruises, or other factors. Therefore, maintaining AST and ALT levels in blood plasma is seen as a clear sign of the overall health of body tissues (28). The presence of active compounds in Cyperus reduces oxidative stress that harms cells, enhances metabolism, and increases the body’s ability to efficiently eliminate toxins. This reduces the amount of these enzymes in the blood, improving liver function. This has a positive impact on overall bird health (17).

Table 5: The effect of adding Cyperus powder and vitamin E to the feed on the activity of the liver enzymes that transfer the amino group in broilers.

Enzyme	Treatments					Sig.	Average adjective	Mean standard error
	T1	T2	T3	T4	T5			
ALT iu L^{-1}	24.73 a	19.10 b	18.33 b	17.86 b	15.63 b	0.4716	19.13	1.53
AST iu L^{-1}	77.10 a	63.00 b	55.90 c	47.50 d	43.76 d	<.0001	57.45	3.25
ALP iu L^{-1}	38.86 c	51.63 b	56.23 ab	59.36 a	63.13 a	0.0001	53.84	2.39

Variations between treatments at the P≤0.05 significance level indicated by different letters (a, b, c) within the same row.
T1: No addition (Control); T2, T3, T4, and T5: diets supplemented with 300 mg kg^{-1} of vitamin E, 2.5 g kg^{-1}, 5 g kg^{-1}, and 7.5 g kg^{-1} of powdered Cyperus, respectively.

Conclusions

The study found that Cyperus powder, a natural additive, significantly improved carcass quality by increasing the percentage of purification with edible entrails and reducing secondary weights. Cyperus powder supplementation raised blood glucose levels in all treatments compared to the control group, followed by vitamin E. All supplementation therapies improved high-density lipoproteins above the control therapy, although generally reducing cholesterol and triglycerides. ALT levels decreased across all addition treatments, indicating that natural and industrial additives affect amine group transport enzymes. ALP increased the most and AST the least from the Cyperus treatments.

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