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Effect of fresh wheatgrass supplementation on haematological and serum biochemical parameters of Pearl guinea fowl (*Numida meleagris*)

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ABSTRACT

The present study was conducted for 12 weeks on 144 day-old Pearl guinea fowls (*Numida meleagris*) at the Instructional Poultry Farm, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand), to evaluate the effect of fresh wheatgrass supplementation on haematological and serum biochemical parameters. Birds were randomly distributed into four dietary treatments with three replicates of 12 birds each in a completely randomized design. The control group (T_1) received basal diet without wheatgrass, whereas T_2 , T_3 and T_4 received fresh wheatgrass at initial levels of 2.5, 5.0 and 7.5 g/bird, respectively. Fresh wheatgrass harvested at 8-10 days of age was chopped and offered along with the basal feed, and the supplementation level was progressively increased at fortnightly intervals. At the end of the experimental period, blood samples were collected for evaluation of haematological and serum biochemical parameters. Results revealed that wheatgrass supplementation significantly ($P < 0.05$) influenced total erythrocyte count (TEC), total leukocyte count (TLC), packed cell volume (PCV), haemoglobin (Hb) and erythrocyte sedimentation rate (ESR), whereas mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) remained unaffected. Serum total protein, albumin, globulin, glucose, cholesterol, HDL-cholesterol and triglycerides were significantly influenced by wheatgrass supplementation, while the albumin-to-globulin (A/G) ratio also differed significantly among treatments. Total protein increased from 4.45 g/dl in T_1 to 5.40 g/dl in T_4 , whereas serum cholesterol decreased from 142.99 to 119.85 mg/dl and HDL-cholesterol increased from 73.61 to 85.45 mg/dl. Serum glucose and triglyceride concentrations decreased with increasing levels of wheatgrass supplementation. Serum AST and ALT activities remained unaffected by dietary treatment. It may be concluded that fresh wheatgrass supplementation modified several haematological and serum biochemical indices of Pearl guinea fowl without producing significant changes in serum transaminase activities under the conditions of the present study.

Keywords: Pearl guinea fowl, *Numida meleagris*, wheatgrass, haematology, serum biochemistry

1. Introduction

Guinea fowl (*Numida meleagris*) is an important alternative poultry species with considerable potential for meat and egg production. Nutritional management plays an important role in maintaining physiological status, productive performance and metabolic homeostasis in poultry. Haematological and serum biochemical measurements are therefore useful indicators for evaluating physiological responses to dietary interventions. Recent studies have demonstrated that dietary manipulation can influence blood and serum biochemical characteristics in guinea fowl (Lala *et al.*, 2022; Lare *et al.*, 2025) [1, 2]. Dietary L-arginine supplementation has been investigated in guinea fowl for its effects on haematological and serum biochemical indices (Lala *et al.*, 2022) [1], while vitamin E, selenium yeast and L-arginine supplementation has also been evaluated for haematological responses in laying guinea fowl (Ajibade *et al.*, 2024) [3].

Similarly, studies conducted specifically in guinea fowl have demonstrated that dietary interventions can alter selected haematological and biochemical parameters. Variation in haematological and serum biochemical values has been documented among guinea-fowl strains and sexes (Musa *et al.*, 2024) [4]. Dietary energy has also been reported to influence biochemical and haematological parameters in guinea fowl (Lare *et al.*, 2025) [2]. More recently, dietary spirulina supplementation was shown to modify serum albumin, HDL-cholesterol and total cholesterol and to affect selected haematological indices in guinea fowl (Dey *et al.*, 2026) [5]. Dietary incorporation of *Moringa oleifera* leaf powder has likewise been associated with changes in serum protein and cholesterol concentrations in guinea fowl-derived offspring (Atitso *et al.*, 2025) [6]. Plant-derived feed resources are receiving increasing attention in poultry nutrition because they may provide nutrients and biologically active compounds. Wheatgrass is the young vegetative portion of *Triticum aestivum*.

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tivum and contains proteins, minerals, amino acids, phenolic compounds, antioxidants and pigments. Its nutritional and phytochemical composition varies according to wheat variety and growing conditions (Kaur *et al.*, 2021; Kumar and Singh, 2024) [7, 8]. The nutritional properties of wheatgrass are also influenced by environmental conditions, including cultivar, growing medium, light exposure, temperature and harvest conditions (Rodríguez *et al.*, 2022) [9]. Therefore, wheatgrass represents a potentially useful plant-derived feed resource, although its composition may vary considerably depending upon production conditions.

Experimental studies with plant-derived dietary supplements in poultry have demonstrated changes in blood characteristics. Dietary phyto-genic supplementation has been associated with changes in haematological and serum biochemical parameters in broiler chickens (Jimoh *et al.*, 2022; Ogbuewu and Mbajorgu, 2023) [10, 11]. More recent studies have similarly reported alterations in haematological or biochemical profiles following supplementation with *Jasminum sambac*, oyster mushroom, glucosamine sulfate and other dietary bioactive products (Maqsood *et al.*, 2025; Islam *et al.*, 2025; Abd El-Aziz *et al.*, 2025) [13, 14, 12]. In guinea fowl, supplementation with *Ocimum gratissimum* leaf powder has also been reported to influence serum biochemical characteristics and organ-related responses (Orbugh *et al.*, 2024) [15].

The response of blood biochemical parameters to plant-derived feed additives may depend on the plant material, inclusion level, duration of feeding, bird species, physiological stage and nutrient composition of the basal diet. Consequently, results obtained from other poultry species or from different plant supplements cannot be directly extrapolated to wheatgrass-fed guinea fowl. Although wheatgrass has been investigated for its nutritional and physiological effects in experimental animals, information regarding the effect of fresh wheatgrass supplementation on the haematological and serum biochemical profile of guinea fowl remains limited.

Therefore, the present study was undertaken to evaluate the effect of graded levels of fresh wheatgrass supplementation on haematological and serum biochemical parameters of Pearl guinea fowl (*Numida meleagris*).

2. Materials and Methods

2.1 Experimental birds and dietary treatments

The experiment was conducted at the Instructional Poultry Farm, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand). A feeding trial of 12 weeks duration was conducted in a completely randomized design (CRD) using fresh wheatgrass as a feed supplement. A total of 144 day-old Pearl guinea fowls were randomly allocated to four dietary treatments, with three replicates of 12 birds each. The control group (T₁) received the basal diet without wheatgrass, whereas T₂, T₃ and T₄ received fresh wheatgrass at initial levels of 2.5, 5.0 and 7.5 g/bird, respectively. Wheatgrass harvested at 8-10 days of age was chopped and offered along with the basal feed. The supplementation level was progressively increased at fortnightly intervals according to the experimental schedule, with the initial supplementation level increased by 50% in successive fortnights. Starter, grower and finisher diets were offered *ad libitum* throughout the experimental period, with clean drinking water available to the birds.

2.2 Housing and management

The guinea fowls were maintained under a fully intensive deep-litter system using paddy husk as litter material. Housing and managemental conditions were maintained uniformly and similarly for all treatment groups throughout the experimental period.

2.3 Blood sample collection

At the end of the 12-week experimental period, on day 84, approximately 6 ml of blood was collected from six guinea fowls from each replicate group through the wing vein into sterile glass test tubes under sterile conditions. The collected blood was divided into two portions. Approximately 2 ml was transferred to tubes containing EDTA as an anticoagulant for haematological analysis. The remaining 4 ml was transferred to clean, dry and sterilized glass tubes and kept in a slanted position at room temperature for 3-4 h. Serum was subsequently separated by centrifugation at 3000 rpm for 10 min, and the upper serum layer was collected. Glucose and enzyme estimations were performed within 24 h of blood collection, while the remaining serum samples were stored at -20 °C until analysis. 03 Materials and Methods 12.8.14

2.4 Haematological parameters

The haematological parameters evaluated were total erythrocyte count (TEC), total leukocyte count (TLC), packed cell volume (PCV), haemoglobin (Hb), erythrocyte sedimentation rate (ESR), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC).

TEC was determined using an improved Neubauer haemocytometer after dilution of blood (1:101) with Natt and Herrick's solution following the method described by Fudge (2000) [16], and the values were expressed as million/ μ l. TLC was determined using a haemocytometer after dilution of blood (1:200) with Natt and Herrick's diluent following Dein (1984) [17], and values were expressed as thousand/ μ l. PCV was estimated by the microhaematocrit method as described by Sharma *et al.* (2000) [18] and expressed as percentage. Haemoglobin concentration was estimated spectrophotometrically by the cyanmethaemoglobin (Drabkin's) method following Fudge (2000) [16] and expressed as g/dl. ESR was estimated using Wintrobe's method following Boddie (1962) [19] and expressed as mm/h. MCV, MCH and MCHC were calculated using standard formulae and expressed as fl, pg and percentage, respectively. 03 Materials and Methods 12.8.14

2.5 Serum biochemical parameters

Serum total protein was estimated by the Biuret method using a commercial diagnostic kit following Johnson *et al.* (1999) [20] and expressed as g/dl. Serum albumin was estimated by the bromocresol green end-point method following Johnson *et al.* (1999) [20] and expressed as g/dl. Serum globulin was calculated by subtracting albumin from total protein, while the albumin-to-globulin (A/G) ratio was calculated from the respective albumin and globulin concentrations.

Serum glucose was estimated spectrophotometrically by the enzymatic glucose oxidase-peroxidase (GOD-POD) method using a commercial diagnostic kit following Sacks (1998) [21] and expressed as mg/dl. Total cholesterol was estimated spectrophotometrically by the enzymatic cholesterol oxidase-peroxidase (CHOD-PAP) method following Tietz (1998) [22] and expressed as mg/dl. HDL-cholesterol was estimated by the phosphotungstic acid method following Tietz (1998) [22], while triglycerides were estimated by the enzymatic CHOD-PAP method following Tietz (1998) [22]. Serum aspartate transaminase (AST) and alanine transaminase (ALT) activities were estimated by the DNPH colorimetric method using a commercial diagnostic kit following Tietz (1998) [22], and expressed as IU/L. 03 Materials and Methods 12.8.14

2.6 Statistical analysis

The experimental data were subjected to analysis of variance (ANOVA). The Critical Difference (CD) was calculated to determine significant differences among treatment means following the procedure described by Snedecor *et al.* (1994) [23]. Differences among treatment means were considered statistically significant at $P < 0.05$.

3. Results and Discussion

3.1 Haematological profile

Table 1. Effect of fresh wheatgrass supplementation on haematological profile of Pearl guinea fowl.

Parameter	T ₁	T ₂	T ₃	T ₄
TEC (10 ⁶ /μl)	2.28 ^c ± 0.18	2.63 ^b ± 0.07	2.87 ^b ± 0.15	3.22 ^a ± 0.18
TLC (10 ³ /μl)	22.01 ^b ± 0.07	22.28 ^b ± 0.11	22.15 ^a ± 0.01	22.56 ^a ± 0.12
PCV (%)	29.01 ^d ± 0.14	32.36 ^c ± 0.16	35.33 ^b ± 0.14	37.89 ^a ± 0.12
Hb (g/dl)	9.96 ^c ± 0.18	10.86 ^{bc} ± 0.16	11.43 ^{ab} ± 0.07	12.37 ^a ± 0.02
ESR (mm/h)	2.08 ^c ± 0.07	2.18 ^{bc} ± 0.02	2.36 ^{ab} ± 0.07	2.44 ^a ± 0.04
MCV (fl)	134.97 ± 0.02	135.99 ± 0.22	142.01 ± 0.06	139.37 ± 0.06
MCH (pg)	36.28 ± 0.21	40.32 ± 0.19	40.22 ± 0.11	41.18 ± 0.08
MCHC (%)	27.53 ± 0.01	26.70 ± 0.11	31.65 ± 0.03	31.51 ± 0.18

Means bearing different superscripts within a row differ significantly ($P < 0.05$).

Fresh wheatgrass supplementation significantly ($P < 0.05$) affected TEC, TLC, PCV, haemoglobin and ESR, whereas MCV, MCH and MCHC were not significantly affected. TEC increased from $2.28 \times 10^6/\mu\text{l}$ in T₁ to $3.22 \times 10^6/\mu\text{l}$ in T₄, with the highest value recorded in birds receiving the highest initial level of wheatgrass supplementation. Thus, the observed response indicates an association between graded wheatgrass supplementation and erythrocyte count under the conditions of the present experiment.

Changes in erythrocyte-related parameters following dietary supplementation have also been reported in other poultry studies. Dietary *Jasminum sambac* leaf powder increased RBC and haemoglobin concentrations in broiler chickens (Maqsood *et al.*, 2025) [13]. Similarly, phytogetic supplementation has been reported to modify selected erythrocyte and leukocyte indices in broilers (Ogbuewu and Mbajiorgu, 2023; Jimoh *et al.*, 2022) [11, 10]. In guinea fowl, dietary supplementation with different bioactive feed resources has also been evaluated based on changes in haematological indices (Lare *et al.*, 2025; Dey *et al.*, 2026) [2, 5].

PCV increased progressively from 29.01% in T₁ to 37.89% in T₄, while haemoglobin concentration increased from 9.96 to 12.37 g/dl. The parallel increase in TEC, PCV and haemoglobin suggests that wheatgrass supplementation was associated with changes in the erythrocytic profile of the birds. Comparable dietary responses in haematological characteristics have been reported in guinea fowl subjected to different nutritional interventions (Ajibade *et al.*, 2024; Lare *et al.*, 2025) [3, 2].

The increase in erythrocyte-related parameters may be related to the nutritional contribution of wheatgrass; however, the present study did not directly measure erythropoietic activity, mineral absorption or specific micronutrient availability. Therefore, the response should be

interpreted as an observed treatment-associated change rather than evidence of a specific physiological mechanism. Wheatgrass contains minerals, amino acids and other bioactive constituents, but their concentrations vary substantially with variety and growing conditions (Kaur *et al.*, 2021; Kumar and Singh, 2024) [7, 8].

TLC was also significantly influenced by wheatgrass supplementation. The values were 22.01, 22.28, 22.15 and $22.56 \times 10^3/\mu\text{l}$ in T₁, T₂, T₃ and T₄, respectively. The treatment means were numerically higher in the supplemented groups, with significant differences detected among treatments according to the statistical comparison. Dietary phytogetic supplementation has similarly been reported to alter leukocyte-related parameters in poultry (Jimoh *et al.*, 2022; Maqsood *et al.*, 2025) [10, 13]. However, because differential leukocyte counts and specific immune assays were not performed in the present experiment, the observed TLC response should not be interpreted as direct evidence of enhanced immunity.

ESR increased from 2.08 mm/h in T₁ to 2.44 mm/h in T₄. Although the treatment effect was statistically significant, ESR is influenced by several physiological and haematological factors. Therefore, the observed increase cannot independently be interpreted as evidence of either improved or impaired health status.

In contrast, MCV, MCH and MCHC were not significantly affected by wheatgrass supplementation. This indicates that the treatment-associated changes in TEC, PCV and haemoglobin were not accompanied by statistically significant alterations in the calculated erythrocyte indices. Similar findings have been reported in poultry receiving different phytogetic dietary supplements, where some erythrocyte parameters changed while MCV, MCH or MCHC remained unaffected (Jimoh *et al.*, 2022; Ogbuewu and Mbajiorgu, 2023) [10, 11].

3.2 Serum biochemical profile

Table 2. Effect of fresh wheatgrass supplementation on serum biochemical profile of Pearl guinea fowl.

Parameter	T ₁	T ₂	T ₃	T ₄
Total protein (g/dl)	4.45 ^d ± 0.14	4.82 ^c ± 0.05	5.15 ^b ± 0.06	5.40 ^a ± 0.05
Albumin (g/dl)	2.00 ^c ± 0.07	2.20 ^b ± 0.17	2.21 ^b ± 0.04	2.29 ^a ± 0.08
Globulin (g/dl)	2.45 ^c ± 0.07	2.62 ^c ± 0.09	2.94 ^b ± 0.16	3.11 ^a ± 0.13
A/G ratio	0.81 ^a ± 0.01	0.83 ^a ± 0.01	0.75 ^b ± 0.03	0.73 ^b ± 0.02
Glucose (mg/dl)	211.00 ^a ± 0.18	201.00 ^{ab} ± 0.03	195.00 ^b ± 0.02	193.00 ^b ± 0.06
Cholesterol (mg/dl)	142.99 ^a ± 0.01	126.89 ^b ± 0.01	120.87 ^b ± 0.07	119.85 ^b ± 0.03
HDL-cholesterol (mg/dl)	73.61 ^c ± 0.07	78.14 ^b ± 0.09	79.61 ^b ± 0.10	85.45 ^a ± 0.05
Triglycerides (mg/dl)	75.00 ^a ± 0.02	74.00 ^{ab} ± 0.08	69.00 ^{bc} ± 0.10	67.00 ^c ± 0.20

Means bearing different superscripts within a row differ significantly ($P < 0.05$).

(continued on next page)

Serum total protein increased significantly ($P < 0.05$) with wheatgrass supplementation, from 4.45 g/dl in T_1 to 5.40 g/dl in T_4 . Albumin increased from 2.00 to 2.29 g/dl, while globulin increased from 2.45 to 3.11 g/dl. Thus, wheatgrass supplementation was associated with a marked alteration in the serum protein profile.

Similar changes in serum protein-related indices have been reported following dietary supplementation with natural feed additives. In guinea fowl, spirulina supplementation increased serum albumin at selected inclusion levels and modified other biochemical characteristics (Dey *et al.*, 2026) [5]. Similarly, dietary *Moringa oleifera* leaf powder supplementation in guinea fowl breeders was associated with increased total protein and albumin concentrations in their offspring (Atitso *et al.*, 2025) [6]. Dietary phytogetic supplementation has also been reported to modify serum protein and globulin concentrations in broiler chickens (Jimoh *et al.*, 2022; Ogbuewu and Mbajorgu, 2023) [10, 11].

The increase in serum protein could be associated with the nutritional contribution of wheatgrass, which contains protein, amino acids and minerals; however, protein synthesis, digestibility and amino acid utilization were not directly measured in the present experiment. Wheatgrass composition is known to vary considerably according to genotype and growing conditions (Kaur *et al.*, 2021; Kumar and Singh, 2024) [7, 8]. Therefore, a specific mechanism for the observed increase in serum proteins cannot be established from the present findings alone.

The A/G ratio increased slightly from 0.81 in T_1 to 0.83 in T_2 , followed by a reduction to 0.75 and 0.73 in T_3 and T_4 , respectively. The lower A/G ratio at the higher supplementation levels was associated mainly with the greater increase in globulin concentration. The present findings demonstrate that wheatgrass supplementation altered the relative distribution of albumin and globulin in serum.

Serum glucose decreased significantly from 211.00 mg/dl in T_1 to 193.00 mg/dl in T_4 . T_3 and T_4 showed significantly lower glucose concentrations than the control. Plant-derived dietary supplements have also been reported to influence glucose-related biochemical characteristics in poultry (Ghosh *et al.*, 2023; Ogbuewu and Mbajorgu, 2023) [24, 11]. Previous experimental work involving wheatgrass has also reported effects on glucose metabolism in animal models, although such findings should not be directly extrapolated to guinea fowl (Al-Awaida *et al.*, 2020) [25].

Serum cholesterol showed a significant decline from 142.99 mg/dl in T_1 to 119.85 mg/dl in T_4 . This finding is of particular interest because

recent guinea-fowl research has similarly reported changes in serum lipid profile following supplementation with natural feed additives. Dietary spirulina supplementation increased HDL-cholesterol and decreased total cholesterol at selected supplementation levels in guinea fowl (Dey *et al.*, 2026) [5]. Similarly, *Moringa oleifera* leaf meal supplementation in breeder diets was associated with reduced total cholesterol concentrations in their progeny at hatch (Atitso *et al.*, 2025) [6].

The observed reduction in serum cholesterol is also supported by experimental studies involving wheatgrass. Fresh wheatgrass juice has previously been reported to reduce total cholesterol and triglycerides in hypercholesterolaemic rats (Kothari *et al.*, 2008) [26]. However, the present experiment did not measure lipid metabolism, bile acid excretion or specific wheatgrass bioactive compounds. Therefore, the mechanism responsible for the reduction in serum cholesterol cannot be established from the present data.

HDL-cholesterol increased significantly from 73.61 mg/dl in T_1 to 85.45 mg/dl in T_4 . The concurrent reduction in total cholesterol and increase in HDL-cholesterol indicates a treatment-associated modification of the serum lipid profile. Similar changes in HDL-cholesterol and total cholesterol have recently been reported in guinea fowl receiving spirulina supplementation (Dey *et al.*, 2026) [5].

Serum triglycerides decreased from 75.00 mg/dl in T_1 to 67.00 mg/dl in T_4 . T_3 and T_4 showed lower triglyceride concentrations than the control. Similar effects of plant-derived feed resources on lipid-related serum variables have been documented in poultry (Ghosh *et al.*, 2023; Ogbuewu and Mbajorgu, 2023) [24, 11]. Experimental wheatgrass studies have likewise reported reductions in circulating triglycerides and cholesterol, although much of the available evidence originates from mammalian models rather than poultry (Kothari *et al.*, 2008; Al-Awaida *et al.*, 2020) [26, 25].

Recent poultry research further supports the usefulness of serum biochemical parameters for evaluating dietary phytogetic interventions. Dietary mangosteen peel preparations altered serum biochemical and antioxidant-related characteristics in broilers (Kim *et al.*, 2024) [27], while *Allium polyrhizum* flavonoid supplementation altered serum biochemical indices and transaminase activities in broilers (Zhao *et al.*, 2025) [28]. These findings indicate that the response of serum biochemical variables may differ according to the botanical source, dose, species and physiological condition of the birds.

3.3 Serum enzyme profile

Table 3. Effect of fresh wheatgrass supplementation on serum enzyme profile of Pearl guinea fowl.

Parameter	T1	T2	T3	T4
AST (IU/L)	168.67 ± 0.45	165.47 ± 0.03	165.78 ± 0.06	159.67 ± 0.06
ALT (IU/L)	20.00 ± 0.10	18.83 ± 0.02	17.63 ± 0.07	15.59 ± 0.06

Treatment differences were non-significant ($P > 0.05$).

Serum AST and ALT activities were not significantly affected by wheatgrass supplementation. AST values ranged from 159.67 to 168.67 IU/L, whereas ALT values ranged from 15.59 to 20.00 IU/L. Although numerical reductions were observed with increasing wheatgrass supplementation, these differences were statistically non-significant.

The absence of a significant treatment effect on transaminase activities indicates that the dietary treatments did not produce a statistically detectable alteration in the measured serum enzyme profile under the conditions of the present study. Similar parameter-specific responses have been reported in poultry receiving dietary phytogetic interventions, where changes in some biochemical variables were not necessarily accompanied by significant alterations in AST or ALT (Ogbuewu and Mbajorgu, 2023; Zhang *et al.*, 2025) [11, 29].

Recent studies in guinea fowl have also demonstrated that dietary feed additives can produce selective responses among serum biochemical parameters. Dietary spirulina supplementation modified se-

lected serum biochemical characteristics in guinea fowl, including albumin, HDL-cholesterol and total cholesterol, while responses differed among individual parameters (Dey *et al.*, 2026) [5]. Similarly, dietary *Moringa oleifera* leaf powder supplementation did not significantly alter AST and ALT in guinea fowl-derived offspring (Atitso *et al.*, 2025) [6].

Dietary supplementation with *Ocimum gratissimum* leaf powder has also been reported to influence ALT activity in guinea fowl, demonstrating that the response of transaminases may depend on the botanical material and dietary inclusion level (Orbugh *et al.*, 2024) [15]. Likewise, *Allium polyrhizum* flavonoid extract produced significant changes in serum transaminase activities in broilers (Zhao *et al.*, 2025) [28]. Such differences may be related to the plant material, dose, duration of feeding, bird species and physiological status.

Therefore, based on the present findings, fresh wheatgrass supplementation at the tested levels was not associated with a significant alteration in serum AST or ALT activity in Pearl guinea fowl.

4. Conclusion

Fresh wheatgrass supplementation significantly influenced several haematological and serum biochemical parameters of Pearl guinea fowl. Supplemented birds showed higher TEC, TLC, PCV, haemoglobin and ESR values, whereas MCV, MCH and MCHC were not significantly affected.

Serum total protein, albumin and globulin increased with wheatgrass supplementation. In contrast, serum glucose, total cholesterol and triglycerides decreased, while HDL-cholesterol increased. These changes indicate that fresh wheatgrass supplementation was associated with modification of several protein-, glucose- and lipid-related serum biochemical indices.

Serum AST and ALT activities were not significantly affected by dietary treatment, indicating that the tested levels of wheatgrass did not produce a statistically significant alteration in these serum enzyme parameters under the conditions of the present study.

Overall, the findings demonstrate that fresh wheatgrass supplementation can modify selected haematological and serum biochemical indices in Pearl guinea fowl. However, the present experiment did not directly evaluate nutrient digestibility, antioxidant status, specific phytochemicals, differential immune responses or the metabolic mechanisms responsible for the observed changes. Therefore, further research incorporating antioxidant biomarkers, differential leukocyte counts, nutrient digestibility, mineral utilization and detailed metabolic profiling would be useful to establish the physiological significance of wheatgrass supplementation in guinea fowl.

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