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Effect of Aloe vera Leaf Meal on Haematological Parameters and Semen Quality of Noiler Cocks

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Abstract

This research was conducted to determine the Effects of Aloe vera Leaf meal on Hematology and Semen Characteristics of Chickens. The study evaluated the impact of Aloe vera (AV) on reproductive performance, haematology, and Semen Characteristics in Noiler cocks. A total of one hundred and fourty four (144) Noiler cocks were fed diets Aloe vera leaf meal at varying inclusion rates (0.0, 0.5, 1.0, and 1.5%). Data collected include semen volume, semen colour, motility, concentration, percentage live and semen morphology. hematological indices recorde include hemoglobin, packed cell volume, red blood cell, white blood, mean corporcular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration. The haematological indices and Semen quality parameters were analyzed. Results on Semen Quality revealed that: AV at 1.0% enhanced sperm motility (52.4% vs. control 34.6%), concentration (47.41 $\times 10^6$/ml), and viability (54.0%) post-storage. Results for Hematology revealed that: Aloe vera improved packed cell volume (PCV: 47.1% at 0.5%) and RBC counts. In conclusion, Aloe vera at 1.0% is recommended for enhancing semen quality and offered the safest hematological outcomes.

Keywords: Aloe vera, Hematology, Semen, Noiler, Cocks

Introduction

Researchers are now more inclined towards the natural plant additives because it is considered to be safer alternative especially for human consumption. The natural feed

additives are capable of improving poultry production in general via enhanced nutrient digestion and absorption by reducing enteric pathogenic microbial loads. The use of these natural plant additives boasts reproductive efficiency in animal production (Agbaye *et al*., 2014, Hayajneh, 2019).

The plant materials either in whole or their extracts are receiving more attention in view of their safety and availability at low cost. However, the search is mostly on herbs that contain antioxidant phytochemicals which can scavenge the free radicals (such as reactive oxygen or nitrogen species) which may result in oxidative stress. Oxidative stress is the presence of reactive species above the antioxidant capacity of the bird. Hence, replacement of the depleted antioxidant reserve in a broiler facing the challenges such as heat stress is a vital factor in ameliorating the impact of the stress in the bird (Afolayan *et al*., 2022). Therefore, this study was designed to determine the effects of varying dietary inclusion levels of *Aloe vera* leaf meal on hematological parameters and semen quality characteristics of Noiler cocks.

Experimental Site

The study was conducted at Poultry unit of Teaching Farm, Federal Polytechnic Bauchi, Bauchi State, Northeastern Nigeria. Bauchi is located at latitude 13.3N and Longitude 90 45E. It has elevation of altitude 690.20 above sea level (Oyeniran *et al*., 2022). Bauchi state has two distinct seasons. The rainy season from May to September with average annual rainfall varies between 600-1300mm, while the temperature ranges from 18.33^0C-40.39^0C. While dry season characterized by clear, partly cloudy, and hot weather, lasting from December to March (BAWA, 2025). As April being hottest month and January the coldest month. Relative humidity is highest in August having the value of 66% and lowest in February with 16.5% (Oyeniran *et al*., 2022).

Experimental Birds and their Management

A total of one hundred and fourty four, 28weeks old Noiler cocks were used for the study. The adult Noiler cocks were purchased from Mahe Integrated farms in Kano (Noiler cocks). Four weeks adaptation period was allowed for each set of cocks prior to the commencement of the trial. The birds were fed formulated experimental diets (Table 1). The experimental diets and clean water were given *ad libitum* throughout the period. During the experiment, all management practices were strictly adhered to. The duration of the experiment was six months

Experimental Diets

The experimental diets were formulated with the PFAs (control, AV, CS and SS) having 0.0, 1.0, 1.0 and 0.5% as diets I, II, III and IV respectively (Tables 3, 4 and 5). The experimental birds were fed diets in treatments I, II, III and IV as indicated in Tables 1, 4 and 5, for the PFAs (Table 3 aloe vera (AV),

Collection and processing of Aloe vera Leaf Samples

Fresh samples of the Aloe vera leaves were harvested from the garden and surrounding of School Agricultural Technology, Federal Polytechnic Bauchi. They were clean shed dried for two weeks in the lab. After which each of the three samples were placed in an electric oven at 40°C for two days until a constant weight was attained. The dried samples were blended separately to powder form using silver crest electric blender and each stored in sealed plastic bottle at ambient conditions for the experimental need.

Table 1. Composition of Experimental Diets with Varying levels of Aloe vera Leaf meal

Treatments Ingredients	I	II	III	IV
Maize	60.38	60.38	60.38	60.38
Soyabean meal	14.28	14.28	14.28	14.28
Wheat offal	20.00	19.50	19.00	18.50
Fish meal	2.00	2.00	2.00	2.00
Lime stone	2.50	2.50	2.50	2.50
Bone meal	0.35	0.35	0.35	0.35
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Lysin	0.10	0.10	0.10	0.10
Methionine	0.30	0.30	0.30	0.30
Aloevera	0.00	0.50	1.00	1.50
Total	100	100	100	100
Calculated analysis				
Crude protein %	16.04	16.01	16.00	15.97
Crude fiber %	4.37	4.35	4.33	4.31
Crude fat %	4.09	4.08	4.06	4.04
Metabolizable energy kcal/kg	2726.66	2726.66	2726.66	2726.66

Experimental Design

Effects of Aloe vera Leaf meal (AV) on hematological parameters /indices and semen characteristics, In Aloe vera Leaf meal one hundred and fourty four cocks were allotted to four (4) dietary treatments: I, II, III and IV each having 0.0, 0.5, 1.0 and 1.5% AV/CS/SS levels of inclusions with treatment I (0%) in each as control (Tables 1) in a completely randomized design each treatments having thirty six (36) cocks that were replicated into three (3) cocks, each having twelve (12) cocks.

Data Collection

Data were collected for determination of the following semen characteristics parameters: Semen samples were collected weekly for 6 weeks, after four weeks feeding trial by abdominal massage as described by Hafez (1987) in the determination of semen characteristics. Volumes, Semen pH, Semen Motility, Percentage of live/Dead, Concentration and Morphology

Blood Sample Collection and Hematology

At the end of the eight-weeks, blood samples were collected from the birds' wing vein using a 5 mL syringe and placed in sterilized bottles containing ethylene diamine tetra-acetic acid anticoagulant for determining the hematological indices which includes: i. Hemoglobins (Hb) ii. Packed cell volume (PCV) iii. Red Blood Cell (RBC) iv. White Blood Cell (WBC), and hematological indices such as i. Mean Cellular Volume (MCV) ii. Mean Cellular Hemoglobin (MCH), and iii. Mean Cellular Hemoglobin Concentration as described by (Gunn *et al*., 2019).

Statistical analysis

The data were subjected to analysis of variance in a completely randomized design using SPSS software (ver.20.0 for windows, IBM SPSS) Means were compared for significance of differences by Duncan multiple range test.

Results and Discussion

The use of phytogenic feed additives (PFAs) as natural alternatives to antibiotic growth promoters in poultry nutrition has gained significant traction. Among these, Aloe vera is renowned for its broad spectrum of bioactive compounds, including vitamins, minerals, polysaccharides (notably acemannan), and antioxidants. The data presented reveals that dietary inclusion of Aloe vera leaf powder has a profound, dose-dependent impact on both the reproductive physiology and blood profile of Noiler cocks.

Haematological parameters in Table 2, are vital indicators of the health, metabolic status, and oxygen-carrying capacity of an animal. The results show that Aloe vera significantly affected most of the measured blood parameters (Table 2,).

Erythrogram (PCV, RBC, MCV, MCH): The haematological data in Table 2, reveals a non-linear, dose-dependent effect. Treatment II (0.5% Aloe vera) was most effective in enhancing the oxygen-carrying capacity and health of red blood cells. It produced the highest Packed Cell Volume (PCV: 47.10%), Mean Corpuscular Volume (MCV: 122.11 fL), and Mean Corpuscular Haemoglobin (MCH: 46.99 pg). Elevated PCV and RBC count (highest in Treatment IV at 5.15 x 10^6/µL) suggest that Aloe vera may stimulate erythropoiesis (the production of red blood cells). This is likely due to its rich portfolio of nutrients and bioactive compounds that serve as co-factors for haemoglobin synthesis and red blood cell development (Oloruntola *et al.*, 2018). The high MCV and MCH values at 0.5% and 1.0% indicate the production of larger, haemoglobin-rich red blood cells.

Contrasting Effects at Higher Doses: It is crucial to note that the 1.5% inclusion level (Treatment IV), while producing the highest RBC count, resulted in the lowest MCV (87.95 fL) and one of the lowest MCH values (31.43 pg). This indicates that at this higher dose, the produced red blood cells are smaller and contain less haemoglobin on average. This could be a sign of a stress response or a shift in erythropoiesis, potentially indicating microcytic hypochromic tendencies if pushed further. Similarly, Treatment III (1.0%) showed a significantly lower RBC count (2.95 x 10^6/µL), suggesting that optimal levels are crucial, as

supra-optimal doses may become inhibitory or pro-oxidant, a phenomenon known as hormesis (South et al., 2022).

Leukogram (WBC) and Immune Implication: The White Blood Cell (WBC) count showed a clear dose-dependent increase with Aloe vera supplementation, rising from 61.34 x 10^3/µL in the control to 151.5 x 10^3/µL at the 1.5% level. Although marked as non-significant (NS) in the table for Aloe vera, the numerical trend is stark. Aloe vera is a well-known immunomodulator; its polysaccharides, particularly acemannan, can activate macrophages and other immune cells (Sanchez *et al*., 2020). This elevated WBC count strongly suggests that Aloe vera boosted the immune status of the Noiler cocks, potentially making them more resilient to infections.

The semen quality parameters are critical indicators of male reproductive potential. The results in Table 3 demonstrate that Aloe vera supplementation significantly influences most semen characteristics except for volume.

Sperm Motility, Concentration, and Viability in Table 3: The 1.0% Aloe vera Leaf meal inclusion level (Treatment III) emerged as the most beneficial for key sperm metrics. It resulted in the highest sperm motility (73.2%), concentration (6.67 x 10^6/ml), and percentage of live sperm (79.9%). This superior performance can be attributed to the potent antioxidant properties of Aloe vera. Sperm cells are highly susceptible to oxidative stress due to their high polyunsaturated fatty acid content, which can lead to membrane lipid peroxidation, reduced motility, and DNA damage (Ahmadi, 2021). The antioxidants in Aloe vera likely mitigate this oxidative damage, preserving sperm integrity and function (Zeweil *et al*., 2016). The significant drop in motility at the 0.5% level (48.0%) is intriguing and suggests that at very low levels, the bioactive components might not be sufficient to exert a protective effect, or may even cause an initial adaptive stress response.

Sperm Morphology: Treatment III also recorded the highest percentage of morphologically normal sperm (77.6%), which was significantly higher than the 59.4% in the 0.5% group. This further corroborates the role of Aloe vera in protecting spermatogenic cells during the delicate process of spermatogenesis from oxidative insults, leading to the production of a higher proportion of normally formed spermatozoa.

Semen pH and Colour: The dramatic drop in semen pH to 6.30 in the 1.0% treatment is a notable finding. While often associated with poor quality in some contexts, in this case, it coincides with the best sperm performance. This could indicate a shift in seminal plasma composition due to Aloe vera's metabolites. Semen colour, scored on a subjective scale, showed variation, with the highest score at 1.5% inclusion. The biological significance of this change is less clear but may relate to concentration or the presence of certain pigments or compounds.

In summary, for semen quality, a 1.0% inclusion rate appears optimal, enhancing fertility potential by improving motility, concentration, viability, and morphology, primarily through proposed antioxidant mechanisms.

Conclusion

The findings clearly demonstrate that Aloe vera Leaf meal is a potent phytogenic additive for Noiler cocks, but its effects are highly dependent on the inclusion level. A 1.0% inclusion level is optimal, significantly enhancing sperm motility, concentration, viability, and morphology. While at 0.5% inclusion level is most beneficial for improving red blood cell quality and oxygen-carrying capacity. However, all inclusion levels above the control showed a positive trend on the immune system, as indicated by the rising WBC count.

Recommendations

i. For a breeding flock, prioritizing semen quality would suggest a 1.0% inclusion, while for general health and vitality, 0.5% may be sufficient.
ii. Further research is recommended to investigate the long-term effects and to elucidate the precise mechanisms behind the observed biphasic (low-dose beneficial, high-dose inhibitory) responses.

Table 2. Effect of Aloe vera Leaf meal on Hematological Parameters /indices of Noiler Cocks

Treatments Parameters	I (0.0%)	II (0.5%)	III (1.5%)	IV (1.5%)	SEM	LOS
Hb (g/dL)	16.20	15.70	18.80	16.10	1.12	NS
PCV (%)	44.40^{ab}	47.10^{a}	44.80^{ab}	41.50^{b}	2.10	*
RBC (×10⁶/µL)	$4.55a^{b}$	4.20^{b}	2.95^{c}	5.15^{a}	0.40	*
WBC (×10³/µL)	61.34^{d}	119.5^{b}	99.25^{c}	151.5^{a}	14.6	NS
MCV (fL)	102.02^{b}	122.11^{a}	113.50^{ab}	87.95^{c}	16.03	*
MCH (pg)	36.31^{b}	46.99^{a}	42.39^{ab}	31.43^{b}	40.39	*
MCHC(g/dL)	37.07	33.33	41.38	39.02	2.76	NS

a,b,c,.. means within each column with different superscript differ significantly at $P < 0.05$

Table 3. Effect of Aloe vera Leaf meal on Semen Characteristics of Noiler Cocks

Treatments Parameters	I (0.0%)	II (0.5%)	III (1.0%)	IV (1.5%)	SEM	LOS
Semen pH	8.60^{a}	8.60^{a}	6.30^{b}	8.60^{a}	0.24	*
Semen Colour	1.60^{ab}	1.20^{b}	1.40^{b}	2.00^{a}	0.04	*
Semen Volume (ml)	0.23	0.15	0.22	0.12	0.18	NS
Sperm Motility%	72.9^{a}	48.0^{b}	73.2^{a}	66.5^{a}	4.38	*
Sperm Concentration (x10⁶ml)	6.57^{ab}	4.67^{c}	6.67^{a}	6.42^{b}	5.76	*
Live sperm %	74.4^{ab}	61.7^{b}	79.9^{a}	74.7^{ab}	4.15	*
Sperm Morphology (% Normal)	73.5^{a}	59.4^{c}	77.6^{a}	64.0^{ab}	3.08	*

a,b,c,.. means within each column with different superscript differ significantly at $P < 0.05$. I = control 0% Aloe vera, II= 0.5% aloe vera III = 1.0% Aloe vera IV= 1.5% Aloe vera

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