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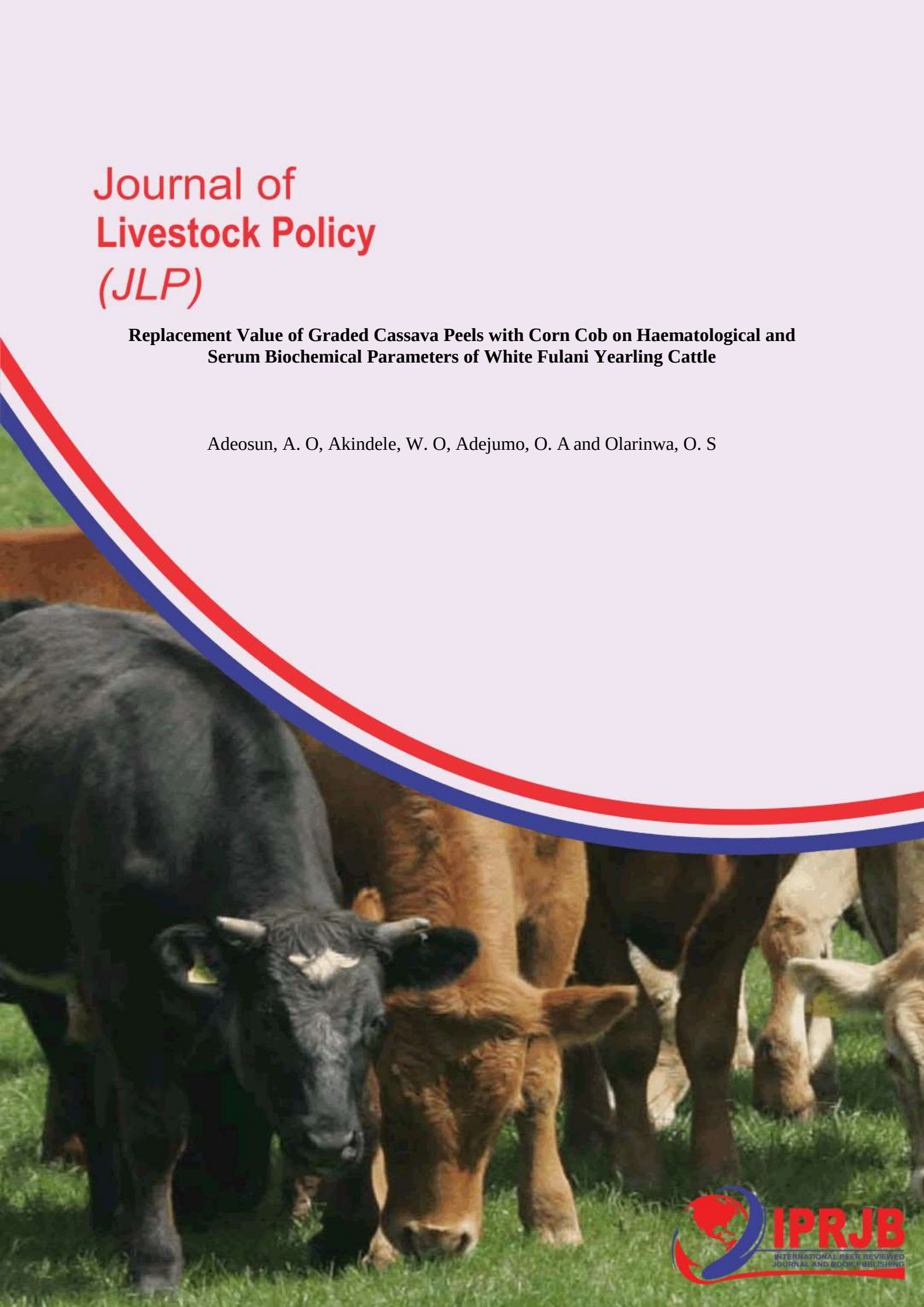

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Abstract

Purpose: This study evaluated the replacement effect of cassava peels with grinded maize cob (GMC) on haematological and serum biochemical parameters of White Fulani yearling cattle.

Methodology: Eight yearling cattle with initial body weights ranging from 63.0 to 90.5 kg were randomly allotted to four dietary treatments in a Completely Randomized Design: T1 (0% GMC, control), T2 (25% GMC), T3 (50% GMC), and T4 (75% GMC), in which GMC replaced cassava peels proportionately. The feeding trial was conducted in 84-day. At the end of the trial, blood samples were collected from the jugular vein of one animal per treatment for haematological and serum biochemical evaluation. All haematological parameters, including packed cell volume (39.5-40.0%), haemoglobin (13.00-13.40 g/dL), red blood cell count (6.40– 6.90 × 10^{12}/L), and leukocytic indices fell within physiological reference ranges and were unaffected by dietary treatment ($P > 0.05$).

Findings: Serum biochemical analysis revealed significant treatment effects on albumin, globulin, albumin-to-globulin ratio, glucose, bilirubin fractions, cholesterol, and urea ($P < 0.05$ or $P < 0.01$). Serum urea was markedly elevated in T4 (46.6 mg/dL), surpassing the reference ceiling. Liver enzyme activities (AST, ALT, GGT) were within reference limits and statistically uniform across treatments, while alkaline phosphatase declined significantly with increasing GMC but remained within the normal range.

Unique Contribution to Theory, Practice and Policy: These findings suggest that GMC can partially replace cassava peels without compromising haematological or hepatic integrity, though biochemical outcomes counsel moderation at inclusion levels approaching 75%.

Keywords: *Cassava Peels, Grinded Maize Cob, Haematological Parameters, Serum Biochemical Parameters, White Fulani Cattle*

INTRODUCTION

Livestock production in many tropical regions, including Nigeria, is constrained by the nutrition as a constant seasonal scarcity and high cost of conventional feed resources, particularly during the dry season when pasture availability declines sharply. This challenge has intensified interest in agro-industrial by-products as alternative feedstuffs capable of sustaining ruminant production without competing directly with human food sources. Among these, maize cob, a major by-product of maize processing, has attracted attention because of its wide availability, low cost, and considerable nutritional and functional properties that make it a potential feed resource for livestock production.

Maize cob contains approximately 5.22% crude protein and appreciable quantities of structural carbohydrates, including 27.71% cellulose and 38.78% hemicellulose, although its utilization is constrained by a relatively high lignin content of 9.4% (Shinners *et al*., 2007). This lignin fraction limits microbial access to fermentable carbohydrates in the rumen, thereby reducing digestibility when the material is fed without prior treatment. Maize cob also contains several anti-nutritional factors, notably saponin (2.09%), phytate (0.72%), and tannin (0.03%) (Ukanwoko and Nwachukwu, 2017), which, depending on concentration, may interfere with nutrient absorption or, conversely, confer mild bioactive benefits. In addition, it serves as a source of essential minerals such as calcium (17.19 mg/100 g), potassium (375.25 mg/100 g), and sodium (129.19 mg/100 g) (Abubakar *et al*., 2016), and exhibits antioxidant activity ranging from 0.3 to 10 µmol/g dry weight (Nawaz *et al.,* 2018). These attributes suggest that maize cob, despite its fibrous nature, could supply meaningful nutritional value when appropriately incorporated into ruminant diets, provided inclusion levels are carefully optimized to balance feed cost savings against potential constraints on intake and digestibility.

The White Fulani breed, a zebu cattle type widely distributed across the West African savanna, is valued for its heat resistance, trypanotolerance, and adaptability to low-input management systems, making it a relevant model for evaluating alternative feed resources under smallholder and semi-intensive conditions. While blood parameters (e.g., packed cell volume, haemoglobin, and blood cell counts) provide critical insights into an animal's nutritional, metabolic, and health status (Ogbu and Herbert, 2018), they are sensitive to factors like age, sex, season, and diet (Mbassa and Poulsen, 2003). Consequently, assessing haematological indices is an effective way to detect early physiological challenges or anti-nutritional effects arising from novel feed ingredients before clinical signs appear (Okoruwa and Ikhimioya, 2014). Despite the documented nutritional composition of maize cobs, limited information exists regarding the physiological consequences of feeding graded levels of this by-product to White Fulani cattle. Therefore, this study was designed to evaluate the effects of raw grinded maize cob inclusion on the haematological profiles and serum biochemistry of White Fulani cattle to establish safe inclusion thresholds, maintain health and performance, and provide baseline data for formulating cost-effective rations in regions where maize cobs are abundant.

METHODOLOGY

Study Site

The experiment was conducted at the Teaching and Research Farm of Oyo State College of Education, Lanlate, Ibarapa East Local Government Area, Oyo State, Nigeria. Lanlate is located at approximately longitude 3.45°E and latitude 7.59°N within the derived savannah agro-ecological zone of southwestern Nigeria. The area experiences a tropical climate characterized by distinct wet and dry seasons. Annual rainfall ranges between 1,200 and 1,500

mm, with the rainy season extending from March to October, while the dry season occurs between November and February. Average daily temperatures range from 25 to 34 °C, and relative humidity varies between 60 and 85% depending on the season. The vegetation of the area is predominantly derived savannah interspersed with patches of secondary forest, making it suitable for livestock production and forage cultivation.

Experimental Design and Animal Management

Twelve White Fulani yearling cattle, approximately one year of age, were used for this study. The animals were randomly allotted to four dietary treatments in a Completely Randomized Design (CRD). Treatment 1 (T1) served as the control with 0% inclusion rate, while Treatments 2 (T2), 3 (T3), and 4 (T4) contained 25%, 50%, and 75% grinded maize cob (GMC), respectively. The initial live weights of the animals ranged from 63.0 to 90.5 kg. Animals assigned to T1 had initial weights of 66.5 and 90.5 kg, while those in T2 had an initial weight of 81.0 to 82.5kg weight recording. Animals in T3 weighed 89.0 and 63.0 kg, whereas those in T4 weighed 89.0 and 80.0 kg at the commencement of the trial. The cattle were housed individually in well-ventilated pens equipped with feeding and watering facilities. Prior to data collection, the animals were acclimatized to experimental diets and management conditions for 14 days. Thereafter, the feeding trial was conducted for 84 days, during which experimental diets were offered daily according to the nutrient requirements of growing cattle. Clean drinking water was provided ad-libitum throughout the study period. Routine management practices, including pen sanitation, health monitoring, and disease prevention measures, were carried out regularly to ensure optimal animal welfare. All experimental procedures were conducted in accordance with accepted guidelines for the care and use of animals in research. Animals were offered the concentrate portion at 2.5% of body weight daily (adjusted bi-weekly) and had ad-libitum access to fresh elephant grass (*Pennisetum purpureum*) grass. Feed was offered twice daily.

Data and Sample Collection

At the end of the 84th day of the trial, two animals from each treatment were randomly selected and 10mls blood sample was collected via the jugular vein (Frandson 1986) and shared into 5mls each in different sterilized specimen bottles containing anti-coagulant (EDTA) for haematological and another without anti-coagulant for serum biochemical evaluations as described by (Olafadehan 2011; Akinrimade and Akinrinde 2012). The collection of blood was done in the morning to avoid excessive bleeding and stress on the cattle.

Statistical Analysis

Data obtained were analysed using one-way analysis of variance (ANOVA) using statistical analysis software (SAS 2001) and means were separated using the Duncan Multiple Range Test (1955).

Table 1: Gross Composition of Experimental Diets Fed to White Fulani Yearlings (Maize Cob Incrementally Replacing Cassava)

Ingredient	T1 0% GMC1	T2 25% GMC	T3 50% GMC	T4 75% GMC
Energy sources				
Cassava peels	50	35	20	0
Corn cob (ground)2	0	15	30	50
Protein sources				
Brewers dried grains (BDG)	20	20	20	20
Palm kernel cake (PKC)	20	20	20	20
Supplements and additives				
Molasses	3	3	3	3
Urea	2	2	2	2
Common salt (NaCl)	2	2	2	2
Bone meal	2	2	2	2
Vitamin– mineral premix3	1	1	1	1
Total	100	100	100	100

RESULTS

Haematological Response of White Fulani Yearling Cattle to Graded Replacement of Cassava Peels with Corn Cob

The haematological indices of White Fulani yearling cattle across the four dietary treatments are presented in Table 2. Across all parameters evaluated, no significant differences ($P > 0.05$) were observed among treatments, suggesting that the graded substitution of cassava peels with corn cob did not adversely alter the blood composition of the experimental animals.

Erythrocytic Profile

The packed cell volume (PCV) values ranged from 39.5% to 40.0% across treatments, falling well within the established reference range of 24.0-46.0% for cattle. Similarly, haemoglobin concentrations (13.00-13.40 g/dL) and red blood cell counts (6.40-6.90 $\times 10^{12}$/L) were consistent across treatments and within normal physiological limits. These findings suggest adequate erythropoiesis and oxygen-carrying capacity in all treatment groups, indicative of satisfactory nutritional status and absence of diet-induced anaemia, a critical consideration in yearling animals whose growth demands sustain high metabolic activity. Mean Corpuscular Volume (MCV) values were largely within the reference range (40.0-60.0 fL), although the value recorded for T2 (62.5 fL) marginally exceeded the upper threshold. This slight elevation may reflect early macrocytic tendency, though its clinical significance is limited given the non-significant treatment effect. Mean corpuscular haemoglobin concentration (MCHC) values (32.75-33.80 g/dL) were uniformly within reference limits, affirming normal haemoglobin saturation per erythrocyte across diets.

Notably, mean corpuscular haemoglobin (MCH) values across all treatments (18.98-20.94 pg) exceeded the established reference range of 11.0-17.0 pg for cattle. While this elevation was consistent and statistically non-significant among treatments, it may warrant physiological interpretation in the context of White Fulani genetics and adaptive erythrocyte characteristics, as breed-specific variations in MCH have been documented in indigenous African cattle.

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Leukocytic Profile

White blood cell counts ranged from 4.55 to 7.00 × 10⁹/L, all within the normal reference range of 4.0–12.0 × 10⁹/L, indicating intact immune surveillance without signs of systemic infection or inflammatory response attributable to diet. Differential leucocyte counts revealed neutrophil and lymphocyte values within their respective reference limits, reflecting a physiologically sound neutrophil-to-lymphocyte ratio characteristic of healthy ruminants.

Eosinophil and basophil counts were uniformly zero across all treatments, consistent with an absence of parasitic challenge or hypersensitivity reactions during the study period. Monocyte values (0.00-1.00%) were marginally below or at the lower boundary of the reference range (1.0-9.0%), though this finding was uniform across treatments and not considered clinically significant in the present context.

Table 2: Haematological Parameters of Cattle Fed Diets Containing Corn Cob Replaced With Cassava Peels at Graded Levels

Parameter	Unit	Reference Range	T1	T2	T3	T4	SEM	P-value
Erythrocytic Profile								
Packed Cell Volume	%	24.0 – 46.0	39.5	40	39.5	40	0.14	>0.05
Hemoglobin	g/dL	8.0 – 15.0	13.35	13.4	13	13.1	0.1	>0.05
Red Blood Cells	×1012/L	5.0 – 10.0	6.9	6.4	6.85	6.8	0.12	>0.05
MCV	fL	40.0 – 60.0	57.23	62.5	57.66	58.82	1.14	>0.05
MCH	pg	11.0 -17.0	19.34	20.94	18.98	19.26	0.44	>0.05
MCHC	g/dL	30.0 - 36.0	33.8	33.5	32.91	32.75	0.23	>0.05
Leukocytic Profile								
White Blood Cells	×109/L	4.0 -12.0	4.55	7	5.95	4.9	0.54	>0.05
Neutrophils	%	15.0 - 45.0	29.5	33	31.5	30	0.74	>0.05
Lymphocytes	%	45.0 - 75.0	70	67	68	69	0.61	>0.05
Eosinophils	%	0.0 - 6.0	0	0	0	0	0	>0.05
Basophils	%	0.0 - 2.0	0	0	0	0	0	>0.05
Monocytes	%	1.0 - 9.0	0.5	0	0.5	1	0.2	>0.05

Serum Biochemical Response of White Fulani Yearling Cattle to Graded Replacement of Cassava Peels with Corn Cob

The serum biochemical parameters of White Fulani yearling cattle fed diets in which corn cob replaced cassava peels at graded levels are presented in Table 3. Unlike haematological indices, several biochemical parameters differed significantly among treatments, providing important insights into metabolic and hepatic function under varying dietary compositions.

Protein Fractions

Total protein concentrations (6.00-6.50 g/dL) remained within the reference range of 6.0-8.5 g/dL across all treatments, with no significant differences observed ($P > 0.05$), suggesting adequate protein synthesis and stable nutritional plane irrespective of dietary treatment. However, significant treatment effects were recorded for albumin, globulin, and the albumin-to-globulin (A:G) ratio ($P < 0.05$). Albumin values in T3 (4.4 g/dL) exceeded the established upper limit of 3.6 g/dL, while globulin concentrations in T2 (2.6 g/dL) and T3 (2.0 g/dL) fell below the reference minimum of 3.0 g/dL. Consequently, the A:G ratio was markedly elevated in T3 (2.20), substantially surpassing the normal range of 0.8-1.2. This disproportionate albumin-to-globulin relationship may reflect altered hepatic protein partitioning or a

diminished acute-phase immune response at higher corn cob inclusion levels, warranting further physiological investigation in White Fulani yearlings.

Glucose

Blood glucose concentrations differed highly significantly among treatments ($P < 0.01$), ranging from 34.3 mg/dL in T1 to 84.0 mg/dL in T2. The T1 value fell below the reference threshold of 40 mg/dL, suggesting a hypoglycaemic tendency in animals on the control diet, while T2 marginally exceeded the upper limit of 80 mg/dL. The remaining treatments (T3 and T4) recorded values within normal range. These differences likely reflect variations in fermentable carbohydrate availability and rumen volatile fatty acid production influenced by the fibre composition of respective diets.

Bilirubin Fractions

Total bilirubin values across all treatments (0.58-0.90 mg/dL) exceeded the upper reference limit of 0.50 mg/dL, with significant treatment differences observed ($P < 0.05$). Conjugated bilirubin values were uniformly elevated (0.26-0.28 mg/dL) beyond the reference ceiling of 0.20 mg/dL, though treatment differences were non-significant ($P > 0.05$). Indirect bilirubin values in T1 (0.47 mg/dL) and T2 (0.62 mg/dL) exceeded the reference maximum of 0.35 mg/dL ($P < 0.05$). The consistent elevation of bilirubin fractions across treatments may suggest mild hepatic stress or altered erythrocyte turnover across all dietary groups rather than a treatment-specific effect.

Cholesterol and Urea

Cholesterol concentrations differed significantly among treatments ($P < 0.05$), with T1 (127.7 mg/dL) and T4 (134.4 mg/dL) exceeding the reference range of 80-120 mg/dL. Serum urea levels were highly significantly different ($P < 0.01$), with T4 recording a markedly elevated value of 46.6 mg/dL, far exceeding the reference ceiling of 30 mg/dL, potentially indicating increased protein catabolism or compromised nitrogen utilisation at the highest corn cob inclusion level.

Table 3: Serum Biochemical Parameters of Cattle Fed Diets in Which Corn Cob Replaced Cassava Peels at Graded Levels

Parameter	Unit	Reference Range	T1	T2	T3	T4	SEM	P-value
Protein Fractions								
Total Protein	g/dL	6.0 - 8.5	6.5	6	6.4	6.5	0.12	> 0.05
Albumin	g/dL	2.1 - 3.6	3.1	3.4	4.4	3.3	0.23	< 0.05
Globulin	g/dL	3.0 - 3.5	3.4	2.6	2	3.2	0.27	< 0.05
Albumin:Globulin	—	0.8 - 1.2	0.91	1.31	2.2	1.03	0.19	< 0.05
Metabolites								
Glucose	mg/dL	40 - 80	34.3	84	55	49.7	8.45	< 0.01
Total Bilirubin	mg/dL	0.01 - 0.50	0.73	0.9	0.61	0.58	0.06	< 0.05
Conjugated Bilirubin	mg/dL	0.01 - 0.20	0.26	0.28	0.27	0.27	0.01	> 0.05
Indirect Bilirubin	mg/dL	0.00 - 0.35	0.47	0.62	0.34	0.31	0.05	< 0.05
Cholesterol	mg/dL	80 - 120	127.7	104.6	114.1	134.4	5.82	< 0.05
Urea	mg/dL	14 - 30	31.9	29.4	22	46.6	4.31	< 0.01

Hepatic Enzyme Profile of White Fulani Yearling Cattle Fed Graded Levels of Corn Cob in Replacement of Cassava Peels

The liver enzyme parameters of White Fulani yearling cattle are presented in Table 4. Hepatic enzyme activities serve as sensitive biomarkers of liver integrity, with elevations beyond physiological thresholds commonly indicating hepatocellular injury, cholestatic dysfunction, or biliary compromise. In the present study, the activities of most liver enzymes were unaffected by dietary treatment, with the exception of alkaline phosphatase (ALP).

Aminotransferases (AST and ALT)

Aspartate aminotransferase (AST) activities ranged from 97 to 100 U/L across treatments, all falling comfortably within the established bovine reference range of 78-132 U/L, with no significant differences recorded ($P > 0.05$). Similarly, alanine aminotransferase (ALT) values were remarkably consistent across all treatment groups at 28-29 U/L, within the reference limit of 11-40 U/L, and statistically homogeneous ($P > 0.05$). The stability of both aminotransferases across dietary treatments suggests the absence of hepatocellular membrane disruption or parenchymal damage attributable to corn cob inclusion, affirming the hepatic safety of the experimental diets in White Fulani yearlings.

AST: ALT Ratio

The AST: ALT ratio, a clinically relevant index for differentiating hepatic pathologies, ranged narrowly from 3.34 to 3.57 across treatments, all well below the critical threshold of 10, with no significant treatment effect ($P > 0.05$). These values corroborate the absence of significant hepatocellular necrosis or skeletal muscle injury across all dietary groups, further validating the hepatoprotective adequacy of the tested diets.

Alkaline Phosphatase (ALP)

ALP activity differed significantly among treatments ($P < 0.05$), with values ranging from 44 U/L in T4 to 74 U/L in T1. Importantly, all values remained within the reference range of 30-170 U/L, precluding clinical interpretation of cholestasis or biliary obstruction. The observed declining trend with increasing corn cob inclusion may reflect reduced osteoblastic activity or modified biliary secretion as dietary fibre composition shifted, though the physiological significance remains limited given the absence of reference range violations.

Gamma-Glutamyl Transferase (GGT)

GGT activities (6.1-9.4 U/L) were within normal reference limits (6.1-17.4 U/L) across all treatments, with no significant differences observed ($P > 0.05$), confirming intact biliary epithelial function regardless of dietary composition. Collectively, the liver enzyme data indicate that graded replacement of cassava peels with corn cob did not induce hepatotoxic effects in White Fulani yearling cattle, supporting its inclusion as a safe dietary ingredient within the tested range.

Table 4: Liver Enzymes Parameters of Cattle Fed Diets in Which Corn Cob Replaced Cassava Peels at Graded Levels

Liver Enzymes	Unit	Reference Range	T1	T2	T3	T4	SEM	P-value
AST	U/L	78 - 132	97.00	99.00	98.00	100.00	1.15	> 0.05
ALT	U/L	11 - 40	29.00	29.00	29.00	28.00	0.41	> 0.05
ALP	U/L	30 - 170	74.00	54.00	64.00	44.00	5.20	< 0.05
GGT	U/L	6.1 - 17.4	8.00	9.40	6.60	6.10	0.64	> 0.05
AST:ALT Ratio	—	< 10	3.34	3.41	3.38	3.57	0.08	> 0.05

Discussions

Haematological Parameters

The erythrocytic and leukocytic indices of White Fulani yearling cattle were unaffected by dietary treatment ($P > 0.05$) across all groups. Packed cell volume (39.5-40.0%), haemoglobin (13.00-13.40 g/dL), and red blood cell counts (6.40-6.90 $\times 10^{12}$/L) were all within normal physiological limits, suggesting uncompromised erythropoiesis regardless of corn cob inclusion level. This aligns with the findings of Ogunleke *et al*. (2014), who reported no deleterious effects on haematological and serum biochemical parameters when up to 30% maize cobs were incorporated into the diets of West African Dwarf goats, concluding that maize cobs were safe for inclusion in ruminant diets up to that level. Similarly, a study on Nigerian White Fulani cattle under intensive and extensive management systems found that both groups maintained comparable haemoglobin concentrations and mean corpuscular volume, regardless of management differences.

The consistent elevation of MCH values (18.98-20.94 pg) beyond the reference ceiling of 17.0 pg across all treatments, despite the absence of significant treatment differences, may reflect breed-specific erythrocyte traits in White Fulani cattle. This is supported by Abwage *et al*. (2022), who found no significant difference in MCV and MCH among White Fulani and other Nigerian indigenous cattle breeds, suggesting these deviations may be constitutive rather than diet-induced.

Leukocytic values, including WBC (4.55–7.00 $\times 10^9$/L), neutrophils (29.5–33.0%), and lymphocytes (67.0–70.0%), fell within normal physiological ranges and showed no significant treatment effects. This is consistent with earlier Nigerian work suggesting that quality experimental diets influence blood constituents positively, and that WBC values within the range of 4.0–12.0 $\times 10^9$/L in ruminants fed crop residue-based diets indicate adequate immune health.

Serum Biochemical Parameters

Total protein concentrations were non-significantly different ($P > 0.05$) and within reference range across all treatments, indicating sustained hepatic synthetic capacity. However, significant treatment effects on albumin, globulin, and the A:G ratio ($P < 0.05$) were recorded. The markedly elevated A:G ratio at T3 (2.20) reflects a distortion in protein fractionation that may indicate altered hepatic partitioning. Prior comparative research has demonstrated that the albumin-to-globulin ratio can differ significantly across cattle genotypes, with differences in indirect bilirubin and total cholesterol also noted between groups on similar diets, suggesting that both genetics and diet contribute to variability in these fractions.

Blood glucose concentrations differed highly significantly ($P < 0.01$), with T1 returning a hypoglycaemic value (34.3 mg/dL) and T2 a marginally elevated value (84.0 mg/dL). This variation is consistent with expected differences in rumen fermentation dynamics as dietary fibre composition shifts. Replacing concentrate with fermented cassava peel at varying inclusion levels in goat diets has similarly been shown to influence rumen fermentation parameters and volatile fatty acid profiles, suggesting that changes in fibrous substrate composition alter propionate availability, the primary gluconeogenic precursor in ruminants.

The markedly elevated serum urea at T4 (46.6 mg/dL) is a notable finding. It is well established that blood urea nitrogen concentrations increase with increasing dietary nitrogen intake in feedlot cattle and are positively correlated with ruminal ammonia nitrogen concentrations. A high-fibre diet with reduced fermentable energy, as occurs at high corn cob inclusion, may impair microbial nitrogen capture, allowing excess ammonia absorption across the rumen wall. When the ammonia concentration in the rumen exceeds what available energy can support microbially, excess ammonia is absorbed across the rumen wall into the bloodstream and transported to the liver for detoxification, elevating serum urea levels.

The uniform elevation of bilirubin fractions across treatments suggests a systemic rather than diet-specific response, potentially reflecting mild hepatic conjugation strain. Prior work on White Fulani cows fed poultry waste-cassava peel-based diets also observed that certain biochemical parameters including urea, sodium, and total protein were significantly influenced by treatment diets, indicating sensitivity of these indices to dietary composition changes in this breed.

Liver Enzyme Parameters

AST, ALT, and GGT activities remained within reference limits and were statistically uniform across treatments, confirming hepatocellular integrity under all dietary regimens. The significant decline in ALP with increasing corn cob inclusion, while remaining within normal range, may reflect diet-modulated osteoblastic activity in growing yearlings. ALP in ruminants has a wide reference range largely attributable to variations in biliary epithelial activity, making its interpretation in the absence of clinical signs complex. High-concentrate rations in cattle have similarly been shown to influence ALP activity, with studies reporting decreased ALP alongside increased AST in some breeds, suggesting that dietary composition meaningfully modulates this enzyme independently of hepatic pathology.

In totality, the haematological and hepatic enzyme data indicate that corn cob substitution is broadly safe in White Fulani yearlings, while the biochemical deviations, particularly at high inclusion levels, require moderation in substitution rates to preserve optimal metabolic homeostasis.

Conclusion

Graded replacement of cassava peels with grinded maize cob at up to 75% did not adversely affect the haematological indices of White Fulani yearling cattle, with all erythrocytic and leukocytic parameters remaining within established physiological reference ranges across the 84-day trial. Liver enzyme activities, including AST, ALT, and GGT, were similarly unaffected, confirming the hepatoprotective adequacy of the experimental diets. However, significant variations in serum albumin, globulin, the albumin-to-globulin ratio, glucose, bilirubin fractions, cholesterol, and urea, particularly the markedly elevated serum urea recorded at 75% GMC, indicate that high inclusion levels may perturb metabolic homeostasis,

especially nitrogen metabolism. Moderate substitution rates of 25– 50% produced more favourable biochemical profiles and are therefore recommended for practical feeding programmes. It is concluded that grinded maize cob can serve as safe and cost-effective when partially replaced for cassava peels in White Fulani cattle diets without compromising blood integrity or hepatic function provided the inclusion rate does not exceed 50%.

Implication of the Study

Corn cob offers smallholder producers a low-cost partial substitute for cassava peels at up to 50% inclusion. Producers should monitor serum urea and glucose as inclusion approaches 75%. As this is a pilot-scale trial with one animal per treatment, findings are preliminary and warrant confirmation in a larger, adequately replicated study.

Recommendation

Theoretically, this supports blood profiling as an early-warning tool in by-product feeding trials; for policy, agricultural extension bodies should promote corn cob inclusion guidelines capped at 50%; in practice, farmers should adopt gradual substitution while monitoring animal health indicators.

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