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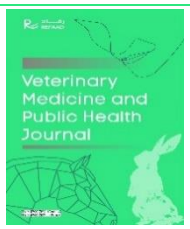

Evaluation of Haematological and Serum Biochemical Parameters of Growing Yankasa Rams Fed Maize Cob Treated with Different Non-Protein Nitrogen Sources and Soyabean Meal

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Research Article

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Abstract:

Objectives: The study investigated the haematological and serum biochemical parameters of growing Yankasa rams fed maize cob treated with various non-protein nitrogen sources and soybean meal.

Methods: Twenty-four Yankasa rams, weighing approximately 11 ± 02 kg and aged between 5 to 8 months, were utilized for the study, they were allotted into 6 treatments of 4 rams each in a Randomised Complete Block Design (RCBD). Each animal received a daily allocation of 300g of supplement and basal diets, divided into two servings provided at 8:00 am and 3:00 pm. The experimental diets were analysed for their proximate composition using the methods of AOAC, 2000) The experiment lasted for 90 days.

Results: The results showed that packed cell volume ranged from 24.54 – 30.44% and were significantly P<0.05) different, the white blood cell count values were between 8.32 – 9.01 x 103 ul and were not significantly different. Furthermore, the mean corpuscular haemoglobin concentration was significantly (P<0.05) elevated in the groups fed with Soya bean unensiled, Urea ensiled, and Poultry litter ensiled compared to those fed with poultry litter unensiled, Soya bean meal ensiled, and poultry litter unensiled. However, there was no significant difference (P>0.05) in mean corpuscular haemoglobin between poultry litter ensiled (35.73pg) and unensiled (30.63pg), except for ALP, GPT, and blood glucose levels..Urea values ranged from 8.67 – 11.13 mmol/l and showed significant P<0.05) difference.. Values for alkaline phosphate fell between 256.23 – 414.37 u/l and were significantly different.

Conclusions: Treatments of maize cobs with different non-protein nitrogen sources and soybean meal did not adversely affect the haematology and serum biochemical parameters of the growing Yankasa rams. It is suggested that urea, poultry litter, and soybean meal could serve as additional feed resources to mitigate dry season feed shortages and reduce feeding costs for small ruminants.

Keywords: *Haematological; Maize Cobs; Serum Biochemical; Non-Protein Nitrogen; feed Intake.*

1 Introduction

Livestock feed resources in tropical regions primarily rely on rangelands supplemented with crop residues. These residues, comprising post-harvest materials or roughages left after the removal of primary feeds (grain) from crop plants, They play a vital role in sustaining ruminants during extended dry seasons (Ashiru *et al*, 2015). Finangwai *et al* (2010) noted the low protein and high cellulose content of crop residues, resulting in decreased voluntary intake and digestibility. In Nigeria, cereal residues such as sorghum, maize, millet stovers, and rice straw serve as crucial feed sources for ruminants. The increasing cost of conventional feeds, driven by their competition for use by humans and industries (Ocheja, 2020), underscores the necessity of utilizing crop residues to supplement feed shortages during the long dry season and to support the production of animal products such as meat and milk. (Ocheja *et al*., 2023 and by –products such as skin, hair, fat, horns, hooves, manure, offals bones etc (Abalaka *et al*., 2021).

Among cereal crop residues, maize cob stands out as the most abundant yet underutilized resource with significant potential as a basal feed for small ruminants in the savannah. However, its utilization is hindered by factors such as high cellulose content and low protein levels, leading to reduced digestibility and relatively poor nutrient composition (Al-maadhidi & AL-khatib, 2010). Consequently, this study was designed to evaluate the haematological and biochemical parameters of growing Yankasa rams fed maize cob treated with various non-protein nitrogen sources and Soybean meal.

2 Materials and Methods

2.1 Location of the Study

The experiment took place at the Kaduna State Veterinary Department in Birnin Gwari Local Government Area, Kaduna State. Situated within the Northern Guinea Savanna ecological zone, the state spans approximately 48,473.2 square kilometers and has an estimated population of 8.9 million (KDBS, 2020). Benefiting from favorable climate and environmental conditions, the state has emerged as a notable hub for cereal crop production, particularly maize (Ammani *et al*., 2012).

2.2 Feed Preparation, Experimental Animals, and Management

Maize cobs were sourced from DawakinBassa in Birnin Gwari LGA, Kaduna State. Deep litter poultry, inorganic granulated urea, and soybean were procured from Kasuwan Gwari local market in Birnin Gwari. Maize cobs were ground using a maize threshing machine to achieve sizes of 5cm and below. Poultry litter was sun-dried for five days, with eight hours of exposure each day, to prevent fermentation.

A total of 300 kilograms of each experimental treatment (Table 1) was produced for the feeding trial. These materials were ensiled for 21 days in proportions specified in Table 1, and polythene was used to seal the silo tightly after filling, ensuring an airtight environment conducive for adequate fermentation.

Twenty-four Yankasa rams, weighing approximately 11 ± 02 kg and aged between 5 to 8 months, were utilized for the study. The animals were individually housed and subjected to treatment with Banminth F and prophylactic measures, including subcutaneous injection of ivomectin (Ivomec) at a dosage of 0.5mL/25kg body weight against parasites, and intramuscular administration of oxytetracycline at a dosage of 1.0mL/10kg body weight against bacterial infections.

Each animal received a daily allocation of 300g of supplement and basal diets, divided into two servings provided at 8:00 am and 3:00 pm. Any leftover feed was collected and weighed the following morning before fresh feed was offered. Fresh drinking water was provided to the rams in graduated plastic cylinders to monitor consumption. The experimental diets were analysed for their proximate composition using the methods of AOAC (2000). The experiment lasted for 90 days.

Table 1: Proportion of Maize Cob to Non- Protein Nitrogen Source

Treatment	Ingredients				Status
	Maize cob	Urea	Poultry Litter	Soybean meal	
A1	70	-	-	30	Ensiled
A2	70	-	-	30	Unensiled
B1	100	+	30		Ensiled
B2	70	-	30	-	Unensiled
C1	100	+	-	-	Ensiled
C2	100	+	-	-	Unensiled

25 kg Maize Cob to 1 kg Urea treatment.

2.3 Blood Sample Collection and Analysis

Blood samples were obtained via the jugular vein from three representative rams per treatment, following the protocol described by Coles (1986). Five milliliters (5mls) of blood were collected by puncturing the jugular vein, allowing it to flow freely into labeled sterile universal bottles containing 1.0mg/ml Ethylene DiamineTetraacetic Acid (EDTA) as an anticoagulant for haematological analysis. The blood samples were then centrifuged at 700 rpm for 15 minutes to separate the serum. The serum was stored at -2 to 20°C in the Medical Laboratory of Jibril Maigwari Memorial Hospital, Birnin Gwari, for biochemical analysis.

The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were calculated using the formulas stated in the Merck Veterinary Manual:

- MCV = PCV% ÷ RBC × 10
- MCH = Hbg/dl ÷ RBC × 10
- MCHC = Hb/dl ÷ PVC% × 100

2.4 Biochemical Analysis

The blood urea concentration was determined using the Nessler reaction method (Tannin and Naylor, 1968). Serum total protein levels were estimated using the Biuret method described by Kohen and Allen (1995). Aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) activities were determined using spectrophotometric methods outlined by Rej and Hoder (1983). Blood glucose levels were determined using the glucose oxidase method.

2.5 Experimental Design and Statistical Analysis

The experimental design employed was a Completely Randomized Design (CRD). Data were analyzed using one-way analysis of variance (ANOVA), and treatment means showing significant differences were separated using the Least Significant Difference (LSD) method with the aid of the SAS 9.04, 2018, Statistical Package. Differences between means were considered significant at a probability level of 5% ($P \leq 0.05$)."

3 Results and Discussion

3.1 Haematological Indices of Yankasa Rams Fed Unensiled or Ensiled Maize Cob Poultry Litter, Soybean, Urea as Basal Diets

Table 2 presents the Haematological Indices of Yankasa Rams Fed Unensiled or Ensiled Maize Cob Poultry Litter, Soybean, Urea as Basal Diets

haematological values reported on were white blood cell (WBC) and lymphocyte (LYM) counts, red blood cell (RBC) counts, haemoglobin (Hb) concentrations, packed cell volume (PCV), and mean corpuscular volume (MCV). Results indicated that WBC and LYM counts, as well as RBC counts, Hb concentrations, and PCV, were not significantly different across treatments ($P>0.05$). However, mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) exhibited significant ($P<0.05$) differences) among treatments. This result was similar to that reported by Oloche,*et al*((2019) for West African dwarf goats fed sweet orange peels meal based diets.

The mean RBC count ranged from 8.57 × 106/µL in treatment B1 to 7.11 × 106/µL in treatment C2. Haemoglobin and PCV values varied from 9.03g/dl in treatment C2 to 10.27g/dl in treatment B1 and from 23.79% in treatment C1 to 30.44% in treatment B1, respectively. Although WBC values were not significantly different ($P>0.05$), they ranged from 8.34% in treatment B2 to 9.01% in treatment A2.

Significantly higher MCHC values were observed in treatment A1, C1, and B2 compared to B1, A2, and B2, while MCH was significantly higher in treatment B1 (35.73pg) compared to B2 (30.63pg). White blood cell and lymphocyte values

fell within the normal range (4 to 12) × 103/μL and 40 to 75%, respectively, according to Merk (1998). These results align with findings by Aliyu *et al*. (2013) but differ from those reported by Usman *et al*., (2010) for Red Sokoto goat and Njidda *et al.* (2014) for Yankasa sheep, as well as Okpanachi *et al* .,(2018) and Ozung *et al*, (2018) for West African dwarf goats fed cashew pulp abd African yam peels based diets

The RBC values obtained in this study were higher compared to those reported by Opara *et al.* (2010) for West African Dwarf (WAD) goats and Usman *et al*. (2010) for Red Sokoto goat but were similar to those reported by Njidda *et al.* (2014) for Yankasa sheep. Mean corpuscular values slightly exceeded the normal values reported by Merk (1998), possibly attributed to differences in age, breed, feed, environment, and analysis period.

MCHC values were higher than those reported by Fajemisin *et al*. (2012) but similar to those reported by Tambuwal *et al.* (2002) for Red Sokoto goat. Additionally, MCH values were higher compared to Fajemisin *et al*. (2010) and Ashiru *et al*. (2014) in studies involving Yankasa sheep fed with sugar cane waste treated with different nitrogen sources.

Table 2: Haematological Indices of Yankasa ram lambs fed experimental diet

TRT	WBC×10³/μl)	LYM(%)	RBC×10⁶/μl)	Hb(g/dl)	PCV(%)	MCV(fl)	MCH(pg)	MCHC(g/dl)
A_1	8.53	74.07	7.39^{b}	9.13^{ab}	24.96^{b}	12.35	33.78^{ab}	38.57^{a}
B_1	8.32	76.17	8.57^{a}	10.27^{a}	30.44^{a}	11.98	35.73^{a}	33.78^{b}
C_1	8.46	67.07	7.38^{b}	9.33^{ab}	23.79^{b}	12.64	32.24^{b}	39.23^{a}
A_2	9.01	74.08	7.73^{b}	9.20^{ab}	26.42^{b}	11.90	34.18^{ab}	34.82^{b}
B_2	8.62	72.43	8.01^{b}	9.47^{b}	24.54^{b}	11.70	30.63^{c}	38.59^{a}
C_2	8.73	77.43	7.11^{b}	9.03^{ab}	27.70^{b}	12.69	38.96^{a}	32.58^{b}
LSD	2.961	13.297	1.776	1.919	4.524	2.129	1.899	2.639

a,b,c Means with different superscripts within the same column are significantly different (P<0.05). WBC: White blood cell LYM: Lymphocyte RBC: Red blood cell Hb: Heamoglobin PCV: Pack cell volume MCV: Mean corpuscular Volume, MCHC: Mean corpuscular Haemoglobin Concentration MCH: Mean corpuscular Haemoglobin.

3.2 Serum Biochemical profile of Yankasa Rams Fed Unensiled or Ensiled Maize Cob Poultry Litter, Soybean, Urea as Basal Diets

Table 3 presents the Serum Biochemical profile of Yankasa Rams Fed Unensiled or Ensiled Maize Cob Poultry Litter, Soybean, Urea as Basal Diets.

Significant differences ($P < 0.05$) were observed in all serum biochemical indices except for ALP, GPT, and blood glucose, which were not significant ($P > 0.05$). Blood urea nitrogen (BUN) values ranged from 7.43 mmol/l in treatment A2 to 11.13 mmol/l in treatment C1. Significant variation in total protein mean values was observed, with treatment A2 recording 69.40 g/l and treatment A1 40.77 g/l, while treatments A1, B2, C1, B1, and C2 being similar ($P > 0.05$).

The mean values of glutamic oxaloacetic transaminase (GOT) were 209.47 U/L in treatment A2 and 124.63 U/L, 135.13 U/L, and 141.17 U/L in treatments A1, C1, and B1, respectively, which were significant ($P < 0.05$). However, treatments A1, B2, C1, B1, and C2 were similar ($P > 0.05$). Conversely, mean values of ALP, GPT, and glucose were not significant ($P > 0.05$), ranging from higher values of 344.20 U/L in treatment A2 to 256.23 U/L in treatment A1, 29.70 U/L in treatment C2 to 26.63 U/L, and 4.40 mmol/l in treatment A2 to 2.43 mmol/l in treatment B1, respectively.

Blood urea nitrogen values fell within the normal range (3.7 to 9.3 mmol/l) as reported by Merk (1998), although significantly different ($P < 0.05$), potentially due to variations in the non-protein nitrogen sources and/or treatment of the maize cob. However, the values obtained were higher (4.5 ± 2.09 mmol/l) compared to those reported by Oyibo *et al* .2020 ; Ocheja *et al*, 2022 for West African dwarf goats and Tambuwal *et al*. 2002) for Red Sokoto goat. Total protein values obtained were similar to those (6.32g/dl to 6.50g/dl) reported by Aruwayo *et al*. (2011) for growing Uda lambs fed alkali-treated Neem Kernel cake, Opara *et al.* (2010) for West African Dwarf (WAD) goats, and Mukhtar *et al.* (2011) for Red Sokoto goats but lower than those reported by Njidda *et al*. (2014) for Yankasa ram and ewe lambs.

Glutamic oxaloacetic transaminase (GOT) values fell within the normal range reported by Merk (1998). Alanine Aminotransferase (ALT) values were similar to those reported by Mukhtar *et al.* (2011) for Red Sokoto goats but lower than those reported by Aruwayo *et al*. (2011) for Uda lamb and Opara *et al*. (2010) for WAD goats.

However, these differences could be attributed to the nature of the non-protein nitrogen sources (urea, poultry litter, and soybean meal) used in the study. Glucose values were similar and fell within the normal range of (3.2 to 5.0 g/dl), consistent with the report by Merk (1998) and similar to values obtained by Opara *et al*. (2010) for WAD goats, Mukhtar *et al.* (2011), and Njidda *et al.* (2014) for Yankasa ram and ewe lambs.

Table 3: Blood Chemistry of Yankasa rams fed ensiled and unesiled maize cob treated with urea, poultry litter and soybean meal

TRT	Urea(mmol/l)	Total Protein (g/l)	ALP (U/L)	GOT(U/L)	GPT(U/L)	GLUmmol/l
A_1	8.67^{ab}	40.77^{b}	256.23	124.63^{b}	28.43	3.40
B_1	8.37^{ab}	60.57^{ab}	435.43	153.60^{ab}	27.77	3.70
C_1	11.13^{a}	54.20^{ab}	414.87	141.17^{b}	27.43	2.80
A_2	7.43^{b}	69.40^{a}	344.20	209.47^{a}	28.57	4.40
B_2	8.01^{ab}	53.70^{ab}	414.93	135.13^{b}	26.63	2.43
C_2	8.60^{ab}	54.97^{ab}	394.17	148.63^{ab}	29.70	3.17
LSD	3.561	23.47	186.07	67.946	8.421	3.166

a,b,c. Means with different superscripts within the same row are significantly different (P<0.05). GLU: Glucose, ALP: Alkaline Phosphatase, ASTor SGOT: Aspartate transaminase, ALT or SGPT: Alanine transaminase.

4 Conclusion and Recommendation

4.1 Conclusion

The findings of this study suggest that the utilization of maize cob treated with poultry litter, urea, and soybean meal, whether ensiled or unensiled, did not adversely affect the haematological and biochemical parameters of growing Yankasa ram lambs. Furthermore, an enhancement in the overall performance of growing Yankasa rams was observed, with the poultry litter ensiled maize cob treatment demonstrating superior performance.

4.2 Recommendations

These results indicate the potential of utilizing maize cob treated with various non-protein nitrogen sources and soybean meal as effective feed resources for improving the health and performance of Yankasa rams. Further research and field trials may be warranted to explore the long-term effects and practical implications of these feeding strategies in small ruminant production systems.

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