HAEMATOLOGY AND SERUM BIOCHEMISTRY OF WEST AFRICAN DWARF GOATS FED DIETS CONTAINING TREATED RICE HUSK AS A REPLACEMENT FOR WHEAT BRAN

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Abstsract
The study was conducted to evaluate the effects of treated rice husk as a replacement for wheat bran on the haematology and serum biochemical parameters of West African Dwarf (WAD) goats. Twenty WAD goats were subjected to five dietary treatments in a completely randomized design with four goats per treatment. The treatments were 0% RH (T1), 25% RH (T2),50% RH (T3),75% RH (T4) and 100% RH (T5). The animals were fed at 5% of their body weight. Blood samples of 10 ml were collected at the end of the growth trial to analyze for haematology and biochemical components. Blood samples were taken before morning feeding via jugular vein puncture into two blood collection bottles. One containing an anticoagulant Disodium salt of ethylene diamine tetraacetic acid (EDTA) and the other with no anticoagulant from which serum was harvested for biochemical analysis. Packed Cell Volume (PCV), Haemoglobin (Hb), red blood cell (RBC) and total white Blood Cells (WBC) were determined. Mean Corpuscular volume (MCV), Mean Corpuscular haemoglobin (MCH) and Mean Corpuscular haemoglobin concentration (MCHC) was calculated from PCV, Hb and RBC. Serum biochemical parameters measured include glucose, total protein, albumin, blood urea nitrogen (BUN), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) parameters were determined. Goat fed with diet T4 had better red blood cell, Pcv, hemoglobin, platelet, eosinophil and AST but high in cholesterol level. Goat on T2 had the highest Tp and better hemoglobin, Pcv, platelet lymphocytes, ALT and globulin content. The treated rice husk had positive impact on the blood parameters, the values are within the normal range for healthy goat. Hence, from this study, 25 – 50% treated rice husk replacement for wheat bran suggests suitable for better performance of WAD goats.
Key words: Haematology, Treated rice husk, Serum, Wheat bran, WAD goats.

INTRODUCTION

The West African Dwarf (WAD) goat is an important livestock breed in sub-Saharan Africa, particularly due to its adaptability to harsh environmental conditions and its ability to efficiently convert low-quality forages into valuable products such as milk and meat (Hanke and Barkmann, 2017). It serves as an important source of income to farmers in order to meet immediate social and financial obligations. Goat is often described as the "village bank" and at the time source of revenue to government especially at the grass-root (Gracinda *et al.*, 2021). To enhance the productivity of WAD goats, a balanced and nutritionally optimized diet is crucial. However, the availability and affordability of traditional feed ingredients, such as wheat bran, may limit the ability of small-scale goat farmers to provide adequate nutrition to their animals (Ocheja *et al.*, 2019). Rice husk, a byproduct of rice milling, is abundant in many rice-growing regions of West Africa. However, it is often considered a waste material and is underutilized in animal feeding. Using rice husk as a potential alternative to wheat bran in WAD goat diets could not only reduce feed costs but also provide a sustainable solution for managing this agricultural residue. The haematology and serum biochemical parameters of WAD goats fed diets containing treated rice husk as a replacement for wheat bran have generated interest among researchers and farmers alike. Understanding how these dietary changes affect the overall health and metabolic profile of WAD goats is crucial to ensure their optimal productivity and welfare. Previous studies have examined the nutrient composition and digestibility of rice husk, suggesting that it is a potential feed ingredient for ruminant animals (Merck Manual, 2012, Okukpe *et al.,* 2015). However, limited research has investigated the effects of incorporating treated rice husk in WAD goat diets on their haematology and serum biochemical

parameters (Isaac *et al.,* 2013). Therefore, there is a need to bridge this knowledge gap and shed light on the potential benefits or drawbacks of using treated rice husk as a replacement for wheat bran in the diets of WAD goats. This research aims to evaluate the impact of different inclusion levels of treated rice husk in WAD goat diets on their haematology parameters, such as red blood cell count, white blood cell count, haemoglobin concentration, and packed cell volume. Additionally, the study will investigate the serum biochemical parameters, including total protein, albumin, globulin, urea, creatinine, and liver enzymes like aspartate aminotransferase (AST) and alanine aminotransferase (ALT). By assessing these parameters, we can gain insights into the nutritional and physiological effects of incorporating treated rice husk in WAD goat diets.

MATERIALS AND METHODS

This research work was carried out at the Small Ruminant Unit, Teaching and Research Farm, Faculty of Agriculture, Kwara State University, Malete, Nigeria. Rice husk was obtained from a reputable rice milling industry within the study area. 500g of the husk was introduced into a cooking pot containing 3 liters of boiling water. The mixture was allowed to boil for one hour fifty minutes with continuous stirring to obtain a homogenous mixture. The cooked rice husk was strained to remove excess water and dried to 35% dry matter. After which the rice husk was packed inside an air-tight polythene bag and it was allowed to ferment for 20 days after which it was dried, packed and weighed to formulate experimental diets (Table 1).

Twenty WAD goats with an average weight of 8.6 kg used in this study were randomly allocated in a Complete Randomized design (CRD) into five treatments with four animals per treatment. The treatments consisted of different levels of replacement of wheat bran with the treated rice husk as follows: (T10% rice husk), (T2, 25% rice husk), (T3, 50% rice husk), (T4, 75% rice husk) and (T5, 100% rice husk). The feeding trial covered a period of 84 days during which the experimental diets were served at 5% of their body weight and clean water was provided *ad libitum* daily. The feed was measured and served to the animals by 8:00am daily; while leftover was weighed the following morning before serving a fresh feed. The difference between the feed served and the leftover gives the feed intake per day. Data obtained were used to determine daily feed intake (DFI). Initial weights of the animals were taken at the beginning of the trial and weekly subsequently using a hanging scale. The data obtained were used to determine daily weight gain (DWG) and total weight gain (TWG). FCR was also calculated at the end of the experiment.

Determination of haematology and serum biochemistry parameters

Blood samples of 10 ml were collected at the end of the growth trial to analyze for haematology and biochemical components. Blood samples were taken before morning feeding via jugular vein puncture into two blood collection bottles. One containing an anticoagulant (Disodium salt of ethylene diamine tetraacetic acid (EDTA)) and the other with no anticoagulant from which serum was harvested for biochemical analysis. Packed Cell Volume (PCV), Haemoglobin (Hb), red blood cell (RBC) and total white Blood Cells (WBC) were determined. Mean Corpuscular volume (MCV), Mean Corpuscular haemoglobin (MCH) and Mean Corpuscular haemoglobin concentration (MCHC) was calculated from PCV, Hb and RBC as described by (Yohannes *et al.,* 2019). Serum biochemical parameters measured Glucose, Total protein, Albumin, Blood Urea Nitrogen (BUN), Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT). These parameters were determined using the routine standard clinical chemistry procedures as described by Bahman *et al.,* (2011).

Statistical Analysis

Data collected for growth parameters were subjected to Analysis of Variance (ANOVA) and differences between treatment means were separated by least significance difference using General Linear Model procedure of Statistical Analysis System (DSAASTAT, 2011).

RESULTS AND DISCUSSION

Proximate composition

Chemical composition of the experimental diets used in this study is presented in Table 2. All the parameters examined were significantly different ($p < 0.05$) among the treatment groups. The maximum value of crude protein (CP) was found in T2 (13.0%) and minimum in T5 (7.5%) while a greater crude fiber content was recorded in T4 (75%RH) than the others T3 (50%RH), T5 (100%RH), and T1 (0%RH). All the diets had crude protein (CP) values above the 6 - 8% CP the minimum

requirement for ruminants (NRC, 1985) in nutrient requirements of domestic Animals. The crude protein levels of the experimental diets were far above the 8% needed to provide the minimum ammonia levels required for microbial activity in the rumen. Faisal *et al.* (2017) reported that low cost of concentrate diets with more than 8% CP could be a good maintenance ration for ruminant animals during dry season. The crude fibre content of the experimental diets in the study was lower than the value (34.85%) reported by Oladotun *et al* (2003) and Olarewaju *et al.,* (2021). The contrast could be as a result of the treated rice husk inclusion in the diets. Ash content increases with increasing rice husk quantity, the same trend was observed in ADF. However, the carbohydrate content recorded a declining trend as the rice husk quantity increases. The crude protein, crude fibre, crude fat, ash and CHO values obtained for the experimental diets used in this study were similar to the values reported by Fasuyi *et al.,* (2010). The values of ADF, NDF and ADL for all the experimental diets were lower than the values 62.29% NDF, 47.83% ADF and 20.25% ADL reported by Oladotun *et al.*, (2003). According to Robert (2013) ADF is used to produce energy content of feed which goes with the T5 (100%RH) having the highest ADF with higher energy content.

Table 1: Chemical composition (%) of the experimental diets

Treatments	DM	CP	CFAT	CF	ASH	CHO	NDF	ADF	ADL	HMC	CELL
T1	96.15^{c}	12.23^{b}	3.55^{c}	11.62^{e}	10.03^{e}	58.81^{a}	39.62^{e}	20.18^{e}	14.05^{e}	19.44	6.13
T2	97.31^{a}	13.04^{a}	3.59^{b}	15.81^{d}	13.18^{d}	51.69^{b}	39.67^{d}	29.08^{d}	19.03^{d}	10.59	10.05
T3	96.13^{c}	9.12^{d}	2.88^{d}	20.55^{b}	14.86^{c}	48.69^{c}	43.76^{b}	34.38^{c}	21.93^{c}	9.38	12.45
T4	97.20^{b}	11.47^{c}	3.92^{a}	20.94^{a}	15.26^{b}	45.61^{e}	44.12^{a}	42.25^{b}	29.55^{a}	1.87	12.7
T5	97.31^{a}	7.59^{e}	2.42^{e}	19.50^{c}	17.15^{a}	50.64^{c}	42.12^{c}	42.34^{a}	27.95^{b}	0.22	14.39
S.E.M	1.52	5.77	4.47	5.38	1.55	4.94	5.37	5.38	5.28	0.01	5.38
P-value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

WB=Wheat Bran, RH-Rice Husk, DM= Dry matter, CP= Crude protein, CFAT=Crude Fat, CF=Crude fibre, CHO= Cabohydrate, NDF= Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin, HMC= Hemicellulose, CELL= Cellulose, T1 (RH0%), T2 (RH25%), T3 (RH50%), T4 (RH75%), T5 (RH100%).

Table 2: Haematological parameters of West Africa dwarf goats fed the experimental diets.

	Treatments						
Parameters	T1	T2	T3	T4	T5	SEM	P-value
WBC (×10³/µI)	7.37	7.60	7.76	7.50	7.24	0.48	0.950
RBC (×10□/ µI)	7.78	8.23	8.33	7.16	7.25	0.58	0.510
PCV (%)	32.33^{a}	31.67^{a}	26.0^{b}	33.67^{a}	32.00^{a}	1.55	0.043
Hb (g/dl)	10.73	9.70	10.35	8.86	10.10	0.59	0.290
LYM (%)	63.33	55.33	63.67	60.33	56.67	4.90	0.670
NEUT (%)	31.67	32.00	31.33	33.67	32.67	4.90	0.935
MON (%)	3.00^{a}	2.00^{abc}	2.67^{a}	1.00	1.33^{bc}	0.49	0.075
EOS (%)	2.00	2.00	2.30	2.00	1.67	0.49	0.920

WBC=White blood cell, RBC=Red blood cell, PCV=Packed cell volume, Hb= Haemoglobin; PLT= platelet count, LYM = lymphocytes, Neut = neutrophil, MON = monocytes, EOS = eosinophils, T1=0%Rice husk, T2=25%Rice husk, T3=50%Rice husk, T4=75%Rice husk, T5=100%Rice husk, abcde= Means in the row with different superscript are significantly different ($P < 0.05$)The haematology parameters of performance of West Africa dwarf goats fed the experimental diets observed in Table 2. No significant ($P > 0.05$) differences was observed in all the parameters except in packed cell volume (PCV). The PCV values ranges between the range of 26 -33.67%. The haemoglobin content varies between 8.86 - 10.73g/dl. The WBC counts recorded values between 7.24 – 7.76 (10^3/µl) while the RBC ranges from 7.16 to 8.33(x10^3/µl). The lymphocyte, eosinophil, neutrophil and monocyte varies between 55.33 - 63.67%, 1.67-2.3%, 31.33-33.67% and 1-3% respectively. Table 3 below, shows serum parameters of performance of West Africa dwarf goats fed the experimental diets. The total protein showed no significant difference ($P > 0.05$) with value ranging between 6.25 - 8.11 g/dl. Albumin (g/dl) recorded the lowest value in T4(75%RH, 3.05g/dl) and highest value in T5(100%RH, 4.47g/dL). The globulin, ALT, AST and Cholesterol varies significantly among treatment means ($P < 0.05$). It ranges between 25.2mg/dl in T1(0%RH) to 131.12mg/dL in T4(75% RH).

Table 3: Serum parameters of West Africa dwarf goats fed the experimental diets.

	Parameters						
Parameters	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**	**P-value**
Glucose(mg/dL)	57.67	52.80	55.33	54.80	58.47	4.16	0.87
TP(g/dL)	6.82^{ab}	8.11^{a}	6.81^{ab}	7.15^{ab}	6.25^{b}	0.48	0.1618
Albumin(g/dL)	4.11^{a}	3.12^{b}	3.77^{ab}	3.05^{b}	4.47^{a}	0.27	0.0153
Globulin(mg/dL)	25.20^{b}	47.20^{a}	32.07^{b}	31.47^{b}	51.00^{a}	5.86	0.00541
ALT(IU/L)	26.66^{bc}	35.58^{a}	27.96^{ab}	26.81^{bc}	21.78^{c}	1.94	0.0209
AST(IU/L)	138.06^{a}	100.75^{b}	130.48^{a}	127.66^{a}	134.09^{a}	3.66	0.0002
Chol(mg/dL)	74.03^{c}	103.03^{b}	116.12^{ab}	131.12^{a}	97.63^{bc}	7.93	0.0052

TP = total protein, ALT = alanine transaminase, AST = aspartate transaminase, Chol = cholesterol, T1 = 0% rice husk, T2= 25% rice husk, T3 = 50% rice husk, T4 = 75% rice husk, T5 = 100% rice husk, abcde = Means with different superscript across the rows differed significantly ($p < 0.05$).

CONCLUSION

Findings from this study revealed that 25% and 50% treated rice husk replacement level of wheat bran (T2) was more nutritious, palatable with less crude fire and appreciable carbohydrate content and more consumed by the goats among the diets without adverse effects on the haematology and serum biochemical parameters of West African dwarf goats

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