Growth Performance and Haemato-biochemical Idicesof West African Dwarf Goats Fed Dried Bovine Rumen Digesta

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Abstract
This study evaluated the growth performance and haemato-biochemical indices of West African Dwarf (WAD) goats fed diets containing Dried Bovine Rumen Digesta. Twelve 12 growing goats (2–4 months old; average weight 8.65 ± 1.8 kg) were assigned randomly to three (3) treatments in a completely randomized design with four (4) replicates each: T1 (0% DBRD), T2 (15% DBRD), and T3 (30% DBRD). The experiment lasted eight (8) weeks. Parameters measured included feed intake, weight gain, feed efficiency ratio, haematology and serum biochemistry. Results showed that DBRD inclusion did not significantly ($P>0.05$) affect final weight, though goats on T3 had the higher weight gain (0.74 kg) and feed intake (17.85 kg). Haematological parameters were mostly within reference ranges, with significant differences only in WBC (with T3 having the highest count of 14,500uL and T2 having the least count of 10,200uL) and Neutrophils (with values of T2 (55) and T3 (54) which were not significantly different from each other). Serum biochemistry indicated non-significant ($P<0.05$) variation in ALT and AST, suggesting possible mild liver stress at higher DBRD inclusion levels. Overall, diets with 30% DBRD improved performance without major adverse effects, though long-term health implications require further study.

Keywords: West African Dwarf goat, dried bovine rumen digesta, growth performance, hematology, serum biochemistry

Description of Problem

Goats (*Capra hircus*) are among the most widely kept small ruminants in sub-Saharan Africa, contributing significantly to rural livelihoods through the provision of meat, milk, hides, and manure [1]. In Nigeria, the West African Dwarf (WAD) goat is the predominant breed, valued for its adaptability to humid and sub-humid zones, prolificacy, and ability to survive under extensive systems [2]. Despite their importance, goat productivity is constrained by poor nutrition, especially during the dry season when available forages are fibrous, of low digestibility, and deficient in crude protein, sometimes as low as 2% [3]. Such nutritional limitations result in poor growth rates, weight loss, reproductive failures, and increased susceptibility to diseases therefore, the search for low-cost, locally available feed resources to supplement small ruminant diets is a priority [4]. Dried bovine rumen digesta (DBRD) is a by-product of abattoirs consisting of partially digested feed materials recovered from the rumen of slaughtered cattle. Previous studies have reported its appreciable crude protein content (up to 19% DM), microbial biomass, minerals, and fermentation end-products [5;6]. Its potential as a non-conventional feedstuff has been explored in rabbits [7], poultry [8] and cattle [9]. However, limited information exists on the use of Dried Bovine Rumen Digesta (DBRD) in small ruminant feeding.

Dried Bovine Rumen digesta (DBRD) is an alternative energy source on nutrient utilization, rumen fermentation characteristiccs, growth performances, and milk production in ruminants [10]. Rumen digesta is a by-product of abattoir; it is a partially digested feed that mainly originates from rumen of ruminants. Rumen digesta contain energy, crude protein and some essential nutrients (microbial cells, amino acids, minerals, and volatile fatty acids [VFAs]), which beneficially affect the ruminant production [6]. Hence, this study therefore evaluated the growth performance, haematology, and serum biochemistry of WAD goats fed diets containing

graded levels of DBRD, with the aim of determining its potential as a sustainable and low-cost feed ingredient for goats.

Materials and Methods

Experimental site

The study was conducted at the Small Ruminant Unit, Institute of Agricultural Research and Training (IAR&T), Moor Plantation, Ibadan, Nigeria (latitude 7.37°N, longitude 3.84°E).

Experimental animals and management

Twelve (12) healthy West African Dwarf (WAD) grower goats (3–4 months; average 8.65 ± 1.8 kg) were procured and acclimatized for two (2) weeks. During this period, they were treated with prophylactic antibiotics (oxytetracycline, 1 ml I/M), anti-parasitics (ivermectin, 1 ml S/C; levamisole, 5 ml I/M), and housed in disinfected pens. The goats were randomly assigned to three (3) dietary treatments (T1 = 0% DBRD, T2 = 15% DBRD, T3 = 30% DBRD), with four (4) goats per treatment. The animals were fed twice daily and water was supplied *ad libitum.*

Collection and processing of DBRD

Fresh rumen digesta was collected from Oyo State Abattoir, Akinyele, dried in ambient temperature for 7 days and then used as a feed ingredient in compounding goat feed.

Experimental diets

The diets were formulated with cassava peels, wheat offal, palm kernel cake, groundnut cake, maize stover, brewer's dried grain, and DBRD (at 0, 15, and 30%).

Data collection

Data collected on growth performance includes: feed intake (feed given less left over) and weekly body weights while, body weight gain (difference between initial and final body weights) and feed efficiency ratio (FER) (body weight gain/feed intake) were calculated.

Haematology and Serum biochemistry

At the end of the trial, blood was collected from the jugular vein of all the goats for haematological analysis (PCV, Hb, RBC, WBC, and differential counts) and serum biochemical analysis (Alanine Aminotransferase -ALT, Aspartate Aminotransferase - AST, Alkaline Phosphatase - ALP and Gamma-Glutamyl Transferase - GGT) was conducted using standard colorimetric methods (15)

Experimental Layout/Statistical analysis

The experiment was laid out in a Completely Random used Design (CRD) and data collected were subjected to analysis of variance (ANOVA) using SAS (version 9.2), and significant means separated using Duncan's Multiple Range Test (DMRT) at $P<0.05$.

Table1: Composition of experimental diet

Ingredients (%)	T1	T2	T3
DBRD	0	15	30
Cassava peel.	40	25	10
Wheat offal	20	20	20
PKC	20	8	0
GNC	0	12	20
Maize Stover	13	13	13
BDG	5	5	5
Salt	1	1	1
BM	1	1	1
Total	100%	100%	100%
Calculated Analysis			
ME (Kcal/kg)	2620	2530	2660
Crude fiber (%)	16.85	16.20	16.16
Crude protein (%)	13.56	13.34	13.49
Crude fat (%)	2.61	2.61	2.65

Results and Discussion

Growth Performance

Table 2 presents the growth performance of goats fed DBRD. Although differences were not statistically significant (P>0.05), goats on T3 (30% DBRD) recorded the highest feed intake (17.85 kg) and body weight gain (0.74 kg). The improved feed intake could be linked to the fiber and nutrient profile of DBRD, which may enhance palatability (5). The higher weight gain in T3 goats indicates that DBRD can support growth when included at moderate levels.

Haematological Parameters

Table 3 shows haematological indices of goats fed DBRD in which all parameters were significantly different (P<0.05), with T3 goats having the highest WBC (14,500/µL). Elevated WBC suggests heightened immune activity, possibly reflecting adaptive responses to diet [11]. RBC, haemoglobin, and MCV values remained within normal ranges [12], indicating no major impairment in oxygen transport or erythropoiesis.

Serum Biochemistry

Serum biochemical indices are shown in Table 4. Only ALT and AST differed significantly among treatments. ALT was highest in T3 (39.09 U/L), suggesting mild hepatocellular stress. Similarly, AST was highest in T2 (68.78 U/L) but lowest in T3 (50.49 U/L). While still within reference ranges, the elevated values may indicate metabolic adjustments or mild liver stress associated with DBRD utilization [13]. The result agrees with the works Olufadehan [14], who observed minimal adverse biochemical responses in goats fed unconventional feedstuffs, though enzyme elevations warrant caution.

Table 2: Performance characteristics of WAD goats fed DBRD

Parameter	T1	T2	T3	±SEM
Initial weight (kg)	6.79	6.89	6.92	0.10
Final weight (kg)	7.03^{a}	6.25^{b}	6.66^{b}	0.46
Body weight gain (kg)	0.24^{c}	0.36^{b}	0.74^{a}	0.02
Total feed intake (kg)	15.40^{b}	16.80^{ab}	17.85^{a}	2.1
FER	0.02	0.02	0.04	0.01
Mortality	0	1	1	

FER – Feed Efficiency Ratio

Table 3: Haematological parameters of WAD goats fed DBRD

Parameter	T1	T2	T3	±SEM	Ref. Values
RBC (m/µl)	10.34^{b}	10.45^{b}	11.02^{a}	0.30	10–15
Haemoglobin (g/dL)	12.24^{b}	12.22^{b}	12.65^{a}	0.22	10–14
Hematocrit (%)	25.00^{b}	28.00^{a}	28.00^{a}	0.50	30–40
WBC (/µL)	13,100^{b}	10,200^{c}	14,500^{a}	22.50	5,000–15,000
Neutrophils (%)	50^{ab}	55^{a}	54^{a}	0.21	50–70

Table 4: Serum Biochemical Parameters of WAD goats fed DBRD

Parameter	T1	T2	T3	±SEM	Ref Values
ALT (U/L)	28.45	38.44	39.09	0.13	10–50
AST (U/L)	55.69	68.78	50.49	1.24	20–100
ALP (U/L)	185.80	186.88	180.65	5.89	50–200
GGT (U/L)	12.25	13.25	12.49	0.13	10–50
Total Bilirubin (mg/dL)	0.65	0.66	0.55	0.01	0.2–1.0

Conclusion and Application

The inclusion of DBRD at 30% in WAD goat diets improved feed intake and body weight gain without significant negative effects on most haematological and biochemical parameters. However, elevated ALT and AST suggest

potential liver stress at higher inclusion levels. The DBRD therefore holds promise as an alternative feedstuff for goats, particularly for smallholder farmers seeking cost-effective protein and energy sources. The DBRD can be safely included up to 30% in goat diets to reduce feed costs and improve performance. Long-term studies are recommended to assess chronic health effects, reproductive performance, and organ function. Further work should explore DBRD in combination with other agro-industrial by-products to maximize nutrient utilization.

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