NITROGEN RETENTION AND SERUM BIOCHEMISTRY OF SHEEP FED DIETS SUPPLEMENTED WITH UREA-MOLASSES TREATED RICE-STRAW

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ABSTRACT
The study was conducted to determine the effect of Urea-Molasses Treated Rice-Straw (UMTRS) supplementation on nitrogen retention and serum biochemistry of sheep. Twenty- four West African dwarf male sheep of about 6 – 7 months old were randomly allotted to four treatment diets with six sheep per treatment in a completely randomised design. The compared treatment diets ED_1, ED_2, ED_3 and ED_4 contained 0%, 10%, 20% and 30% of UMTRS supplementation respectively. The results showed that sheep on ED_1 had significantly ($p<0.05$) higher triglycerides and cholesterol. Nitrogen intake, nitrogen balance with retention, total protein and albumin were significantly ($p<0.05$) increased for sheep on diet ED_2. Faecal, urinary and total nitrogen output, glucose, and creatinine with urea were significantly higher ($p<0.05$) in diet ED_4. Globulin was not significantly ($p>0.05$) affected by sheep on treatment diets. It can be concluded that supplementation of UMTRS in diets enhanced nitrogen retention and serum biochemistry of sheep on diets ED_2, and ED_3 than other diets.

Keywords: Nitrogen, blood, urea-molasses, rice-straw, sheep.

DESCRIPTION OF PROBLEM
Sheep constitute a very important aspect of ruminant livestock that play a unique role in the socio-economic sub-sector of Nigeria. They contribute significantly to the nutritional needs and economic livelihoods for humans due to their affordable provision of essential high quality animal protein (1). Thus, there is a need to pay more attention to sheep productivity as their advantages appear promising than ever before. This is particularly in view of their ability to be of multipurpose utility. Nonetheless, nutritional inadequacy remains one of the primary constraints that affect sheep performance (2). Grass forages that are often abundant for sheep consumption are often low in protein but high in indigestible fibre due to seasonality. The strategic use of conventional feeds is not a feasible option for farmers due to escalating prices (1). This issue has prompted many researchers to search for sustainable alternative feed resources that are not required for human diets. Thus, the use of different techniques in crop residues as alternative supplementary feeds can go a long way in solving the problem of feed shortage.

Rice straw is a crop residue that can be used as a supplement to the basal diet of forage grass in sheep. However, its low protein and high silicon content coupled with indigestible fibre content limit its utilisation (3). Therefore, any interventions that improve the potential of rice straw alleviate its poor quality. Hence, the use of urea-molasses in rice straw treatment can have the benefits of optimising nutrient utilisation and health enhancement of sheep. The objective of this study was to assess nitrogen retention and serum biochemistry of sheep as affected by urea-molasses-treated rice straw supplementation.

MATERIALS AND METHODS
The study was conducted at the Sheep and Goat Unit of the Teaching and Research Farm, Ambrose Alli University, Ekpoma. Rice straw was collected after grain harvest on the University farm. The straw was hand-chopped with a cutlass to a size of about 4 to 5cm lengths to facilitate packing. A mixture of 2kg urea and 0.5kg molasses was diluted in 50 litres of water to form a mixed solution. The mixture was sprayed on the straw during packing into 50kg capacity double-layer polyethene-bags to ensure even distribution. The straw was compacted and sealed with a polyethene-sheet to prevent the escape of nitrogen. The straw was ensiled for 30days as

prescribed by (3). Any straw taken from the bag for feeding was exposed overnight to reduce nitrogen concentration before use. Guinea grass was harvested in the University pasture land, wilted for 24hours and chopped with a cutlass to lengths of about 4 to 5cm before being used. Concentrate supplement that comprised maize grain-15%, maize offal-20%, wheat offal-10%, cotton seed cake-5%, cowpea husk-46%, bone meal-2.5% and salt-1% was also used. The basal diets of Guinea Grass (GG) or GG with varying levels of Urea-Molasses Treated Rice-Straw (UMTRS) and Concentrate Supplement (CS) were used in a ratio of 70:30 respectively. Thus, the four dietary treatments were; ED_1 (70% GG and 30% CS), ED_2 (60% GG with 10% UMTRS and 30% CS), ED_3 (50% GG with 20% UMTRS and 30% CS) and ED_4 (40% GG with 30% UMTRS and 30% CS).

Twenty-four West African dwarf rams of 6-7 months old with initial an average body weight of 6.00 ± 0.90kg were used for the study. They were quarantined for 14 days before assigning them to four dietary treatments with six sheep per treatment. Each treatment comprised three replicates with two animals per replicate in a completely randomised design. Diets were offered at 5% of their body weight twice daily and management procedures for animals were similar irrespective of their groups. Sheep were having free access to drinking water and the study lasted for 84 days excluding 14 days of the adaptation period.

A metabolic trial was conducted after the feeding trial with three sheep from each treatment and was acclimatised for 7 days. This was followed by a 7-day collection of faeces and urine excreted from each sheep. Faecal samples were collected in the morning weighed and pooled for each sheep before morning feeding. They were bulked to obtain about 10% representative samples and kept in plastic bags in the deep-freezer at -20^0C. Urine sub-samples were also collected in plastic bottles with 4 drops of diluted sulphuric acid (10% H_2SO_4) to prevent loss of nitrogen due to volatilisation. The collected faecal and urinary samples for each sheep were separately thawed, thoroughly mixed and sub-sampled were used for laboratory analysis. Thereafter, nitrogen retention was calculated as the difference between nitrogen intake and that recovered from faeces and urine expressed as a percentage of nitrogen intake (4)

After the metabolic study, 5ml of blood sample was collected from each sheep through jugular venipuncture with the help of disposable heparinised syringes into sterilised evacuated collection tubes before morning feeding. The samples were transferred into anti-coagulant-free plastic tubes and gently inverted a couple of times, before being kept in an ice box to allow coagulation at room temperature. They were later centrifuged for 15 minutes at 890xg at - 4^0C and maintained for 8 hours in a refrigerator at - 4^0C to biochemical analysis. The serum biochemical parameters estimated include total protein, albumin, glucose, triglycerides, cholesterol, creatinine and urea (5). Globulin was calculated by subtracting albumin from the total serum protein.

Guinea grass, urea-molasses treated rice straw, concentrate supplement as well as experimental diets and faecal samples were analysed for proximate composition, following the methods reported by (6). Total nitrogen urine was analysed by the Kjeldahl procedure as outlined by (6).

Data generated from nitrogen retention and serum biochemistry of sheep were subjected to analysis of variance (ANOVA) and significant differences between means were separated using Duncan's multiple range test (7)

RESULTS AND DISCUSSION

Table 1, presents the proximate composition of guinea grass, urea-molasses treated rice-straw, concentrate supplement and experimental diets. As seen in Table 2, nitrogen intake had higher significant ($p< 0.05$) values in sheep on diets ED_2 and ED_3 than on diets ED_1 and ED_4. This difference might be traced to the positive association effect between forage grass and treated rice straw with their similarity in protein intake. McDonald (4). noted that a positive relationship exists between the quality of protein in feed and the intake of animals. .Faecal, urinary and total nitrogen output were significantly ($p<0.05$) higher in diet ED_4 compared with other diets. This could probably be linked with the lignin and residual contents of silica with phytic acid in rice straw. It was observed that high indigestible fibre and residual anti-nutritional factors in

straw impair protein digestibility and absorption (1). However, nitrogen balance and retention in sheep followed the same significant ($p<0.05$) trends as observed in nitrogen intake. This suggests that nitrogen absorbed was well tolerated and better utilised by sheep on test diets ED_2 and ED_3 than those on ED_1 and ED_4. However, the positive nitrogen balance recorded in this study could be attributed to the fact that protein quality ingested by sheep was above 7 - 8% crude protein, the minimum requirement for body development by small ruminants (4).

Table 1: Proximate composition (%DM) of GG, UMTRS, CS and experimental diets

Parameters	Feed Ingredients			Experimental Diets			
	GG	UMTRS	CS	ED_1	ED_2	ED_3	ED_4
Dry matter	90.35	76.43	92.59	94.87	92.92	90.87	87.06
Crude protein	9.49	9..06	12.09	10.57	10.48	10.36	10.24
Crude fibre	35.24	27.34	17.45	29.90	29.11	28.33	27.54
Ether extract	5.71	1.05	4.05	5.22	4.76	4.29	3.82
Ash	2.78	16.40	9.20	4.71	6.07	7.43	8.79
Nitrogen-free extract	46.78	46.85	55.21	49.03	48.91	48.81	48.73

GG = Guinea Grass, UMTRS = Urea-Molasses Treated Rice Straw, CS = Concentrate supplement. ED_1 = 70% GG and 30% CS., ED_2 = 60% GG with 10% UMTRS and 30% CS., ED_3 = 50% GG with 20% UMTRS and 30% CS.,, ED_4 = 40% GG with 30% UMTRS and 30% CS

Table 2: Nitrogen indices of sheep fed diets supplemented with treated rice-straw .

	Experimental Diets				
Parameters	ED_1	ED_2	ED_3	ED_4	**SEM ±**
Nitrogen (N) intake (g/day)	8.86^b	9.12^a	9.05^a	$8..58^b$	0.06
Faecal N-output (g/day)	2.73^a	1.85^b	1.94^b	2.97^a	0.02
Urinary N-output (g/day)	0.99^b	0.96^b	0.98^b	1.09^a	0.01
Total N- output (g/day)	3.72^b	2.81^c	2.92^c	4.06^a	0.03
N-balance (g/day)	5.14^b	6.31^a	6.13^a	4.52^c	0.05
N-retention (g/day)	0.57^b	0.69^a	0.69^8	0.53^b	0.01
N-retention % intake	57.99^b	69.09^a	67.73^a	52.68^c	0.97

^{a,b,c} Means in the same row with varying superscript differ significantly ($P < 0.05$)
ED_1 = 70% GG and 30% CS., ED_2 = 60% GG with 10% UMTRS and 30% CS., ED_3 = 50% GG with 20% UMTRS and 30% CS., ED_4 = 40% GG with 30% UMTRS and 30% CS

Table, 3 shows serum biochemical parameters of sheep fed experimental diets. Total protein and albumin values were significantly ($p< 0.05$) higher in sheep on diets ED_1, ED_2 and ED_3 than diet ED_4, while globulin was not significantly ($p>0.05$) influenced by the diets. This indicates that the dietary quality of protein in these diets was effectively utilised by the sheep. This tally with the work of (5) that serum total protein and its fractions have a positive connection with the quality and density of protein available in diets which animals utilise for their body physiological activities.

Table 3: Serum biochemical parameters of sheep fed diets containing varying levels of urea- molasses treated rice straw.

	Experimental Diets				
Parameters	ED_1	ED_2	ED_3	ED_4	**SEM ±**
Total protein (g/d)	7.29^a	7.92^a	7.68^a	6.99^b	0.05
Albumin (g/d)	4.01^a	4.06^a	4.02^a	3.78^b	0.03
Globulin (g/d)	3.28	3.86	3.66	3.21	0.02
Glucose (mg/dl)	61.54^b	67.92^a	68.03^a	68.14^a	0.59
Triglycerides (mg/dl)	21.34^a	20.41^b	20.09^b	20.01^b	0.27
Cholesterol (mg/dl)	50.01^a	48.72^b	47.60^b	47.38^b	0.46
Creatinine (mg/dl)	0.99^b	0.91^b	0.93^b	1.01^a	0.01
Urea (mg/dl)	9.72^b	9.78^b	10.01^b	11.97^a	0.09

^{a,b,c} Means in the same row with varying superscript differ significantly ($P < 0.05$), *ED_1 = 70% GG and 30% CS., ED_2 = 60% GG with 10% UMTRS and 30% CS., ED_3 = 50% GG with 20% UMTRS and 30% CS.,, ED_4 = 40% GG with 30% UMTRS and 30% CS*

Blood glucose was significantly higher ($p<0.05$) in test diets than the control diet. This suggests that the test ingredient was capable of furnishing the sheep with higher-quality energy from molasses that led to better serum glucose level (3) in the sheep. The significant ($p<0.05$) decrease in triglycerides and cholesterol in test diets revealed that a negative relationship exists between oil and urea-treated rice straw. This further attests to the crucial effect of urea treatment in diets that depressed oil utilisation in animals.(2). Creatinine and urea were higher in sheep on diets ED_1 and ED_4 as compared with diets ED_2 and ED_3. However, the negative relationship that existed between total protein and urea with creatinine in this study, demonstrated that UMTRS had led to positive protein utilisation efficiency in sheep without compromising their body reserves (1) which could lead to tissue wastage

CONCLUSION AND APPLICATION

Based on the results obtained in this study, it can be concluded that urea-molasses-treated rice straw supplementation in the basal diet of guinea grass improved nitrogen retention and enhanced serum biochemical indices of sheep. This improvement was more pronounced in diets ED_2 and ED_3 than in other diets.

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