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Rumen characteristics and blood parameters of West African dwarf goats fed vetiver grass (*Chrysopogon zizanoides*. L. Roberty) ensiled with cassava peels at different ratio

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Abstract

Vetiver is a perennial grass of tropical origin, commonly used as edge row plants for the control of erosion. Being leafy and with a high tillering ability, it has not been properly integrated as forage for ruminants. Thus, an experiment was carried out to determine the effect of ensiling a four week re-growth of vetiver grass with cassava peels on rumen and blood metabolites of West African dwarf goats. Sixteen goats were used for the study. A completely randomized design was used with four animals per treatment. Vetiver grass was ensiled with cassava peels at ratio (A) 80:20, (B) 70:30, (C) 60:40 and (D) 50:50 were provided ad-libtum at 5% body weight. Rumen and blood samples were collected at the end of the experiment which lasted for 90 days. Results of the study showed rumen ammonia nitrogen (NH_3-N) concentration of 7.25-7.93mg/100mL, and pH of 6.75-6.81. Variations among the treatments were within the acceptable range for rumen microbial activity. There was a uniformly low plasma urea (4.36-5.16mm/l). Glucose (85.36-89.04g/dL), total protein (6.42-7.50g/dL), cholesterol (60.95-66.19g/dL), haemoglobin (10.9-12.7g/100ml), packed cell volume (30.0-31.0%) and white blood cell (10.25-10.67×10^3/ul) were within the range reported for healthy goats. Ensiled vetiver grass with cassava peels had no detrimental effects on the rumen and blood parameters of the experimental animals.

Keywords: Vetiver grass, cassava peels, silage, WAD goats, rumen fluid and blood metabolites

Introduction

Vetiver is a perennial grass of tropical origin, for several years it has been commercially cultivated for the scented oil that can be distilled from its roots, which is a treasured ingredient in some of the world's best known perfumes and soap and largely because of its potential as an export commodity, vetiver grass can be found in at least 70 nations (NRC, 1993). In recent years vetiver grass has been widely known for its effectiveness in erosion and sediment control, and has been found to be highly tolerant to extreme soil conditions (Truong Baker, 1998). Vetiver grass may also be promising feed resource because of its various advantages such as high quality, fast growth rate and easy adaptation to the environment and can bear repetitive mowing without occupying farming land. Previous research has shown that vetiver grass is edible herbage of high quality for cattle and goat especially in the early stages of growth (Liu and Cheng 2002).

Blood examination is a good way of screening the health status of an animal. It provides the opportunity to clinically investigate the presence of several metabolites and other constituent's in the body of animals. It also plays a vital role in the physiological, nutritional and pathological status of an organism (Onifade, 1993). It has been noted that the ingestion of numerous dietary components have measurable effects on blood constituents. Changes in haematological levels usually precede or signal the onset of such outward signs as weight changes, loss of hair or

feathers and changes in milk or egg production, following dietary intervention. However, so far there are very few studies on the application of vetiver grass for ruminant feed. The aim of this study was to determine the influence of 4 week re-growth of vetiver grass ensiled together with cassava peels at different ratio on rumen fluid characteristics and some blood parameters of West African dwarf goats.

Materials and methods

The experiment was carried at sheep and goat unit of National Center for Genetics and Biotechnology, (NACGRAB) Moor Plantation, Ibadan. (Latitude 7^0 15^1 to 7^o 30^1 N and Longitude 3^0 45^1 to 4^0 E), the mean monthly temperature was 31^0C. Sixteen WAD goats weighed 8.80kg ±1were used for the study in a completely randomized design with four animals per treatment. The goats were kept in individual pens throughout the period of the experiment. They were randomly assigned to four dietary treatments consisting of fourweek re-growth of vetiver grass ensiled with cassava peels at different ratio: (A) 80%vetiver+20%cassava peels, (B) 70%vetiver+30%cassavapeels,(C)60% vetiver+40%cassava peels and (D) 50%vetiver+ 50%cassava peels. The study lasted for 90 days.

Rumen fluid collection

Rumen fluid was collected with the aid of suction tube manually. The rumen fluid was sampled at four hours after feeding. The fluid was immediately strained through a cheese cloth. The pH was immediately determined with a digital pH meter. Rumen fluid samples were stored in plastic bottles into which 3 drops of concentrated hydrochloric acid were added and stored in a deep freezer and later analysed for ammonia-nitrogen (Roy Markham, 1942).), Total Volatile Fatty acids (AOAC ,1980).

Blood collection

Blood samples were also collected from three animals per replicate via jugular vein into specimen bottles with Ethylene Di-amine Tetra Acetic acid (EDTA) for heamatological analysis. The Packed Cell Volume (PCV), White Blood Cell (WBC) and Haemoglobin (Hb) concentration were determined according to standard procedures (Schalm *et al.,* 1975). Blood samples for serum biochemical analysis were allowed to clot. Serum total protein, cholesterol and plasma urea nitrogen were determined as described by (Daramola *et al.,* 2005).

Statistical analysis

Data collected were subjected to analysis of variance procedure using GLM of SAS (SAS,1999).

Results and discussion

Chemical composition of the silages is presented in Table 1. Crude protein decreased with increasing level of cassava peels. This is due to the lower CP content of cassava peels than Vetiver grass. The crude protein value (8.48%-8.97%) obtained was higher than the normal range of (7.7%) which is the critical value recommended for small ruminants (NRC, 1981) and lower than the minimum protein requirement of 10-12% recommended by ARC (1985) for ruminants. Crude fiber ranged from 22.61 – 24.33% Increasing proportion of cassava peels reduced the fibre contents of the silage. Values obtained for rumen pH, rrumen ammonia-nitrogen and volatile fatty acids were presented in Table 2.There were significant ($p < 0.05$) variations in pH among the treatments, these variations were within normal pH range of the rumen environment, the pH obtained 6.72 - 6.81and were within the range for optimum rumen fermentation. Ndlovu, (1992) reported 6.5 – 6.8 being

optimal for maximum celluloysis. The pH obtained was conducive for optimum microbial digestion. There were variations in the level of ammonia-nitrogen obtained among the treatments, the values ranged from7.25-7.93mgNH_3/100mL.NRC, (1981) and ARC*, (1985)* reported optimum rumen ammonia concentration ranging 5-20mg NH_3/100mL *ARC, (1985).* Satter and Slyter (1974) reported 50mg/l as the optimum ammonia concentration for microbial growth, while Satter and Roffler (1976) in an in vitro experiment reported 3.6 to 17mg/100mL. The values obtained (7.25-7.93mgNH_3/100mL) in this study were in agreement with that of Satter and Slyter (1974) and Satter and Roffler (1976). The concentration of ammonia nitrogen which promotes maximum microbial protein production is an important factor in determining the utilization of nitrogen in the rumen. Volatile fatty acids are the main energy sources for ruminants feeding mainly on roughages. Their levels in the rumen gave an indication of the energy values of the feeds. The values obtained ranged from 54.8-68.5mm/l the highest value was observed at 50% inclusion level of cassava peels while the lowest at 20% inclusion level. The increase in VFA from 54.8mm/l in20% inclusion to 68.5mm/l in 50% inclusion level of cassava peels could be associated with increase in digestibility of the diet (Pawel *et al.*, 1981).

Table 1: Chemical composition (g/100g DM) of Vetiver grass (VG) ensiled with cassava peels

Parameters	A	B	C	D	±SEM
Crude fibre	24.33	23.87	22.65	22.61	3.54
Crude protein	8.97	8.72	8.52	8.48	0.51
Ether extract	9.32	9.37	9.42	9.39	0.23
Ash	9.73	9.77	9.82	10.05	0.32
NDF	48.68	45.73	43.75	40.81	7.89
ADF	27.69	25.75	22.75	21.45	6.24
ADL	7.69	7.52	7.34	7.24	0.45

^{SEM} = standard error of means ^{a,b,c} means with the same superscripts on the same row are not significantly($p > 0.05$) different

Table 2: Rumen VFA, pH, and NH_3-N of goats fed vetiver grass ensiled with cassava peels

Parameters	A	B	C	D	SEM
VFA	54.8^{d}	58.1^{c}	63.7^{b}	68.5^{a}	13.7
pH	7.93^{a}	7.81^{b}	7.52^{c}	7.25^{d}	0.68
NH_3-N	6.75^{bc}	6.72^{c}	6.81^{a}	6.77^{b}	0.09

.^{SEM} = standard error of means ^{a,b,c} means with the same superscripts on the same row are not significantly($p > 0.05$) different

Blood variables

Table 3 shows the blood variables of goats fed vetiver grass ensiled with cassava peels at different ratio. The mean concentrations of packed cell volume (30.0-31.0%), heamoglobin (10.9-12.7g/100mL) and white blood cell count (10.25-10.67×10^3/ul) obtained in this result were within the normal range. The positive influence of these diets on blood parameters is in agreement with the work of Orskov and Ryle (1990) who observed that feeding levels affected heamoglobin and packed cell volume. Rekwot *et al.* (1997) stated that there is a relationship between nutrition and blood profile and that protein deficiency can lead to clinical anaemia due to decreased erythrocytes and hyperproteinemia. Alabi (2005) also reported that the plane of nutrition affects heamoglobin level. Heamoglobin is important for oxygen transport. Values obtained for total protein

(6.42-7.50g/dL), cholesterol (60.95-66.19mg/dL) and glucose (85.36-89.04mg/dL) were within the normal physiological range reported for healthy goats (8).Total protein is an indication of protein quality in the diets. Hewet, (1974) reported that cholesterol level of 180mg/dl and below is safe and may not result in arteriosclerosis. The cholesterol concentration obtained in this study therefore suggests a safe concentration. Plasma urea nitrogen ranged from 4.36-5.16mm/l, these values were similar to (4.24-5.56mm/l) reported by Agbedana (1977.) when grass silage supplemented with barley or molasses based supplements was fed. The values obtained in this study were low to medium levels (2.0-6.37) suggesting better urea nitrogen utilization. Moloney *et al*. (1994) stated that a high value of plasma urea nitrogen indicates an inability of the animal to utilize nitrogen made available by digestion. Rumen ammonia enters the plasma urea pool after it has been absorbed into the blood and is converted to urea by the liver. Woodman and Evans, (1974) suggested that rumen ammonia and blood urea may serve as effective indices of nitrogen utilization.

Table 3: Blood parameters of goats fed vetiver grass ensiled with cassava peels at different ratio

Parameter	A	B	C	D	SEM
PCV(%)	30.03	30.03	31.0	31.0	0.01
Heamoglobin	10.9^{b}	11.3^{b}	12.3^{a}	12.7^{a}	0.05
WBC ($x100^{9}$/l)	10.25^{c}	10.54^{b}	10.67^{a}	10.25^{c}	0.42
Plasma urea-N (mm/l)	5.16^{a}	4.92^{ab}	4.56^{b}	4.36^{b}	0.80
Total protein (g/dl)	7.50^{a}	7.40^{a}	6.54^{b}	6.42^{b}	0.18
Cholesterol (g/dl)	66.19^{a}	64.32^{b}	65.52^{a}	60.95^{c}	0.24
Glucose (mg/dl)	85.35^{b}	86.34^{b}	87.88^{ab}	89.04^{a}	3.68

^{SEM} = standard error of means; ^{a,b,c} means with the same superscripts on the same row are not significantly($p>0.05$) different.

Conclusion

This study has shown that vetiver grass ensiled with cassava peels had beneficial effects on the rumen environment and blood profile of the experimental animals.

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