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Rumen Characteristics and Blood Parameters of West African Dwarf Goats Fed Vetiver Grass Ensiled With Cassava Peels at Different Ratio.

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Abstract

An experiment was carried out to determine the effect of ensiling 4 week re-growth of vetiver grass with cassava peels on rumen and blood metabolites of West African Dwarf goats (WAD). Sixteen goats were used for the study. A completely randomized design was used with four animals per treatment. Vetiver grass ensiled with cassava peels at ratio 80:20, 70:30, 60:40 and 50:50 were provided *ad-libitum* 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 (7.25-7.93mg/100ml), pH (6.75-6.81) variation among the treatments are 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), hemoglobin (10.9-12.7g/100ml), Packed Cell Volume (30.0-31.0%) and white blood cell (10.25-10.67×10^3/µl) were within the range reported for healthy goats.

Keywords: ammonia-nitrogen, hematology, pH, serum biochemistry, volatile fatty acids (VFA).

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 industries 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 and 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 hematological 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

Experimental site

The experiment was carried out at the sheep and goat production unit of National Center for Genetic Research and Biotechnology (NACGRAB), Moor plantation, Ibadan.

Treatments and experimental design

Sixteen West African Dwarf goats of weight ranging into 8.80kg were 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 4 week re-growth of vetiver grass ensiled with cassava peels at different ratio: T1= 80%vetiver+20% cassava peels, T2=70%vetiver+30% cassava peels, T3= 60% vetiver+40% cassava peels and T4= 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. 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(HCl) were added and stored in a deep freezer and later analyzed for ammonia-nitrogen (Roy Markham, 1942), total volatile fatty acid (VFA) (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 hematological analysis. Blood samples for serum biochemical analysis were allowed to clot. All the hematological and serum biochemical were analyzed as outlined by (Ochei and Kolhatkar, 2000).

Statistical analysis:

Data obtained were subjected to analysis of variance (ANOVA) using the procedure of SAS (2007). Significant means were separated using Duncan Multiple Range Test of the same software.

Results and discussion:

Chemical composition of the silage 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 fiber contents of the silage. Values obtained for rumen pH, rumen ammonia-nitrogen and volatile fatty acids were presented in Table 2. There were variations in pH among the treatments, these variations were within normal pH range of the rumen environment, the pH obtained (6.72 - 6.81) were within the range for optimum rumen fermentation. Ndlovu (1992)

reported (6.5 – 6.8) being optimal for maximum cellulolysis. 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 from 7.25-7.93mgNH_3/100ml. Leng and Nolan (1984) also reported optimum rumen ammonia concentration ranging 5-20mg NH_3/100ml. Satter and Slyter (1974) and (Satter and Roffler 1976) reported 50mg/l as the optimum ammonia concentration for microbial growth, while Pawel *et al.,* (1981) in an in vitro experiments reported 3.6 to 17mg/100ml. The values obtained (7.25-7.93mgNH_3/100ml) in this study were in agreement with these reports, the concentration of ammonia nitrogen which promotes maximum microbial protein production is an important factor in determining the utilization of nitrogen in the rumen. High ammonia-nitrogen concentration indicates a more stable environment necessary for efficient microbial fermentation (Orskov, 1982), while low ammonia-nitrogen concentration indicates slow and poor degradation of the diets, lower rumen ammonia concentration might also be due to ammonia diffusion out of the rumen or is being utilized in microbial protein synthesis. 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 in 20% inclusion of cassava peels to 68.5mm/l in 50% inclusion level of cassava peels could be associated with increase in digestibility of the diet (Orskov and Ryle, 1990).

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%), haemoglobin (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 reported in this study is in agreement with the work of Orskov and Ryle (1990) who observed that feeding levels affected haemoglobin and packed cell volume. Rekwot *et al.,* (1997) stated that there is a relationship between nutrition and blood profile, she reported that protein deficiency can lead to clinical anemia due to decreased erythrocytes and hyperproteinemia. Alabi, 2005 also reported that the plane of nutrition affects haemoglobin level. Haemoglobin 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 (Daramola *et al.,* 2005). 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 Moloney *et al.,* (1994) 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. Woodman and Evans (1974) 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. Egan and Kellaway (1971) suggested that rumen ammonia and blood urea may serve as effective indices of nitrogen utilization.

Conclusion

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

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

Parameters	80:20	70:30	60:40	50:50	±SEM
Crude fiber	24.33[a]	23.87	22.65	22.61	0.54
Crude protein	8.97[a]	8.72	8.52	8.48	0.51
Ether extract	9.32[b]	9.37	9.42[a]	9.39	0.23
Ash	9.73	9.77	9.82	10.05	0.32
NDF	48.68[a]	45.73	43.75	40.81	0.89
ADF	27.69	25.75	22.75	21.45	0.24
ADL	7.69	7.52	7.34	7.24	0.45

SEM = standard error of means [a,b] 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 at different ratio.

Parameters	80:20	70:30	60:40	50:50	SEM
VFA	54.8^{d}	58.1^{c}	63.7^{b}	68.5^{a}	13.7
NH_3-N	7.93^{a}	7.81^{b}	7.52^{c}	7.25^{d}	0.68
pH	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.

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

Parameter	80:20	70:30	60:40	50:50	SEM
PCV (%)	30.0	30.0	31.0	31.0	0.01
Haemoglobin	10.9^{b}	11.3^{b}	12.3^{a}	12.7^{a}	0.08
WBC ($\times 10^9$/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(mg/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.

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