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Rumen Parameters of West African Dwarf (WAD) Goats Fed Cassava Peels- Poultry Manure Concentrate Supplements

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Abstract— *This experiment was conducted to evaluate the effects of supplementing cassava peels with dried poultry manure on rumen parameters of West African Dwarf (WAD) goats. Twenty growing West African Dwarf bucks aged 5-7 months with an average body weight of 5.05±0.02kg were used in a completely randomized experiment. The goats were randomly assigned to one of the five dietary treatments which consisted of processed cassava peels and dried poultry manure in different ratios of 100:0(diet 1), 50:50(diet 2), 60:40(diet 3), 70:30(diet 4) and 80:20(diet 5). Data collected were subjected to analysis of variance. The result indicated that among all the parameters examined, acetic acid was significantly (P<0.05) influenced by dietary treatments at the start of the experiment and ranged from 20.77mol/100ml to 26.18mol/100ml while pH and acetic acid were significantly (P<0.05) influenced at the end of the trial. There was a significant (P<0.05) increase in value of acetic acid across the treatments at the end of the experiment. The study revealed that supplementing the diets of goats with cassava peels and poultry manure has the potentials of meeting the nutritional needs of the animal without negative effects on the rumen parameters.*

Keywords— ***Cassava Peels, Poultry manure, WAD, Rumen parameters.***

I. INTRODUCTION

Inadequate availability of animal feed in terms of quality and quantity is a major challenge for livestock production, sustainability and profitability (Ajagbe *et al*., 2015, Abo zeid *et al.,* 2017). Natural herbage which used to serve as feed stuffs for ruminant often decline in quality and quantity during dry season. More so, using cereals grains in ruminant diets is considered to be a direct conflicting competition between livestock production and human nutrition (Abo zeid *et al.,* 2017). As a result, livestock producer especially ruminant both at smallholders and commercial production levels have to seek for alternative feed resources without sacrificing quality of feed and productive performance of the animals. As a result of the fore going research efforts have been shifted to use of cheap sources of agro- based industrial by- product and organic waste as supplements in ruminant production. Parts of these feed resources are cassava peel and poultry manure. FAO (2005), stated that productive feeds for the ruminant livestock could be prepared with various components of cassava plant such as tuber, peels, pulp etc as non-structural carbohydrates and fermentable energy source. Dried poultry manure would provide fermentable nitrogen required for optimum utilization of the readily fermentable carbohydrates of the cassava peels in the concentrate diets (Yousuf *et al.,* 2013). Ruminant animals are unique in their feeding status based on the physiology of their rumen. Therefore, adequate feeding to meeting the nutritional need of the rumen microbes plays vital role in ruminant animal nutrition. Mohammed and Chaury, (2008) indicated that rumen fermentation products such as volatile fatty acids are essentials nutrients to meet the demand of rumen microbes and animals body build up. This study was carried out to evaluate rumen parameters of growing West African Dwarf goats fed cassava peel meal and dried poultry manure concentrate supplements.

II. MATERIALS AND METHODS

The experiment was carried out at the Sheep and Goat Unit of Department of Animal Production, Kogi State, University, Anyigba, Kogi State. Anyigba is located in the derived

Savannah of Nigeria on Latitude 7^0 15^1 and 7^0 29^1N of the equator and Longitude 7^0 11^1 and 7^0 32^1 E of the Greenwich meridian (Ifatimehin *et al*., 2006). The wet season spreads over a minimum of seven (7) months and it extends from late April to October with the dry season spanning from November to March with an appropriate of five (5) months. Rainfall here is highly seasonal and September is the rainiest month with short dry season (break) in August with a mean annual rainfall ranging from 150mm to 250mm. The area has a humidity of about 70% on the average and a mean annual temperature of 27^0C (Iji, 2007). The area is characterized by luxuriant growth of many tall grass species like Gambia grass (*Andropogon tectorium*, *Andropogon gayanus*), Elephant grass (*Pennisetum purpuerm*), Guinea grass (*Panicum maximum*) and some short grasses (Ifatimehin *et al*., 2006). Fresh cassava peels, free from stumps were collected and grated before being subjected to hydraulic press for dewatering. The dewatered peels were then pulverized and sieved to obtain the coarse mash, which was then sun-dried for 2-3days before being loaded into bags for feeding animals (Ajagbe *et al.*, 2019). Cassava foliage was harvested fresh and sun dried until the leaves became brittle for milling.

Experimental Procedure

A total of twenty (20) West African Dwarf bucks of about 5-7 months, having an initial weight between 5.00kg to 6.50 kg were obtained from goat producers within Anyigba town for 60 days experiment. Goats were housed semi-intensively in well-ventilated wooden cages in the pens. The cages were built on wooden stands, 40 cm from the floor. Before the goats were brought in, the pen was cleaned, washed and disinfected with izal solution two weeks prior to arrival. The entire goat house was fumigated using strong fumigants (Dimethoate 40% and Action 40%) against fleas. Prophylactic treatments were given to all the goats: they were dewormed and vaccinated against pests des petits ruminantae (PPR). Treatment against ecto-parasites was done with the use of Amitraz solution. Multivitamin was also administered to boost appetite. The goats were randomly distributed to 5 treatments of 4 animals each. A 14 days adjustment period was allowed for the goats before data collection commenced. Concentrate supplements were fed daily on 5% body weight after 5-7 hour grazing. The weighing of the goats was done weekly to determine the weight gain.

The goats were randomly assigned to five treatments with four replicates in a Complete Randomize Design (CRD). 100% treated cassava peel was allotted to T1 as the control diet, 50% untreated cassava peel + 50% cassava foliage was allotted to diet 1, 60% untreated cassava peel + 40% cassava foliage was allotted to diet 2, 70% cassava peel + 40% cassava foliage diet 3 and 80% Cassava peel + 20% cassava foliage allotted to diet 4 respectively. Goats were fed daily supplementary diets on 5% body weight after about 5-6 hours daily grazing.

Rumen Fluid Collection

Rumen liquor samples were collected from two animals per treatment at the start and end of the feeding trial with the use of stomach tube as describe by (Wanapat and Khampa2007) 20ml of the rumen liquor was collected from two replicates per treatment into sample bottles, the rumen pH of each sample was determined immediately after collection using the Jenway pH meter, model 3150 and immediately stored in the freezer at -5° C. until analysis. Rumen fluid sample were strained through four layers of cheese cloth.

Laboratory Analysis

Proximate composition of the experimental diets was analyzed according to the methods of Association of Official Analytical Chemists (AOAC) (2005). Individual volatile fatty acids production was determined using gas chromatography (Mabrahtu and Tenaye, 1997).

Statistical Analysis

Data collected were subjected to one way analysis of variance (ANOVA) SPSS (20).The Mean separations were compared using Duncan's Multiple Ranged Test.

Table 1: Gross Composition of experimental diet (%)

Ingredients	**T1**	**T2**	**T3**	**T4**	**T5**
Cassava Peels	100	50	60	70	80
Cassava Foliage	-	50	40	30	20
Total	100	100	100	100	100

III. RESULTS

Nutrient composition of supplementary diets is shown in Table 2. Dry matter (DM) ranged between 89.16% and 89.90%, diet 2 had higher value than other treatments. Observed value for crude protein ranged between 11.11% and 12.44% with diet 2 having the highest value. Values obtained for crude fibre indicated that diet 2 had higher value while diet 5 had the lowest value**.**Ash contents was higher in diet 2 (3.19%) while diet 1 had higher nitrogen free extract (86.12%).

Table 2: Nutrient Composition of Cassava peel- poultry manure concentrate supplement (%)

Nutrient	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Dry Matter	89.16	89.90	89.76	89.60	89.46
Organic Matter	86.66	82.53	86.71	86.69	86.68
Crude Protein	5.27	12.44	11.94	11.53	11.11
Crude Fibre	4.45	6.34	5.96	4.59	5.20
Ether Extract	0.82	0.74	0.75	0.77	0.79
Ash	2.50	3.19	3.05	2.91	2.78
Nitrogen Free Extract	86.12	72.29	73.30	74.82	75.12

Rumen parameters of West African Dwarf goats fed cassava peels and dried poultry manure concentrate supplements is shown in Table 3. At the start of the experiment, acetic acid and butyric acid were significantly (P<0.05) influenced by dietary supplements while pH, lactic acid and propionic acid were not (P>0.05) significantly different among the treatments. Acetic acid ranged between 20.77mol/100ml and 26.18mol/100lml with diet 3 having higher value. Propionic acid differed (P<0.05) among the treatments ranging from 19.15 to 22.14% following similar trend of higher value in diet 3. The values of pH ranged from 6.48 to 7.14, lactic acid (47.43mol/100ml-48.18mol/100ml).All parameters examined at the end of the trial were not significantly different (P>0.05) among the dietary treatments except pH and acetic acid. Higher value of acetic acid was observed for diet 2 (38.70mol/100ml). Values obtained for diet 1,3,4 and 5 were similar but different from diet 2. Values of pH significantly ranged between 6.64 and 7.11 pH. Lactic acid and propionic acid had higher values for diet 4 (14.62mol/100ml and 20.63mol/100ml) respectively while butyric acid had higher value for diet 2 (22.92mol/100ml).

Table 3: Rumen parameters of WAD goats fed cassava peels-dried poultry concentrate supplements.

	Diets						
Parameters	T1	T2	T3	T4	T5	SEM	LOS
At the start of the experiment							
pH	6.52	6.48	7.14	6.72	6.49	0.12	NS
Lactic acid (mol/100ml)	47.43	48.06	48.12	47.97	47.43	0.34	NS
Acetic Acid (mol/100ml)	24.15^{ab}	25.40^{a}	26.18^{a}	20.77^{b}	25.11^{a}	0.72	*
Propionic Acid (mol/100ml)	20.12	19.50	22.06	20.90	20.33	0.41	NS
Butyric Acid (mol/100ml)	19.46^{ab}	19.39^{ab}	22.14^{a}	18.54^{b}	19.15^{b}	0.48	*
At the end of the Experiment							
pH	6.82^{ab}	6.64^{c}	7.11^{a}	6.72^{c}	7.01^{ab}	0.63	*
Lactic acid (mol/100ml)	14.14	13.83	14.26	14.62	14.30	0.11	NS
Acetic Acid (mol/100ml)	28.17^{b}	38.70^{a}	29.09^{b}	28.22^{b}	29.38^{b}	1.35	*
Propionic Acid (mol/100ml)	20.31	18.82	19.47	20.63	19.43	0.31	NS
Butyric Acid (mol/100ml)	20.59	22.92	19.16	22.17	21.15	0.56	NS

IV. DISCUSSION

Dry matter values of the experimental diets ranged from 89.16%- 89.90%. Crude protein values decreased with decrease ratio of poultry manure supplementation. The dry matter content in this study was higher than 85.00% to 88.50% reported by Yusuf *et al*. (2013). The dry matter content was higher than 83.23-85.60% reported by Ajagbe *et al.* (2020) in their study with West African Dwarf goats fed nitrogen supplemented cassava peel meal. Organic matter content varied between 82.53% and 86.77%. These values are higher than 77.86 -80.53 reported by Ajagbe *et al.* (2020). Crude protein content was lower than 10.00% to16.0% reported by Yusuf *et al.* (2013*)* for their study with young WAD goats fed broiler litter waste and urea based diets. Values of crude fibre content ranged from 6.20% to 9.34%. These values were lower than 5.50% to 25,00% reported by Bello and Tsado (2013). Ether extract content was lower compared to 5.00% to 20.00% reported by Bello and Tsado (2013) for their study on Yankasa rams fed sorghum stover supplemented with graded levels of dried poultry droppings based diets. Ash content values in this study were lower than 10.50% -10.89% reported by Bello (2017) for finger millet straw supplemented with varying levels of dried poultry dropping based diets. Nitrogen free extract in this study was lower than 7.29% -14.56% reported by Ukanwoko and Ibeawuchi (2009). Variation in nutrient composition of experimental diets might be attributed to different feed ingredients, processing methods of feed ingredients, soil condition on which the feed materials used was harvested and other factors such as climatic factors of the location etc.

All the pH values recorded fell within the reported values (6.00-7.20 pH) suitable for the growth and activities of rumen microbes (Jallow and Hsia, 2011). Kamra (2005) stated that a range of 6.0- 6.9 pH can facilitate optimum growth of rumen bacteria. Among the parameters examined at the start of the experiment for volatile fatty acids, acetic acid and butyric acid were significantly ($P<0.05$) influenced by treatment diets. Values of acetic acid for diets 1,2,3 and 5 were similar but different from diets 1. The values of acetic obtained in this study were higher for diet 3. These values were lower compared to the values (52.5-68.9mol/100ml reported by Abo zeid *et al.* (2017). The values were also lower than 42.03mol/100ml- 46.65mol/100ml reported by Okoruwa *et al.* (2016). Butyric acid values were higher than 8.80-12.47mol/100ml reported by Adebayo *et al.* (2017) for their study on rumen fermentation characteristics of West African Dwarf goats fed enzyme supplemented total mixed ration in the dry season. The values were higher than 16.77mol/100ml-18mol/100ml reported by Puga *et al.* (2001) for sheep fed controlled release urea supplements. Variations in the values might be attributed to physical fibrousness, levels of starch content and carbohydrate solubility of the different dietary treatments used in different studies conducted. Aside from lactic acid, values acetic acids obtained indicate that acetic acid predominates the volatile fatty acid production followed by propionic and butyric acid. Values of pH obtained were comparable to 6.47- 6.67 reported by Puga *et al.* (2001) but higher than 5.97-6.17 reported by Oni *et al.* (2017). Lactic acid values obtained at the start of the trial were higher than 5-21mol/1ooml reported by Suarez *et al.* (2006). Values of propionic acid obtained were lower than 21.6mol/100ml -28.8mol/100ml reported by Suarez *et al* (2006) in their study on effects of different levels of roughage- concentrate dietary treatments on rumen fermentation characteristics of sheep. The difference in values obtained by different authors might be attributed to nature of the diets fed to the animals as well as the chemical composition of the test ingredients.

At the end of the study, values of pH obtained were higher than 6.22-7.01 reported by Njidda *et al.* (2016) on rumen fermentation parameters of Red Sokoto goats fed cowpea husk replacing *Daniella oliveri* leaf. The values are comparable to the normal value range of 6.0-7.0 reported by Petrovski (2017). The observed non- significant value of the volatile fatty acids examined indicated that lactic acid and acetic acid reduced across the treatments while propionic acid increased in diet1. Butyric acid values were higher at the end of the study for diet 1, 2, 4 and 5. The increased value of butyric acid might be attributed to levels of carbohydrate degradation of the cellulosic substances present in the feed. Higher values of propionic were observed in diet 3 at the start of the study than at the end of the trial.

V. CONCLUSION

Based on the results obtained in this study, supplementing the diets of grazing growing West African Dwarf goats with cassava peels and dried poultry manure has the potentials of meeting the nutritional needs of the animals without adverse effects on the rumen parameters.

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CONFLICT OF INTEREST

The authors declared that they have no conflicts of interest with the contents of this article.

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