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Supplemental Effects of Cassava Sieviate Meal with *Panicum Maximum* as Basal Diet on Growth Performance of West African Dwarf Goat

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Abstract
The effects of feeding diets containing cassava *fufu* sieviate meal (FSM) on growth performance of West African Dwarf (WAD) goats were investigated. Thirty six, 5-8 week old WAD goats with an average weight of 6.52 kg were randomly distributed into four groups to assess four treatment diets. Four diets T_1, T_2, T_3, and T_4, were formulated to contain FSM at 0%, 20%, 40% and 60% FSM respectively, in a completely randomized design. Each animal received a designated treatment diet in the morning for 98 days. Feed offered was based on 3.5% body weight per day; the animals in addition were fed a kg wilted chopped *Panicum maximum* later in the day as basal diet to enhance rumination and chime chewing. The FSM result showed high dry matter and energy values. The fibre fractions were relatively low in the FSM and moderate for the experimental diets. Growth performance data indicated that body weight gain and feed conversion ratio were significantly improved ($p<0.05$) and better for goats on FSM diets compared with the control. Dietary treatments, however did not influence ($p>0.05$) feed intake, dry matter intake and dry matter intake as percentage of body weight. It was therefore concluded that replacement of 60% of maize offal with FSM resulted in superior growth performance of WAD goat over the control diet.

Keywords: Cassava sieviate, goats, feed, *Panicum maximum*, *Manihot esculenta*

Introduction

Cassava (*Manihot esculenta* Crantz) is a non-seasonal crop grown in the tropics and subtropics mainly for its underground starchy tuberous roots. Recently cassava annual production has increased by approximately 100 million tonnes since 2000 (Morgan and Choct, 2016), this may be partly due to high demand for cassava food products and for dried cassava by-products for use in livestock and poultry feeds. Cassava production is vital as it is seen as the future of food security in Nigeria; with approximately 500 million people currently depend on it as a major carbohydrate source (Montagnac *et al*., 2009). Cassava is a drought and disease tolerant crop, with high underground storage ability and can be planted in a poor soil with flexible harvesting dates. FAO (2014) reported 4.6% cassava output growth in 2013 and 2014, with Nigeria being the world largest producer. Under tropical conditions it is the most productive crop in terms of energy yield per unit land area, with a yield of between 25 and 60 tonnes/ha (1 ha ¼ 10,000 m2) (Garcia and Dale,1999). These have enhanced the availability of cassava by-products for livestock feed. One of such by products from cassava processing that has no human or industrial use at the moment and can be incorporated into goat feeding due to its high energy and fibre density, local availability and not affected by seasonality is fufu sieviate.

This experiment was therefore carried out to determine the growth performance of WAD goats fed fufu sieviate meal.

Materials and Methods

The research work was carried out at the sheep and goat unit of Federal College of Agriculture, Ishiagu, Ivo Local Government Area of Ebonyi State. The fufu sieviate was sourced within Ishiagu and Agwu communities. The fufu sieviate is a by-product of cassava root. It is gotten after the cassava roots meant for fufu production are peeled or not, washed clean and soaked in clean water for 3-5 days to ferment so as to reduce the hydrogen cyanide level and also to soften the roots to enable sieving. Thereafter, the soaked cassava roots are sieved, the sieviate (waste) collected and sundried for about 5 days to reduce the moisture contents and possible anti-nutrients that were not removed during the fermentation process. The sundried fufu sieviate was milled using hammer mill and later used in the formulation of the experimental diets.

Four diets T_1, T_2, T_3, and T_4, were formulated. The FSM was included at the levels of 0%, 20%, 40% and 60% for T_1, T_2, T_3, and T_4, respectively as presented in Table 1. All feeds and test ingredients were analyzed for proximate compositions using the method of AOAC (2000). Gross energy was calculated using the formula $T = 5.72Z_1 + 9.50Z_2 + 4.79Z_3 + 4.03Z_4 \pm 0.9\%$; where T = Gross energy, Z_l = Crude protein, Z_2 = Crude fat, Z_3 = Crude fibre, Z_4 = Nitrogen free extract (Nehring and Haelein, 1973).

Thirty six (36) WAD goats of about 5 – 8 months of age were selected from the College flock for this experiment. The goats were randomly divided into 4 groups of 9 animals each with 3 goats constituting a replicate. The four treatments were assigned to the four experimental diets in a Completely Randomized Design (CRD). The goats were housed individually in well ventilated cement floored pens equipped with feeders and drinkers. Each animal received a designated treatment diet in the

morning for 98 days. Feed offered was based on 3.5% body weight per day; the animals in addition were fed a kg wilted chopped *Panicum maximum* later in the day as basal diet to enhance rumination and chime chewing. Regular access to fresh drinking water was made available. Feed offered and refused were recorded on a daily basis. Average initial weights of the animals were taken at the beginning of the trial and weekly subsequently.

Data generated from the study were statistically analyzed using the Special Package for Social Sciences Window 17.0. One-way analysis of variance (ANOVA) was employed to determine the means and standard error. Treatment means were compared using Duncan's new multiple range test (Duncan 1955).

Table1: Composition of the experimental diets

	Dietary Level (%)			
Ingredients	T1	T2	T3	T4
*Fufu*sieviate meal	0.00	20.00	40.00	60.00
Maize offal	60.00	40.00	20.00	0.00
Groundnut meal	8.00	8.00	8.00	8.00
Wheat offal	27.50	27.50	27.50	27.50
Bone meal	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
Salt	1.00	1.00	1.00	1.00
Vitamin premix	0.50	0.50	0.50	0.50
Total	100	100	100	100

Results and discussion

The proximate composition of the experimental diets, fufu sieviate meal and *Panicum maximum* are presented in Table 2. The proximate composition of *Panicum maximum* in this study is in comparison with the values reported by Odedire and Babayemi (2008) and Onyeonagu and Eze (2013) for the same tropical forage. The crude protein content of the fufu sieviate is below the acceptable 7% CP for ruminant performance as recommended by ARC (1980) and 8% suggested by Norton (1994) for ruminal function. The fibre fractions (NDF, ADF and hemicellulose) have implication on the digestibility of plants. The neutral detergent fibre (NDF), which is a measure of the plants' cell wall contents, is the chemical component of the feed that determines its rate of digestion. Odedire and Babayemi (2008) noted that the higher the NDF, the lower the plant's digestible energy. The values obtained for the fufu sieviate may imply moderate cell wall content. The Acid detergent fibre (ADF) consist mainly the lignin and cellulose. Hemicellulose has been reported to be more digestible than cellulose (Gillespie, 1998). The reportedly lower values of the fibre fractions are in agreement with the findings of Boonnop *et al*. (2009) for the same cassava by product. The high energy value reported for the sieviate is in agreement with Khampa *et al*. (2009) who noted that cassava roots contain high levels of energy and have been used as a source of readily fermentable energy in ruminant rations. The high dry matter value reported is favourably compared with the values of Boonnop *et al*. (2009). The proximate composition of the experimental diets revealed that the crude protein and the energy requirements are within the ranges reported for goats (ARC, 1980; NRC 1981; Norton, 1994). The DM, CP, ash NDF, ADF and hemicellulose were higher in the control, but however compared to the treatment groups.

Table 2: Proximate composition of the experimental diets, FSM and *Panicum maximum*

Nutrients (%)	Treatments					
	T1(0)	**T2(20)**	**T3(40)**	**T4(60)**	**FSM**	**PM**
Dry matter	89.95	90.40	91.00	91.44	88.60	30.93
Crude protein	13.83	13.52	13.39	12.85	2.57	5.34
Crude fibre	17.82	18.70	18.98	20.11	13.38	12.64
Ash	4.21	4.18	4.03	3.50	1.80	4.01
Ether Extract	3.41	3.46	4.31	3.64	2.71	3.17
Nitrogen free extract	47.71	48.63	50.52	52.16	68.14	26.37
Gross energy (MJ/kg)	3.89	3.96	4.12	4.15	3.79	2.27
Neutral detergent fibre	51.82	39.34	33.71	32.81	25.34	58.31
Acid detergent fibre	49.83	38.90	31.82	29.29	6.68	28.60
Hemi cellulose	17.26	12.84	16.36	15.72	8.66	19.17

FSM = f*ufu* sieviate meal; PM = *Panicum maximum*

The feed intake and body weight changes of WAD goats fed diets containing FSM is presented on Table 3. Data on average daily feed intake (ADFI), average daily dry matter intake, and average daily weight gain (ADWG) is presented in Figure I. There are significant ($p < 0.05$) variation in final weight gain, total weight gain, ADWG and feed conversion ratio (FCR) among the groups. There were no significant differences ($p > 0.05$) in feed intake, dry matter intake and dry matter intake as percentage of body weight between the treatment groups and control. The final body weight, total weight gain and ADWG showed significant ($p < 0.05$) linear increase with increasing levels of *fufu* sieviate across the groups. The improved weight gain observed among the treatment groups in comparison to the control maybe attributed to the high energy and fibre values which may have supported growth among the goats. This is in tandem with earlier report of Jiwuba *et al*. (2016) for WAD goats fed pro-vitamin A cassava peel. The non-significant high feed intakes reported in this study may indicate high palatability of the diets. The dry matter intake observed values expressed as percentage of the animal's body weight (3.5%) agreed with the recommended value of ARC (1980), an evidence that the diets were palatable and acceptable to the animals which may be attributed to the protein quality of the diets. However, animals fed the control diet had the highest dry matter intake as percentage of body weight compared to values recorded for other groups. The superior FCR of diets T3 and T4 over the other diets is a reflection of the observed higher growth rates and higher feed utilization of the goats fed the respective diets.

Table 3: Feed intake and body weight changes of goats feed diets containing *fufu* sieviate meal

Parameters	T_1	T_2	T_3	T_4	SEM
Initial Body Weight (kg)	6.34	6.21	6.98	6.55	0.22
Final Body Weight (kg)	8.72^{b}	9.83^{ab}	10.92^{a}	10.78^{a}	0.64
Total Weight Gain (kg)	2.38^{c}	3.62^{b}	3.94^{b}	4.23^{a}	0.29
Total Feed intake (kg)	29.62	30.76	29.98	31.14	2.52
Total Dry Matter intake (kg)	26.64	27.81	27.28	28.47	0.66
Feed Conversion Ratio	12.44^{a}	8.50^{b}	7.61^{c}	7.36^{c}	0.64
DMI % BWT concentrate (%)	3.06	2.83	2.50	2.64	0.12
DMI % BWT forage (%)	1.05	0.97	0.85	0.89	0.09
Total dry matter intake % BWT (%)	4.11	3.80	3.35	3.53	0.14

$^{a\text{-}c}$ means in the row with different superscripts are significantly different ($p < 0.05$)

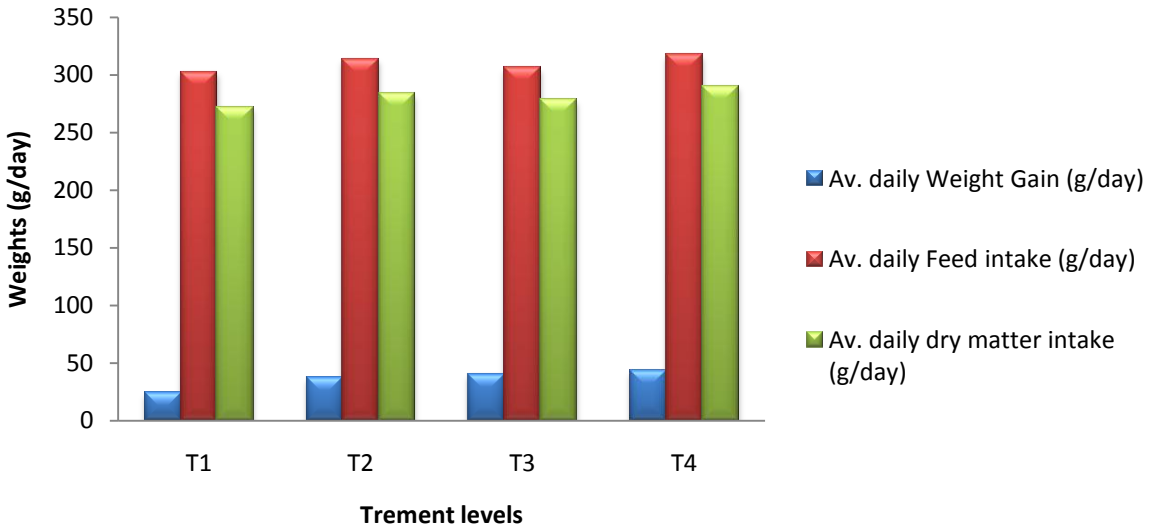


Fig. I: Effects of FSM on daily feed intake, daily dry matter intake and daily weight gain

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