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INFLUENCE OF METHIONINE AND LYSINE SUPPLEMENTATION ON NUTRIENT DIGESTIBILITY IN WEANED RABBITS FED GRADED LEVELS OF SWEET POTATO VINES

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ABSTRACT

This experiment was conducted to evaluate the effect of feeding sweet potato vines on the digestibility in seventy-two weaned rabbits comprising males and females between six and weeks old, with initial liveweight ranging from 600 1130 g. They were allocated to twelve treatment diets in a 3 x 2 x 2 factorial experiment in a completely randomized design. The factors were sweet potato vines (0, 15 and 30 %), methionine (0.07 and 0.1 kg supplemental levels) and lysine (0.12 and 0.15 kg supplemental levels).the study lasted ten days with three days adjustment to crates and seven days of fecal and urine collection. Dry matter, crude fibre, ether extract, ash, acid detergent fibre and neutral detergent fibre digestibility decreased significantly as level of sweet potato vine increased. Interaction between sweet potato vines and lysine showed significant difference in acid detergent fibre and neutral detergent fibre. High level of methionine and lysine supplementation resulted in higher nutrients digestibility. It was concluded that supplementation of higher levels of methionine and lysine (0.1 and 0.15 kg) respectively in the diets of rabbits improved nutrient digestibility.

Key words: sweet potato vines, nutrient digestibility, methionine, lysine, weaned rabbits

INTRODUCTION

The use of leaf meals could help in alleviating the competition between humans and animals for some conventional feedstuffs, such as soybean meal and maize (Al-Harthi *et al*., 2009).

Sweet potato *(Ipomoea batatas)* is a herbaceous creeper plant which resists draught, has short generation interval of about four months, and can therefore be planted twice a year; hence its availability throughout the year is not in doubt (Hong *et al*., 2003). The leaves of this plant have been used in the tropics as a cheap protein sources in ruminant feeds probably as a result of its high protein contents (An, 2004; Ekenyem and Madubuike, 2006). For instance, reports from several authors (Ali *et al*., 1999; Ishida *et al*., 2000; Ekenyem and Madubuike, 2006; Adewolu, 2008) indicated that the leaf has high protein content (26 to 35%) with high amino acid content in addition to its good mineral contents including vitamins A, B2, C and E.

Despite the good nutritive content of the leaf meal, it has been reported to contain some amount of antinutritive factors namely invertase and protease inhibitor (Tacon, 1993). Sweet potato vines are palatable to rabbits and have been found to be more palatable that *Leucaena leucocephala* and the foliage of other legume trees (Raharjo *et al.*, 1985).

Earlier, Oyenuga (1968) on observing the rich nutrient qualities of sweet potato leaves and stem recommended their use as source of feed for livestock in the tropics as using concentrates alone for raising rabbits would not be cost

effective. However, sweet potato leaves alone may not have a good balance of nutrients that can support the optimal performance of animals. The objective of this study was therefore to evaluate the effects

of methionine and lysine supplementation on nutrient digestibility in weaned rabbits fed graded levels of sweet potato vines

MATERIALS AND METHODS

Study Area

The study was carried out at Bayero University, Kano Animal Science Farm Research Unit. It is located at the new site of the University, about 5Km West of Kano City in Ungogo Local Government Area of Kano State. Kano is located within the general area demarcated by the lines of longitude 8°E and 9°E and latitude 12°N and 13°N in the Northern Guinea Savannah Zone of Nigeria. The area has two seasons, the wet (May-September) and dry seasons (October-April). The annual temperature and rainfall ranges between 21°C and 39°C and 787mm to 960mm respectively (KNARDA, 2001).

Experimental Design

A 3 x 2 x 2 factorial arrangement in a Completely Randomized Design was used for this study. The factors were sweet potato vine at 0, 15 and 30% level, methionine at low (0.07kg) and high (0.10kg) levels, and lysine at low (0.12kg) and high (0.15kg) levels. The treatments were allocated to the experimental units completely at random. The model used is as shown below

$y_{ijkl} = \mu + \alpha_i + \beta_j + \gamma_k + (\alpha\beta)_{ij} + (\alpha\gamma)_{ik} + (\beta\gamma)_{jk} + (\alpha\beta\gamma)_{ijk} + e_{ijkl}$.

Where;

y_{ijkl} = observation of factor 1 level i, factor 2 level j and factor 3 level k for the lth unit

μ = population mean of y

α_i = effect of factor 1 (sweet potato vine level)

β_j= effect of factor 2 (methionine level)

γ_k= effect of factor 3 (lysine level)

$(\alpha\beta)_{ij}$= interaction of factor 1 and factor 2

$(\alpha\gamma)_{ik}$= interaction of factor 1and factor 3

$(\beta\gamma)_{jk}$= interaction of factor 2 and factor 3

$(\alpha\beta\gamma)_{ijk}$= interaction of factor 1, factor 2 and factor 3

e_{ijkl} = random variation of the observation

Experimental Animals and their Management

A total of 72 weaned rabbits used in this study were obtained from a local farmer. The rabbits were mainly of heterogeneous population, between six to seven weeks old with initial live weight ranging from 600g to 1130g.Six rabbits were allocated to each treatment, with three replicates of two rabbits per treatment. The study was conducted for 70 days (ten weeks). The animals were dewormed with Wormazine Hydrosoluble Antihelmintic at a dosage of 1g/litre of drinking water, Keproceryl WSP (Hydro soluble mix of antibiotics and vitamins) at a dosage of 0.5g/litre of drinking water was administered for 5 days and AnupcoVitalyte at dosage of 10g to 20 litres of drinking water as an anti-stress factor. Sweet potato foliage with the proximate composition shown in Table 1 was sun-dried and milled to obtain the sweet potato vine meal which was used in diet formulation.

Table 1: Proximate composition of sweet potato vines

Parameter	(Dry matter %)
Dry matter	85.69
Crude protein	18.35
Crude fibre	14.14
Ash	12.10
Ether extract	0.27
Nitrogen free extract	40.83
Acid detergent fibre	22.90
Neutral detergent fibre	25.84
Hemicellulose	2.94

The rabbits were weighed before the feeding trial and the treatment diets (Table 2) were gradually given to the rabbits to replace the feed they were used to for a week in order to allow the rabbits adjust to the experimental diets. The rabbit house and cages were thoroughly cleaned and disinfected before placing the rabbits in the cages with dimensions of 0.5m x 0.5m x 0.5m (0.125m3). The house and cages were cleaned daily. Aluminum feeders with dimensions of 0.25m x 0.10m x 0.8m were used as feed troughs for feeding the rabbits. The feeding was done at 08.00hours of the morning. Clean water was supplied to the rabbits *ad libitum* in aluminum drinkers with dimensions of 0.20m x 0.10m x 0.8m. Feed refusal was collected in the morning, weighed and used to determine feed intake. The feeders and drinkers were washed with clean water daily before new feed and water were offered.

Table 2: Composition of treatment diets

Sweet potato vine (	**0**				**15**				**30**			
Methionine level	**Low**		**High**		**Low**		**High**		**Low**		**High**	
Lysine level	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Maize	21.97	21.97	21.97	21.97	21.97	21.97	21.97	21.97	21.97	21.97	21.97	21.97
Maize offal	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31
Wheat offal	14.66	14.66	14.66	14.66	12.46	12.46	12.46	12.46	10.26	10.46	10.26	10.26
Sweet potato vine	0.00	0.00	0.00	0.00	2.20	2.20	2.20	2.20	4.40	4.40	4.40	4.40
Rice bran	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31	18.31
Groundnut cake	23.03	23.03	23.03	23.03	23.03	23.03	23.03	23.03	23.03	23.03	23.03	23.03
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Palm oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.07	0.07	0.10	0.10	0.07	0.07	0.10	0.10	0.07	0.07	0.10	0.10
Lysine	0.12	0.15	0.12	0.15	0.12	0.15	0.12	0.15	0.12	0.15	0.12	0.15
Calculated	17.60	17.61	17.63	17.50	17.50	17.48	17.51	17.59	18.02	18.03	18.06	18.09
value	20.4.5	20.45	20.45	20.44	20.96	21.40	21.81	21.79	23.08	22.87	23.02	23.07
Crude protein	2602.	25312	2531.2	2548.1	2548.1	2547.3	2549.0	2548.1	2564.1	2564.3	2565.1	2566.0
Crude fibre	10	0	0	0	0	0	0	0	0	0	0	0
ME (Kcal/Kg)												

Roche VM502 premix supplied per Kg diet; Vitamin A: 12000 I.U; Vitamin D_3: 12000 I.U; Vitamin E: 3.6 I.U; Vitamin K: 1.8 mg Vitamin B_2: 3.6 mg; Nicotinate: 18 mg; Calcium-d-Pantothenate: 9.6 mg; Biotin: 0.36 mg; Vitamin B_{12}: 0.12 mg; Choline chloride: 120 mg; Chloteteracycline: 4.8 mg; Manganese: 24 mg; iron: 48 mg; zinc: 96 mg; Copper: 60 mg; Iodine: 1.8 mg; Cobalt: 48 mg ; ME = Metabolizable energy

Digestibility Study

The digestibility study was conducted at the end of ninth week of the feeding trial. Six rabbits were used per treatment in three replicates. The total amounts of feed given to two rabbits per replicate were recorded. The leftover and spilled feed were collected and weighed daily in the morning to calculate the feed intake. Faeces voided were collected from the particle-board floor of each cage cell of each replicate for seven days, sun-dried, weighed, recorded daily, stored in a cool and dry place in well labeled polyethylene bags, and used to determine digestibility criteria such as dry matter intake, and nutrient digestibility. Feed intake was determined daily for each replicate by weighing amounts of feed offered and leftover/spilled. The intake was expressed as the difference between the amount offered and the amount leftover/spilled.

Chemical Analysis

The sweet potato vines, diets, faecal droppings and rabbit carcass samples were analysed for chemical composition. The dry matter (DM), crude fibre (CF), ash, ether extracts (EE) and nitrogen free extract (NFE) were determined by method of AOAC (1990).The DM was determined by oven drying at 100°C to constant weight, fat by Soxhlet fat extraction method, Nitrogen–free extract (NFE) was calculated by the use of the following formula:

%NFE = 100 – (%CP + %CF + %EE + %Ash).

The acid detergent fibre (ADF), neutral detergent fibre (NDF) and hemicellulose were determined by the method of Van Soest *et al*. (1991). Hemicellulose was determined by the difference between NDF and ADF: NDF – ADF = Hemicellulose.

The nitrogen content was determined by the method of Kjeldahl (AOAC, 1990). Crude protein (CP) was calculated by multiplying the nitrogen content by 6.25.

Statistical Analysis

All data collected were subjected to analysis of variance using the General Linear Model Procedure (PROC GLM), for factorial experiment in a complete randomized design packaged in SAS (1987). When analysis of variance indicated significance for treatment effects, specific differences between means were detected and separated by Pair-wise Difference (pdiff) and Duncan's Multiple Range as described by Steel and Torrie (1980) and Duncan (1955).

RESULTS

Table 3 presents the effect of sweet potato vine level on nutrient digestibility of rabbits. Nutrient digestibility of dry matter, crude fibre, ether extract, ash, acid detergent fibre and neutral detergent fibre decreased as level of sweet potato vine increased. Dry matter, crude protein, crude fibre, ether extract, acid detergent fibre and neutral detergent fibre digestibility were higher in rabbits on 0% sweet potato vine than 15 and 30% sweet potato vine which were similar. Hemicellulose digestibility was higher in rabbits on 15% sweet potato vine than those on 0 and 30% sweet potato vine which were similar.

Table 3: Effect of sweet potato vine level on nutrient digestibility of rabbits

	Sweet potato vine level (%)				
Parameters	**0**	**15**	**30**	**SE**	**LOS**
Dry matter (%)	71.18[a]	57.84[b]	54.26[b]	3.06	0.0031
Crude protein (%)	87.30[a]	80.24[b]	82.66[b]	1.35	0.0046
Crude fibre (%)	75.16[a]	64.43[b]	60.53[b]	2.70	0.0035
Ether extract (%)	94.98[a]	88.99[b]	85.75[b]	0.90	<0.0001
Ash (%)	80.97	76.45	74.40	1.80	0.0514
Nitrogen free extract (%)	46.95	34.95	37.27	3.56	0.0815
Acid detergent fibre (%)	74.34[a]	62.52[b]	59.49[b]	2.60	0.0020
Neutral detergent fibre (%)	74.29[a]	63.29[b]	58.09[b]	2.58	0.0009
Hemicellulose (%)	7.66[b]	9.34[a]	7.66[b]	0.07	0.0068

Means with the same superscript within row are similar, LOS = Level of Significant, SE = Standard Error

The results of the effect of methionine supplementation on nutrients digestibility is presented in Table 4. The results obtained showed that there was significant ($P > 0.05$) effect of methionine supplementation on ash and neutral detergent fibre digestibility of rabbits. Rabbits on high methionine supplementation level had a higher ash and neutral detergent fibre digestibility than rabbits on low methionine supplementation. Lysine supplementation had non-significant ($P > 0.05$) effect on nutrients digestibility of rabbits.

There was no interaction between sweet potato vine level and methionine supplementation on dry matter, crude protein, crude fibre, ether extract, ash, nitrogen free extract, acid detergent fibre, neutral detergent and hemicellulose digestibility.

Table 4: Effect of methionine and lysine supplementation on nutrient digestibility of rabbits

	Methionine Level				Lysine Level			
Parameter	**Low**	**High**	**SE**	**LOS**	**Low**	**High**	**SE**	**LOS**
Dry matter (%)	58.07	64.12	2.77	0.12	60.99	61.2	2.65	0.96
Crude protein (%)	81.82	84.98	1.13	0.06	83.58	83.2	1.12	0.83
Crude fibre (%)	63.64	69.77	2.38	0.07	65.92	67.4	2.30	0.63
Ether extract (%)	89.13	90.68	0.75	0.15	89.79	90.0	0.74	0.83
Ash (%)	75.13	79.42	1.53	0.05	77.20	77.3	1.49	0.95
Nitrogen free extract (%)	37.30	42.15	2.91	0.28	41.92	37.5	2.93	0.33
Acid detergent fibre (%)	62.71	68.18	2.31	0.10	64.27	65.4	2.22	1.00
Neutral detergent fibre (%)	61.55^{b}	68.90^{a}	2.29	0.03	65.44	66.1	2.20	0.54
Hemicellulose (%)	59.93	67.57	2.88	0.07	63.03	64.4	2.88	0.73

Means with the same superscript within row are similar, LOS = Level of Significant, SE = Standard Error

There was no interaction between sweet potato vine, methionine and lysine on nutrient digestibility (Table 5).

Table 5: Interaction between sweet potato vine level, methionine and lysine level supplementation on nutrients digestibility of rabbits

Sweet potato vine level (%)	**0**				**15**				**30**				
Methionine level	**Low**		**High**		**Low**		**High**		**Low**		**High**		
Lysine level	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**SE**
LOS													
Dry matter (%)	66.96	70.58	74.67	72.51	58.53	45.19	70.44	57.21	43.78	63.37	51.56	58.33	7.05	0.78
Crude protein (%)	85.97	87.97	88.23	87.04	79.98	74.24	86.15	80.60	77.19	85.57	83.94	83.94	2.98	0.54
Crude fibre (%)	70.76	74.59	78.68	76.60	61.99	55.93	74.79	65.00	50.29	68.28	59.01	64.52	4.71	0.85
Ether extract (%)	94.35	94.53	95.75	95.29	88.56	86.28	92.30	88.82	82.43	88.63	85.37	86.56	1.01	0.66
Ash (%)	79.31	81.23	81.46	81.89	78.19	63.44	84.95	79.20	68.88	79.71	70.42	78.60	3.31	0.47
Nitrogen free extract (%)	43.15	48.72	57.83	38.10	28.42	35.47	48.53	27.40	33.30	34.74	40.32	40.72	9.20	0.40
Acid detergent fibre (%)	70.73	73.85	77.49	75.30	64.33	51.63	73.53	60.58	48.33	67.41	58.23	63.98	4.92	0.70
Neutral detergent fibre (%)	70.01	73.55	77.41	76.19	63.51	51.44	73.36	64.84	43.98	66.79	57.36	64.22	4.93	0.44
Hemicellulose (%)	64.15	71.41	78.29	81.24	60.63	50.59	71.53	57.20	50.58	62.24	53.04	64.11	5.45	0.98

LOS = Level of Significant , SE = Standard Error

DISCUSSION

Dry matter, crude fibre, ether extract, ash, acid detergent fibre and neutral detergent fibre digestibility decreased significantly as level of sweet potato vine increased in accordance with Dominguez (1992) and Close (1993) who stated that the inclusion of sweet potato foliage lowered the digestibility of all nutrients due to the increased fibre content of the diets. In contrast, the digestibility of dry matter, crude protein and crude fibre increased as the level of inclusion of sweet potato vines in the diets increased (Abonyi *et al*., 2012).Dry matter and crude protein digestibility obtained in this study are higher than that reported by Bamikole and Ezenwa (1999) who obtained dry matter digestibility of 0.45-0.56 and crude protein digestibility of 0.50-0.64 for combinations of concentrate and grass (guinea grass) or concentrate and legume (verano stylo). High level of methionine and lysine supplementation resulted in higher nutrients digestibility. This could be because methionine and lysine are essential for nutrients digestibility. This agrees with Ukpabi *et al*. (2008) who stated that raw bambarra groundnut offal should be supplemented with lysine and methionine to improve broiler feed conversion ratio, protein efficiency ratio, digestibility coefficient of crude protein and reduce feed cost. Dry matter and nitrogen free extract digestibility obtained in this study was lower than the values reported by Ajayi *et al*. (2007) and Abonyi *et al*. (2012) respectively. However, crude protein, crude fibre, ether extract and ash digestibility obtained were higher than values reported by Ajayi *et al.* (2007). Acid detergent fibre, neutral detergent fibre and hemicellulose digestibility of rabbits obtained in this study were high as a result of high fibre content of the diet. The nutrients digestibility recorded in this study is comparable with values reported by Adegbola and Okonkwo (2002) and Taiwo *et al*. (2005).

Significant decrease in nutrients digestibility of rabbits fed graded level of sweet potato vine supplemented with low methionine and lysine levels showed that as the graded level of sweet potato vine inclusion increases so also the nutrients digestibility decreases. From the result of this study it could be concluded that optimum nutrients digestibility is achieved on higher levels of supplementation of methionine and lysine of 0.1 and 0.15 kg respectively when rabbits are fed sweet potato vines.

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