EFFECT OF SIMPLE PROCESSING METHODS OF CASSAVA LEAVES ON HYDROCYANIC ACID CONTENT AND UTILIZATION BY SHEEP

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Abstract

An experiment was conducted to determine the effect of simple methods of processing cassava leaves (Cultivar TMS 30752) on its hydrocyanic acid (HCN) content and utilization by sheep. Cassava leaves (CL) were subjected to four processing methods, namely, cassava leaves washed (CLW); cassava leaves chopped and washed (CLCW); cassava leaves washed and wilted for 24 hours (CLWW) and cassava leaves chopped, washed and wilted for 24 hours (CLCWW). Four (4) West African Dwarf (WAD) rams in a 4 × 4 Latin square design were used to assess the intake and digestibility of the processed CL by the animals. The results of the study showed that HCN content (mg/kg) varied significantly ($P < 0.05$) among the treatments with CLCWW having the least ($P < 0.05$) HCN content of 26.50 and CLW with the highest content (36.57). DM intake, weight gain, DM and CP digestibilities were least ($P < 0.05$) in rams fed CLW diets relative to the other treatments. The weight gain (g/day) of sheep fed CLCWW diets was significantly ($P < 0.05$) higher compared to other treatments. It was concluded that the effect of simple processing methods of cassava leaves reduced the HCN content. Fresh cassava leaves chopped, washed and wilted for 24 hours before feeding can be included in the diets of sheep for optimum performance.

Key words: cassava leaves, processing, hydrocyanic acid, sheep, performance

INTRODUCTION

Cassava is the most important root crop, grown principally for its starchy root in Africa. Because of its efficient production of cheap food energy, year round availability, tolerance to extreme ecological conditions, and suitability to present farming and food systems, it plays a major role in efforts to alleviate the Africa food crisis (IFPRI, 2000).

Traditionally, cassava tuberous roots are a major source of carbohydrates in human diets and are processed by various methods into numerous products utilized in diverse ways according to local customs and preferences (Hahn, 1992). The young shoots (young stem, leaves and petioles) are a good supplementary source of protein, vitamins and minerals which have been found edible and are widely used as food and feed (Lancaster and Brooks, 1983; Adegbola and Okonkwo, 2002). The use of cassava leaves as feed for ruminants has been investigated and documented (Ngi et al., 2006; Fasae et al., 2006; Fasina et al., 2008). However, the presence of hydrocyanic acid is a limiting factor in its utilization by livestock, although various processing has been found to reduce the level of its toxicity. These vary from simple sun drying to complex methods involving fermentation (Bui Huy et al., 1996; Ngi et al., 2006; Fasae et al., 2009). However, sun-drying is most difficult to accomplish when leaves are harvested in wet season and ensiling is labour intensive. The effect of simpler methods such as washing and wilting has also been reported by Du Thang Hang and Preston (2005) to reduce HCN content of some cassava varieties and improve intake in growing pigs.

This study therefore looks into the possibility of reducing HCN contents in cassava cultivar (TMS30572) leaves through simple processing methods such as chopping, washing and wilting and the effect of these processing methods on the performance of sheep.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Small Ruminant Unit of the Teaching and Research Farm, College of Animal Science and Livestock Production, University of Agriculture, Abeokuta, Nigeria.

Cassava leaves sourcing and processing

Cassava leaves (CL) cultivar TMS 30572 were obtained fresh during the harvest of the tuber crop from an

Table 1: Experimental layout

Identification/ Period	Sheep 1	Sheep 2	Sheep 3	Sheep 4
1	CLW	CLCW	CLWW	CLCWW
2	CLCW	CLWW	CLCWW	CLW
3	CLWW	CLCWW	CLW	CLCW
4	CLCWW	CLW	CLCW	CLWW

established plot within the university. After harvest, the leaves were processed under different methods as follows: CL washed; CL chopped and washed; CL washed and wilted for 24 hours and CL chopped, washed and wilted for 24 hours. Washing of CL was done in water while the chopping was carried out using a cutlass to cut the leaves to about 3 cm length. The processed leaves were taken to the laboratory for the determination of its HCN content and proximate analysis.

Experimental animals and their management

Four West African Dwarf (WAD) rams with an average weight of 12 kg kept at the sheep unit of the Teaching and Research Farms, University of Agriculture, Abeokuta, Nigeria were used in a 4 × 4 Latin square design (Table 1) for the experiment. They were taken to the metabolic cages to facilitate easy collection of faeces and urine. The rams were allowed to acclimatize to the cage and feed for one week during which they were dewormed with albendazole tablets. The animals were allotted to diets containing fresh leaves of cassava processed as follows:

Diet A – Cassava leaves washed then fed (CLW)

Diet B – Cassava leaves chopped and washed prior to feeding (CLCW)

Diet C – Cassava leaves washed and wilted for 24 hours prior to feeding (CLWW)

Diet D – Cassava leaves chopped, washed and wilted for 24 hours before feeding (CLCWW)

Each animal was offered processed cassava leaves with a basal diet of *Pennisetum purpureum* and 100 g of concentrate given as supplement. Water was given *ad libitum.* Each digestion trial involved an adjustment period of 7 days to allow the animals adjust to the diets, followed by a collection period of 4 days as described by Adeleye and Fasae (2008).

Data collection

Samples of processed cassava leaves and faeces were collected and oven dried at 105 °C to constant weight, bulked and stored until when required for chemical analysis. The individual animals were weighed at the onset of the experiment using a spring balance and subsequently thereafter to coincide with the change to each regime. Feed intake and refusals were weighed daily to estimate the feed intake for each animal.

Chemical analysis

The dry matter, crude protein, crude fibre, ash and ether extract contents was analyzed according to the method of AOAC (1995). The NDF and ADF component were determined by the method of Van Soest and Robertson (1985). The HCN content was determined as described by Makkar et al. (1993).

Statistical analysis

Data collected from parameters investigated were based on completely randomized design and subjected to one way analysis of variance using the statistical package (SAS, 1999). Significant means were separated using Duncan Multiple Range Test (Duncan, 1955). Descriptive statistics was used to describe the HCN contents in the leaves.

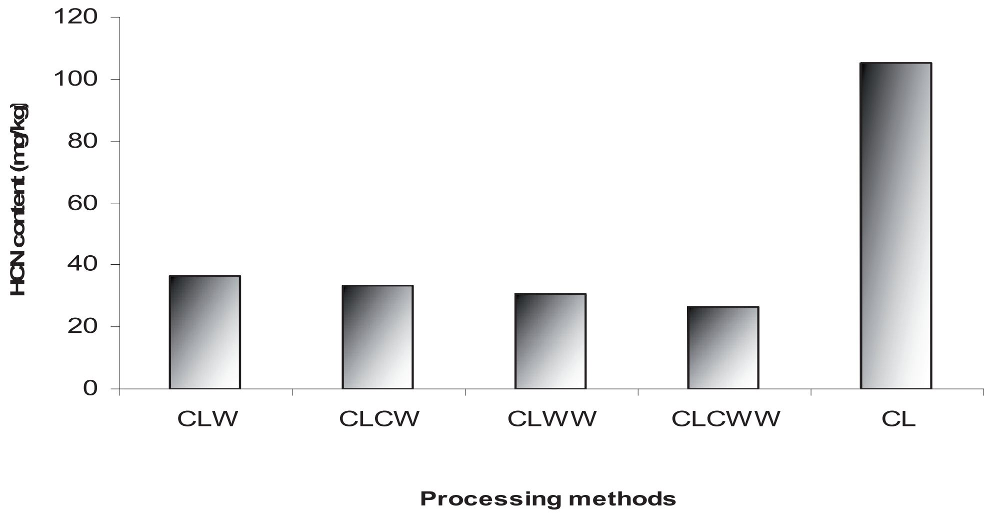
RESULTS AND DISCUSSION

The effect of different processing methods of cassava leaves (CL) in this study had significant ($P < 0.05$) effect on the HCN content (mg/kg) among the treatments (Figure 1). There was a drastic reduction ($P < 0.05$) in the HCN content of processed leaves compared to the unprocessed fresh leaves of cassava. CLCWW had the lowest HCN content of 26.50 mg/kg followed by CLWW with 30.67 mg/kg; CLCW (33.56 mg/kg) and CLW having the highest HCN content (36.50 mg/kg). The variation could be attributed to the different processing methods used in the study.

The HCN content among the treatments is similar to 36.70 mg/kg reported Ogbonna and Oredein (1998) for cassava leaf meal. However, these ranges are below 50 mg/kg reported to be harmless to animals (Phuc et al., 2000) suggesting the suitability of these processed CL for sheep production. The cyanide content in leaves has been reported to be influenced by genetic, physiological and climatic differences with the stage of maturity being perhaps the major source of variation (Ravindran, 1995).

The chemical composition (%) of the processed cassava leaves, concentrate and *Pennisetum purpereum* are shown in Table 2. The DM content of the processed CL was significantly ($P > 0.05$) the same among the treat-

Figure 1: Effect of different processing methods of cassava leaves on the Hydrocyanic acid content (mg/kg)



ments and was similar to those observed by Adegbola and Okonkwo (2002) and Fasina et al. (2008) when cassava leaf meal was fed to rabbits and goats, respectively.

The crude protein (CP) content of CL was not affected (P > 0.05) by the processing methods among the treatments but lesser than that of the unprocessed CL (24.81%) used for this study. The CP content of CL in this study are lower than 34.25% reported by Ogbonna and Oredein (1998) for cassava leaf meal. However, they were higher than values reported by Alli-Balloqun et al. (2003) and Fasina et al. (2008). This variation may be attributed to the time cassava leaves were harvested, processing methods as well as the variety of cassava used. Other researchers have shown variation in the chemical composition among leaves of different cassava varieties (West et al., 1988; Wanapat et al., 1997; Ngi et al., 2006).

Table 3 shows the DM intake (g/day) and weight changes (g/day) of sheep fed the experimental diets. The DM intake of the rams differed significantly (P < 0.05) across the diets with animals fed diet CLW having the least (P < 0.05) DM intake of 319.50 (g/day) although there were no significant difference (P > 0.05) observed among the other treatments.

The DM intake reported in this study is within the range reported by Ngi et al. (2006) when goat was fed 50% maize offal and 50% dried cassava leaf meal, but was significantly (P < 0.05) lower than those reported by Fomunyan and Meffeja (1987) and Lamidi et al. (1998) in sheep fed sun dried cassava peels and Ficus leaves, respectively. The variation may be attributed to the diet fed, age and the breed of animal used. However, the results showed that DM intake across the diet increased (P < 0.05) with a decrease in the HCN content of the

Table 2: Proximate composition (%) of processed cassava leaves, *Pennisetum purpureum* and concentrate fed to sheep

Parameters	Diets (%)						
	CLW	CLCW	CLWW	CLCWW	CL	*Pennisetum purpureum*	Conc.
Dry matter	88.76	89.80	90.76	89.60	87.02	90.45	84.30
Crude protein	22.05	21.60	21.40	20.84	24.81	9.75	16.85
Ether extract	4.50	4.10	3.46	4.61	4.16	2.10	5.73
Ash	17.24	18.12	16.75	16.90	17.25	15.33	5.73
Neutral detergent fibre	51.00	59.02	59.40	51.50	63.48	61.12	ND
Acid detergent fibre	45.10	45.10	42.31	44.23	46.19	43.87	ND

CLW = Cassava leaves washed and fed; CLCW = Cassava leaves chopped and washed; CLWW = Cassava leaves, washed and wilted; CLCWW = Cassava leaves chopped, washed and wilted; CL = Cassava leaves; Conc. = Concentrate; ND = Not determined

Table 3: Mean value for dry matter intake (g/day) and weight changes (g/day) of sheep fed the experimental diets

Parameters	Diets (%)				
	CLW	CLCW	CLWW	CLCWW	SEM
Dry matter intake(g/day)					
Cassava leaves	234.00	301.95	278.70	267.00	-
Concentrate	85.30	85.30	85.30	85.30	-
Total DM intake(g/day)	319.50^{b}	387.25^{a}	364.00^{a}	352.30^{a}	16.87
Initial weight (kg)	11.36	12.15	12.37	11.77	2.10
Final weight (kg)	11.65	12.49	12.70	12.15	2.01
Weight gain (g/day)	29.88^{c}	34.00^{b}	33.30^{b}	37.50^{a}	3.34

$^{a, b, c}$ means followed by the same superscript in a row is significantly different (P < 0.05)
CLW = Cassava leaves washed and fed; CLCW = Cassava leaves chopped and washed; CLWW = Cassava leaves, washed and wilted; CLCWW = Cassava leaves chopped, washed and wilted; CL = Cassava leaves; Conc. = Concentrate; ND = Not determined

leaves suggesting that HCN content of CL may have an effect on DM intake of sheep.

The daily gain in weight (g/day) of sheep fed CLCWW was highest (P < 0.05) with 37.50 compared to the other treatments. Animals fed CLW had the least (P < 0.05) value (29.88). However, the weight gain across the treatments were within the range of 28.75 to 55.20 g/day earlier reported for the same breed of sheep fed cassava leaves (Alli-Ballogun et al., 2003).

The nutrient digestibility of sheep fed cassava leaves processed under different methods is shown in Table 4. DM and CP digestibility followed the same trend with highest (P < 0.05) value obtained for CLCWW diet, which were significantly (P > 0.05) the same with diets containing CLCW. DM digestibility was however lowest (P < 0.05) in the CLW diet.

The DM digestibility in this study were similar to that obtained by Lamidi et al. (1998) for sheep fed *Ficus* and *Hyparrhenia* sp. and higher than those obtained by Ngi et al. (2006) in goats fed 30% maize offal and 70% cassava leaf meal. This may have been as a result of the breed of animal used. Digestibility of CP was within the range reported by Anigbogu (2002) and Arigbede et al. (2005) reported for WAD sheep fed cassava residues and pigeon pea based diet, respectively. The fibre fractions, ether extract and ash digestibilities of the processed CL were however not affected (P > 0.05) by the various processing methods.

CONCLUSION

The HCN content of cassava leaves was reduced by the four simple processing methods employed in this study. Fresh cassava leaves chopped, washed and wilted before feeding for 24 hours resulted in better performance in terms of higher digestibility and better weight gain in sheep. This can therefore be included in the diets of sheep for optimum performance.

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Table 4: Mean nutrient digestibility (%) of cassava leaves processed under different methods in sheep

Parameters	Diets (%)				
	CLW	CLCW	CLWW	CLCWW	SEM
Dry matter	58.03^{c}	63.94^{bc}	65.66^{ab}	67.34^{a}	2.29
Crude protein	58.18^{c}	62.13^{bc}	66.12^{ab}	68.92^{a}	1.17
Ether extract	55.62	54.70	61.42	59.26	1.31
Ash	51.22	52.65	57.64	56.19	1.79
Neutral detergent fibre	60.87	61.28	59.96	64.38	2.85
Acid detergent fibre	50.87	51.28	49.96	55.58	1.77

$^{a, b, c}$ means on the same row with different superscript differ significantly (P < 0.05)
CLW = Cassava leaves washed and fed; CLCW = Cassava leaves chopped and washed; CLWW = Cassava leaves, washed and wilted; CLCWW = Cassava leaves chopped, washed and wilted

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