

Nutrient Profile and *in vitro* Digestibility of Fresh and Ensiled Cassava in Swine

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Abstract

Market availability and price of conventional feedstuffs are variable, making imperative to explore alternative feedstuffs. Cassava (*Manihot esculenta*) is a starchy tuber that can be a potential feedstuff for swine. Three sample type (combinations of cassava parts): 100% tubers (T100), 50% tubers and 50% leaves (T50), and 25% tubers and 75% leaves (T25) were ensiled over three periods [fresh (M0), ensiled for two (M2) and three (M3) months]. Samples were analyzed for nutrient profile. *in vitro* digestibility of samples were determined using a 3-step enzymatic assay. Gross energy (GE) content ranged from 3838 to 5013 kcal/kg DM. The pH content ranged from 3.73 (T100-M2) to 4.23 (T25-M2), and dropped in respective combinations in M3 samples. DM digestibility was higher ($P<0.05$) in T100 (87.6%) than T50 (72.6%) and T25 (50.9%). DM digestibility of M0 (76.1%) was higher ($P<0.05$) than M2 (67.7%) and M3 (67.3%). GE digestibility was higher ($P<0.05$) in T100 (86.9%) than T50 (70.0%) and T25 (51.6%), while GE digestibility of M0 (74.9%) was higher ($P<0.05$) than M2 (66.7%) and M3 (66.7%) silage. There was an interaction ($P<0.05$) between sample type and period of ensiling for both DM and GE digestibility. In conclusion, increasing leaves in samples decreased nutritional value of cassava silage but digestibility was still at a reasonable level. Thus, ensiling the combination of tubers and leaves of cassava can be useful to supply enough feedstuffs for swine. However, ensiling period needs to be considered with combination of tuber and leaves.

Keywords: alternative feedstuff, cassava silage, energy, *in vitro* digestibility, swine

Introduction

Market availability and price of conventional feedstuffs like corn and soybean meal used in swine feeding are variable. Thus, it is imperative to explore alternative feedstuffs which can either completely or partially replace these feedstuffs to ensure the sustainability of the swine production. Use of alternative feedstuffs in swine diets can be optimized by characterizing their nutrient profile and digestibility. Cassava (*Manihot esculenta*) is a starchy tuberous plant which can serve as a potential alternative feedstuff for swine (Ravindran, 1995). Cassava roots are a good source of energy while leaves are rich in protein, vitamins and minerals (Montagnac *et al.*, 2009). Thus, combination of both roots and leaves can be a potential alternative feedstuff for swine. The objective of this study was to determine the nutrient profile and *in vitro* digestibility of cassava (*M. esculenta* var Crantz) ensiled over 2 periods as compared to fresh cassava samples.

Materials and Methods

Three cassava sample type [combinations of cassava parts, 100% tubers (T100), 50% tubers and 50% leaves (T50), and 25% tubers and 75% leaves (T25)] were ensiled over three periods [fresh (M0), ensiled for two (M2) and three (M3) months]. The fresh samples were ground and analyzed for nutrient profiles including dry matter (DM), crude protein (CP), crude fat, acid detergent fiber (ADF), neutral detergent fiber (NDF), and gross energy (GE) contents following the standard procedures (AOAC, 2006). Starch content was determined using test kit (Megazyme International, Ireland; AOAC 996.11). The pH in silage samples was measured using a digital pH meter (SymPHony, VWR International, USA). Silage samples were freeze dried and analyzed following the same procedures. A 3-step enzymatic technique (Boisen and Fernandez, 1997) was used to get the *in vitro* apparent total tract digestibility of nutrients (DM and GE) in swine. The means of the nutrients digestibility were compared statistically using Proc MIX model of SAS 9.1 software and declared significantly different at $P<0.05$.

Results and Discussion

There was wide variation in nutrient profile and *in vitro* nutrient digestibility of samples, both due to type and ensiling period. The pH of the silages ranged from 3.73 (T100-M2) to 4.23 (T25-M2), and dropped in respective combinations in M3 samples due to increased acid production from fermentation over time. The lower pH in the intestine may have potential gut health benefit to pig (Jha and Berrocoso, 2015). The GE content ranged 3838 to 5013 Kcal/kg DM of sample. Crude protein content increased with increasing inclusion of leaves (T25>T50>T100) as protein content in leaves is higher than tuber of cassava. Also, there was increased CP content with ensiling as the carbohydrates are fermented making the other nutrients more concentrated on DM basis. No effect of ensiling was seen in the fat content. Starch content ranged from 14.7 to 65.2%, and decreased as ensiling progressed (M0>M2>M3) as part of starch were utilized by microbes for fermentation over period. With increasing the leaves proportion in the mix, there was increase in the ADF and NDF content, which in turn, had negative effect on both DM and GE digestibility. It was expected as the leaves are richer in fiber content than tuber which is less digestible by swine. The DM and GE digestibility was significantly ($P<0.001$) affected by both sample type and ensiling period. Also, there was an interaction ($P<0.001$) between sample type and ensiling period for both DM and GE digestibility.

Table 1. *In vitro* apparent total tract digestibility of combination of cassava parts (Type) ensiled over different duration (Period) in swine

Variables	Type			Period			SEM	P-value		
	T100	T50	T25	M0	M2	M3		Type	Period	Type × period
DM digestibility	87.6	72.5	50.8	76.1	67.7	67.2	0.484	<.0001	<.0001	<.0001
GE digestibility	86.9	69.9	51.6	74.9	66.7	66.7	0.342	<.0001	<.0001	<.0001

*All data is expressed on a dry matter basis

Conclusion

Increasing leaves in samples decreased nutritional value of cassava silage, but digestibility was still at reasonable level. Ensiling resulted in a reduction of the CP, NDF and ADF contents compared with the fresh cassava samples. Thus, ensiling the combination of tubers and leaves of cassava can be useful strategy to supply enough feed for swine. However, ensiling period needs to be considered with combination of tubers and leaves. The increase in ensiling period decreased pH of the silages, such silage may provide gut health benefit, in addition to providing energy and other nutrients to swine.

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