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Potentials of two varieties of cashew apple pulp as feedstuff for ruminants

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Abstract

The study was aimed at assessing the effects of two varieties of cashew (Anacardium occidentale) apple pulp as feedstuff for ruminants. Samples of the yellow and red varieties of cashew apple pulp were collected, processed and analysed for mineral, crude fiber fraction and pH. Results showed that sodium value in red variety was significantly higher (P<0.05) than that of the yellow variety. Potassium value in red variety was significantly higher (P<0.01) than that of the yellow variety. Values for calcium, magnesium, and phosphorus in the yellow variety were significantly higher (P<0.01) than those of the red variety. Values for cellulose, hemicelluloses and neutral detergent fibre in the red variety were significantly higher (P<0.01) than those of the yellow variety. Acid Detergent Lignin value for the yellow variety was significantly higher (P<0.01) than that of the red variety. Values for acid detergent fibre, crude protein, carbohydrate and pH were not significantly affected (P>0.05). Yellow cashew apple pulp from the results of this study is richer in minerals when compared to the red variety. Results from the crude fibre fraction suggest that the yellow cashew apple pulp variety may have a better digestibility when compared to the red variety. Although the values of the various parameters from the 2 varieties show that they are fit to be used as feeding stuff for ruminants, the yellow variety appears to be better on the general basis.

Keywords: Cashew apple pulp, Mineral, Crude fibre fraction, pH, Varieties, ruminants

Introduction

Cashew apple (*Anacardium occidentale* L.) is a fruit peduncle, also called pseudo-fruit (Akinwale 2000; Assunção and Mercadante 2003). Cashew apple juice, a very popular juice in Brazil with an estimated production of 200 million liters per year, is rich in vitamin C and minerals (sodium, potassium, phosphorus, chloride and magnesium). Cancer prevention, antimicrobial activity against the bacteria *Helicobacter pylori*, which causes gastric diseases, and antioxidant properties have been reported for this tropical fruit (Sampaio 1990; Kubo *et al.,* 1999; Wharta *et al.,* 2004). Cashew is one of the most important plantation crops in India, Brazil, Nigeria and Vietnam (Muniz *et al*., 2006) and Kogi State is the largest cashew producing state in Nigeria (Okpanachi *et al*., 2016a; 2016b; 2016c). Unlike cashew nut kernel, which has an indisputably exclusive fine taste and a commercial attractiveness of its own, cashew "apple," despite its high nutritive values (high content of vitamin C and minerals, i.e., Ca, P, Fe) is less attractive (Ogunmoyela, 1983; Moura, 1998). It is rich in Vitamin C than oranges and contains high amount of mineral salts (Deckers *et al.,* 2001; Denise *et al.,* 2002). The cashew apple is very rich in vitamin C (262 mg/100 mL of juice) and contains five times more vitamin C than orange. A glass of cashew apple juice meets an adult individual's daily vitamin C (30 mg) requirement (Azam-Ali and Judge,

2001). The cashew apple or pulp is also a rich source of minerals and other essential nutrients (Deckers *et al.,* 2001). The cashew apple is also rich in sugars and contains considerable amounts of tannins and minerals, mainly calcium, iron and phosphorous. Furthermore, the fruit has medicinal properties. It is used for curing scurvy and diarrhoea and it is effective in preventing cholera. It is applied for the cure of neurological pain and rheumatism. It is also regarded as a first-class source of energy. When fermented with appropriate enzymes, it produces very valuable beverage drinks. Besides its kernel and pulp, other alternative end use to process cashew into include cashew nut shell liquid (CNSL) from which many products can be derived such as paints, plastics, printing ink, wood preservative, insecticide, aviation fuels, water-proof compounds, and anti fade agent in brake-lining (Azam-Ali and Jugde, 2001). When these fruits (pulp) are dried, they turn brown due to the effect of heat on them and these can be incorporated in animal feed since it is in abundance in the study area and often times left to constitute environmental pollution (Okpanachi *et al*., 2016b). The inclusion of sun-dried yellow cashew pulp to the level of 30% in the diet of West African dwarf goats provided a cheaper source of feed and also help to reduce environmental pollution, since the pulp, unlike the seed is left to waste during its season. (Okpanachi *et al*., 2016a and 2016c). The main objective of this study was to assess the potentials of both the red and yellow varieties of cashew apple pulp in regards to the mineral, pH and crude fibre fraction, as what already exist in literature either talks about the yellow variety alone or just about cashew pulp, without putting the variety into consideration.

Materials and methods

Procurement and preparation of varieties of cashew pulp

Samples of the 2 main varieties of cashew pulp (red and yellow) were obtained from Anyigba and its environs. Known weights were sun dried to determine the dry matter (DM). They were washed, sliced with the aid of knives and chopping boards into bits, air-dried and moved to the glass house where they were properly dried. The dried cashew pulp were packaged, weighed and stored in a safe place. The dried cashew pulp was milled packaged and then sent to the laboratory for analysis.

Mineral analysis

Analysis of dried cashew pulp for minerals such as calcium, phosphorus, sodium, magnesium and potassium were determined using the methods described by Udo *et al*. (2009) and Ibitoye (2005).

Crude fibre fraction analysis

Samples of the two major varieties of cashew pulp were dried and milled and were analysed for Neutral detergent fibre (NDF), Acid detergent fibre (ADF) and Acid detergent lignin (ADL), according to Van Soest and Robertson (1980) while the values of cellulose and hemicelluloses were obtained by calculation using these formulas; Hemicellulose = NDF – ADF and Cellulose = ADF – ADL.

Experimental design and statistical analysis

Completely randomized design was used. Data obtained were subjected to Analysis of Variance (ANOVA) and means that were significantly different were separated using Least Significant Difference (LSD), both contained in SPSS for Window, version 16.

Result

Some minerals in sun-dried cashew pulp

Results showed that sodium and potassium in the red variety (0.0663 and 1.0787) were significantly higher ($P<0.05/P<0.01$) than 0.0613 and 0.9133 for sodium and potassium respectively in the yellow

variety. Calcium, magnesium and phosphorus in the yellow variety (0.1840, 0.1403 and 0.1250) were however significantly higher (P<0.01) than 0.1473, 0.1117 and 0.1043 for calcium, magnesium and phosphorus respectively in the red variety.

Table 1: Some minerals in sun-dried cashew pulp

	Varieties of cashew		
Minerals (%)	**Yellow**	**Red**	**SEM**
Sodium	0.0613^{b}	0.0663^{a}	0.0013^{*}
Potassium	0.9133^{b}	1.0787^{a}	0.0370^{**}
Calcium	0.1840^{a}	0.1473^{b}	0.0082^{**}
Magnesium	0.1403^{a}	0.1117^{b}	0.0065^{**}
Phosphorus	0.1250^{a}	0.1043^{b}	0.0047^{**}

a, b = Means with different superscripts on the same row are significantly different.
SEM = Standard Error of Mean, * = Significant at (P < 0.05) ** = Significant at (P < 0.01).

Effect of variety on cellulose, hemicellulose, NDF, ADF, ADL and pH of sun-dried cashew pulp meal

The effect of variety on cellulose, hemicellulose, NDF, ADF, ADL, crude protein, carbohydrate and pH of sun-dried cashew pulp meal is presented in Table 2. Results for cellulose, hemicellulose, NDF and ADL were significantly affected (P < 0.01) by the varieties. Results for ADF, crude protein, carbohydrate and pH were however, not significantly affected (P > 0.05) by the varieties. The values for cellulose, hemicellulose and neutral detergent fibre in the red variety (13.30, 25.57 and 62.53) were significantly higher (P<0.01) than 3.97, 19.39 and 56.13 for cellulose, hemicellulose and neutral detergent fibre respectively in the yellow variety. The value for acid detergent lignin in the yellow variety (32.77) was however significantly higher (P<0.01) than 24.16 for acid detergent lignin in the red variety.

Table 2: Effect of variety on cellulose, hemicellulose, NDF, ADF, ADL and pH of sun -dried cashew pulp meal

	Varieties of cashew		
Components (%)	**Yellow**	**Red**	**SEM**
Cellulose	3.97^{b}	13.30^{a}	2.31^{**}
Hemicellulose	19.39^{b}	25.57^{a}	1.42^{**}
Neutral Detergent Fibre	56.13^{b}	62.53^{a}	1.43^{**}
Acid Detergent Fibre	36.74	36.96	0.30^{ns}
Acid Detergent Lignin	32.77^{a}	24.16^{b}	1.93^{**}
Crude protein	13.82	16.96	0.93^{ns}
Carbohydrate	54.79	52.28	1.44^{ns}
pH	4.60	4.22	0.13^{ns}

a, b = Means with different superscripts on the same row are significantly different (P < 0.01)
SEM = Standard Error of Mean, ** = Significant at (P < 0.01), ns = not significant.

Discussion

Effect of cashew varieties on selected mineral compositions of sun-dried cashew pulp

The value of sodium for sun-dried red cashew pulp was higher than that of the yellow variety. Armah (2011) reported 0.56 % as value for sodium in sun-dried cashew meal. The value of potassium for sun-dried red cashew pulp was higher than that of the yellow variety. Armah (2011) reported 1.65 % as value for potassium in sun-dried cashew meal. The value of calcium for sun-dried yellow cashew pulp was higher than that of the red variety. Adebowale *et al*. (2011) reported 0.21 % as value for calcium

in sun-dried cashew meal. Armah (2011) reported 0.72 % as value for calcium in sun-dried cashew meal. The value of magnesium for sun-dried yellow cashew pulp was higher than that of the red variety. The value of phosphorus for sun-dried yellow cashew pulp was significantly higher ($P < 0.01$) than that of the red variety. Armah (2011) reported 0.60 % as value for phosphorus in sun-dried cashew meal; whereas **Adebowale *et al*. (2011) reported** 0.26 % as phosphorus content in dried cashew pulp. The difference between the mineral content obtained in this study and those reported by **Adebowale *et al*. (2011) and** Armah (2011) may be due to the difference in handling and processing, storage, environment, etc. The result on mineral composition agreed with the study of Deckers *et al.* (2001) and Denise *et al.* (2002), that cashew contains high amount of mineral salts.

Effect of cashew variety on cellulose, hemicellulose, NDF, ADF, ADL and pH of sun-dried cashew pulp meal

The cellulose, hemicellulose, NDF and ADL were affected by the varieties, implying that there were differences in cellulose, hemicellulose, NDF and ADL among the treatments. There were no difference in ADF among the treatments; however values of cellulose, hemicelluloses and NDF for the sun-dried red cashew pulp meal were higher than those of the sun-dried yellow cashew pulp meal. The value of ADL for the sun-dried yellow cashew pulp meal was however higher than that of sun-dried red cashew pulp meal. These differences in nutritive values may be due to varietal difference (sun-dried yellow and red cashew pulp meal), the type of soil (environment) on which the cashew were grown and the stage of maturity at which the cashew were harvested. The values of 18.31 % - 31.50 %, 19.30 % - 27.18 % and 23.91 % - 32.21 % were reported by Dos Santos Lima *et al.* (2012) for cellulose, hemicelluloses and lignin of dried cashew pulp respectively. The values (3.97 %, for sun-dried yellow cashew pulp meal and 13.30 %, for sun-dried red cashew pulp meal) of cellulose in this study are lower than that reported by Dos Santos Lima *et al.* (2012). The values of hemicelluloses (19.39 %, for sun-dried yellow cashew pulp meal and 25.57 %, for sun-dried red cashew pulp meal) and lignin (24.16 %, for sun-dried red cashew pulp meal - 32.77 %, for sun-dried yellow cashew pulp meal) obtained in this study are however very close to those reported by Dos Santos Lima *et al.* (2012). Kalio *et al.* (2013) reported 5.63 % and 1.95 % for ADF and ADL of Yam; 32.85 % and 10.20 % for ADF and ADL of cassava; 7.64 % and 1.95 % for ADF and ADL of sweet potato and 13.70 % and 5.90 % for ADF and ADL of ripe plantain respectively. Okoruwa and Adewumi (2010) reported 57 %, 27 % and 26 % for NDF, ADF and CF of Dried pineapple pulp.

The pH value 4.22 (sun-dried red cashew pulp meal) and 4.60 (sun-dried yellow cashew pulp meal) obtained in this study is higher than 4.1 reported by La Van Kinh *et al.* (1997) and 4.11 reported by Oliveira (1999). Although the pH value in this study was not affected by variety, the red variety is slightly more acidic since it had a pH of 4.22 compared to the yellow variety with a pH of 4.6. This is however not in agreement with Adou *et al.* (2012) who reported a pH of 4.47 and 4.4 for cashew juice from red and yellow cashew variety, respectively.

Conclusion

In conclusion, it was observed that the red variety is richer in sodium and potassium while the yellow variety is richer in calcium, magnesium and phosphorus. The red variety also recorded the highest values for

cellulose, hemicelluloses and acid detergent fibre while the yellow variety recorded the highest value for acid detergent lignin. The red variety may be said to be more acidic when compared to the yellow variety. From the results of this study it can be concluded that the yellow variety recoded the overall best performance

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