NSUK Journal of Science & Technology, Vol. 6: No. 2. 2016. pp. 91 -94 ISSN: 1597- 5527

PROXIMATE AND PHYTOCHEMICAL COMPOSITION OF SUN-DRIED CASHEW APPLE OF BOTH RED AND YELLOW FLESH VARIETIES

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ABSTRACT

Apples or pulps of both red and yellow cashew were picked from cashew plantations within and around Anyigba in Dekina Local Government Area of Kogi State. The collected apples were washed, sliced and sun-dried. It was then milled and samples of the two varieties (red and yellow) were taken to the laboratory for both proximate composition and anti-nutritional factors analysis. Proximate composition of all the components for both varieties were not significantly affected ($p>0.05$) by variety. Numerically however, red cashew pulp had the highest dry matter, crude protein and crude fibre while the yellow variety had the highest ether extract, ash and carbohydrate values. Tannin, saponin, phytate, oxalate and flavonoids were analysed as anti-nutrients. None of the phytonutrients showed significant difference ($p > 0.05$). The red cashew pulp had the highest values for Tannin, phytate and oxalate while the yellow variety recorded the highest values for saponin and flavonoids. It was concluded that phytonutrients present in the pulps of both cashew varieties are in very low amounts. It was recommended that since both varieties of cashew are rich in one component or the other, crop scientists should work towards increasing their production.

Key words: Composition, Proximate, Red Cashew Pulp, Yellow Cashew Pulp, Protein, Tannin, Phytochemical

INTRODUCTION

Cashew pulp is considered as a waste in cashew nut processing industry. Although there is growing awareness surrounding the economic importance of cashew production in Asian and African countries, the present practice in most established large-scale plantations is to allow the apples to drop naturally from the trees before harvesting the nuts. The cashew apples get wasted. The crude protein, fat, ash, and crude fibre contents of dry cashew pulp (DCP) were 86.0 g kg^{-1}, 99.6 g kg^{-1}, 38.0 g kg^{-1} and 116.0 g kg^{-1}, respectively on dry matter (DM) basis while digestible energy value was 14.38 MJ (Armah, 2011). Cashew pulps are not popular, in part because of highly astringent taste which has been traced to the waxy skin that irritate tongue and throat after eating. Astringent taste in cashew pulp is caused by its high acidic content. Cashew apple, due to its fleshy pulp, high sugar content, good flavour and no seeds content, could be processed into different beverages (Akinwale 1999, Muniz *et al.* 2006). However, Dubuc (1997) attributed the chemicals that cause this effect (astringency) to be polyphenols, which according to him, are rather like the tannin found in wine. This astringent property of the cashew pulp is typically removed by steaming the fruit for five minutes before washing it in cold water. Alternatively boiling the fruit in salt water for five minutes or soaking it in gelatin solution reduces the concentration to palatable and acceptable levels (Harold 2004, Azam-Ali and Judge, 2004). The fruit is pressure-steamed for 5 to 15 minutes in order to reduce astringency before candying or making into jam or chutney or extracting the juice for carbonated beverages, syrup or wine. Efforts are made to retain as much as possible the ascorbic acid. Food technologists in Costa Rica recently worked out an improved process for producing the locally popular candied, sun-dried cashew pulp. Failure to remove the tannin from the juice may account for a nutritional deficiency in heavy imbibers of cashew pulp wine, for tannin prevents the body's full assimilation of dietary protein (Morton, 1995). The fermentation of cashew apple into wine was studied by Shuklajasha *et al.* (2006). The cashew wine obtained from their study was a light yellow (in appearance) beverage with alcohol content of 7.0%. It was slightly acidic (1.21-g tartaric acid/100 mL), which, together with comparatively high tannin content (1.9±0.22 mg/100 mL), imparted the characteristic cashew apple flavor and astringency.

This study evaluated the proximate composition and phytochemical contents of red and yellow flesh coloured cashew apple.

Table 1: Composition of Cashew Pulp Reported by Different Authors.

Nutrients	Authors			
	Fanimo *et al.* (2003)	Armah (2011)	Obioha (1992)	La Van Kinh *et al.* (1997)
Crude Protein (%)	187 g kg^{-1} (18.7)	8.6	11.6	13.7
Crude fibre (%)	84 g kg^{-1} (8.4)	11.6	7.0	11.8
Ether extract (%)	24 g kg^{-1} (2.4)	9.96	9.6	-
Ash (%)	54 g kg^{-1} (5.4)	3.8	1.8	1.4
Nitrogen free extract (%)	-	-	69.9	-
Energy (kcal/kg)	-	3440.2	3490	-
pH	-	-	-	4.1

MATERIALS AND METHODS

Procurement and preparation of varieties of cashew pulp

The samples of both Red- and yellow-skin coloured cashew apple pulp were obtained from Anyigba and its environs. Anyigba is in Kogi State, Nigeria. 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 later milled and sent in triplicate to the laboratories for analysis. Proper hygiene was ensured to avoid contamination throughout the whole process.

Analysis of proximate c omposition

Samples of the red and yellow flesh coloured varieties of cashew apples were dried, milled and analysed for crude protein (CP), crude fibre (CF), crude fat and ash according to AOAC (1990). Carbohydrate was estimated by difference [100- (protein+ fat + moisture + ash)]. Proximate contents were reported in percentages (Okwu and Morah, 2004).

Determination of phytochemicals

Samples of the two major varieties of cashew pulp were dried, milled and analysed for tannin, saponin, phytate, oxalate and flavonoids. Screening and quantitative determination were done according to the procedures of Harbone (1973), Trease and Evans (1989) and Sofowora (1993).

Data Analysis

Data were subjected to one way analysis of variance (ANOVA) using SPSS, 16.0 Version. Mean where significantly different at $p < 0.05$ level were separated using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Proximate Composition of Red and Yellow Flesh Coloured Cashew Apples

The effect of variety on chemical composition of cashew pulp meal is presented in Table 2. The chemical composition of all the components for both varieties were not significantly affected ($p > 0.05$). The values of dry matter, crude protein, crude fibre, ether extract, ash and carbohydrate were 88.78%; 89.20%, 13.82%; 16.96%, 6.71%; 7.08%, 10.62%; 10.41%, 2.85%; 2.48% and 54.79%; 52.28% for the sun-dried yellow and red cashew pulp meals respectively.

The dry matter content of 88.78% (for sun-dried yellow cashew pulp meal) and 89.20% (for sun-dried red cashew pulp meal) reported in this study are higher than 81% reported by Armah (2011). The crude protein (13.82%, for sun-dried yellow cashew pulp meal and 16.96%, for sun-dried red cashew pulp meal) of cashew pulp meal in this study are higher than 8.6%, 11.6%, 12.68% and 13.7% reported by Armah (2011), Obioha (1992), Adebowale *et al.* (2011) and La Van Kinh *et al.* (1997) respectively, but lower than 18.7% reported by Fanimo *et al*. (2003). The crude fibre (6.71%, for sun-dried yellow cashew pulp meal and 7.08%, for sun-dried red cashew pulp meal) in this study are close to 7.0% reported by Obioha (1992), but lower than 8.4%, 10.05 %, 11.6 %, and 11.8 % reported by Fanimo *et al.* (2003), Adebowale *et al.* (2011), Armah (2011) and La Van Kinh *et al.* (1997) respectively. The ether extract (10.41%, for sun-dried red cashew pulp meal and 10.62 %, for sun-dried yellow cashew pulp meal) in this study are higher than the 2.4%, 9.96%, and 9.6% reported by Fanimo *et al.* (2003), Armah (2011) and Obioha (1992) respectively. The value of ash (2.48%, for sun-dried red cashew pulp meal and 2.85%, for sun-dried yellow cashew pulp meal) obtained here are higher than 1.06%, 1.8% and 1.4% reported by Adebowale *et al.* (2011), Obioha (1992) and La Van Kinh *et al.* (1997) respectively, but lower than 5.4% and 3.8% reported by Fanimo *et al.* (2003) and Armah (2011).

Methods of processing, handling, storage, variety, environment and other factors might have resulted in these differences in chemical composition reported by various authors since they authors cited all worked on cashew pulp.

Phytochemicals (Quantitative and Qualitative) in Varieties of Sun-Dried Cashew Apple

The phytochemicals (quantitative and qualitative) in varieties of sun-dried cashew pulp is presented in Table 3. None of the phytonutrients showed significant difference ($p>0.05$). The values of saponin, tannin, flavonoid, phytate and oxalate were 0.1568%; 0.0701%, 0.0621%; 0.0877%, 0.0767%; 0.0438%, 0.3159%; 0.3661% and 0.0287%; 0.0327% for the sun-dried yellow and red cashew pulp meals respectively. The result showed that all the phytonutrients analysed are present in sun-dried cashew pulp, at different levels of intensity. The level of intensity of saponin in the red cashew variety is higher than that in the yellow variety. The level of intensity of tannin in both varieties is the same. Same level of intensity was also obtained for flavonoid, phytate and oxalate.

Table 2: Effect of Variety on Proximate Composition of Sun-Dried Cashew Pulp Meal

	Cashew Varieties		
Components (%)	Yellow	Red	SEM
Dry matter	88.78	89.20	1.07^{ns}
Crude protein	13.82	16.96	0.93^{ns}
Crude fibre	6.71	7.08	0.83^{ns}
Ether extract	10.62	10.41	1.04^{ns}
Ash	2.85	2.48	0.16^{ns}
Carbohydrate	54.79	52.28	1.44^{ns}

SEM = Standard Error of Mean, ns = not significant

Table 3: Phytochemicals (Quantitative and Qualitative) in Varieties of Sun-Dried Cashew Pulp

	Varieties of Cashew		
Anti-nutrients (%)	Yellow	Red	SEM
Saponin	0.1568 (+)	0.0701(++)	0.0483^{ns}
Tannin	0.0621 (++)	0.0877 (++)	0.0282^{ns}
Flavonoid	0.0767 (+)	0.0438 (+)	0.0235^{ns}
Phytate	0.3159 (+)	0.3661 (+)	0.1246^{ns}
Oxalate	0.0287 (+)	0.0327 (+)	0.0101^{ns}

SEM = Standard Error of Mean, ns = Non- Significant at (p>0.05) (+) = Level of Intensity

Saponin content is higher in the red cashew variety than in the yellow variety. Both varieties have the same level of tannin content but different levels of flavonoid, phytate and oxalate.

The values of 0.0701% (sun-dried red cashew pulp meal) and 0.1568% (sun-dried yellow cashew pulp meal) of saponin in this study for sun-dried cashew pulp meal are The value of saponin in this study for sun-dried cashew pulp is higher than 0.037% - 0.043% reported by Oluremi *et al.* (2007a) for peels of some citrus fruits varieties. The saponin content of sun-dried cashew pulp were also observed to be far lower than 3% which was reported by Kumar (1991) to be responsible for cattle losses when they grazed on alfonibrilla (*Drymaria arenaroides*).

The range of 0.062 – 0.088% tannin contents reported in this study for the sun-dried red and yellow flesh varieties was lower than the level (1% - 20%) reported in cereals and legumes by Price and Butler (1980) to cause adverse effect in live stocks. In ruminants however, dietary tannin content

of 2% - 3% have been shown to reduce protein degradation in the rumen by formation of tannin-protein complex at high alkaline pH. This complex is however dissociated post-ruminally at a lower pH and the protein becomes available for digestion (Barry, 1987).

The values of 0.0438% (sun-dried yellow cashew pulp meal) and 0.0767% (sun-dried red cashew pulp meal) for flavonoid in this study for sun-dried cashew pulp meal are higher than 0.025% - 0.045% reported by Oluremi *et al.* (2007b) for citrus fruit peel meal, but lower than 0.09% reported by Oyewole (2011) for fermented sweet orange (*Citrus senensis*) fruit peel meal. Flavonoids have been reported to function as pigments and antioxidants (Kumar, 1991).

The phytate content of 0.3159% in yellow cashew pulp meal and of 0.3661% in red cashew pulp meal are higher than 0.062% - 0.082% reported by Oluremi *et al.* (2007b) for citrus fruit peel meal. Phytate is found within the hulls of nuts, seeds and grains, and the phosphorus in phytate form is usually bio-unavailable to non-ruminants as they lack the digestive enzyme, phytase, which is required to extract phosphorus from phytate molecule. Ruminants however can readily use phytate also because of the activities of the rumen (Wikipedia, 2014b).

The values of 0.0287% (sun-dried yellow cashew pulp meal) and 0.0327% (sun-dried red cashew pulp meal) of oxalate in this study for sun-dried cashew pulp meal are lower than 0.033% - 0.048% reported by Oluremi *et al*. (2007b) for citrus fruit peel meal and 1.34% reported by Oyewole (2011) for fermented sweet orange (*Citrus senensis*) fruit peel meal. Monogastrics are susceptible to oxalate, such that a diet containing 0.020% can be deadly to chickens. In ruminants however, oxalate is broken down by *Oxalobacter formigenes* in the gut flora such that, sheep and goats are able to adapt to diets with relatively high oxalate, although introducing feeds high in oxalate has to be gradual to allow time for the animal to adapt to the oxalate (DFID, 2006).

CONCLUSION AND RECOMMENDATIONS

Studies on proximate composition and phytochemicals of sun-dried cashew pulp meal reveals that based on the proximate composition, the red cashew flesh variety is richer in crude protein while the yellow cashew flesh variety is richer in carbohydrate.

The values of Phytochemicals present in both cashew varieties as shown in this study are in very low amounts, lower than the levels that can bring about an adverse effect in livestock as reported by other authors. It was recommended that since both varieties of cashew are rich in one component or the other (e.g. the red variety is rich in protein, while the yellow variety is rich in carbohydrate), crop scientists should work towards increasing the production of both varieties (especially the red cashew variety) since the red variety is not mostly cultivated when compared to the yellow variety.

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