International Journal of Nutrition and Food Sciences
2017; 6(6-1): 22-25
http://www.sciencepublishinggroup.com/j/ijnfs
doi: 10.11648/j.ijnfs.s.2017060601.14
ISSN: 2327-2694 (Print); ISSN: 2327-2716 (Online)

Proximate Composition, Phytonutrients and Antioxidant Properties of Oven Dried and Vacuum Dried African Star Apple (*Chrysophyllum albidum*) Products

Oluwole Oluwatoyin Bolanle[1, *], Odediran Olajumoke[1], Ibidapo Olubunmi Pheabean[1], Owolabi Samuel[1], Chuyang Li[2], Garry Shen[3]

[1]Food Technology Department, Federal Institute of Industrial Research, Oshodi, Lagos, Nigeria

[2]Department of Bioactive Compounds and Functional Foods, Institute of AgroFood Science and Technology, Jiangsu Academy of Agricultural Sciences, Nanjing, China

[3]Department of Internal Medicine, University of Manitoba, Manitoba, Canada

Email address:

oluwatoyinoluwole575@yahoo.com (O. O. Bolanle)

[*]Corresponding author

To cite this article:

Oluwole Oluwatoyin Bolanle, Odediran Olajumoke, Ibidapo Olubunmi Pheabean, Owolabi Samuel, Chuyang Li, Garry Shen. Proximate Composition, Phytonutrients and Antioxidant Properties of Oven Dried and Vacuum Dried African Star Apple (*Chrysophyllum albidum*) Products. *International Journal of Nutrition and Food Sciences.* Special Issue: Advances in Food Processing, Preservation, Storage, Biotechnology and Safety. Vol. 6, No. 6-1, 2017, pp. 22-25. doi: 10.11648/j.ijnfs.s.2017060601.14

Received: July 31, 2017; **Accepted**: August 1, 2017; **Published**: October 10, 2017

Abstract: *Chrysophyllum albidum* has been reported to be a medicinal plant due to its high Vitamin C content and the presence of phytonutrient such as phenols and flavonoids. Freshly harvested African star apple fruits were processed and separated into pulp, seeds and peel and were dried between 60°C to 65°C using different forms of drying technology, specifically Oven drying and Vacuum drying. The dried products were subjected to proximate, elemental and vitamin C analysis. Also, the total phenolic and flavonoid content of the products were determined and their antioxidant potentials explored. Results showed that samples that were vacuum dried retained their nutritional composition, phytonutrient content and antioxidant potentials better than samples that were oven dried. Also, results showed that the seeds appeared to contain more fibre, ash, protein and fat content than all other fruit parts. However, the pulp contained more moisture and Vitamin C content while the peels were the richest in carbohydrates. Results also revealed that the pulp had the highest phytonutrient content and as such exhibited more antioxidant potentials than all other fruit part.

Keywords: *C. albidum*, Antioxidant, Vacuum Drying, Oven Drying

1. Introduction

Fruits are main sources of minerals, fibre and vitamins which are inevitable for human health. *Chrysophyllum albidum* is a typical ever green edible fruit tree. It belongs to the family Sapotaceae and is common throughout the tropical Central, East and West Africa regions for its sweet edible fruits and ethno-medical uses. The African star apple tree is about 8-36cm in height and the fruit is seasonal (December – April). Medicinal plants are used as sources of therapeutic agents due to the presence of secondary metabolites and also their reduced cost, relative lower incidence of adverse reactions compared to modern synthetic pharmaceuticals.

C. albidum is widely used as an application to sprains, bruises, wounds and as a medicinal plant for yellow fever and malaria. The leaves are used as emollients for the treatment of skin eruptions, diarrhea and stomach aches which are as a result of infections and inflammatory reactions. It also has great medicinal benefits which include plasma cholesterol reduction rate of sugar uptake as well as detoxifying actions. The sweet fleshy fruit is an excellent source of Vitamin C, iron and is used as a thickener, flour and raw materials for some manufacturing industries. The plant could be employed as a source of natural antioxidant boosters in the treatment of some oxidative stress disorders in

which free radicals have been implicated [1].

The results of phytochemical studies of extracts show the presence of alkaloids, saponins, steroids, tannins and volatile oils but the presence of saponins and tannins were not detected in hexane extract of *C. albidum* [1].

The fruit has immense economic potentials [2]. When ripe, its ovoid to subglobose, pointed at the apex, up to 6cm long and 5cm in diameter, the skin or peel is orange to golden yellow and the pulp within may be orange, pink or light yellow. Within the succulent pulp are three to five seeds and their coats are hard, bony, shiny, dark brown in colour and when broken reveal white cotyledons [2]. The peel contains 58.9% moisture, 6.1% protein, 12.4% fat, 4.6% ash, 62.4% carbohydrates and 14.5% crude fibre. The pulp contains 67.5% moisture, 8.8% protein, 13.1% fat, 68.7% carbohydrates, 40% crude fibre and 3.4% ash. Anti-nutrients present include; total oxalate (skin = 211mg/100g, pulp = 167mg/100g), tannins (skin = 264mg/100g, pulp = 627mg/100g), hydrocyanic acid (skin = 5.4mg/100g, pulp = 6.8mg/100g) and phytic acid (skin = 0.8mg/100g, pulp = 1.6mg/100g) [3]. The seed has been reported to have very high crude protein content.

Recent studies using experimental animals have shown the antidiabetic properties of different parts of the *Chrysophyllum alibidum* [4] [5].

2. Materials and Methods

2.1. Materials to Be Used

Freshly harvested African star apple fruits, fresh pulp, seeds and peel of African star apple, potable water.

2.2. Production of African Star Apple Products

Different parts of the African Star Apple plants specifically the seeds, pulp and peel were dried at between 60^{o}C to 65^{o}C using different forms of drying technology, specifically Oven drying and Vacuum drying. The different African Star Apple flours obtained were then and stored in a cool environment until required for analysis

2.3. Determination of Chemical Composition of African Star Apple

The different parts of the African Star Apple plant (peel, pulp and seeds) were subjected to proximate, elemental and vitamin analysis using the method of Association of official analytical Chemists [6]. Vitamin C was the major vitamin determined in this study

2.4. Quantitative Screening for Phytonutrients

Determination of Total Phenolics

Total phenolic content of the products were determined with Folin Ciocalteu method [7]. The Folin–Ciocalteu (F–C) reagent is sensitive to reducing compounds, polyphenols and thus produces a blue colour complex. The F-C assay relies on the transfer of reducing equivalents (electrons), in the alkaline medium, from phenolic compounds to phosphomolybdic/phosphotungstic acid complexes, manifested in the formation of blue colour complexes that were determined on a UV-visible spectrophotometer (Thermo Fischer model Evolution 201) by monitoring the absorbance at 765 nm. 18, 19 Gallic acid was used as the reference compound for comparison and values are evaluated as the mg equivalent of gallic acid per g of extract. Briefly, a mixture containing 0.1 g of the product, 0.8 ml of deionised water and 0.1 ml of Folin-Ciocalteu reagent was first incubated at room temperature for 3 min. After adding 0.3 ml of Na_2CO_3 (20% w/v), the mixture was further incubated at room temperature for 30 min. To obtain a calibration curve, various concentration of gallic acid solutions (0.05, 0.04, 0.03, 0.02, 0.01, 0.008, 0.005 and 0.001 mg/ml) were prepared. Appropriate volume of sodium carbonate solution was added in each flask and the final volume was adjusted with distilled water. Measurements were carried out after 1 h at 765 nm on a UV-visible spectrometer against the reagent blank. The calibration curve of concentration against the absorbance was plotted. 1 mL of stock solution of extracts was transferred in a 25 mL flask; similar procedure (vide supra) was adopted for the preparation of calibration curve. With the help of the calibration curve, the phenolic concentration of extracts was determined

2.5. Determination of Flavonoids

Flavonoids in the test sample was determined by the acid hydrolysis spectrophotometric method. 0.5g of the sample was mixed with 5ml of dilute HCl and boiled for 30mins. The boiled extract was then allowed to cool and filtered. 1ml of the filtrate was added to 5ml of ethylacetate and 5ml of 1% NH3. Then the absorbance was read at 420nm [8].

Determination of antioxidant potentials of developed African star apple products

2.5.1. FRAP Assay

The FRAP method was performed as described by Benzie & Strain [9] with some modifications. The FRAP reagent was prepared with acetate buffer (300 mM, pH 3.6), TPTZ (10 mM in HCl, 40 mM) and FeCl3 (20 mM). The proportions were 10:1:1 (v:v:v), respectively. A suitable dilution of the extract was then added to the FRAP reagent (1:30, v:v) and incubated at 37°C. The absorbance at 593 nm at time zero and after 4 min was recorded. The analysis was performed in triplicate for each sample and values were determined from a calibration curve of Trolox (ranging from 2.5 to 33 µM). The results were expressed as mmol or g of Trolox equivalent per gram of dry weight.

2.5.2. DPPH Free-Radical Scavenging Activity

The extracts were analyzed for their antioxidant activity based on their scavenging activity of the 1, 1-diphenyl2-picryl hydrazyl (DPPH) free radical, using the method of Mensor et al. [10]. DPPH is a stable free radical and acts as a scavenger for other radicals. Rate reduction of a chemical reaction using DPPH is a useful indicator of the radical state

of a reaction. Samples (2.5mL) were prepared in triplicates at different concentrations (100- 4000 µg/mL) and transferred into 1 mL 0.3mM methanolic DPPH solution. Samples were then left to stand for 30 minutes in the light and the absorbance was measured at 517nm, zeroing the spectrophotometer with a methanol blank. Ascorbic acid (BDH laboratories) was used as a positive control. The% inhibition was calculated using the following equation:

$$\%\ Inhibition = 1 - \frac{(Absorbance\ of\ sample\ - Absorbance\ of blank)}{(Absorbance\ of\ control)} \times 100$$

3. Results and Discussion

The chemical composition of vacuum dried and oven dried African Star apple seeds, pulp and peels are represented in table 1. From the results gotten, the seeds appeared to contain more fibre, ash, protein and fat content than all other fruit parts. However, the pulp contained more moisture and Vitamin C content while the peels were the richest in carbohydrates. Also, it was observed that vacuum drying preserved the nutritional composition of the fruit better than oven drying and this is in agreement with previous reviews [11] where it was reported that vacuum drying preserved nutritional compounds in waxy skinned fruits better than conventional drying methods such as oven drying.

Table 1. *Mean values of Chemical Composition of African Star Apple.*

Plant part	Moisture (%)		Ash (%)		Fibre (%)		Protein (%)	
	VD	OD	VD	OD	VD	OD	VD	OD
Seed	4.75±.07	6.36±.39	3.64±.28	2.95±.09	6.00±.12	6.17±.15	7.06±.08	6.24±.55
Pulp	6.77±.17	7.18±.15	3.38±.28	2.70±.13	5.75±.28	5.67±.11	5.68±.06	5.44±.20
Peel	3.96±.07	5.31±.14	4.30±.29	3.65±.10	6.27±.16	6.29±.22	3.51±.10	2.90±.12

Table 1. *Continue.*

Plant part	Fat (%)		Carbohydrates (%)		Vitamin C (mg/g)	
	VD	OD	VD	OD	VD	OD
Seed	7.99±.11	7.04±.08	70.56±.11	71.24±.44	.087±.006	.033±.001
Pulp	3.88±.13	3.56±.12	74.54±.24	75.46±.35	.967±.015	.810±.036
Peel	2.33±.09	2.12±.11	79.63±.28	79.73±.44	.775±.013	.533±.025

The presence of phytochemicals such as phenols and flavonoids in African Star Apple have been previously reported [12]. The total phenolic and flavonoid content of the African Star Apple seeds, pulp and peels are shown in table 2. The pulp appears to have the highest concentration of these phytochemicals followed by the peels and then the seed. Also, the method of drying affected the preservation of these phytochemicals in the dried products with vacuum drying preserving them better.

Table 2. *Total phenolic and total flavonoid content of African Star Apple.*

Plant part	Total Phenols (mgGAE/100g)		Total Flavonoids (mgCAT/100g)	
	VD	OD	VD	OD
Seed	315.62 ± 2.67	279.79 ± 6.68	128.89 ± 4.02	116.68 ± 2.90
Pulp	1057.50 ± 6.01	690.99 ± 2.50	769.44 ± 15.01	650.98 ± 1.75
Peel	347.56 ± 4.68	308.30 ± 3.66	258.84 ± 2.27	160.21 ± 2.81

The phytochemicals present in the African Star Apple have been reported to confer some antioxidant properties on the fruit [12] and results obtained in this study confirms that report. The pulp was observed to have the highest antioxidant properties and this can be linked to the fact that it had the highest concentrations of the phytochemicals tested for. Also, the drying methods used affected the antioxidant properties with the vacuum dried products exhibiting better antioxidant properties than the oven dried products.

Table 3. *Antioxidant properties of African Star Apple.*

Plant part	DPPH (%)		FRAP (mgAAE/100g)		MC (%)	
	VD	OD	VD	OD	VD	OD
Seed	52.82 ±.24	50.67 ±.73	143.36 ± 1.53	143.68 ± 2.24	43.53 ±.82	42.72 ± 1.56
Pulp	60.95 ±.45	55.70 ± 1.68	175.11 ±.99	174.05 ±.96	51.46 ±.50	47.13 ± 1.01
Peel	41.98 ± 1.68	40.14 ± 1.58	124.10 ± 1.09	121.17 ±.67	44.81 ±.68	43.35 ±.65

References

[1] Orijajogun, O. J., Olajide, O. O., Fatokun, A. O., Orishadipe, A. Y and Batari, M. L. 2013. The preliminary chemical constituent of free radical scavenging activity of the exocarp of the fruit extract of African star apple (*Chrysophllum albidum*). International Journal of Pharma Science and Research, 3(3): 72-80.

[2] Essien, A. I., Ebana, R. U. B. and Udo H. B. 1992. Chemical evaluation of pod and pulp of the fluted pumpkin (*Telfaira occidentalis*) fruit. Food Chemistry, 45: 175-178.

[3] Edem, C. A., Dosunmu, M. I., Ebong, A. C. and Jones, M. 2008. Determination of Proximate composition of Ascorbic acid and heavy metal content s of star fruit (*Averrhoa carambola*) Global Journal of Pure and Applied Sciences, 14 (2); 193-195.

[4] Adebayo, A. H., Abolaji, A. O., Opata, T. K. and Adegbenro, I. K. 2010. Effects of ethanolic leaf extract of *Chrysophyllum albidum* G. on biochemical and haematological parameters of albino Wistar rats. African Journal of Biotechnology, 9: 2145-2150.

[5] Olorunnisola, D. S., Amao, I. S., Ehigie, D. O. and Ajayi Z. A. F. 2008. Anti-Hyperglycemic and Hypolipidemic Effect of Ethanolic Extract of *Chrysophyllum albidum* Seed Cotyledon in Alloxan Induced-Diabetic Rats. Research Journal of Applied Science, 3: 123-127.

[6] AOAC. 2010. Official Methods of Analysis, 18th ed. Association of Official Analytical.

[7] Kaur, C., H. C. Kapoor, Anti-oxidant activity and total phenolic content of some Asian vegetables, Int. J. Food Sci. Technol. 37 (2002) 153–161.

[8] Harbone, J. B. 1973. Textbook of Phytochemical methods. London. Chapman and Hall, Ltd. pp. 49-188.

[9] Benzie, I. F. and Strain, J. J. 1996. The ferric reducing ability of plasma (FRAP) as a measure of "antioxidant power": the FRAP assay. Analytical Biochemistry, 239(1); 70–6.

[10] Mensor, L., Menezes, F., Leitao, G., Reis, A., Santos, T. and Coube, C. 2001. Screening of Brazilian plant extracts for antioxidant activity by the use of DPPH free radical method. Phytotherapy Research, 15, 127-130.

[11] St. George, S. D., Cenkowski, S. and Muir, W. E. 2004. A review of drying technologies for the preservation of nutritional compounds in waxy skinned fruit. A presentation at ASAE/CSAE conference, Winnipeg, Manitoba, Canada.

[12] Imaga, N. O. A. and Urua, E. E. 2013. Chemical and antioxidant evaluation of Start Apple fruit (Chrysophyllum albidum) crude extracts. Planta Med; 79-83.