www.iaajournals.org
ISSN: 2636-7246

The phytochemical constituents of jackfruit (*Artocarpus heterophyllus* Lam) and African breadfruit (*Treculia africana* Decne).

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ABSTRACT

The phytochemical constituents of jackfruit (*Artocarpus heterophyllus* Lam) and African breadfruit (*Treculia africana* Decne) were determined. The seeds, leaves, stem and root of *Treculia africana* and *Artocarpus heterophyllus* were obtained from Umuoji, in Idemmili North Local Government Area of Anambra State, Nigeria. Qualitative and quantitative phytochemical analyses were done using standard methods. The result of the quantitative phytochemical compositions of the stem, root, seed and leaf of both plantsis revealed that for *A. heterophyllus*, its leaf extract of gave higher composition of flavonoid (10.37±0.15%) and phenol (37.28±0.02%),its seed extract gave higher composition of saponin (40.95±0.02%), the root extract gave the higher composition of hydrogen cyanide (4.05±0.02mg/g) and alkaloid (5.77±0.15%), andits stem extract gave higher composition of tannin (11.32±0.02 %). While for *T. africana*, its stem extract gave higher composition of hydrogen cyanide (8.91±0.02mg/g), the root extract gave higher composition of tannin (14.60±0.53%), its seed extract gave higher composition of flavonoid (9.63±0.15 %) and alkaloid (4.80±0.10 %) while the leaf extract gave the higher composition of saponin (58.10±0.02 %) and phenol (37.75±0.01%). In conclusion, jackfruit (*Artocarpus heterophyllus* Lam) and African breadfruit (*Treculia africana* Decne) are rich in phytochemicals and could be responsible for the medicinal properties of the plants.

Keywords: Phytochemical, jackfruit, *Artocarpus heterophyllus* Lam, African breadfruit *Treculia africana* Decne.

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* Lam) is one of the most significant dicotyledonous trees in tropical homegardens and perhaps the most widespread and useful tree in the genus *Artocarpus* [1,2,3,4,5]. The generic name comes from the Greek words 'artos' (bread) and 'karpos' (fruit); the fruits are eaten and are commonly called 'African breadfruit' or 'Bread of the Tropics'. The specific name, 'heterophyllus', in Latin means, with leaves of different sizes and shapes and the word 'heteros' in Greek corresponds to the word 'different' [6,7,8]. The word 'jackfruit' comes from Portuguese jaca, which in turn, is derived from the term 'chakka' in Malayalam language [9,10]. The ancient Indian Language Sanskrit refers this fruit as [11] and it is known in south east of Nigeria among the igbos as *ukwa bekee/ukwa oyibo* (white-man bread fruit) [12]. Jackfruit is both the name of the fruit and of the tree it grows on [7]. It is a perennial fruit tree crop, growing vigorously on both the branches and trunks of trees that can reach up to 8-25 meters in height and 2 meters in girth [13]. Fully- riped Jackfruit will fall from the tree, so it is often harvested early to avoid having the large fruits fall on top of anyone. These attribute are close to the features of *Treculia*. The aroma of a mature Jackfruit has been described as off-putting, similar to overripe fruit. Younger ripe fruit has a sweeter aroma. Jackfruit has a sweet taste and a flavor that is likened to bananas, pineapple and even bubblegum. As the fruit matures, the bulbs become a darker orange-yellow and the taste gets sweeter [14]. The succulent, aromatic, and flavorful fruit is eaten fresh or preserved in myriad ways. The nutritious seeds are boiled or roasted and eaten like chestnuts, added to flour for baking, or cooked in dishes [15]. It is also known for its remarkable, durable timber, which ages to an orange or redbrown color. The leaves and fruit waste provide valuable fodder for cattle, pigs, and goats. Many parts of the plant including the bark, roots, leaves, and fruit are attributed with medicinal properties. Wood chips yield a dye used to give the famous orangered color to the robes of Buddish priest [16]. The tree can provide many environmental services. In homegardens, the dense jackfruit canopy can provide a visual screen and is very ornamental. The fruit is known as the 'poor man's fruit' in eastern and southern parts of India because it is a

major part of their diet as a vegetable and nutritious dish during the season [17,18]. The tree is reportedly native to the rainforests of Malaysia and the Western Ghats of India [19]. Garcia de Orta- a physician and naturalist, in his book 'Coloquious dos simplese drogasda India', written in 1563 gives reference of 'Jack Fruit'. It was introduced into Northern Brazil in the middle of 19th century and became popular there. Today the tress is widely grown in Bangladesh, Malaysia, Burma, Indonesia, in the Carribbean islands, in the evergreen forest of West African, in Nortern Australia, in part of USA, in Brazil, in Pueroto Rico, Pacific islands, Yap, Samoa and other Islands [20]. It is also found in South-East of Nigeria where it grows wild or semi-conserved [21]. Jack fruit is a highly nutritive seasonal food with edible portion rich in carbohydrate, protein, fat, fiber, calcium, phosphorous, iron, vitamin A, thiamine and minerals [22,23,24]. It has more protein, calcium, thiamine, riboflavin and carotene than banana but less nutritious than mango [25]. When compared to other tropical fruits like orange, banana, mango, pineapple papaya and ber, jackfruit pulp and seeds quantitatively contains more protein, calcium, iron and thiamine and are a good source for these essential nutrients [26]. Jackfruit provides instant boast of energy and anti-oxidant beneficial. Fructose, glucose and sucrose are the major sugars present in jack fruit [27]. This tropical sweet tasting seeded fruit is stomach and heart friendly [8] and also boast immunity and protects the body from viral and bacterial infections, due to the presence of phytonutrient and vitamin [10]. African breadfruit is a traditionally important edible fruit tree whose importance is due to the potential use of its seeds, leaves, timber, roots and bark. It is increasingly becoming commercially important in Southern Nigeria hence, [11] described it as an important natural resource which contributes significantly to the income and dietary intake of the poor. [12], reported that there is an increased interest in African breadfruit seed, which is an important food item among the Igbo tribal group of South-Eastern Nigeria. The seeds are highly nutritious and constitute a cheap source of vitamins, minerals, carbohydrates, fats, fibre, vegetable oil and high quality protein in differentproportions [7,9,11] and can be recommended tothe aged, patients of diabetics, allegery and anemiabecauseof the high percentage content of digestible protein in thespecies seeds [14]. The seed is a rich protein source therefore among the plants consumed in the world; it is one of the richest in terms of its benefits [17]. It is also a good source of vegetable oil. In the past the consumption was limited to poor village dwellers for whom it supplemented their diets during times of food scarcity and substituted the more expensive rice during festivals and other ceremonies on the basis of tradition and cost [14], thus addressed as a poor man's source of diet. But today, African breadfruit has become a delicacy and a specialized meal not only for the rich and the urban dwellers in Nigeria but has also become a source of foreign exchange as the dehulled seeds are sun-dried and exported to cater for the African consumer interests overseas. It is in high demand in rural and urban populations, widely used in catering at official events and ceremonies [15]. Prices for African breadfruit have increased in recent years [17]. This important plant unfortunately is fast disappearing due to development as the bulky fruit produced by the plant seems to suggest that it is a forest species. It is not planted around homes or open places where people gather for any form of activities even along roads. Technology had even reduced the height through micro propagation but the extreme weight of the fruit continues to create problem for the branches that may not carry the fruits [9]. Interestingly however, jackfruit has been reported to be the closest alternative, although detailed information to support the claim is still scanty. It is however known that jackfruit is highly nutritious.

Aim of the Study

The aim of this research was to acertain the phytochemical constituents of jackfruit (*Artocarpus heterophyllus* Lam) and African breadfruit (*Treculia africana* Decne).

MATERIALS AND METHODS

Source of Materials

The test samples, (the seeds, leaves, stem and root of *Treculia africana* and *Artocarpus heterophyllus*) were obtained from Umuoji, in Idemmili North Local Government Area of Anambra State, Nigeria. Chemicals and facilities used in the practical were obtained from the Yitzhak Rabin Laboratory Biotechnology

Research Centre, Nnamdi Azikiwe University, Awka and Plant Science and Biotechnology Laboratory, University of Nigeria Nsukka, Nigeria.

Identification of Materials

All plant materials used in this study were identified by Prof. C.U. Okeke, - a professor of Taxonomy in Botany Department, Nnamdi Azikiwe University, Awka.

Preparation of Samples for Phytochemical analysis

Quantities of each of the four samples (the seeds, leaves, stem and root) of *T. africana* and *A.heterophyllus* were dried in an oven at 80˚C for one day. After which, each was ground with pestle and mortar and sieved to get a fine sample of each.

Qualitative Phytochemical Screening

Qualitative phytochemical test was conducted to ascertain the presence or absence of phytochemicals like tannins, saponin, alkaloids, flavonoids, hydrogen cyanide and phenol. These tests were carried out by the methods of [3].

Quantitative Phytochemical Screening

Standard methods were used in the quantitative estimation of tannins, saponins, flavonoids, alkaloids, hydrogen cyanide and phenol as described by [3]. The values were expressed as percentages.

Statistical Analysis

Data collected was analysed using Analysis of Variance (ANOVA) and test of significance were processed using Duncan's Multiple Range Test [8] and Student's 't' test at 5% level of probability.

RESULTS

Table 1: Qualitative Phytochemical Constituentsof *A. heterophyllus* and *Treculia africana*

Constituents	Plant species	Result Stem	Root	Seed	Leaf
Tannin	*A. heterophyllus*	+ + +	+	+ +	+ +
	T. africana	+ +	++ +	++ +	+ +
Flavonoid	*A. heterophyllus*	+	+ +	+	+ + +
	T. africana	++	++	++ +	++
Saponin	*A. heterophyllus*	+ +	+ +	+ + +	+ + +
	T. africana	+++	++	++	+++
Alkaloid	*A. heterophyllus*	+	+ +	+	+ +
	T. africana	++	++	++	++
Phenol	*A. heterophyllus*	+ +	+ +	+ +	+ + +
	T. africana	++	++	++	+++
Hydrogen Cyanide	*A. heterophyllus*	+	+	+	+
	T. africana	++	+	+	+

very deeply present = (+++), Deeply present = (++), Slightly present = (+)

ComparativePhytochemical Constituents of the Parts of *A. heterophyllus* and *T. africana*. Result of the quantitative phytochemical compositions of the

stem, root, seed and leaf of both plantsis shown in Table 2.The Table 2 revealed that for *A. heterophyllus*, its leaf extract of gave higher composition of flavonoid (10.37±0.15%) and phenol (37.28±0.02%),its seed extract gave higher composition of saponin (40.95±0.02%), the root extract gave the higher composition of hydrogen cyanide (4.05±0.02mg/g) and alkaloid (5.77±0.15%), andits stem extract gave higher composition of tannin (11.32±0.02 %). While for *T. africana*, its stem extract gave higher composition of hydrogen cyanide (8.91±0.02mg/g), the root extract gave higher composition of tannin (14.60±0.53%), its seed extract gave higher composition of flavonoid (9.63±0.15 %) and alkaloid (4.80±0.10 %) while the leaf extract gave the higher composition of saponin (58.10±0.02 %) and phenol (37.75±0.01%). There was significant difference in all the phytochemicals assayed between the stem, root, seed and leaf extracts of *A. heterophyllus*and also between those of *T. africana* ($p>0.05$). In comparism of the same part of the two plants, aside for root and leaf saponin content, stem tannin content and leaf alkaloid content of both plants, significant differences exist in all other phytochemical constituent of the same part of the two plants.

Table 2: Comparative Percentage Phytochemical Constituents of the Parts of *A. heterophyllus*and *T. africana*

Constituent	Specie	P-value	Plant Part				P-value for parts
			Stem	Root	Seed	Leaf	
Flavonoid	*A.heterophyllus*		4.67±0.15[a]	8.00±0.02[b]	1.43±0.15[c]	10.37±0.15[d]	0.00
	T. africana		5.60±0.20[a]	5.57±0.15[a]	9.63±0.15[b]	7.20±0.20[c]	0.00
		p-value	0.00	0.00	0.00	0.00	
Saponin	*A.heterophyllus*		26.67±0.02[a]	19.05±0.02[b]	40.95±0.02[c]	38.11±0.02[d]	0.00
	T. africana		33.33±0.02[a]	18.39±0.53[b]	28.57±0.02[c]	58.10±0.02[d]	0.00
		P-value	0.00	0.16	0.00	0.56	
Tannin	*A.heterophyllus*		11.32±0.02[a]	4.46±0.01[b]	7.51±0.02[c]	7.98±0.02[d]	0.00
	T. africana		8.90±0.02[a]	14.60±0.53[b]	12.68±0.02[c]	7.97±0.01[d]	0.00
		P-value	0.41	0.00	0.00	0.00	
Phenol	*A.heterophyllus*		19.26±0.02[a]	10.77±0.02[b]	22.41±0.02[c]	37.28±0.02[d]	0.00
	T. africana		19.25±0.02[a]	8.21±0.02[b]	20.09±0.02[c]	37.75±0.01[d]	0.00
		P-value	0.00	0.00	0.00	0.00	
Alkaloid	*A.heterophyllus*		3.87±0.15[a]	5.77±0.15[b]	1.57±0.15[c]	4.27±0.15[d]	0.00
	T. africana		4.31±0.02[a]	3.23±0.15[b]	4.80±0.10[c]	4.20±0.20[a]	0.00
		P-value	0.00	0.00	0.00	0.67	
Hydrogen cyanide	*A.heterophyllus*		2.87±0.02[a]	4.05±0.02[b]	2.04±0.01[c]	3.80±0.01[d]	0.00
	T. africana		8.91±0.02[a]	3.05±0.02[b]	3.42±0.01[c]	5.52±0.02[d]	0.00
		P-value	0.00	0.00	0.00	0.00	

For each parameter, columns sharing similar superscripts are not significantly different at P>0.05. Results are in Mean ± Standard Deviation

DISCUSSION

The result of the phytochemical assessment of *Artocarpus heterophyllus* and *Treculia africana* (Table 1) showed the presence of all the phytochemicals tested though at varying concentrations. These are the compound [9] termed the radical scavengers that have antioxidant effects. The presence of these phytochemicals revealed the medicinal properties of the plants. This agreed with so many reports [10,14,17,19] on the use of extracts of these plant for antimicrobial and other medicinal purposes. [20], reported that health benefits of fruit and vegetables are from additive and synergistic combination of

phytochemicals. The high presence of phenols and saponins in both plants showed the antiseptic properties of the plants and could be used as immune boaster. They can also be used in industries in soft drink, beers, soaps etc.

CONCLUSION

In conclusion, jackfruit (*Artocarpus heterophyllus* Lam) and African breadfruit (*Treculia africana* Decne) are rich in phytochemicals and could be responsible for the medicinal properties of the plants.

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