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METALS AND PHYTOCHEMICAL COMPOSITION OF LEAVES AND PEELS OF PAWPAW (*Carica papaya*) SOLD WITHIN PORT HARCOURT, RIVERS STATE, NIGERIA

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ABSTRACT

Leaves and peels of pawpaw bought from open market within Port Harcourt metropolis were examined for metals and qualitative phytochemical compositions. The metals examined in the leaves and peels of the pawpaw were manganese (Mn), potassium (K), sodium (Na), zinc (Zn), magnesium (Mg), calcium (Ca), iron (Fe), arsenic (As), nickel (Ni), copper (Cu), lead (Pb), and selenium (Se). Their concentrations were in the order of Fe > Mn > Zn > Mg > K >Cu > Ca > Ni > Na > Pb> Ar = Se in the leaves, while those of the peels were in the order of Fe > Mn > Zn > Mg > Cu > Ca > K > Ni = Na > Pb> Ar = Se. The results of heavy metals in leaves and peels were not significantly different from each other, but were slightly higher in the peels than the leaves. The phytochemicals examined in the leaves and plants were flavonoids, alkaloids, glycosides, phenol, terpenoids, tannins, carboxylic acids, quinones and xanthoproteins. In the aqueous extracts of the leaves and peels were; flavonoids, alkaloids, phenolics, caboxylic acids and xanthoprotein, while methanolics extracts showed the presence of flavonoids, alkaloids, glycosides, phenolics, terpenoids and xanthoproteins. The presence of micronutrients and phytochemicals in the pawpaw plant might be the reason for its utility for the cure of different diseases and ailments.

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Introduction

Plants contain important chemicals used in traditional herbal drug dispensing for curative purposes. The usage of plants for curative and preventive remedies is an age-long activity. The advantage of medicinal plants over orthodox or synthetic lies in the fact that it is cheap, common with low or no side effects on humans. Plants contain chemical ingredients of medicinal importance which has the capacity to change some bodily actions in the human body functions [1].

Medicinal plants have been naturally sought for thousands of years in the past ages, and have contributed immensely to the synthesis of a large number of modern-day drugs. They have found the usage as alternative remedies in the daily treatment of numerous sicknesses universally [2]. Lately, the quest for the separation and production of novel compounds from therapeutic plants have become a new area of interest to researchers. The reasons of the recent upsurge in the study of ethno-pharmaceutical based drugs lie in the fact that they possess efficient antimicrobial, antifungal, antidiabetic, and antioxidant characteristics [3].

Pawpaw (*Carica papaya*) belongs to the order of plant kingdom known as Brassicales and the family of Caricaceae [4]. The juice obtained from pawpaw has been applied to many domestic and medicinal uses such as softening of meat (during cooking), treatment of digestive problems [5, 6]. The chemical contents of pawpaw have also been found useful in increasing the immune system and dealing with cell tumour [7]. The unripe fruit has been used to treat intestinal and other parasitic worms, skin diseases, urinary problems, and abnormalities [3].

This study was therefore undertaken to examine the concentrations of some metals, and phytochemical composition of the leaves and fruit peels of the pawpaw plant.

Materials and Methods

Source of Plant Parts and Preparation

Carica papaya leaves and peels were obtained from fruit sellers within the Rumuolumeni axis of Port Harcourt, Rivers State, Nigeria. They were washed and separately dried to constant weight without direct heat from the sun. The dried samples were

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pulverized to fine powder with an electric blender. The blended particles were sieved with a 2mm sieving basket, and stored in the laboratory.

Digestion of Samples and Heavy Metals Analysis

2g of the powdered leaves and peels were separately digested using the method of mixed acids [8]. The obtained mixture was filtered into sample bottles to obtain the digest and made up to 20 ml mark. The digest was sent to the Analytical Laboratory Unit of the JAROS Base Scientific Laboratory and was analyzed for heavy metals using an atomic absorption spectrophotometer (AAS).

Extraction of Phytochemicals

One hundred grams of the powdered pawpaw leaves and peels were separately put into 500ml volumetric flask, which contained 250ml of distilled water and methanol. They were allowed standing for 72 hours. Thereafter, the contents were filtered with Whatman filter paper. The filtrate (extract) was concentrated by reducing the volume to 100 ml by vitalization, and stored in a freezer at –2^{o}C for 24 hours before use.

Phytochemical Analysis

Flavonoids

To a mixture of 2.5 ml of the extracts and a little portion of magnesium ribbon, concentrated HCl was added in drops. A change in colour from an initial orange to red indicated that flavones were present. Further change from red to cherry-pink showed that flavonoids were present.

Alkaloids

To 2.5 ml of the extract in a test tube, precisely 3 drops of Dragendoff's reagent was added. The mixture was allowed to react, and the observation for orange red precipitate complemented with turbidity indicated that alkaloids were present.

Glycosides

10ml of 50% H_2SO_4 was mixed with 2.5 ml of the extract and heat was applied for 15mins. Thereafter, 10ml of Fehling's solution was added and allowed to boil. The appearance of a brick red precipitate showed that glycosides were present.

Phenol

To 3 ml of the extract was added ferric chloride ($FeCl_3$) solution. The mixture was observed for an intense blue colour which indicated that phenol was present

Terpenoids

A mixture of 3 ml of extract, 1 ml of chloroform and 1 ml of concentrated H_2SO_4 were thoroughly mixed together. Then, the mixture was observed for a deep red-brown colour which indicated that terpenoids were present in the extract

Tannins

Distilled water was used to dilute 2ml of the extract, and then 3 drops of 5% ferric chloride ($FeCl_3$) solution was introduced into the test tube, and the content was shaken briefly. The presence of a green – black or blue colour showed the presence of tannins.

Carboxylic acids

To 2 ml of the various extracts, few drops of a solution of sodium bicarbonate (Na_2CO_3) were added. There was effervescence, indicating that CO_2 has been liberated, thus indicating the presence of carboxylic acid

Quinones

To 1ml of the extracts, 1 ml of concentrated tetraoxosulphate (vi) acid (H_2SO_4) was added. The mixture was observed for a red color which was an indication of the presence of quinones.

Xanthoprotein

Few drops of concentrated trioxonitrate (v) acid (HNO_3) and ammonia (NH_3) solutions were added to 2 ml of the extracts, and then observed for orange-red precipitate which showed the presence of xanthoproteins

Results and Discussion

Metals content of Leaves and Peels of Pawpaw (*Carica papaya*)

The concentrations of the different metals examined have been shown in Table 1. The values indicated a non-significant variation between the leaves and the peels of the pawpaw plant. The concentrations of metals observed in this work was lower than those observed in different parts of pawpaw in Jabalpur region India [9], and those of Eludoyin and Ogbe (2017) [10] in selected workshops within Port Harcourt city, Rivers State, Nigeria, but fell within the range of values observed in pawpaw from artisanal farms in Kaani, Bori, Rivers State, Nigeria [11]. The concentrations of the different metals showed that the metals which are of importance to man were higher in concentrations as compared to non-vital metals. The low concentrations of the metals indicated that the plants were probably bought from sellers who might have brought them from farms not impacted by heavy metals.

Plant intake of metals is associated with the environment that it is planted and the nature of the plant. In the present work, the concentrations of Mn and Fe were the only metals that exceeded the WHO/FAO recommended values that should be present in fruits, while the other metals fall within the requirement for food consumption by the earlier stated body. According to Kalagbor and Diri, (2014), some of these metals are carcinogenic in nature; so, their presence at very high levels in plants is not desirable. However, others such as K, Na, Ca, Fe, Mg, Cu, Zn, Se, etc are essential for proper body metabolism and

fitness to combat pathogens by building or boosting the body immune system. Despite their importance, they have limits for human intake.

Very high levels of metals in plant types are associated with the nature of absorption by the different parts of plant and their storage or accumulation capacity [12]. Remarkably, the rate of uptake of metals in the pawpaw plant can be useful in the transport of heavy metals from the roots to the other parts. Any plant type or species that has high transfer or transport can serve valuable uses in phytoremediation practices in the removal of metals from the soil [13].

Table 1: Concentrations of selected metals in leaves and peels of pawpaw (Carica papaya) plant

Metals (µg/g)	Leaves	Peels
Manganese (Mn)	19.64± 3.28	21.72± 4.13
Potassium (K)	0.37± 0.01	0.22±0.01
Sodium (Na)	0.04±0.00	0.04±0.00
Zinc (Zn)	5.83± 1.22	6.77±1.06
Magnesium (Mg)	2.72±0.23	2.11± 0.12
Calcium (Ca)	0.30±0.00	0.35±0.10
Iron (Fe)	21.43±3.91	27.60± 4.63
Arsenic (As)	< 0.001 ± 0.00	< 0.001± 0.00
Nickel (Ni)	0.07±0.01	0.04±0.01
Copper (Cu)	0.36±0.17	0.57±0.21
Lead (Pb)	0.004±0.00	0.002±0.00
Selenium (Se)	< 0.001±0.00	< 0.001±0.00

Phyto-composition of Aqueous and methanol extracts of Pawpaw (*Carica papaya*)

The different phytochemicals observed in the different extracts from the solvents have been given in Table2. The results showed the presence of flavonoids and alkaloids in the leaves of the plant in both solvent extracts, but the presence of both was observed only in the leaves in the methanol extract. Glycosides was only present in the leaves and peels of the methanol extract, while phenol was only present in the leaves of aqueous and methanol extracts. Terpenoids were only present in the peels of methanol extract. Tannins and quinones were not observed in any of the solvent extracts, while carboxylic acid was only observed in the leaves of the aqueous extract and xanthoproteins detected in the peels of aqueous extract and leaves of methanolic extract.

The observation of different phytochemicals in different parts of the plants and different solvent extracts was in conformity with other observations in similar studies [14-16]. The presence of secondary metabolites as observed in this study had earlier been reported to be active against some pathogens [17]. The flavonoids have been used in traditional medicine for the treatment of some pathogenic diseases, and are notably good sources of traditional medicine [18]. The presence of alkaloids in plants has found utility in the treatment of headache and fever. They possess antiseptic and painkilling characteristics [19]. According to Robinson, (1985), alkaloids in *Carica papaya* contains quinine, a potent anti-malarial drug [20]. This might be the reason that in trado-medical practice, the leaf in combination with other plant parts are boiled and taken orally for malarial treatment. It has been confirmed that alkaloid has the potential to affect protein kinase that takes part in signal transduction and development route of different cells and tissues of animals [21].

Glycosides are a group of organic compounds that are present in plants, which possess the capacity to contract cardiac muscle, and are probable disruptors of the different roles performed by the heart. However, most of the classes of this group have been known to be very poisonous [22]. Most of the negative uses of glycosides are in coating of arrows, destructive and desperate taken of personal live, rodent poisons, tonic for heart diseases, diuretics and emetics. Positive applications included its use in management of heart failure and congestion and cardiac arrhythmia [23]. The presence of phenolic compounds is an indication that the plant can be used due to its antioxidants characteristics that can be responsible in the prevention of cells from destruction or damage. Terpenoids, though only present in the peels of the pawpaw in the methanolic extract has curative or preventive potentials against some microbes and fungi and also have anti-hyperglycemic, antispasmodic and anti-allergic properties in the inhibition of numerous ailments [24].

Table 2: Phytochemical composition of leaves and peels of pawpaw plant (*Carica papaya*) in aqueous and methanol extracts

Phytochemical Component	Aqueous extract		Methanol extract	
	Leaves	Peels	Leaves	Peels
Flavonoids	+	+	+	-
Alkaloids	+	+	+	-
Glycosides	-	-	+	+

Phenolics	+	-	+	-
Terpenoids	-	-	-	+
Tannins	-`	-	-	-
Caboxylic acids	+	-	-	-
Quinones	-	-	-	-
Xanthoprotein		+	+	-

Conclusion

The presence of higher concentrations of trace metals as compared to non-trace metals is an indication that the plant can serve useful purposes for nutritional needs and as well as food for humans and that its uses might not pose risk to consumers. The essence, synthesis and eventual production of drugs from natural products is an ever developing discussion, which has helped to bridge the borderline between nutrition, food and medications. The phytochemicals observed in *Carica papaya* has proven that it is a vital source of therapeutic plants for pharmaceutical drugs productions. Furthermore, the leaves and peels of *Carica papaya* indicated that both parts were equally important in utility for the extraction of bioactive components for medicinal uses. However, the use of the plant should not be taken for granted with regard to intake, since chemical components in plants are environmentally conditioned.

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