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Antioxidant Activity, Functional Groups, Minerals, and Phytochemical Composition of Fruit Seed, Fruit Pericarp and Leaf Stalk of *Polyalthia longifolia*

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ABSTRACT

This study investigated the antioxidant activity, mineral and phytochemical contents of aqueous ethanol extracts of fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia* using standard methods. Also, functional groups present in the extracts were determined by Fourier Transform Infra-red (FTIR) spectroscopy. The results of mineral analysis revealed that the minerals with the highest concentrations in the fruit seed, fruit pericarp, and leaf stalk were potassium (436.02 mg/100 g), potassium (945.18 mg/100 g) and calcium (1260.03 mg/100 g), respectively. Phytochemical screening showed the presence of flavonoid, tannins and carbohydrate in all three plant parts. Quantitatively, flavonoid, phenolic and tannin contents ranged from 35.85-76.72 mg QEg^{-1}, 47.25-49.28 mg $GAEg^{-1}$ and 28.05-55.15 mg $TAEg^{-1}$, respectively. From the antioxidant activity results, the highest DPPH scavenging activity (59.96%) and total reducing power (1.001) were shown by the leaf stalk and fruit pericarp extracts, respectively. The FTIR results established the presence of alcohols, alkanes, alkenes, amine, esters, carboxylic acids, sulphate, halo and nitro compounds in the various parts of *P. longifolia*. This study demonstrated that the fruit seed, fruit pericarp and leaf stalk of *P. longifolia* are invaluable sources of pharmacologically important phytochemicals and minerals making them useful in pharmaceutical formulations.

Keywords: *Polyalthia longifolia*, phytochemicals, mineral, antioxidant, FTIR

INTRODUCTION

Despite the tremendous scientific advancements in medicine, medicinal plants remain the cheapest and safest source of pharmaceutical principles. They have a long history of use in many parts of the world for treating a vast array of infectious and lifestyle diseases. Their immense contribution to the wellbeing of man has made them an important part of the health care system in many nations especially the developing

ones. This is attributed to the fact that they contain nutrients, minerals, and phytochemicals which possess potential health benefits. This makes them suitable for food and also for combating infectious and life-threatening lifestyle illnesses such as cancer and cardiovascular diseases [1]. Almost all plant parts are useful in herbal formulations since they contain a wide spectrum of pharmacological principles. Nutrient analysis and biological activities of various parts of a plant are crucial in order to determine the overall nutraceutical potential and health benefits of such plant.

Polyalthia longifolia (Family: Annonaceae) is a dual-purpose plant renowned for its use in the beautification of the environment and in herbal medicine. It has been shown to possess a variety of medicinal properties in indigenous systems of medicine. Almost all parts of the plants are used in the traditional system of medicine for the treatment of various human ailments. The stem bark of *P. longifolia* is used to treat, among other ailments; inflammation, digestive disorders, gonorrhea, mouth ulcers, menorrhagia and leucorrhoea [2, 3]. Decoctions of leaf and bark are used as teas in the treatment of fever, diabetes and skin diseases [2]. Ethno-pharmacological reports suggest that *P. longifolia* leaf depresses heart muscles, lowers blood pressure, and stimulates respiration [4]. Different solvent extracts of various parts of *P. longifolia* (e.g. leaves, root bark, stem bark, green berries, flowers, etc.) have been reported to demonstrate antimicrobial properties [5]. Anticancer potential of *P. longifolia* tested in various cell lines with the mechanism of apoptosis induction has also been reported [6]. Bioactive principles such as diterpenes, alkaloids, steroids, and lactones have been isolated from different parts of the plant and reported to possess anti-inflammatory, antibacterial, antifungal, anti-tumor, antioxidant activities [7].

This present study investigated the distribution of various essential minerals and phytochemicals as well as the antioxidant activities and functional groups of aqueous ethanol extracts of the fruit seed, fruit pericarp, and leaf stalk of *Polyalthia longifolia*.

Plate 1: Showing the different parts of the *Polyalthia longifolia* plant

MATERIALS AND METHODS

Collection of plant materials

The fruits and stem barks of *Polyalthia longifolia* were obtained from its tree growing on the premises of Babcock University campus, Nigeria. The samples were washed thoroughly with distilled water and the seeds and pericarp of the fruits were separated manually. The samples were then shade-dried for fourteen days. Thereafter, the shade-dried samples were separately pulverized with the use of a laboratory grinder (LEXUS MG-2053 OPTIMA) and kept in an airtight container for further use.

Extraction of plant samples and percentage yield

Extraction of plant samples (20 g) was achieved by cold maceration in 200 mL of ethanol-water mixture (70:30) for 24 h on a magnetic stirrer (200 rpm) at room temperature. The mixture was double-filtered with a Whatman No. 1 filter paper plucked with cotton wool. The extraction process was repeated for 48 h and the filtrates were combined. The plant extracts were obtained by evaporating the combined filtrate to dryness at 40 ^{o}C under reduced pressure with a vacuum rotary evaporator (Eyela N-1001). Percentage yield of each extract was estimated using Equation 1:

$$\text{Yield (\%)} = \frac{\text{Weight of extract}}{\text{Weight of sample}} \times 100 \qquad \text{Eq.1}$$

Determination of mineral content

The minerals present in the fruit seed, fruit pericarp, and leaf stalk of *P. longifolia* was estimated using standard dry ashing method of AOAC [8]. Briefly, 2 grams of each pulverized sample were incinerated in a muffle furnace at 550 ^{o}C for 6 hours. Then, 50 mL of nitric acid solution (10 % v/v) was added to the ash and the mixture solution heated on a hot plate for about 20 min. The mixture was double-filtered while hot with a Whatman No. 1 filter paper into a 100 mL volumetric flask and made up to mark with hot distilled water. A reagent blank; 50 mL of nitric acid solution (10 % v/v) was concomitantly prepared without the sample. The filtrate was then analyzed for calcium, magnesium, manganese, iron, copper, and zinc content using Atomic Absorption Spectrophotometer (Buck Scientific Model, 2010 VGP) while sodium and potassium were determined with Flame Photometer (Jenway FP 160).

Qualitative phytochemical analysis

In order to determine the presence of alkaloids, cardiac glycoside, saponin, steroids, phytosterol, phenol, flavonoids, anthraquinones, phlobatannins, tannins, and carbohydrates in the different plant parts,

phytochemical screening of the extracts was carried out as described in previously reported methods [9, 10].

Quantitative phytochemical analysis

Flavonoid content

The Aluminum chloride colorimetric method of Ohikhena et al [11] was used to determine flavonoid content of the extracts. Briefly, 0.5 mL aliquot of the ethanol extract (1 mg/mL) and quercetin standards (10–100 μgmL^{-1}) were put into separate test tubes. Two milliliters of distilled water were added to each test tube followed by 5% sodium nitrite (0.15 mL) and the mixture was left to stand for 6 minutes. Then, 10 % $AlCl_3$ (0.15 mL) was added to the mixture and left to stand for another 5 min. Thereafter, 1 M sodium hydroxide (1 mL) was added and the mixture was made up to 5 mL with distilled water. The absorbance was measured at 420 nm on a UV-Visible Spectrophotometer (JENWAY 6305). The flavonoid content was expressed as milligram quercetin equivalent per gram of the extract.

Total Phenolic Content

Total phenolic content was assayed using Folin-Ciocalteu method of Wintola & Afolayan [12]. Briefly, 0.5 mL of the plant extract (1 $mgmL^{-1}$) and gallic acid standards (10–100 μgmL^{-1}) were separately prepared and added to 2.5 mL of Folin-Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) in a test tube. Thereafter, 7.5 % w/v sodium carbonate solution (2 mL) was added to the tube and the mixture was properly mixed and allowed to stand for 30 minutes at 40 ºC for color development. The absorbance of the mixture was measured at 765 nm using a UV-Visible Spectrophotometer (JENWAY 6305). The phenolic content was calculated as gallic acid equivalent (GAE) by comparison with a calibration curve of gallic acid standards (R^2 = 0.9971). Results were expressed as mg gallic acid equivalent per gram (mg $GAEg^{-1}$) of dry extract.

Total Tannin Content

Total tannin content was determined by the previously described method of Akter et al [13] with slight modification. Briefly, 1.25 $mgmL^{-1}$ solution of the extract was prepared in ethanol. The sample solution (50 μL) was mixed with 3 mL of vanillin-methanol reagent (4 %) followed by the addition of 1.5 mL of HCl (11.6 M). The resulting mixture was thoroughly mixed and allowed to stand for 15 min after which its absorbance was measured on a UV-Visible Spectrophotometer (JENWAY 6305) at 500 nm against a

blank. The total tannin content was calculated as tannic acid equivalent after comparison with a calibration curve of tannic acid standard solutions (10–100 μgmL^{-1}) and was expressed as mg tannic acid equivalent per gram of dry extract (TAEg^{-1}).

Antioxidant activity

DPPH Free Radical Scavenging Activity

The ability of the extracts to scavenge 2, 2-diphenyl-2- picrylhydrazyl (DPPH) free radical was assayed by previously described spectrophotometric method of Álvarez-Casas et al [14]. An aliquot (100 µL) of extract (20, 40, 60, 80 and 100 µgmL^{-1}) was mixed with 3.9 mL of 0.1 mM DPPH solution (prepared in methanol). The mixture was thoroughly mixed and allowed to stand in the dark for 30 min at room temperature. The absorbance of the solution was read at 517 nm. Results were expressed as the percentage inhibition of DPPH free radical which was calculated according to equation 2.

$$\% \text{ inhibition of DPPH } = \frac{\text{Abs control} - \text{Abs sample)}}{\text{Abs control}} \times 100 \qquad \text{Eq. 2}$$

Where Abs control is the absorbance of the DPPH without plant extracts, and Abs sample is the absorbance of the DPPH after adding extracts. The IC50 value representing the concentration of plant extract that caused 50% inhibition of radical formation was obtained by interpolation from linear regression analysis. Lower IC50 value indicated higher antioxidant activity.

Total reducing power assay

The total reducing power of the extracts was determined by the previously described method of Subramanian et al [15]. Exactly 1 mL of the extract (20, 40, 60, 80 and 100 µgmL^{-1}) was mixed with 2.5 mL phosphate buffer (0.2 M, pH 6.6) and 2.5 mL of 1% Potassium ferricyanide solution. The mixture was incubated at 50 °C for 30 min. Thereafter, 2.5 mL of 10% Trichloroacetic acid solution was added to the mixture and then centrifuged at 3000 rpm for 10 min. Finally, 2.5 mL of the supernatant was mixed with 2.5 mL of distilled water in a test tube followed by the addition of 0.5 mL of 0.1% ferric chloride solution. The absorbance was measured at 700 nm using a UV-Visible Spectrophotometer (JENWAY 6305). The intensity of reducing power is directly proportional to the absorbance of the reaction mixture.

FTIR analysis of plant extracts

The functional groups present in aqueous ethanol extracts of fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia* were investigated using Fourier Transform Infra-red spectroscopy. The samples were mixed with KBr and homogenized in an agate mortal, and then compressed into appropriate pellets. The FTIR spectra were recorded from 3800 - 800 cm^{-1} on Pelkin Elmer 3000 MX FTIR spectrometer. Scans were 32 per spectrum with a resolution of 4 cm^{-1}. The IR spectra were analyzed using the spectroscopic software Win-IR Pro Version 3.0 with a peak sensitivity of 2 cm^{-1}.

Statistical Analysis

All analyses were carried out in triplicates and data obtained were reported as mean ± SD of three replicates. Data were also plotted using Microsoft excel and Origin 9.0 Pro software.

RESULTS AND DISCUSSION

Minerals and phytochemicals are essential components of medicinal plants that contribute to their nutraceutical properties. It is generally believed that the major active constituents contributing to the protective effects of plants are phytochemicals, vitamins, and minerals. Phytochemicals are renowned for their antibacterial, antifungal, antiviral, insecticidal, and antioxidant properties [16]. Hence, they offer protection against the myriad of diseases such as cancers, coronary heart disease, diabetes, high blood pressure, osteoporosis, inflammatory and infectious diseases [17]. According to the World Health Organization (WHO), evaluation of mineral content of medicinal plants is a part of quality control to establish their purity, safety, and efficacy [18]. Therefore, determining the presence of these phytochemicals and minerals in plants is imperative in order to establish their medicinal and their nutritional potentials. In this present study, the fruit seed, fruit pericarp, and leaf stalk of *P. longifoila* were comparatively evaluated for their antioxidant activity, functional groups as well as minerals and phytochemical compositions.

The concentrations of minerals including calcium, magnesium, potassium, sodium, manganese, iron, copper and zinc in the fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia* were investigated and the results are presented in Table 1. The order of the abundance of each mineral in the plant parts were as follows: Calcium: leaf stalk >fruit seed > fruit pericarp; Magnesium: leaf stalk >fruit seed > fruit pericarp; Potassium: leaf stalk > fruit pericarp >fruit seed; Sodium: fruit pericarp > fruit seed > leaf stalk; Manganese: leaf stalk > fruit seed > fruit pericarp; Iron: fruit seed > fruit pericarp > leaf stalk;

Copper: fruit seed > fruit pericarp > leaf stalk; Zinc: fruit seed > leaf stalk > fruit pericarp. It was observed from the results that the leaf stalk had the highest contents of calcium (1260.03 ± 2.11 mg/100 g), magnesium (81.12 ± 0.11 mg/100 g), potassium (952.52 ± 0.22 mg/100 g), and manganese (3.81 ± 0.03 mg/100 g). The highest contents of iron (5.47 ± 0.01 mg/100 g), copper (2.31 ± 0.01 mg/100 g) and zinc (4.86 ± 0.01 mg/100 g) were obtained for fruit seed while the highest content of sodium (150.53 ± 0.14 mg/ 100 g) was obtained for fruit pericarp.

Of all the minerals assayed, the minerals with the highest concentration in the fruit seed, fruit pericarp, and leaf stalk were potassium (436.02 ± 0.21 mg/ 100 g), potassium (945.18± 0.01 mg/ 100) and calcium (1260.03 ± 2.11 mg/ 100 g). These results showed that *P. longifoila* is generally rich in micro (Na, Mn, Fe, Cu, Zn) and macro minerals (Ca, Mg, K). This study found that calcium, magnesium, potassium and sodium were the most prominent minerals in all the plant parts. The higher potassium to sodium ratio in all the plant parts is considered a great benefit because diets with higher potassium to sodium ratio have been shown to reduce blood pressure; preventing health-threatening ailments such as hypertension and arteriosclerosis. Meanwhile, diets with higher sodium to potassium ratio have been linked to incidences of hypertension [19]. Potassium is reported in this present study as the highest mineral in the fruit seed; a result which is in agreement with a previous study by Folashade et al [20]. The presence of P, K, Mg, Zn, Cu, Fe, and Mn in significant amounts in the leaf and seed of *P. longifoila* has also been reported [21]. Ripe and unripe pericarps of *P. longifoila* were also reported by Prashith et al [22] to contain considerable amount of Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Li, Ni, and Cr; with K having the highest concentration in both as reported in this present study. The minerals present in the studied plant parts have been reported to possess various therapeutic properties required for normal growth, development and proper functioning of the body [23]. These elements play vital roles in several biochemical reactions such as enzyme reactions, transportation of gases, muscle contraction, transmission of nerve impulses, and utilization of nutrients from foods [22]. Minerals also play an essential role in enzyme activity in plants [24].

Therefore, the presence of these biologically important minerals in such significantly high quantities in the various parts of *P. longifoila* may contribute to the renowned medicinal properties of this plant. This implies that intake of herbal or feed formulations from any part of *P. longifolia* will be a good supply of these minerals and may also help in alleviating ailments resulting from the deficiencies of these minerals.

Table 1: Mineral contents of different parts of *Polyalthia longifolia*

Plant part	Mineral (mg/100 g sample)							
	Calcium	Magnesium	Potassium	Sodium	Manganese	Iron	Copper	Zinc
Fruit seed	43.21 ± 0.11	67.53 ± 0.12	436.02 ± 0.21	89.84 ± 0.21	2.11 ± 0.84	5.47 ± 0.01	2.31 ± 0.01	4.86 ± 0.01
Fruit pericarp	40.23 ± 0.03	49.23 ± 0.22	945.18±0.01	150.53 ± 0.14	0.81± 0.141	3.68 ± 0.31	1.33 ± 0.02	0.42 ± 0.12
Leaf Stalk	1260.03 ± 2.11	81.12 ± 0.11	952.52 ± 0.22	29.76 ± 0.92	3.81 ± 0.03	2.97 ± 0.01	1.01 ± 0.01	2.46 ± 0.01

Data are expressed as mean ± standard error of three replicates

In this study, the distribution of various phytochemicals in the fruit seed, fruit pericarp, and leaf stalk of *P. longifoila* was determined both qualitatively and quantitatively. The results of qualitative phytochemical screening are presented in Table 2 showing the presence flavonoids, tannins and carbohydrates in the fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia* .However, of the eleven phytochemicals screened for, steroid, phytosterol and phlobatannins were not present in the fruit seed; alkaloids, cardiac glycosides, steroids and phenols were not present in the fruit pericarp; while saponin, phytosterol, anthraquinone and phlobatannins were not present in the leaf stalk. The results of the percentage yield of the plant extracts and their quantitative flavonoid, phenolic and tannin contents are shown in Fig. 1. The extraction yield of the fruit pericarp (8.92 %) was highest followed by the fruit seed (5.13%) and the least was leaf stalk (3.82%).

The results of the quantitative phytochemical analysis showed that flavonoid content ranged from 35.85 to 76.72 mg QEg^{-1} with the leaf stalk having the highest and the fruit seed having the least. Phenolic content was highest in fruit pericarp (105.20 ± 0.46 mg $GAEg^{-1}$), followed by leaf stalk (49.28 ± 0.66 mg $GAEg^{-1}$) and the least (47.25± 1.06 mg $GAEg^{-1}$) was obtained for fruit seed. Tannin content was highest in fruit seed (55.15 ± 0.16 mg $TAEg^{-1}$), followed by fruit pericarp (38.01 ± 1.11 mg $TAEg^{-1}$) and the least was leaf stalk (28.05 ± 0.34 mg $TAEg^{1-}$). The presence of steroids and glycosides in *P. longifoila* fruit pericarp has been reported by Manasa et al [25] but are absent in the fruit pericarp in this study. This

difference may be due to variation in species, maturity, environmental factors among others. A study by Kavita et al [26] has reported the presence of alkaloids, tannins, phenols, flavonoids, and carbohydrates in *P. longifolia* fruit seed which agrees with the results of this present study. Tannins had the least concentration relative to phenols and flavonoids in all the plant parts except in the fruit seed where tannin content was highest. The lowest concentrations of the flavonoids and phenols in the fruit seeds reported in this study could be due to the fact that the seeds are enclosed in the fruits where they seem to be hidden as some of these phytochemicals tend to be concentrated in the outer layers of various plant parts [27].

Biological activities of these secondary plant metabolites have been established. Alkaloids are known to have anti-diabetic, anti-arrhythmic, antihypertensive, anticancer and antimalarial effects [25]. Plant flavonoids and phenols show antioxidant, antimicrobial, anti-inflammatory and anti-carcinogenic properties [28]. Phytosterols possess anti-inflammatory, anti-neoplastic, anti-pyretic, immuno-modulating and LDL-cholesterol lowering activities [29]. Saponins show antioxidant,anti-inflammatory and immune boosting properties [30]. Tannins are used in antidiarrhoeal, hemostatic, and antihaemorrhoidal preparations while steroids have been reported to possess analgesic properties [31]. Glycosides are used to treat congestive heart failure and cardiac arrhythmia while anthraquinones have been reported to possess antiosteoporotic activity [32]. Hence, the presence of these phytochemicals underscores the vast array of pharmacological properties reported in the literature for various parts of *P. longifoila.*

Table 2: Phytochemical screening of ethanol extract of different parts of *P. longifolia*

S/N	Phytochemical	Test	Fruit seed	Fruit pericarp	Leaf stalk
1.	Alkaloid	Mayer's test	+	-	+
		Wagner's test	+	-	+
2.	Cardiac	Keller-Killani test	+	-	+
	Glycoside	Legal's test	+	-	+
3.	Saponin	Frothing test	+	+	-
4.	Steroid	Salkowski's test	-	-	+
5.	Phytosterol	Lieberman Buchard test	-	+	-
6.	Phenols	Ferric chloride test	+	-	+
7.	Flavonoid	Alkaline test	+	+	+
		Ammoniun test	+	+	+
8.	Anthraquinone	Anthraquinone test	+	+	-
9.	Phlobatanins	Phlobatanin test	-	+	-

10.	Tannins	Ferric chloride test	+	+	+
		Lead Sub Acetate test	+	+	+
11.	Carbohydrate	Fehling's test	+	+	+
		Molisch's test	+	+	+

+ = present **- = absent**

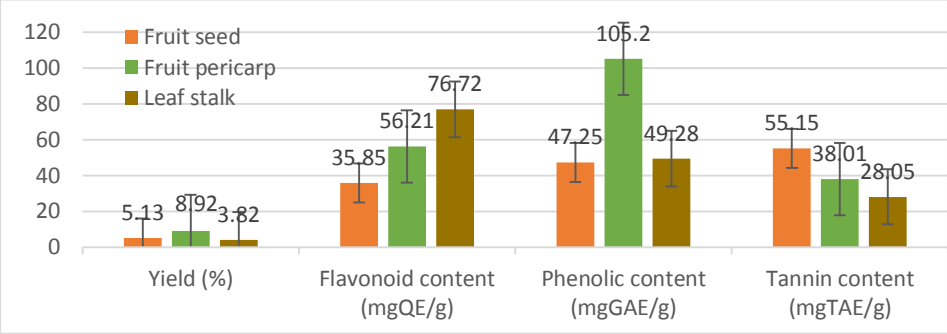

Fig.1: Percentage yield, flavonoid, phenolic and tannin contents of different parts of *P. longifolia*

Figures 2a and 2b show results of the antioxidant activities of the ethanol extracts of different parts of *P. longifolia* in terms of their ability to scavenge DPPH free radical and their total reducing power. The results showed that the DPPH free radical scavenging activity and total reducing power of all the extracts increased with increasing concentration for all the samples. However, the highest DPPH scavenging activity (59.96 %) and total reducing power (1.001) were shown by the leaf stalk and fruit pericarp extracts, respectively. Also, fruit seed extract had the lowest values for both DPPH scavenging activity (45.09 ± 0.24 %) and total reducing power (0.755 ± 0.02). Meanwhile, the IC50 values of the extracts for DPPH scavenging activity and total reducing power are as shown in Fig. 3. Lower IC50 value indicated higher antioxidant capacity and vice-versa. Hence, the leaf stalk extract with the highest percentage inhibition of DPPH free radical showed the lowest IC50 value (75.34 μgmL^{-1}), while the fruit pericarp extract with the highest total reducing power also showed the lowest IC50 value (34.58 μgmL^{-1}). Also, the fruit seed extract with the lowest percentage inhibition of DPPH free radical as well as lowest total reducing power showed the highest IC50 values of 103.94 μgmL^{-1} and 53.99 μgmL^{-1} for DPPH and total reducing power, respectively. The lowest DPPH scavenging activity and total reducing power obtained for the fruit seed correlates with the least flavonoid and phenolic contents obtained for the same. This suggests that these phytochemicals contribute significantly to the antioxidant capacity of the plant. The

results of this study are in agreement with Brand-Williams et al [33] who reported higher radical scavenging activity of leaves than in seed extracts. The IC50, which is inversely related to the antioxidant capacity of plant extracts, represents the concentration of the sample extract which scavenges 50% DPPH free radical and gives an absorbance of 0.5 for the total reducing power. The IC50 values obtained for the various plant parts followed this inverse trend; that is, as the IC50 value reduced, the antioxidant activity increased. The DPPH radical scavenging activity of the extracts indicated their electron transfer/ hydrogen donating ability which is a renowned characteristic of phenolic and flavonoid compounds [34]. Also, the reducing power of the extracts indicated that they are electron donors, reducing oxidized intermediates and thus acting as primary and secondary antioxidant substances [35]. This has also been linked to the presence of phenolic and flavonoids and hence their use in treating oxidative stress disorders and aging [36].

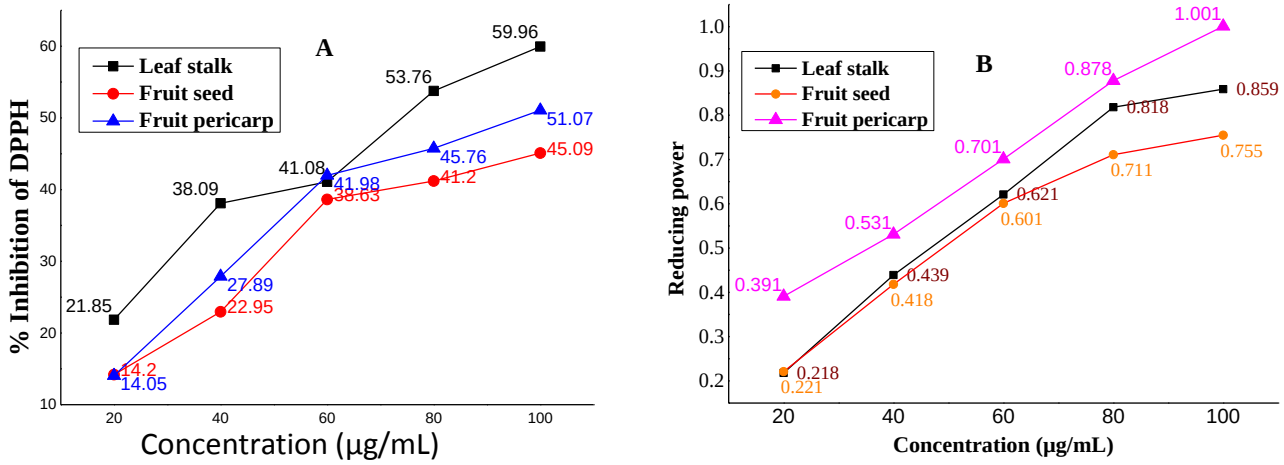

Fig.2: Antioxidant activity as a) DPPH scavenging activity and b) total reducing power of different parts of *P. longifolia*

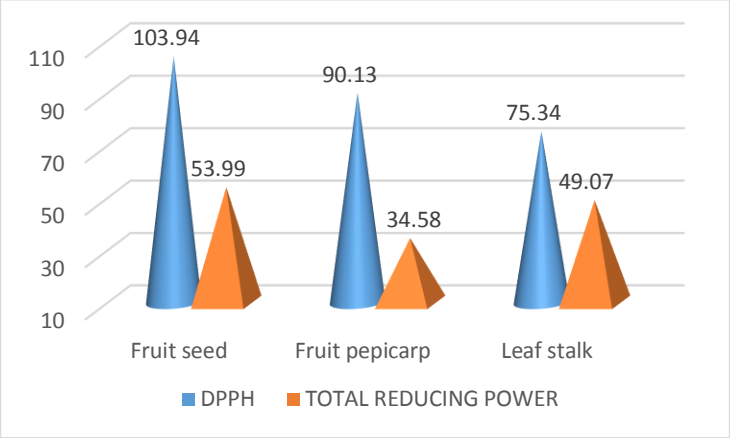

Fig. 3: IC50 (µgmL^{-1}) values of the extracts for DPPH scavenging and Total reducing power activities

Furthermore, the functional groups present in each of the aqueous ethanol extracts of fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia* were elucidated using FTIR. The FTIR spectra of the extracts are shown in Fig. 4 with the fruit seeds, fruit pericarp and leaf stalk having eleven, eight and sixteen peaks, respectively. The specific functional groups in each extract are stated in Table 3. It can be observed from Table 3 that alcohol, alkane, alkene, amine, and aliphatic esters were commonly present in all the extracts. Other functional groups were nitro compounds and aldehydes in fruit seed extract, sulphate in the fruit pericarp and carboxylic acids, aromatic esters with other aromatics and halo compounds in the leaf stalk extract. The presence of these functional groups further supports the huge medicinal potentials of these plant parts.

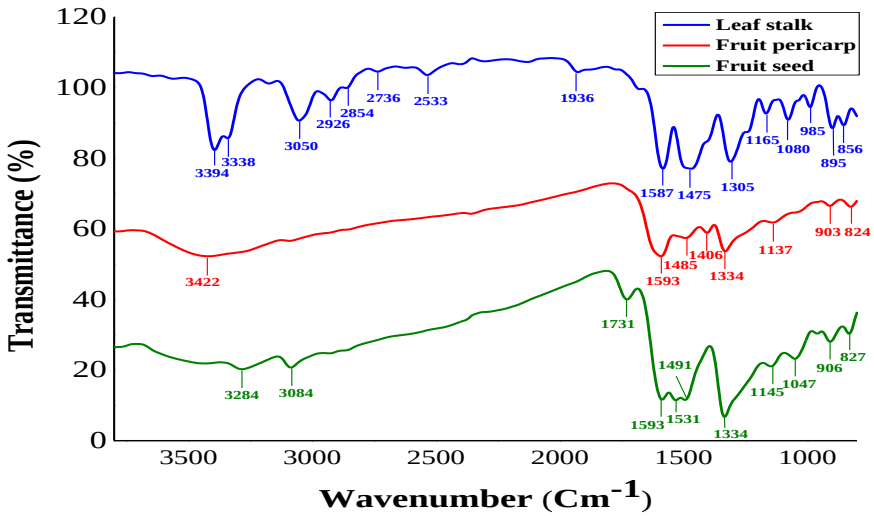

Fig 4: FTIR spectra of fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia*

Table 3: Functional groups in the fruit seed, fruit pericarp and leaf stalk of *Polyalthia longifolia*

S/N	FUNCTIONAL GROUP	Wavenumber (cm^{-1})		
		Fruit seed	**Fruit pericarp**	**Leaf stalk**
1.	Alcohol			
	(O-H stretching)	3284	3422	3394
	(O-H bending)	1334	1334	-
2.	Alkane (C-H stretching)	-	-	2926, 2854,
	(C-H bending)	1491	1485, 903 (1,2,4-trisubstituted)	2736 1475
3.	Alkene (C-H stretching)	3084	-	3050
	(C-H bending)	-	-	
4.	Amine (N-H stretching)	-	-	3338
	(N-H bending)	1593	1593	1587
5.	Carboxylic acids			
	(O-H stretching)	-	-	2533
6.	Aromatic (C-H bending)	-	-	1936
7.	C-O stretching			
	(aromatic ester)	-	-	1305
	Aliphatic ester	1145	1137	1165
8.	C-O stretching (alcohol)	-	-	1080
9.	C=C bending (alkene)	-	824	985, 895
10.	C-Cl (halo compound)	-	-	856
11.	N-O stretching (nitro compound)	1531	-	-
12.	S=O stretching (sulphate)	-	1406	-
13.	CO-O-CO stretching (aldehyde)	1047	-	-

CONCLUSION

This study demonstrated that the fruit seeds, fruit pericarp and leaf stalk of *Polyalthia longifolia* plant contain both micro and macro minerals and phytochemicals in significant amounts. They also showed potent free radical scavenging activity and total reducing power. Therefore, this study showed that investigated parts of *P. longifolia* are invaluable potential sources of dietary minerals and pharmacologically important phytochemicals and hence can be employed in nutraceutical formulation.

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