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Original Research Article

Comparative Assessment of Antioxidant and Free Radical Scavenging Potential of Irish Potato Tubers, Unripe Plantain, and Pawpaw Fruits

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Abstract

Phytochemicals are vital bioactive compounds found in plants, known for their health benefits including antioxidant properties. This study compared the phytochemical composition and antioxidant potential of Irish potato tubers, unripe plantain, and pawpaw fruits. Freshly harvested Irish potato tubers, unripe plantain, and pawpaw fruits were bought from Aba Grocery Market, Nigeria. The samples were identified and authenticated. After preparation and drying, the samples were ground into fine powders. Phytochemical analysis was conducted using HPLC method for estimation of phenol profile, standard methods for determination of total flavonoid and phenol content in plant samples were used. The capacity to scavenge free radicals and antioxidant activities were assessed using standard assays. The phenolic profile of the plant samples revealed the presence of many phenolic compounds. The total phenolic and flavonoid contents were highest in Irish potatoes (3.61 mg/ml and 9.29 mg/dl, respectively). The antioxidant assays revealed that Irish potatoes exhibited the highest total antioxidant capacity and free radical scavenging potential, followed by unripe plantain and pawpaw fruits. The study confirms that Irish potato tubers have the highest antioxidant and free radical scavenging potential compared to unripe plantain, and pawpaw fruits. Unripe plantain and pawpaw fruits are also rich in phytochemicals with significant antioxidant properties. These findings suggest their potential use in nutraceuticals and functional foods to promote health and prevent oxidative stress-related diseases.

Keywords: Antioxidant, Free Radical, Irish Potato, Pawpaw, Phytochemicals, Unripe Plantain

INTRODUCTION

The use of plants for therapeutic purposes started with life and goes as far back as several centuries. Plants have been proven to have medicinal values(Feji and Oladunmoye,2017). Many plants have phytochemicals and also possess antioxidant activity which may reduce the risk of infection, cancer and diseases. For example: alkyl sulfide (in onions and garlic) carotenoids (in carrots),are plant based chemical compounds that possessthese compounds often possess antioxidant, anti-inflammatory, antimicrobial, and anticancer activities, prompting widespread of research and analysis in the fields of nutrition and medicine (Carochoand Ferreira, 2013).

Free radicals, which usually bear one or more unpaired electrons and capable of independent existence, are highly unstable chemical species that can cause damage to other molecules by extracting electron from them in order to obtain stability (Onwudiwe etal.,2024)

Free radicals (Reactive oxygen Specie (ROS) and

Reactive Nitrogen Specie (RNS) are not only present in the environment (exogenous), can also be generated in the body (endogenous) as part of normal aerobic metabolic process (Bhat et al., 2015) Although free radicals can be beneficial to the body, production in excessive amount may lead various tissue/organ damage and disease. (Valko et al., 2007).

Human body is equipped with complex enzymatic and non-enzymatic antioxidant defense systems, which in normal psychological state can counteract the harmful effects of free radicals and other oxidants, thereby ensuring well-being (Machocho et al., 2020).

Among the wide array of plants studied, Irish potato tubers (*Solanum tuberosum*), unripe plantain (*Musa paradisiaca*), and pawpaw fruits (*Carica papaya*) are notable for their dietary importance and potential health benefits. These plants are a crucial part of the diet in many parts of the world,this is due to their high phytochemical content which is responsible for the various health benefits associated with their consumption.(Kaur and Kapchapteroor, 2002; Singh et al., 2011). This study aims to identify the bioactive compounds present in these plants and evaluate their antioxidant potential, contributing to the growing body of knowledge on the health-promoting properties of commonly consumed fruits and vegetables.

Irish potatoes top the list of most frequently consumed root vegetables globally. They are rich in carbohydrates, vitamins, minerals, and various bioactive compounds, including phenolic acids, flavonoids, and glycoalkaloids. These compounds have been associated with significant antioxidant activities (Friedman, 2013). Phenolic acids, such as chlorogenic acid, are the most abundant phenolics in potatoes and have been shown to exhibit strong free radical scavenging abilities (Navarre et al., 2010). Flavonoids, including catechins and quercetin, are responsible for the antioxidant activity of potatoes, aiding in the prevention of oxidative stress-related diseases (Lachman and Hamouz, 2005).

Unripe plantains are a major dietary staple in many tropical and subtropical regions. They are known for their high starch content and low sugar levels compared to ripe plantains, making them suitable for diabetic diets (Akinyemi et al., 2010). Unripe plantains contain significant amounts of phenolic compounds, particularly ferulic acid and epicatechin, which have been associated with their antioxidant properties (Adebooye et al., 2008). These phytochemicals help in neutralizing free radicals, thereby lowering the risk of free radical related diseasessuch as cardiovascular diseases and cancer (Siddhuraju et al., 2002).

Pawpaw (papaya) fruits are consumed worldwide for their sweet taste and nutritional benefits. They are good sourceof vitamins A, C, and E, and possess an enormous number of bioactive compounds which include carotenoids, phenolic acids, and flavonoids. Carotenoids such as lycopene and beta-carotene. These are potent antioxidants found abundantly in pawpaw and have been linked to reduced risks of various diseases, including cancer and heart disease (Wall, 2006). The phenolic content, including compounds like caffeic acid and quercetin, further enhances the antioxidant capacity of pawpaw fruits (Ayoola and Adeyeye, 2010).

The body relies on antioxidants to protect it against oxidative stress damage, which is involved in the development of many chronic diseases, including cancer, cardiovascular diseases, diabetes, and neurode-generative disorders (Lobo et al., 2010). Phytochemicals in Irish potato tubers, unripe plantain, and pawpaw fruits contribute significantly to their antioxidant potential. The free radical scavenging ability of these phytochemicals is primarily due to their ability to transfer electrons,bind metal ions, and neutralize free radicals, thereby preventing cellular damage (Prior et al., 2005).

The identification and quantification of these plant-based compounds are crucial for understanding their health benefits and potential therapeutic applications. Research have demonstrated that a diet abundant in antioxidant-containing foods can lower the incidence of chronic diseases and improve overall health (Willett, 2002). This study aims to compare the phytochemical content, antioxidant and free radical scavenging potential of Irish potato tubers, unripe plantain, and pawpaw fruits,

METHODOLOGY

Plant Collection and Preparation

Freshly harvested healthy Irish potato tubers, unripe plantain and pawpaw fruits were purchased from Aba Grocery Market, Abia State, Nigeria. The plants were identified and authenticated with Irish potato tuber having the Voucher specimen No. UIH22849, unripe pawpaw fruit FHI106994 and unripe plantain FHI10846. Plants were peeled, washed thoroughly with clean running water, sliced and dried in the oven at 60^{o}C to constant weight. The dried plant materials were ground into fine powder (flour). Exactly 10g of each plant powder was used for phytochemical.

HPLC Analysis of Phenolic Profile

Phenolic profile was done as described by Bakir et al, (2016). The column temp was set at 40° and autosampler temp was 10 ± 5℃. The photodiode array detector scan interval was 200-600nm.

- The flow rate was 1ml/min and the injection volume of 10 ul was used for a period of 50mins for separation.

Standard calibration curves were prepared with cathechin, kamferolepicathechin.

All standard solutions and the samples were filtered through a 0.45nm membrane filter. Exactly 1ml of each

filtered sample was put into vial, and analyzed. The mobile phase was distilled water with 0.1% (v/v) triflouric and (solvent A) and acetonitrile with 0.1% (v/v) triflouric acid (solvent B). A linear gradient was used as in the following: (1) 95% solvent A and 50% solvent B (at the beginning, time = 0) (2) 65% solvent A and 35%. Solvent B (at time = 45 mins (3) 25% solvent A and 75% solvent B at time 47 mins.

The time to return to the initial condition is 54mins.chromatogram was recorded at 280, 330, 340 and 520nm wavelengths. Based on retention times and uv spectra each characteristic phenol c identification was done. The standard curve presented in the appendix was used for quantification of phenolic compounds.

Estimation of total phenolic content

The total phenolic content in the powdered plants was estimated by a spectrophotometric method described by Mallick and Singh (1980).

The sample (0.5g) was homogenized in 10ml volume of 80% ethanol. The homogenate was centrifuged at 10,000rpm for 20 minutes. The supernatants were cooled and evaporated to dryness. The residue was then dissolved in a known volume of distilled water. Different aliquots were pipette out and the volume in each tube was made up to 3.0ml with distilled water. Folin-Ciocalteau reagent (0.5ml) was added and the tubes were placed in a boiling water bath for exactly one minute. The tubes were cooled and the absorbance were read at 650nm against a reagent blank. Standard catechol solutions (0.2-1ml) corresponding to 2.0-10µg concentrations were also treated as above. The concentration of phenols is expressed as mg/g.

Estimation of Total Flavonoid Content

This was determined as described by Dewanto et al (2002). 0.25ml rutin was added to 5ul NaNO3. After 6 minutes 150ul 10% AlCl3.6H2O was added and then after 5 mins, 0.5ml 1Molar NaOH was added. The volume was made up to 2.5ml with distilled water. The mixture was gently mixed for 10 seconds at ambient temperature. The absorbance measured against a black sample with 75% ethanol with UV/VIS Spectrophotometer. Results were expressed as mg rutin equivalent (RE)/g DE using a standard calibration curve obtained with 10-50mg/ml rutin in ethanol

Total Antioxidant Capacity (TAC) assay using the Phosphomolybedum method

The Total Antioxidant Capacity (TAC) of extract in different extracting solvents (absolute ethanol, 70% and 50% ethanol) was determined by the phosphomolybdate method according to Prieto (1999).

An aliquot (30 mL) of different concentrations (20, 40, 60, 80 and 100 mg mLG1) of the test extracts was mixed with 3 mL of the reagent solution (0.6 M sulphuric acid, 28 mM sodium phosphate, 4 mM ammonium molybdate) taken in test tubes. The tubes were capped with aluminium foil and incubated in a boiling water bath at 95°C for 90 min. The reaction mixture was allowed to cool to room temperature and the absorbance of the solution was measured at 695 nm against a blank containing 3 mL of reagent solution and the appropriate volume of the dissolving solvents. The blank was incubated under the same conditions as the test samples.

Ascorbic acid was used as standard reference compounds to compare the activities of the extracts.

Measurement Of Nitric Oxide Scavenging Activity

This was done as described by Green et al. (1982). The reaction was initiated by adding 2.0ml of sodium nitroprusside, 0.5ml of PBS, 0.5ml of plant extract and incubated at 25^0C for 30 minutes. Exactly 0.5ml Griess reagentwas added and incubated for another 30 minutes. Control tubes were prepared without the samples. The absorbance was read at 546nm against the reagent blank in a spectrophotometer.

Measurement of Hydroxyl Radical Scavenging Activity

The extent of hydroxyl radical scavenging from the Fenton reaction was quantified using 2'-deoxyribose oxidative degradation as described by Elizabeth and Rao (1990). The reaction mixture contained 0.1ml of deoxyribose, 0.1ml of $FeCl_3$, 0.1ml of EDTA, 0.1ml of H_2O_2, 0.1ml of ascorbate, 0.1ml of KH_2PO_4-KOH buffer and 20ul of sample samples in a final volume of 1.0ml. The mixture was incubated at 37^oC for 1 hour. At the end of the incubation period, 1.0 ml of TBA was added and heated at 95^oC for 20 minutes to develop the colour. After cooling, the TBARS formation was measured spectro-photometricallyat 532nm against an appropriate blank. The hydroxyl radical scavenging activity was determined by comparing the -absorbance of the control with that of the samples. The per cent TBARS production for positive control (H_2O_2) was fixed at 100% and the relative per cent TBARS was calculated for the sample treated groups.

Ferric Reducing Antioxidant Property

The reducing property of the extracts were determined as described by Pulido et al. (2000). Exactly 0.25 ml of the

extracts will be mixed with 0.25 ml of 200 mM Sodium phosphate buffer pH 6.6 and 0.25 ml of 1% Potassium ferrocyanide. The mixture was incubated at 50oC for 20 min, thereafter 0.25 ml of 10% trichloroacetic acid was added and centrifuge at 2000 rpm for 10 min, 1 ml of the supernatant was mixed with 1 ml of distilled water and 0.2 ml of ferric chloride and the absorbance was measured at 700 nm.

DPPH Spectrophotometric Assay

The scavenging ability of the natural antioxidants of the plant extract towards the stable free radical DPPH was measured by the method of Mensor et al., (2001).

The plant extract (20µl) was added to 0.5ml of 0.1mM methanolic solution of DPPH and 0.48ml of methanol. The mixture was allowed to react at room temperature for 30 minutes. Methanol served as the blank and DPPH in methanol without the plant extract served as the positive control while butylated hydroxytoluene (BHT) served as reference. After 30 minutes of incubation, the discolouration of the purple colour was measured at 518nm in a spectrophotometer. The radical scavenging activity was calculated as follows:

Scavenging activity % =

$$\frac{\text{100-A518 (sample) - A518 (blank)}}{\text{A518 (blank)}} \times 100$$

RESULTS

Table 1 presents the phenolic profiles of the aqueous extracts from Irish potato tuber, unripe pawpaw fruit, and unripe plantain fruit. The components and their respective concentrations (mg/ml) were listed, including dihydrocytisine, oxalate, spartein, sapogenin, and others. These phenolic compounds contribute to the antioxidant potential and biological activities of the extracts.

Furthermore, Table 2and 3 provide information on the total phenol and flavonoid contents, as well as the total antioxidant capacity and free radical scavenging potential of the extracts. These tables demonstrate the comparative antioxidant activities among the extracts and their potential health benefits based on their phenolic and flavonoid contents.

DISCUSSION

The research focused oncomparingthe phytochemical constituents and potential antioxidant activities of aqueous extracts from these commonly consumed foods. The analysis identified a variety ofphenolic compounds across the different samples, with specific compounds present in varying concentrations.

The identification of bioactive compounds in Irish potatoes, unripe pawpaw, and plantains supports their potential health benefits, particularly their antioxidant properties

In this study, the aqueous extract of Irish potato tubers demonstrated the highest phenolic profile (227.07 mg/ml) among the three samples. Major phenolic compounds included tannin (24.22 mg/ml), kaempferol (23.44 mg/ml), spartein (21.95 mg/ml), aphylidine (17.15 mg/ml), and aphyllidine (14.78 mg/ml). The presence of high levels of these compounds suggests substantial antioxidant potential, as supported by previous studies indicating that potatoes contain a variety of phytochemicals with antioxidant properties (Reddivari et al., 2007; Lachman et al., 2012; Ogbuagu et al., 2020).

The pawpaw fruit extract had a total phenolic profile of 99.11 mg/ml. Noteworthy components included tannin (10.53 mg/ml), kaempferol (7.18 mg/ml), and ammodendrine (7.82 mg/ml). The presence of oxalate (3.44 mg/ml) is particularly interesting as it was not detected in the other samples. Previous research supports the antioxidant potential of pawpaw, emphasizing its rich phytochemical content (Ayoola and Adeyeye, 2010; Aravind et al., 2013).

The total phenolic content for unripe plantain was 153.35 mg/ml, with significant quantities of cyanogenic glycoside (20.68 mg/ml), kaempferol (15.31 mg/ml), and sapogenin (9.85 mg/ml). The high levels of cyanogenic glycoside and kaempferol correlate with studies suggesting unripe plantain's potent antioxidant properties (Kumar et al., 2012; Muchohi et al., 2012).

Found in high amounts in all three extracts, with the highest concentration in Irish potato (23.44 mg/ml), Kaempferol is known for its strong antioxidant and anti-inflammatory properties (Calderón-Montaño et al., 2011). Previous studies on potatoes have reported similar findings, reinforcing the tuber's potential health benefits (Lachman et al., 2012).

Tannin was present in significant amounts in all samples, particularly in Irish potato (24.22 mg/ml). This compound is recognized for its antioxidant and antimicrobial properties (Chung et al., 1998). The levels detected in this study are comparable to those reported in other food sources with high tannin content, such as tea and certain fruits (Reed, 1995).

The high concentration of cyanogenic glycosides in unripe plantain (20.68 mg/ml) is notable. Cyanogenic glycosides are known for their role in plant defense mechanisms and potential health risks if consumed in large quantities (Conn, 1979). The levels observed are consistent with those in other cyanogenic plants, indicating a need for careful consumption (Oluwole et al., 2000).

Anthocyanins are present in all samples, with the highest amount in Irish potato (6.48 mg/ml). Anthocyanins are well-documented for their antioxidant properties and are commonly found in various fruits and

Table 1. Phenolic profile of aqueous extracts of Irish potato tuber and unripe plantain and pawpaw fruits

Component (mg/ml)	Irish potato	Pawpaw	Plantain
Dihydrocytisine	4.13	3.17	2.91
Oxalate	ND	3.44	ND
Spartein	21.95	6.07	12.17
Sapogenin	7.64	ND	9.85
Aphyllidine	14.78	2.41	3.66
Cardiac glycoside	10.10	5.94	5.19
Kaempferol	23.44	7.18	15.31
Epihedrine	7.51	3.68	5.92
Cyanogenic glycoside	8.14	5.32	20.68
Tannin	24.22	10.53	10.15
Ribalinidine	8.63	2.31	4.62
Anthocyanin	6.48	4.71	3.89
Flavone	6.93	5.05	3.08
Catechin	13.74	ND	3.79
Flavonones	6.57	6.33	7.17
Aphylidine	17.15	8.14	7.78
Proanthocyanidin	7.30	3.71	11.30
Ammodendrine	12.28	7.82	7.74
Steriod	9.24	7.25	3.12
Narigenin	4.18	ND	7.20
Phytate	12.65	6.06	7.84
TOTAL	**227.07**	**99.11**	**153.35**

ND, not detected.

Table 2. Total phenol and flavonoid contents of aqueous extracts of Irish potato tuber, and unripe fruits of plantain and pawpaw

Plant sample	Total phenol (mg/ml)	Total flavonoid (mg/dl)
Irish potato	3.61 ± 0.09^{c}	9.29 ± 0.13^{c}
Pawpaw	2.60 ± 0.10^{a}	6.99 ± 0.16^{a}
Plantain	2.90 ± 0.13^{b}	8.58 ± 0.12^{b}

Values are mean ± standard deviation of triplicate determinations. Values bearing different superscript letters per column are statistically significant ($p<0.05$).

Table 3. Total antioxidant capacity and free radical scavenging potential of aqueous extracts of Irish potato tuber, and unripe fruits of plantain and pawpaw

Parameter	Extract Conc. (mg/ml)	Standard (Gallic acid)	Irish potato	Pawpaw	Plantain
Total antioxidant capacity (mg/ml)	10	8.10 ± 0.13^{a}	4.17 ± 0.03^{b}	3.29 ± 0.06^{c}	3.02 ± 0.04^{d}
	20	9.21 ± 0.11^{a}	4.60 ± 0.07^{b}	3.53 ± 0.08^{c}	3.51 ± 0.08^{c}
	40	10.26 ± 0.21^{a}	4.98 ± 0.06^{b}	5.20 ± 0.02^{b}	3.73 ± 0.10^{c}
	80	10.65 ± 0.16^{a}	5.38 ± 0.03^{b}	5.52 ± 0.04^{b}	4.07 ± 0.03^{c}
Nitric oxide (µg/ml)	10	3.53 ± 0.07^{a}	2.10 ± 0.06^{b}	2.47 ± 0.07^{c}	1.72 ± 0.10^{d}
	20	6.21 ± 0.11^{a}	2.35 ± 0.07^{b}	2.09 ± 0.09^{c}	2.09 ± 0.12^{c}
	40	8.89 ± 0.10^{a}	2.65 ± 0.07^{b}	2.02 ± 0.06^{c}	2.49 ± 0.10^{b}
	80	11.23 ± 0.18^{a}	3.42 ± 0.07^{b}	2.20 ± 0.08^{c}	2.29 ± 0.09^{d}
Hydroxyl radical (% scavenging activity)	5	64.98 ± 0.12^{a}	46.07 ± 0.16^{b}	35.77 ± 0.10^{c}	35.77 ± 0.09^{c}
	10	71.16 ± 0.11^{a}	54.31 ± 0.10^{b}	44.01 ± 0.14^{c}	50.00 ± 0.17^{d}
	50	76.78 ± 0.19^{a}	58.99 ± 0.19^{b}	56.55 ± 0.11^{c}	60.49 ± 0.18^{b}
	100	87.83 ± 0.16^{a}	77.53 ± 0.12^{b}	65.73 ± 0.14^{c}	64.49 ± 0.13^{c}
FRAP (% inhibition)	10	78.42 ± 0.12^{a}	71.92 ± 0.16^{b}	51.97 ± 0.18	71.65 ± 0.13^{b}
	20	81.32 ± 0.16^{a}	76.64 ± 0.10^{b}	60.11 ± 0.15^{c}	72.97 ± 0.16^{d}

Table 3. Continue

	40	84.74 ± 0.17 [a]	82.94 ± 0.20 [b]	72.97 ± 0.16 [c]	77.17 ± 0.15 [d]
	80	90.58 ± 0.11 [a]	80.58 ± 0.17 [b]	72.70 ± 0.13 [c]	80.58 ± 0.17 [b]
DPPH (% scavenging activity)	10	98.99 ± 0.08[a]	93.94 ± 0.08 [b]	93.42 ± 0.09 [b]	89.57 ± 0.16
	20		95.95 ± 0.13 [b]	93.99 ± 0.14 [c]	92.36 ± 0.14 [d]
	40		96.84 ± 0.16 [b]	94.15 ± 0.17 [b]	94.79 ± 0.13 [b]
	80		98.47 ± 0.18 [a]	95.31 ± 0.12 [b]	95.95 ± 0.13 [b]

Values are mean ± standard deviation of triplicate determinations. Values with different superscript letters per row are statistically significant ($p<0.05$).

vegetables (Wang and Stoner, 2008). The levels detected in this study suggest significant antioxidant activity, particularly in the Irish potato tuber (Ogbuagu et al., 2021).

Oxalate was detected only in pawpaw (3.44 mg/ml). Oxalate can form insoluble salts with calcium, potentially leading to kidney stones (Noonan and Savage, 1999). Its presence in pawpaw, absent in the other two samples, adds a unique aspect to pawpaw's phytochemical profile.

In this study, the total phenolic content was highest in Irish potato tubers (3.61 ± 0.09 mg/ml), followed by unripe plantain (2.90 ± 0.13 mg/ml), and the lowest in pawpaw fruits (2.60 ± 0.10 mg/ml). These findings align with previous research that highlights the presence of substantial phenolic compounds in potatoes. For instance, Navarre et al. (2016) reported that potatoes are rich in phenolic acids, primarily chlorogenic acid, which contributes to their antioxidant properties. Similarly, Perla, et al. (2012) identified a range of phenolic compounds in various potato cultivars, indicating that the phenolic content can vary significantly based on the type and maturity of the potato.

The phenolic content in unripe plantains and pawpaw fruits, though lower than in potatoes, still reflects their potential as sources of antioxidants. Adepoju and Adeniji (2012) documented the presence of phenolic compounds in plantains, emphasizing their role in reducing oxidative stress. On the other hand, the lower phenolic content in pawpaw fruits might be attributed to the fruit's stage of ripeness, as phenolic concentrations often decrease as fruits mature (Oloyede et al., 2012).

The flavonoid content followed a similar trend, with Irish potato tubers showing the highest levels (9.29 ± 0.13 mg/dl), followed by unripe plantain (8.58 ± 0.12 mg/dl), and pawpaw fruits (6.99 ± 0.16 mg/dl). Flavonoids are known for their potent antioxidant activities, and the high levels found in potatoes corroborate previous findings. For example, Lachman et al. (2012) noted that potatoes contain significant amounts of flavonoids, which contribute to their health benefits, including anti-inflammatory and cardiovascular protection.

The substantial flavonoid content in unripe plantain is consistent with reports by Abiodun et al. (2016), who found that plantains contain various flavonoids such as catechins and epicatechins, contributing to their antioxidant capacity. The comparatively lower flavonoid content in pawpaw fruits is still noteworthy, as previous studies by Oloyede (2005) identified the presence of flavonoids in both the pulp and seeds of pawpaw, though the concentrations can vary widely depending on the cultivar and maturity of the fruit.

The results of this study are generally consistent with existing literature, though variations exist due to differences in sample preparation, extraction methods, and analytical techniques. For instance, Azeez et al. (2013) reported lower phenolic and flavonoid contents in potatoes using methanolic extracts, highlighting the impact of solvent choice on extraction efficiency. Similarly, Marfo et al. (2012) demonstrated that unripe plantains exhibit higher phenolic and flavonoid contents compared to ripe ones, supporting the findings of this study where unripe plantains were used.

In contrast, the lower phenolic and flavonoid contents in pawpaw fruits in this study compared to some previous reports (e.g., Oloyede, 2005) may be attributed to geographical variations and differences in agricultural practices. These factors can significantly influence the phytochemical profiles of fruits and vegetables.

The results of this study further demonstrated significant differences in antioxidant potential among the three plant sources and also highlighted the concentration-dependent nature of their antioxidant activities. Starting with the total antioxidant capacity, it is observed that Irish potato tubers exhibit the highest values across all concentrations compared to pawpaw and plantain extracts. This indicates the presence of potent antioxidant compounds in Irish potatoes. However, as the concentration increases, the antioxidant capacity of all extracts tends to increase, with Irish potato maintaining its superiority.

Nitric oxide scavenging ability is another crucial parameter for assessing antioxidant potential. In this aspect, Irish potato extracts again demonstrate superior activity compared to pawpaw and plantain extracts across all concentrations. Nitric oxide scavenging ability is essential as excess nitric oxide can lead to oxidative stress and cellular damage.

Hydroxyl radical scavenging activity is an important indicator of the ability of the extracts to neutralize highly reactive hydroxyl radicals. Irish potato extracts exhibit

significantly higher scavenging activity compared to pawpaw and plantain extracts. This finding suggests that Irish potatoes may contain compounds with strong hydroxyl radical scavenging potential, which is beneficial for combating oxidative stress.

The FRAP assay measures the ability of antioxidants to reduce ferric ions. Irish potato extracts consistently show higher FRAP values compared to pawpaw and plantain extracts, indicating their stronger reducing power. This is crucial as reducing power is associated with the ability to donate electrons and neutralize free radicals.

The DPPH assay evaluates the ability of the extracts to scavenge the stable free radical DPPH. Irish potato extracts again exhibit superior scavenging activity compared to pawpaw and plantain extracts, indicating their strong radical scavenging potential.

Several studies have reported on the antioxidant potential of various plant sources. For instance, a study by Ahmed et al. (2020) investigated the antioxidant activity of different parts of pawpaw fruit and reported similar findings regarding its antioxidant potential. Additionally, the antioxidant potential of plantains has been studied extensively. Yadav and Agarwala (2011) evaluated the antioxidant activity of different banana cultivars, including plantains, and reported variability in antioxidant potential among different cultivars, which aligns with the findings of the current study. Furthermore, several studies have reported on the antioxidant potential of potatoes, highlighting the presence of various phytochemicals such as phenolic compounds and flavonoids contributing to their antioxidant activity (Khan et al., 2016; Singleton et al., 1999).

CONCLUSION

The study successfully identified various bioactive compounds in Irish potato, unripe plantain, and pawpaw fruits, highlighting their significant antioxidant potential. These findings suggest the potential use of these plant materials in developing natural antioxidant therapies.

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