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Research Article

Phytochemical Composition and Antioxidant Activity of Edible Wild Fruits from Malawi

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The purpose of this study was to investigate the phytochemical composition and antioxidant activity of 17 edible wild fruits that are widely distributed and consumed in Malawi for pharmacological value exploration. Qualitative phytochemical analysis, total phenolic content, total flavonoid content, ferric reducing antioxidant power (FRAP), total antioxidant activity (TAA), and 1,1-diphenyl-2-picrylhydrazyl radical scavenging activity (DPPH) were performed in aqueous and methanolic fruit extracts. The results showed that the extracts contained alkaloids, saponins, terpenoids, glycosides, coumarins, phenolic compounds, tannins, flavonoids, steroids, and quinones. *Piliostigma thonningii* had the highest total phenolic content (1675.33 ± 12.34 mg GAEg^{-1} FW) in methanolic extracts, and *Annona senegalensis* gave the highest levels of total flavonoid content (649.67 ± 2.08 mg RE g^{-1} FW) in aqueous extracts. The results of antioxidant activities (FRAP, TAA, and DPPH) varied widely, and the variations were significant ($P < 0.05$). *Thespesia garckeana* and *Mangifera indica* exhibited a high ability to chelate metal cations in methanolic extracts and in aqueous extracts, respectively. DPPH levels were higher in aqueous extracts and ranged from 11.07% to 99.61%. This study provides evidence that the studied edible fruits of Malawi have potential as value-added products for various treatments of oxidative stress-associated ailments as they contain more phytochemical constituents. We recommend further studies to determine if the presence of a particular class of phytochemicals would translate into the bioactivity capability of these edible fruits.

1. Introduction

Malawi is rich in edible wild fruits that are distributed in most areas of the country [1–4]. These fruits are good sources of nutrients and minerals that are deficient in the most common diets [1, 5]. Different plants in Malawi are used in folk medicine for the treatment of various disorders [6, 7]. However, frequent use of plant parts, such as roots and bark, has been reported to be not sustainable because the practice is a threat to plant biodiversity as it reduces plant development and continuity [8–11]. This necessitates the need to explore alternative plant parts to minimize the use of roots and barks. Research has shown that some edible wild fruits contain valuable phytochemicals such as some medicinal plants, which play a significant role in the treatment of diseases and may be useful in pharmaceutical development [12, 13]. Therefore, in addition to nutritional value, edible wild fruits could also be evaluated and used in the treatment of diseases. This is because phytochemicals are distributed in all parts of the plant, including fruits [12–14], which are widely available in many countries around the world, including Malawi [1–4]. The widely reported phytochemicals associated with disease management include alkaloids, saponins, terpenoids, glycosides, coumarins, phenolic compounds, tannins, flavonoids, steroids, and quinones, of which phenolic compounds are

potent antioxidants against reactive oxygen species (ROS) or reactive nitrogen species (RNS) and have several potential health benefits [15–17]. Many diseases have been documented to be managed by these phytochemicals, including diabetes, stomach pain, constipation, inflammation, sexually transmitted infections, fever, and malaria [16]. Various fruits have also been reported to have medically useful bioactivities, namely, antitumor, antibacterial, antiviral, hematologic, and immunomodulating management [17, 18]. Therefore, studies have been widely done in many parts of the world to assess widely reported activities, as well as find new ones, since different places can lead to a varied phytochemical composition in plants. In Malawi, many wild fruits are widely distributed throughout the country, and many plants are reported to be used in disease management, but comprehensive data on phytochemical composition and antioxidant activity are limited. The study investigated the phytochemical composition and antioxidant activity of 17 edible wild fruits that are widely distributed in Malawi. Qualitative phytochemical analysis, total phenolic content, total flavonoid content, and antioxidant activity of 17 edible wild fruits were carried out, and the results are presented in this article. The findings would provide baseline data for further studies on the pharmacological use of edible wild fruits in Malawi.

2. Materials and Methods

2.1. Chemicals and Reagents. Chemicals used in this study include quercetin and gallic acid from EMD Millipore Corporation; Folin-Ciocalteu phenol reagent from Sigma; 2,4,6-tris-2-pyridyl-s-triazine (TPTZ) and 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) from Sisco Research Laboratories; and Trolox from Acros Organics. All other chemicals, including sodium carbonate, aluminium chloride hexahydrate, iron(III) chloride hexahydrate, Wagner reagent, sodium hydroxide, chloroform 98% *v*/*v*, sulfuric acid, glacial acetic acid, 32% hydrochloric acid solution, and methanol, were of guaranteed pure reagent grade and used as obtained.

2.2. Collection, Preparation, and Extraction of Fruits. A total of 17 fruits were collected (Table 1). Fresh ripe and edible wild fruits were randomly collected by handpicking during their seasonal availability in the years 2021 and 2022. The fruits were collected in different districts of the country where there is an increased occurrence and consumption of them. The samples were botanically authenticated at the National Herbarium and Botanic Gardens of Malawi. The collected samples (approximately 1 kg of each fruit type) were washed properly with distilled water. The fruits were peeled, and the pulp was separated from the seed, after which the edible parts were homogenized using a porcelain mortar and pestle. The phytochemical extraction was done as described by other studies with some modifications [19, 20]. Homogenized materials (10 g) were dissolved in distilled water (100 ml) and methanol (80% *v*/*v* and 100 ml). The mixtures were macerated overnight with continuous shaking using a magnetic stirrer followed by centrifugation at 4500 rev for 15 min. The supernatant was filtered through gravity filtration using Whatman filter paper no. 1 and kept deep frozen until further subsequent analyses.

2.3. Phytochemical Screening of Fruit Extracts. Qualitative phytochemical screening of both methanolic and aqueous fruit extracts was performed using standard procedures [21–23]. For alkaloids, Wagner reagent (2.0 ml) was thoroughly mixed with the sample extract (1.0 ml). The presence of a brownish to yellowish precipitate indicated the presence of alkaloids. For flavonoids, aluminium chloride hexahydrate (1.0 ml) was mixed with sample extract (1.0 ml). The appearance of deep yellow coloration showed the presence of flavonoids. For tannins, ferric chloride (1% and 1.0 ml) was added to the sample extract (5.0 ml). A blue-black coloration showed the presence of tannins. For saponins, sample extract (5.0 ml) and distilled water (5.0 ml) were mixed in a test tube and shaken vigorously. The formation of stable foam indicated the presence of saponins. For coumarins, 10% *m*/*v* sodium hydroxide solution (1.0 ml) was added to the sample extract (2.5 ml) followed by the addition of chloroform (1.0 ml). The yellow coloration indicated the presence of coumarins. For terpenoids, chloroform (1.0 ml) was mixed with sample extract (2.5 ml) followed by the addition of sulfuric acid (1.5 ml) to form a layer. A reddish-brown coloration at the interface indicated the presence of terpenoids. For glycosides, 1% *m*/*v* ferric chloride (1 drop) was added to glacial acetic acid (1.0 ml). The sample filtrate (2.5 ml) was then added to the mixture followed by the dropwise addition of concentrated sulfuric acid (1.0 ml) to form a layer. A brown ring at the interface indicated the presence of glycosides. For steroids, the crude extract (2.5 ml) was mixed with chloroform (1.0 ml) followed by the addition of concentrated sulfuric acid (1.0 ml) and glacial acetic acid (1.0 ml). The development of a greenish coloration indicated the presence of steroids. For quinones, 10% sodium hydroxide (0.5 ml) was added to the sample extract (1.0 ml). The blue, green, or red coloration indicated the presence of quinones. For phenolics, the sample extract (0.5 ml) was mixed with 10-fold diluted Folin-Ciocalteu reagent (2.5 ml) followed by the addition of 0.5 M sodium carbonate (2.0 ml). The blue and black coloration indicated the presence of phenolics.

2.4. Total Phenolic Content (TPC). The total phenolic content of both aqueous and methanolic fruit extracts was analysed using the Folin-Ciocalteu assay [23] with some modifications as previously reported [24]. Briefly, 1.0 ml of each extract was diluted with water and was mixed with 10-fold diluted Folin-Ciocalteu reagent (5.0 ml) followed by the addition of sodium carbonate (1 M, 4.0 ml) within 3-8 min, and the mixtures were left for 2 h. The absorbance of the mixtures and blank was measured using a UV-Vis spectrophotometer at 765 nm. Gallic acid (30–500 μg/ml) was used as a standard solution, and the results were expressed as milligram of gallic acid

Table 1: Data of 17 edible wild fruits of Malawi.

SN	Local name	Scientific name	English/common name	Family	Month/year of collection	District of collection
1	Msekese	*Piliostigma thonningii*	Monkey bread tree	Fabaceae	November 2021	Rumphi
2	Masuku	*Uapaca kirkiana*	Wild loquat	Phyllanthaceae	December 2021	Rumphi
3	Mpoza/Mabovumale	*Annona senegalensis*	African custard-apple	Annonaceae	November 2021	Nkhata-Bay
4	Masau	*Ziziphus mauritiana*	Indian jujube	Rhamnaceae	September 2021	Dedza
5	Mbula	*Parinari curatellifolia*	Mobola plum/hissing tree	Chrysobalanaceae	August 2021	Mzimba
6	Mkama	*Cocos nucifera*	Coconut palm	Arecaceae	December 2021	Rumphi
7	Matowo	*Thespesia garckeana*	African chewing gum	Malvaceae	October 2021	Mzimba
8	Mahuhu/Mbwanga	*Vitex doniana*	Black plums	Lamiaceae	December 2021	Nkhata-Bay
9	Malambe/buyu	*Adansonia digitata*	Baobab	Malvaceae	September 2021	Karonga
10	Maviru	*Vangueria infausta*	Wild medlar	Rubiaceae	November 2021	Mzimba
11	Mango	*Mangifera indica*	Mango	Anacardiaceae	January 2022	Mzimba
12	Mkuyu	*Ficus sycomorus*	Sycamore fig	Moraceae	November 2021	Mzimba
13	Matwatwa	*Landolphia Kirkii*	Sand apricot-vine	Apocynaceae	January 2022	Nkhata-Bay
14	Kabeza	*Strychnos spinosa*	Natal orange	Loganiaceae	August 2021	Mzimba
15	Mkwaju/bwemba	*Tamarindus indica*	Tamarind	Fabaceae	October 2021	Karonga
16	Matyokolo/nthuza	*Flacourtia indica*	Madagascar plum	Salicaceae	April 2022	Mzimba
17	Zipwete	*Cucumis metuliferus*	African horned cucumber	Cucurbitaceae	May 2022	Mzimba

equivalents per gram of fresh weight (mg GAE g^{-1} FW) using the following formula:

$$\text{Total contents} = \frac{C \times \text{DF} \times V}{m}, \quad (1)$$

where C is the concentration of the sample from calibration curve of absorbance against concentration of standards in mg/ml, DF is the dilution factor, V is the volume of the solvent used for extraction in ml, and m is the mass of the sample in g.

2.5. Total Flavonoid Content (TFC). The total flavonoid content of both the aqueous and methanolic fruit extracts was analysed using aluminum chloride colorimetric [25] with some modifications [24]. In brief, 1.0 ml of each of the diluted extracts was mixed with 2% *m*/*v* aluminum chloride hexahydrate (1.0 ml), and the mixture was incubated at room temperature (25°C) for 60 min. The absorbance of the standards (rutin 50–300 μg/ml), extracts, and blank was measured using a UV-Vis spectrophotometer at 415 nm. The results were calculated using equation (1) and reported as milligram of rutin equivalent per gram of fresh weight (mg RE g^{-1} FW).

2.6. Antioxidant Activities

2.6.1. Ferric Reducing Antioxidant Power. The capacity of aqueous and methanolic fruit extracts to chelate metal cations was analysed using a ferric reducing antioxidant power (FRAP) assay [26, 27] with modifications as reported previously [28]. Briefly, the FRAP reagent was prepared fresh by mixing acetate buffer, TPTZ solution, and $FeCl_3 \cdot 6H_2O$ solution (10 : 1 : 1 by volume) and then warmed to 37°C. The diluted fruit extracts (1.0 ml) and standard solution (Trolox) were then mixed with freshly prepared FRAP reagent (5.0 ml) and left at RT (25°C) for 10 min. The absorbance of the mixtures and the blank was measured using the UV-Vis spectrophotometer at 593 nm, and the results were quantified as milligram of Trolox equivalent antioxidant capacity per 100 grams of fresh weight (mg TEAC 100 g^{-1} FW) using equation (1).

2.6.2. Total Antioxidant Activity. Total antioxidant activity (TAA) of both aqueous and methanolic extracts was evaluated using the phosphomolybdenum method [29]. The method is based on the reduction of Mo (VI) to Mo (V) by the sample analyte. Exactly 0.5 ml of working solution (0.6 M sulfuric acid, 28 mM sodium phosphate, and 4 mM ammonium molybdate) was added to the sample extracts (2.5 ml). The mixture was then incubated at 90°C for 60 min. After the samples had cooled to RT, the absorbance was measured at 695 nm using a UV-Vis spectrophotometer against the blank. Ascorbic acid was used as a standard, and the results were expressed as milligrams of ascorbic acid equivalents per gram of fresh weight (mg AAE g^{-1} FW) using equation (1).

2.6.3. DPPH. The radical scavenging activity of aqueous and methanolic extracts was evaluated using the 1,1-diphenyl-2-picrylhydrazyl radical scavenging activity assay (DPPH) [30]. Briefly, sample extracts (1.0 ml) were added to 0.3 mM DPPH (2 ml). The mixtures were incubated at RT for 30 min in the dark. The absorbance of the sample and control was measured using a UV-Vis spectrophotometer

at 517 nm. The percentage of DPPH scavenging activity of fruit extracts was determined using the following equation:

$$\%\text{DPPH} = \frac{\text{Ac} - \text{As}}{\text{Ac}} \times 100, \quad (2)$$

where Ac is the absorbance of the control (DPPH without extract) and As is the absorbance of the sample (DPPH with fruit extract).

2.7. Statistical Analysis. Univariate statistical analysis was performed using GraphPad Prism for windows, version 9.4.1 (GraphPad Software, San Diego, CA 92108, USA). Statistical significance between means was evaluated at a 95% confidence level. The analysis was carried out in triplicate, and all data were presented as means ± standard deviation ($n = 3$).

3. Results and Discussions

3.1. Phytochemical Screening. Phytochemical screening of plants is significant because it helps identify new sources of therapeutically important compounds and may lead to drug discovery and development [22]. In this study, a total of seventeen (17) edible wild fruits were screened for alkaloids, saponins, terpenoids, glycosides, coumarins, phenolic compounds, tannins, flavonoids, steroids, and quinones. The results showed the presence of phenolic compounds in all samples (Table 2). Alkaloids were available in the methanolic extracts of *Piliostigma thonningii*, *Cocos nucifera*, *Adansonia digitata*, *Landolphia kirkii*, *Tamarindus indica*, and *Cucumis metuliferus*. More flavonoids, coumanins, terpenoids, glycosides, and quinones were available in methanolic extracts compared to aqueous extracts. Generally, methanolic extracts contained most of the compounds compared to aqueous extracts. These findings are similar to previous investigations by Muchuweti et al. [30], who reported the presence of flavonoids in *Uapaca kirkiana*, and Dabesor et al. [31], who reported the availability of alkaloids, tannins, and glycosides in *Cocos nucifera*. Rathore et al. [32] reported availability of flavonoids, glycosides, phenolics, saponins, and sterols, while alkaloids were not available in *Ziziphus mauritiana*. Some phytochemicals were not detected, and this could be attributed to many factors such as actual lack of them, the different solvents used, the extraction and analysis methods, and the seasonal variation and the place of collection [28]. Do et al. [29] observed that more compounds were soluble and present in aqueous methanol compared to water or pure solvents only.

Many phytochemical constituents found in plants are known to be responsible for anti-inflammatory, antioxidant, antilarvicidal, and antimicrobial activities [16, 19]. Phenolics, alkaloids, and some flavonoids are free radical scavengers that can contribute to the suppression of oxidative stress and anti-inflammatory effects in the human body that play significant roles in the treatment of various diseases such as cancer, and the presence of these compounds gives the potential to use fruits for the treatment of such diseases [17]. Generally, more phytochemical constituents were available in the fruits studied and could be considered as value-added products for the treatment of various ailments. However, the study did not investigate the impact of the presence of phytochemicals on the management of diseases. Therefore, more studies are needed to investigate these suggestions.

3.2. Total Phenolic Content (TPC) and Total Flavonoid Content (TFC). The total phenolic and flavonoid contents of edible wild fruits are presented in Figures 1 and 2, respectively. The total phenolic content in the methanolic extracts varied from 490.00 ± 7.58 to 1675.33 ± 12.34 mg $GAEg^{-1}$ FW while those of aqueous ranged from 139.00 ± 1.00 to 1250.33 ± 3.61 mg $GAEg^{-1}$ FW. *Tamarindus indica*, *Strychnos spinosa*, *Landolphia kirkii*, *Vangueria infausta*, *Adansonia digitata*, *Thespesia garckeana*, and *Ziziphus mauritiana* contained higher concentrations in aqueous extracts than in methanolic extracts. *Uapaca kirkiana*, *Parinari curatellifolia*, *Cocos nucifera*, *Piliostigma thonningii*, *Annona senegalensis*, *Vitex doniana*, *Mangifera indica*, *Ficus sycomorus*, *Flacourtia indica*, and *Cucumis metuliferus* contained higher concentrations of methanolic extracts compared to aqueous extracts. On average, the TPC results of the methanolic extract were higher than those of aqueous extracts with a significant difference ($P < 0.05$). The total flavonoid content (Figure 2) in the methanolic extracts ranged from 59.33 ± 0.58 to 562.00 ± 5.57 mg RE g^{-1} FW while those of aqueous extracts ranged from 48.67 ± 1.15 to 649.67 ± 2.08 mg RE g^{-1} FW. All samples contained higher contents of flavonoids in methanolic extracts except *Annona senegalensis*, *Ziziphus mauritiana*, *Cocos nucifera*, and *Strychnos spinosa*. On average, the TFC results of the methanolic extracts were higher than those of the aqueous extracts with a significant difference ($P < 0.05$).

Figures 1 and 2 show that the total phenolic content is higher than the flavonoid content. These findings are in agreement with those reported in Tanzania where the total phenolic content was 255.38 ± 23.80 mg GAE/100 g FW while the flavonoid content was 55.97 ± 4.36 mg RE/100 g FW for *Uapaca kirkiana* [33]. Dureja and Dhiman [34] reported a total phenolic content of 2870 ± 3.57 mg GAE/100 g and a flavonoid content of 2528 ± 6.55 mg QE/100 g for *Ziziphus mauritiana* which was higher than those obtained in this study. Ncube et al. [19] reported a TPC of 1890 ± 1.61 mg GAE/100 g FW for *Adansonia digitata*, which was higher than our findings. Ochieng and Nandwa [35] reported a total phenol content of 601.40 mg GAE/100 g FW in *Vitex doniana*, which is within the range obtained in our study. Phenolic compounds are one of the secondary metabolites widely distributed in plants and are found primarily in the flesh of most fruits, whereas flavonoids are mostly found in seeds [36]. These compounds are important constituents of many fruits for their taste, flavor, and color. They also exhibit therapeutic properties such as anti-inflammatory, antimutagenic, antioxidant, anticarcinogenic, antimicrobial, antiatherosclerotic, and antiallergic [37]. Phenolic compounds are potent antioxidants, so increased consumption of fruits daily could assist with the provision of adequate phenolic antioxidants.

Table 2: Phytochemical screening of aqueous and methanolic extracts from edible wild fruits.

Wild fruits	Alkaloids		Flavonoids		Tannins		Saponins		Coumanins		Terpenoids		Glycosides		Steroids		Quinones		Phenolics	
	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH	H_2O	MeOH
Piliostigma thonningii	+	++	+	+	++	++	+	++	+	++	++	+	+	++	+	+	+	++	+++	++++
Uapaca kirkiana	-	-	+	+	-	-	-	-	-	+	-	+	+	++	-	+	-	+	+	++
Annona senegalensis	-	+	+	+	-	+	+	+++	+	++	+	+	+	++	+	+	-	-	+++	++++
Ziziphus mauritiana	-	-	-	+	-	-	-	+	-	++	+	++	-	+	-	+	-	+	+++	++++
Parinari curatellifolia	-	-	-	+	-	+	-	-	-	++	+	++	+	++	+	-	-	+	++	++
Cocos nucifera	-	+	+	+	-	+	++	+++	+	++	+	++	-	+++	-	-	-	+	+++	+++
Thespesia garckeana	+	-	+	+	+	+	-	-	++	++	+	+	-	++	+	+	+	+	+	++
Vitex doniana	-	-	-	+	-	-	+	+	+	+++	-	+	+	+++	-	+	-	+	+++	++++
Adansonia digitata	-	+	+	+	++	+++	++	+++	+	++	+	+++	++	+++	-	+	-	+	+	+
Vangueria infausta	-	-	+	+	-	-	++	+	++	++	-	+	-	++	-	++	-	++	+++	++++
Mangifera indica	-	-	+	++	-	-	-	-	+	-	-	+	-	+	-	-	+	-	+++	++++
Ficus sycomorus	-	-	-	+	++	+++	++	+++	+	++	-	-	-	-	-	-	+	+	+++	++++
Landolphia kirkii	-	+	+	+	+	++	+	++	+	+	++	+++	++	+++	-	+	+++	++	+++	++++
Strychnos spinosa	-	-	-	++	+	++	+	++	++	+	+	++	-	-	-	+	-	-	++	++++
Tamarindus indica	+	+	+	+	-	++	-	++	++	+++	+++	+++	++++	+++	+	+	-	++	+++	+++
Flacourtia indica	-	+	+	+	+	+	+	++	-	+	-	+	-	++	-	+	+	+	++	++++
Cucumis metuliferus	-	+	+	+	+	+	+	+++	+	+	+	+	+	+	-	+	-	+	++	+++

Abbreviations: H_2O: water; MeOH: methanol; (+): present; (-): absent.

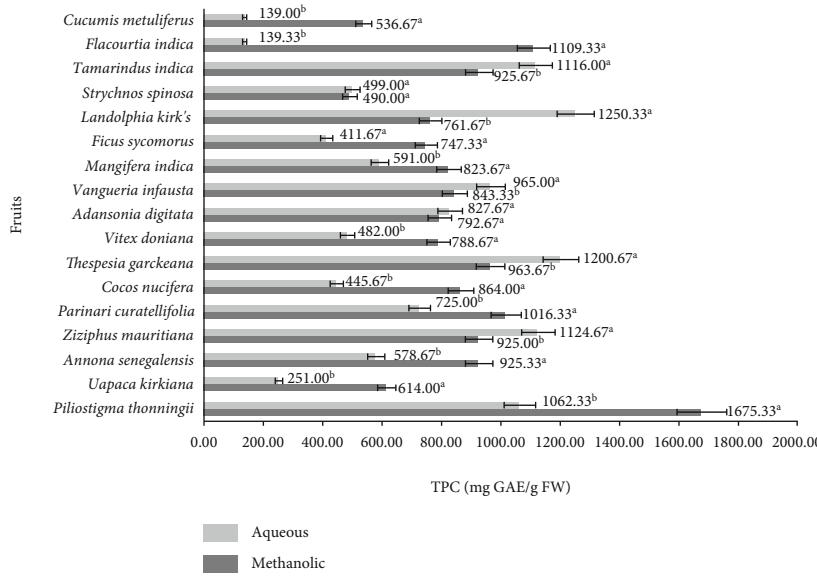

Figure 1: Total phenolic content (TPC) of edible wild fruits in milligrams of gallic acid equivalent per gram of fresh weight (mg GAEg^{-1}FW). Values of means ($n = 3$) of the same plant that do not share a letter indicate significant differences ($P < 0.05$).

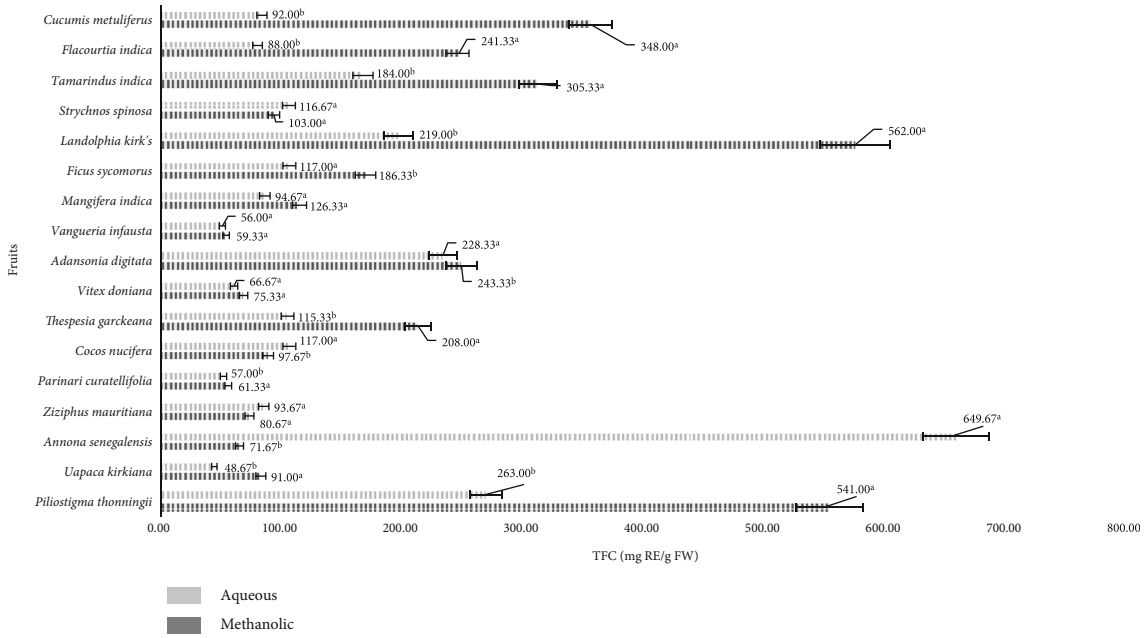

Figure 2: Total flavonoid content (TFC) of edible wild fruits in milligrams of rutin equivalent per gram of fresh weight (mg REg^{-1}FW). Mean values ($n = 3$) of the same plant that do not share a letter indicate significant differences ($P < 0.05$).

3.3. Antioxidant Activity. The antioxidant activity of fruits (Table 3) was evaluated using three parameters, namely, ferric reducing antioxidant power (FRAP), total antioxidant activity (TAA), and 1,1-diphenyl-2-picrylhydrazyl radical scavenging activity assay (DPPH). The FRAP values (ability to chelate metal cations) for aqueous and methanolic fruit extracts ranged from 136.35 ± 1.53 to 70.78 ± 1.73 TEAC 100 g^{-1} FW and 148.98 ± 1.73 to 97.91 ± 1.25 TEAC 100 g^{-1} FW, respectively (Table 3). *Mangifera indica* and *Thespesia garckeana* exhibited a high ability to chelate metal cations in aqueous extract (136.35 ± 1.00) and methanolic extracts (148.98 ± 1.73), respectively. *Parinari curatellifolia* and *Landolphia kirkii* reported low ability in aqueous extracts (70.78 ± 1.73) and methanolic extracts (97.91 ± 1.25) extracts, respectively. The values of total antioxidant activity (TAA) of the aqueous extracts varied from 80.53 ± 0.17 to 162.43 ± 0.20 mg AAE g^{-1} FW, while those of the methanolic extracts ranged from 102.80 ± 0.76 to 179.36 ± 0.59 mg AAE

Table 3: Antioxidant activity of methanolic and aqueous extracts of edible wild fruits.

Name of fruits	FRAP (mg TEAC/100 g FW)		TAA (mg AAE/g FW)		DPPH (%)	
	Methanolic	Aqueous	Methanolic	Aqueous	Methanolic	Aqueous
Piliostigma thonningii	137.98 ± 1.30	115.15 ± 7.51	141.73 ± 1.30	124.90 ± 0.75	45.4	13.5
Uapaca kirkiana	112.31 ± 4.04	101.21 ± 1.5	120.06 ± 0.40	110.96 ± 0.15	15.57	11.07
Annona senegalensis	99.05 ± 7.56	108.08 ± 1.7	102.80 ± 0.76	117.83 ± 0.17	36.01	83.17
Ziziphus mauritiana	116.61 ± 0.58	103.21 ± 5.7	123.36 ± 0.06	112.96 ± 0.06	29.94	21.53
Parinari curatellifolia	113.91 ± 5.5	70.78 ± 1.73	128.66 ± 0.55	80.53 ± 0.17	26.03	87.67
Cocos nucifera	122.55 ± 1.53	120.35 ± 1.53	144.30 ± 0.15	137.10 ± 0.15	39.92	92.56
Thespesia garckeana	148.98 ± 1.73	132.78 ± 1.00	171.73 ± 0.17	150.53 ± 0.10	35.23	99.61
Vitex doniana	120.98 ± 4.58	101.18 ± 1.00	133.73 ± 0.46	110.93 ± 0.10	37.77	38.94
Adansonia digitata	117.26 ± 4.67	126.55 ± 2.08	130.00 ± 0.67	140.30 ± 0.21	36.01	62.23
Vangueria infausta	114.88 ± 4.00	109.68 ± 1.00	120.63 ± 0.40	126.43 ± 0.10	41.68	36.59
Mangifera indica	141.61 ± 5.86	136.35 ± 1.53	179.36 ± 0.59	140.10 ± 0.15	91.56	57.39
Ficus sycomorus	132.95 ± 1.44	121.55 ± 1.12	155.70 ± 1.44	139.30 ± 0.12	47.36	33.07
Landolphia kirkii	97.91 ± 1.25	102.65 ± 6.35	117.66 ± 1.25	112.40 ± 0.64	36.4	93.54
Strychnos spinosa	139.98 ± 2.65	120.98 ± 2.65	142.73 ± 0.26	135.73 ± 0.26	24.27	29.94
Tamarindus indica	126.41 ± 2.31	131.41 ± 3.35	139.16 ± 0.23	155.16 ± 3.35	69.67	97.46
Flacourtia indica	118.48 ± 7.21	104.68 ± 2.00	171.23 ± 0.72	162.43 ± 0.20	66.83	39.23
Cucumis metuliferus	124.48 ± 1.00	112.28 ± 1.00	134.23 ± 0.10	121.03 ± 1.00	25.37	20.74

Abbreviations: FRAP: ferric reducing antioxidant power; mg TEAC 100 g^{-1} FW: milligram Trolox equivalent antioxidant capacity per 100 grams of fresh weight; TAA: total antioxidant activity; mg AAE g^{-1} FW: milligram ascorbic acid equivalents per gram of fresh weight; DPH: 1,1-diphenyl-2-picrylhydrazyl. Results are means ± standard deviation ($n = 3$).

g^{-1} FW (Table 3). The radical scavenging activity results ranged from 11.07% to 99.61% in aqueous extracts, while in methanolic extracts, they ranged from 15.57 to 91.56% (Table 3). *Thespesia garckeana* showed higher scavenging activity in aqueous extracts (99.61%), while *Mangifera indica* reported higher activity in methanol extracts (91.56%). On average, the values of FRAP and TAA in methanolic extracts were higher than those of aqueous extracts with significant difference ($P < 0.05$). The DPPH results were higher in the aqueous extracts than in the methanolic extracts with insignificant difference ($P > 0.05$). The results of the study have revealed that the fruits evaluated had antioxidant activity (Table 3). In this study, the presence of DPPH antioxidant activity of fruits was similar to those reported in the literature for all studied plants. For example, in a study conducted in Zimbabwe on fruits, the methanolic extract of the *Uapaca Kirkiana* fruits showed DPPH antioxidant activity in the range of 34.96% ± 0.86 to 36.68 ± 0.46% that was higher than the same species found in Malawi evaluated in this study (15.57%) [38]. Similar findings of antioxidant activity parameters for the studied plants showed similar results for the rest of the plants, namely, *Ziziphus mauritiana* [39], *Parinari curatellifolia* [40], *Cocos nucifera* [41], *Thespesia garckeana* [42], *Vitex doniana* [43], *Adansonia digitate* [44], *Mangifera indica* [45], *Ficus sycomorus* [46], *Landolphia kirkii* [47], *Strychnos spinose* [48], *Tamarindus indica* [49], *Cucumis metuliferus* [50], and *Piliostigma thonningii* [51].

The antioxidant activity reported in this study shows that the fruit samples studied have the potential to exhibit bioactivities exploited by folk medicine for the treatment of various disorders such as hypertension, asthma, epilepsy, mental illness, and nervous disorders [6, 7]. This can help reduce the unsustainable use of plants that involves the use of leaves, bark, or roots of plants that threaten plant biodiversity [8–11]. This study has also shown that the edible wild fruits studied contain valuable phytochemicals that can be useful in pharmaceutical exploration studies, as reported in the literature [12, 13]. Therefore, in addition to their nutritional value, these edible wild fruits can be used as sources of bioactive extracts and compounds for the management of ailments associated with cellular oxidation, such as cardiovascular disease and cancer [12–14]. However, similarity in the presence of a particular phytochemical cannot in itself determine the bioactivity ability of a fruit, as many factors play a role in the bioactivity of plants and hence the need for further studies.

4. Conclusion

This present study provides evidence that the edible wild fruits studied in Malawi have potential as a good source of natural phytochemicals. These fruits could be considered as value-added products for various treatments of oxidative stress-associated ailments, as they contain more phytochemical constituents. Most of these phytochemicals are potent antioxidants; therefore, increased consumption of fruits under study could help provide an adequate natural antioxidant. We recommend further studies to determine if the presence of a particular class of phytochemicals would translate into the bioactivity capability of these edible wild fruits.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

There are no conflicts of interest that have been declared.

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