Nutritional Properties, Phytochemicals and *In Vitro* Antioxidant Assessment of Two Wild Edible Fruits from Assam of North-East India

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Abstract: The aim of present study was to ascertain the nutritional properties, phytochemical contents and *in vitro* antioxidant capacities of two wild edible fruits *viz. Aporosa dioica* (Roxb.) Muell.-Arg. and *Ottelia alismoides* (L.) Pers. found in Assam of North-East India. Nutritional properties, phytochemical screening, total phenolic content (TPC) and total flavonoid content (TFC) were investigated employing standard methods. Antioxidant properties were assessed following DPPH (1, 1-diphenyl-2-picrylhydrazyl), ABTS (2, 2´-Azinobis (3-ethylbenothiazoline-6-sulfonic acid) diammonium salt), H_2O_2 (Hydrogen peroxide) and FRAP (Ferric reducing antioxidant power) assays. The results obtained in this study were presented and discussed. *A. dioica* fruit extract exhibited lower IC_{50} (DPPH, ABTS and H_2O_2) values in contrast to *O. alismoides* fruit extract indicating stronger antioxidant capacity in *A. dioica* fruit. Higher FRAP value of 106.583 ± 5.204 µM trolox equivalent (TE)/g dry extract (DE) was found in the methanol extract of *A. dioica* fruit compared to that of *O. alismoides* fruit (44.083 ± 7.637 µM TE/g DE). The TPC found in the methanol extracts of *A. dioica* and *O. alismoides* fruits were 146.710 ± 2.807 mg gallic acid equivalents (GAE)/g DE and 93.860 ± 1.172 mg GAE/g DE, respectively, while the TFC was found to be 72.510 ± 8.833 mg quercetin equivalents (QE)/g DE in *A. dioica* fruit and 43.270 ± 5.361 mg QE/g DE in *O. alismoides* fruit. These fruits are good sources of nutrients and natural antioxidants and may find applications in formulation of various pharmaceutical drugs.

Keywords: Wild edible fruits, *Aporosa dioica, Ottelia alismoides,* phytochemicals, antioxidant.

1. INTRODUCTION

Wild edible fruits are important sources of nutrients such as minerals, fibres and vitamins and these also contain carbohydrates in form of soluble sugars, cellulose and starch [1]. Wild edible fruits have traditionally been playing a great role with a meant to meet significant part of the nutritional and medicinal requirements of rural communities. Fruits contain biologically active compounds abundantly that impart health benefits beyond basic nutritional values. Among the biologically active constituents, natural antioxidants have been attracting attention because of their safety and potential therapeutic effects [2]. Several studies have demonstrated that indigenous wild fruits are essential for health and nutrition, food security, and economic welfare of rural communities in the developing country [3, 4] and consuming such fruits is helpful in the prevention of chronic and degenerative diseases [5, 6]. Frequent consumption of wild fruits can prevent non-communicable diseases such as diabetes, atherosclerosis, and cancers [7]. Wild plant fruits contain many natural antioxidant compounds such as carotenoids, vitamins, polyphenols, flavonoids, and many other secondary metabolites which have been recognized as a free-radical or active oxygen scavengers [6, 8]. Considering these facts, recently, the wild fruits are receiving increased attention throughout the world as potential food supplements or cheaper alternatives to conventional commercial fruits.

Aporosa dioica (Roxb.) Muell.-Arg. locally known as *Bergao* in Bodo in Assam (India) belongs to the family Euphorbiaceae. It is distributed through the eastern Himalayas and North-East India. Fruits size range from 1–1.3 cm long and is ellipsoid. The fruit is green, turns yellow when it ripens, and it generally has a sweet-sour taste. *Ottelia alismoides* (L.) Pers. locally known as *Khar* belongs to the family Hydrocharitaceae and is widespread throughout India, East and South-East Asia and Northern Australia. Fruit is ellipsoid to ovoid, cylindrical, 1.5–4 cm long, 1–2 cm wide and is opened by decay of the pericarp. In the present study, an attempt has been made to evaluate the nutritional composition, phytochemical contents and antioxidant properties of *A. dioica* and *O. alismoides* fruits found in Assam of North-East India as no such informations of these fruits are available in the literatures.

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2. MATERIALS AND METHODS

2.1. Chemicals

Chemicals are procured from Merck, Mumbai, India (Ascorbic acid, H_2O_2, and Folin-Ciocalteu's reagent), Sigma Aldrich, Bangalore, India (Trolox), Himedia Laboratories Pvt. Ltd., Mumbai, India (DPPH, ABTS, Quercetin), and Central Drug House Pvt. Ltd., New Delhi, India (Gallic acid).

2.2. Collection and Identification of Plants

Ripe fruits of *A. dioica* and *O. alismoides* were harvested in the month of April and October, 2015 respectively from Kokrajhar district of Assam (India) and the plants were identified at BSI (Botanical Survey of India), Shillong, Meghalaya.

2.3. Sample Preparation

The collected fruits of *A. dioica* and *O. alismoides* were cleaned and washed. The moisture and vitamin C contents were determined from the fresh fruits. The fruits were freeze dried for 72 h, powdered using a grinder and extracted with hexane, methanol, acetone, chloroform and water separately maintaining 1:10 ratio (w/v), stirred, kept for 72 h, filtered (Whatman No. 1), solvent removed using Buchi Rotavapor R-215 (Switzerland) and the dried extracts were kept in containers at 4^{o}C for further analysis.

2.4. Analyses of Proximate Composition

Association of Official Analytical Chemists (AOAC) methods [9] were followed for the determination of proximate compositions, James method [10] for dry matter and total carbohydrate, and Food and Agriculture Organization (FAO) method [11] for calorific value.

2.5. Determination of Mineral Contents

The powdered samples were digested with concentrated HNO_3 and the minerals content were determined at Sophisticated Analytical Instrumentation Centre (SAIC), Tezpur University, Assam using Atomic Absorption Spectrometer (AAS-ICE 3500, Thermo Scientific, UK). The results were presented in mg/100 g of dry sample.

2.6. Phytochemical Screening

The phytochemicals present in the different solvent extracts of fruits were investigated following the reported methods [12, 13].

2.7. Evaluation of Antioxidant Properties

Antioxidant capacity of methanolic extract of the fruits was assessed using the UV-VIS spectrophotometer (Lambda 35, Perkin Elmer, USA) according to the previously reported DPPH and ABTS assays [13]. H_2O_2 scavenging capacity was also examined at 230 nm employing the procedure of Ruch *et al*. [14]. FRAP value in µM trolox equivalent (TE)/g dry extract was determined following the method of Benzie and Strain [15].

2.8. Investigation of Total Phenolic Content (TPC) and Total Flavonoid Content (TFC)

TPC and TFC in the methanolic extract of fruits were investigated using UV-VIS spectrophotometer (Lambda 35, Perkin Elmer, USA) employing previously reported methods [13].

2.9. Estimation of Vitamin C Content

Vitamin C content was determined from the fresh fruits following the method of Suntornsuk *et al*. [16].

3. STATISTICAL ANALYSIS

The experiments were performed in triplicates and the results were presented as mean ± standard deviation. Standard deviations were calculated using Microsoft Excel. Statistical analyses were done by the one-way ANOVA *t*-test at $p<0.05$ using OriginPro 8.5 software (OriginLab Corporation, MA 01060 USA). The study of Pearson's correlation was performed using SPSS 13.0 software.

4. RESULTS

The results of proximate analyses in g/100 g dry weight (DW) are presented in Table **1**. *A. dioica* fruit showed the moisture content of 13.323 ± 0.035 g/100 g DW (80.066 ± 3.557 g/100 g fresh weight) and *O. alismoides* fruit showed 4.170 ± 0.021 g/100 g DW (90.93 ± 1.484 g/100 g fresh weight). Low ash content was found to be observed in both the fruits (Table **1**). Crude fat and crude protein contents were also found to be low in both the fruits. *A. dioica* fruit (28.460 ± 0.702 g) had significantly higher amount of crude fibre than *O. alismoides* (17.501 ± 0.301 g). The total carbohydrate contents of *A. dioica* and *O. alismoides* fruits were 82.572 ± 0.285 g and 93.418 ± 0.221 g, respectively. *O. alismoides* fruit (95.826 ± 0.021 g) showed higher dry matter content than *A. dioica* fruit (86.676 ± 0.351 g). In this study, both the fruits were found to contain high calorific value (Table **1**).

Table 1: Proximate Composition of *A. dioica* and *O. alismoides* Fruits per 100 g of DW

Parameters	*A. dioica*	*O. alismoides*
Moisture (g)	13.323 ± 0.035[a] 80.066 ± 3.557[**a]	4.170 ± 0.021[b] 90.930 ± 1.484[**b]
Ash (g)	0.362 ± 0.004[a]	0.284 ± 0.004[a]
Acid insoluble ash (g)	0.183 ± 0.006[a]	0.102 ± 0.002[a]
Acid soluble ash (g)	0.176 ± 0.005[a]	0.183 ± 0.003[a]
Crude fat (g)	2.633 ± 0.251[a]	1.266 ± 0.208[b]
Crude protein (g)	1.153 ± 0.030[a]	0.856 ± 0.035[a]
Crude fibre (g)	28.460 ± 0.702[a]	17.501 ± 0.301[b]
Total carbohydrate (g)	82.572 ± 0.285[a]	93.418 ± 0.221[b]
Dry matter (g)	86.676 ± 0.351[a]	95.826 ± 0.021[b]
Calorific value (kcal)	358.422 ± 1.101[a]	388.501 ± 1.125[b]

**, Moisture content of fresh fruit; DW, dry weight; The results followed by different letters along a row are significantly different from each other at p<0.05 (one-way ANOVA *t*-test).

The mineral compositions of the fruits in mg/100 g of dry weight (DW) determined in this study are depicted in Table **2**. Sodium level of *A. dioica* fruit (3.297 ± 0.036 mg) was found lower than that of *O. alismoides* fruit (162.50 ± 1.131 mg). A high level of potassium was detected in both the fruits which showed 1555.960 ± 15.560 mg in *A. dioica* and 2776.15 ± 28.891 mg in *O. alismoides*. Calcium content was found higher in *A. dioica* fruit (337.850 ± 1.689 mg) than *O. alismoides* fruit (206.021 ± 7.691 mg). *O. alismoides* fruit showed higher levels of magnesium (252.83 ± 2.811 mg), iron (28.96 ± 0.112 mg), zinc (2.780 ± 0.041 mg), copper (5.51 ± 0.101 mg), manganese (13.02 ± 0.202 mg), and cobalt (0.490 ± 0.051 mg) than that of *A. dioica* fruit (Table **2**).

In present study, the phytochemical screening results of five different solvent extracts *viz*. methanol, chloroform, hexane, acetone and water extracts of *A. dioica* and *O. alismoides* fruits are summarized in Tables **3** and **4**, respectively which indicated the presence of many bioactive compounds having potential pharmacological properties.

In vitro antioxidant activities of methanolic extracts of *A. dioica* and *O. alismoides* fruits were investigated using DPPH, ABTS, H_2O_2 and FRAP assays. Table **5** showed that the percentage inhibition increased with concentration of sample extract indicating radical scavenging capacities in a concentration-dependent manner. *A. dioica* fruit extract exhibited a lower DPPH IC_{50} value (168.001 ± 2.645 µg/mL) than that of *O. alismoides* fruit (364.33 ± 5.507 µg/mL). Similarly, *A. dioica* fruit extract also showed a lower ABTS IC_{50} value and H_2O_2 IC_{50} value in comparison to *O. alismoides* fruit extract (Table **5**) exhibiting *A. dioica*

Table 2: Mineral Contents of *A. dioica* and *O. alismoides* Fruits

Minerals	*A. dioica* (mg/100 g DW)	*O. alismoides* (mg/100 g DW)
Sodium	3.297 ± 0.036[a]	162.500 ± 1.131[b]
Potassium	1555.960 ± 15.560[a]	2776.150 ± 28.891[b]
Calcium	337.850 ± 1.689[a]	206.021 ± 7.691[b]
Magnesium	73.771 ± 0.295[a]	252.830 ± 2.811[b]
Iron	6.649 ± 0.027[a]	28.960 ± 0.112[b]
Zinc	0.926 ± 0.022[a]	2.780 ± 0.041[b]
Copper	0.637 ± 0.055[a]	5.510 ± 0.101[b]
Manganese	5.008 ± 0.055[a]	13.020 ± 0.202[b]
Cobalt	0.261 ± 0.019[a]	0.490 ± 0.051[a]

DW, dry weight; The results followed by different letters along a row are significantly different from each other at p<0.05 (one-way ANOVA *t*-test).

Table 3: Phytochemical Screening of *A. dioica* Fruit with Different Solvent Extracts

Phytochemicals	Test	Methanol	Chloroform	Hexane	Acetone	Water
Alkaloids	Wagner's	+	+	+	+	+
	Dragendroff's	+	+	+	+	+
Saponins	Froth test	+	+	+	+	+
Cardiac glycosides	Keller-Killiani's test	+	+	+	+	-
Steroids (Terpenoids)	Liebermann-Burchard test	-	+	+	-	+
	Salkowski's test	+	-	+	+	-
Anthraquinones	Modified Borntrager's test	-	-	-	+	+
Coumarins		+	+	-	-	+
Phenols	$FeCl_3$ test	+	+	+	+	+
Tannins	Gelatin test	+	-	-	+	-
Flavonoids	Shinoda's test	+	-	+	-	+
Carbohydrates	Molisch's test	+	+	+	+	+
	Fehling's test	+	+	+	+	-
Starch	Iodine test	-	+	-	-	+
Anthocyanins		+	-	+	+	-
Proteins	Ninhydrin test	-	-	+	-	-
	Millon's test	+	-	-	-	+
Phlobatannins		-	-	-	+	+
Lignin		-	-	-	+	+

(+), present; (–), absent.

Table 4: Phytochemical Screening of *O. alismoides* Fruit with Different Solvent Extracts

Phytochemicals	Test	Methanol	Chloroform	Hexane	Acetone	Water
Alkaloids	Wagner's	+	+	+	+	+
	Dragendroff's	+	+	-	-	+
Saponins	Froth test	+	+	+	+	+
Cardiac glycosides	Keller-Killiani's test	+	+	+	-	-
Steroids (Terpenoids)	Liebermann-Burchard test	+	+	+	-	+
	Salkowski's test	+	+	+	+	-
Anthraquinones	Modified Borntrager's test	+	-	-	+	+
Coumarins		+	-	-	+	-
Phenols	$FeCl_3$ test	+	+	+	+	+
Tannins	Gelatin test	+	-	-	+	-
Flavonoids	Shinoda's test	+	-	-	+	+
Carbohydrates	Molisch's test	+	+	+	+	+
	Fehling's test	-	+	+	+	-
Starch	Iodine test	-	+	+	-	+
Anthocyanins		+	-	+	+	-
Proteins	Ninhydrin test	-	-	+	-	-
	Millon's test	+	-	-	-	+
Phlobatannins		-	-	-	+	+
Lignin		-	-	+	+	+

(+), present; (–), absent.

Table 5: DPPH, ABTS and H_2O_2 Scavenging Activities of Methanolic Extracts of *A. dioica* and *O. alismoides* Fruits

Conc. (µg/mL)	Inhibition (%) of fruits for DPPH assay		
	A. dioica	***O. alismoides***	**Ascorbic acid*** **
2	16.110 ± 0.461[a]	16.636 ± 0.522[a]	15.801 ± 0.556[b]
5	18.340 ± 0.373[a]	19.643 ± 0.275[b]	27.101 ± 0.754[c]
10	20.050 ± 0.731[a]	22.383 ± 0.155[b]	36.433 ± 0.702[c]
50	37.053 ± 0.410[a]	26.786 ± 0.515[b]	93.233 ± 0.404[c]
100	48.070 ± 0.461[a]	32.433 ± 0.282[b]	93.600 ± 0.501[c]
200	78.230 ± 0.462[a]	44.220 ± 0.471[b]	94.166 ± 0.550[c]
400	83.236 ± 0.365[a]	51.496 ± 0.362[b]	94.333 ± 0.650[c]
500	87.481 ± 0.462[a]	58.513 ± 0.715[b]	95.066 ± 0.450[c]
IC_{50}	168.001 ± 2.645[a]	364.33 ± 5.507[b]	16.666 ± 2.516[c]
Conc. (µg/mL)	Inhibition (%) of fruits for ABTS assay		
25	32.220 ± 0.291[a]	13.070 ± 1.231[b]	36.093 ± 0.875[c]
50	52.113 ± 0.511[a]	23.430 ± 1.381[b]	38.520 ± 1.176[c]
75	71.380 ± 0.721[a]	31.586 ± 1.078[b]	55.550 ± 1.023[c]
100	80.196 ± 0.865[a]	33.686 ± 0.860[b]	66.856 ± 0.661[c]
150	85.883 ± 0.729[a]	41.690 ± 0.461[b]	73.506 ± 0.810[c]
250	91.901 ± 1.012[a]	57.380 ± 0.621[b]	79.426 ± 1.168[c]
IC_{50}	27.333 ± 1.527[a]	201.00 ± 6.557[b]	73.666 ± 3.214[c]
Conc. (µg/mL)	Inhibition (%) of fruits for H_2O_2 assay		
5	19.286 ± 0.145[a]	5.256 ± 0.305[b]	10.410 ± 0.307[c]
10	37.653 ± 0.315[a]	13.500 ± 0.236[b]	27.890 ± 0.160[c]
15	40.126 ± 0.104[a]	24.040 ± 0.186[b]	41.940 ± 0.231[c]
20	61.046 ± 0.142[a]	37.450 ± 0.186[b]	51.451 ± 0.122[c]
25	68.256 ± 0.285[a]	52.410 ± 0.141[b]	60.523 ± 0.281[c]
IC_{50}	16.566 ± 0.251[a]	24.466 ± 0.115[b]	19.766 ± 0.152[c]

Conc., concentration; IC_{50} value in µg/mL; ***, Ascorbic acid was used as standard for DPPH, ABTS, H_2O_2 assays; Results are expressed as mean of 3 replicates ± standard deviation; The results with different letters along a row are significantly different from each other at $p<0.05$ (one-way ANOVA *t*-test).

fruit as a potent antioxidant. The FRAP value (Table **6**) found in the methanol extract of *A. dioica* fruit (106.583 ± 5.204 µM TE/g DE) was higher compared to that of *O. alismoides* fruit (44.083 ± 7.637 µM TE/g DE) indicating stronger antioxidant power in *A. dioica* fruit. TPC, TFC and vitamin C content of the fruits are shown in Table **6**. The TPC found in the methanol extracts of *A. dioica* and *O. alismoides* fruits were 146.710 ± 2.807 mg GAE/g DE and 93.860 ± 1.172 mg GAE/g DE, respectively, while the TFC was found to be 72.510 ± 8.833 mg QE/g DE in *A. dioica* fruit and 43.270 ± 5.361 mg QE/g DE in *O. alismoides* fruit.

The vitamin C contents of *A. dioica* and *O. alismoides* fruits were 6.120 ± 0.610 mg/100 g FW and 3.680 ± 0.835 mg/100 g FW, respectively.

Table 6: Ferric Reducing Antioxidant Power (FRAP), TPC, TFC and Vitamin C Content of the Fruits

Parameters	***A. dioica***	***O. alismoides***
FRAP value (µM TE/g DE)	106.583 ± 5.204[a]	44.083 ± 7.637[b]
TPC (mg GAE/g DE)	146.710 ± 2.807[a]	93.860 ± 1.172[b]
TFC (mg QE/g DE)	72.510 ± 8.833[a]	43.270 ± 5.361[b]
Vitamin C (mg/100 g FW)	6.120 ± 0.610[a]	3.680 ± 0.835[b]

DE, dry extract; FW, fresh weight; The results followed by different letters along a row are significantly different from each other at $p<0.05$ (one-way ANOVA *t*-test).

5. DISCUSSION

Variations in proximate compositions of the two wild fruits *viz*. *A. dioica* and *O. alismoides* were seen in the present study (Table **1**). The moisture content found was close to that of the conventional fruits reported by Ruiz-Rodríguez *et al*. [17]. The ash content which indicates the total minerals content was very low in both the fruits and these values are similar with the works of Ogoloma *et al*. [18] reported in pineapple, orange and pawpaw grown in oil producing community of Rivers State, Nigeria. Crude fat content of *O. alismoides* fruit was lower than *A. dioica* fruit (Table **1**) which is comparable to the values of some wild edible fruits of Meghalaya (India) reported by Seal [19]. The crude protein content was found higher in *A. dioica* fruit (1.153 ± 0.03 g) than *O. alismoides* fruit (0.856 ± 0.035 g) and similar values in some fruits were also reported by French [20]. High amount of crude fibre was obtained in the two wild fruits (Table **1**) and these fruits are considered to be good sources of fibre. Foods with high fibre content can improve digestibility and absorption processes in large intestine, and prevent constipation [21]. The fruits showed rich carbohydrate contents (Table **1**) and the results were similar to that of some fruits of Meghalaya reported by Seal [19] and some wild edible plants of the Sikkim Himalaya reported by Sundriyal *et al*. [22]. The energy or calorific value of *A. dioica* and *O. alismoides* fruits were quite high and similar results were also reported by Seal [19].

Minerals are essential elements for living organisms which support in the normal functioning of health. Inadequate intake of minerals in the food leads to weakening of the immune system which increases the susceptibility to infectious diseases [13]. In medicinal plants, metal analyses along with other biological and chemical analyses have been recommended strongly by World Health Organisation [23, 24]. Generally metals are accumulated in plants by absorbing or adsorbing on the vegetable and fruit surfaces, either from the environments or soil [25, 26]. Some heavy metals obtained in plants are essential like Cu, Zn, Cr, Fe, Mn, Co and Ni which are required in very trace amounts as they are essential for the physiological and biological functions of the human body and the excess or deficiency of minerals are both detrimental and may cause metabolic complaints [27]. Amongst the macro elements, potassium was found to be the most abundant mineral in both the fruits (Table **2**) and similar results were also reported by Nyanga *et al*. [28]. Similar to this study, Seal [19] reported close value of calcium. Similar to this work, Leterme *et al.* [29] and Ekholm *et al*. [30] reported comparable values of magnesium in their study. High amount of iron was present in *O. alismoides* which is close to the values of *Terminalia chebula* reported by Seal [19]. Zinc content of *O. alismoides* was also similar to that of *Borojoa sorbilis* and *A. dioica* also showed close value of zinc to that of *Zizyphus jujuba* reported by Leterme *et al.* [29].

Phytochemical screening provides basic information about medicinal importance of the plants. Phytochemicals obtained in plants contain several bioactive compounds which have medicinal properties like antimicrobial, antioxidant, antiinflammatory, antidiabetic, anticancer and antifungal properties [7, 13, 31]. Phytochemical screening of the two wild fruit extracts indicated presence of many bioactive compounds (Tables **3** and **4**) which have importance for pharmacological uses. Alkaloids are known to have anti-bacterial, anti-spasmodic, and analgesic properties [13, 32]. Steroids possess antiinflammatory, antibacterial and analgesic properties [32]. Saponins have bitterness, hemolytic, anti-inflammatory and cholesterol binding properties [13, 33]. Glycosides possess anti-diarrhoeal property and can reduce blood pressure [13, 33]. Fruits and vegetables are important sources of polyphenols, flavonoids, and anthocyanins which have various biological properties like anti-carcinogenic, antioxidant, and health-promoting properties [13, 31]. Tannins also possess many physiological properties like antimicrobial, antioxidant and anti-inflammatory, and are also used for the treatment of dysentery and diarrhoea [13, 34]. Coumarins possess strong antioxidant property which has the ability to scavenge free radicals [34].

Many of the antioxidant compounds like polyphenols, flavonoids *etc*. found in plant foods are soluble in polar solvents like methanol and hence plant extracts are prepared mostly in methanol for investigation of antioxidant properties [13, 35]. In present study, the methanolic extracts of *A. dioica* and *O. alismoides* fruits were used for investigation of antioxidant capacities employing DPPH, ABTS, H_2O_2 and FRAP assays (Tables **5** and **6**). DPPH assay is used normally to determine the capability of compounds to scavenge free radicals or donate hydrogen and finally to evaluate the antioxidant capacity in the extracts [36]. IC_{50} value of the crude extract means the inhibitory concentration of that extract which is capable of scavenging 50% reactive oxygen species or prevent oxidation by 50%. It is inversely correlated to antioxidant activity which means

Table 7: Pearson's Correlation Coefficients of Antioxidant Capacity (DPPH, ABTS, H_2O_2, FRAP), TPC, TFC and Vitamin C in the Fruits

	DPPH	ABTS	H_2O_2	FRAP	TPC	TFC	Vitamin C
DPPH	1						
ABTS	1.000[a]	1					
H_2O_2	1.000[a]	1.000[a]	1				
FRAP	-1.000[a]	-1.000[a]	-1.000[a]	1			
TPC	-1.000[a]	-1.000[a]	-1.000[a]	1.000[a]	1		
TFC	-1.000[a]	-1.000[a]	-1.000[a]	1.000[a]	1.000[a]	1	
Vitamin C	-1.000[a]	-1.000[a]	-1.000[a]	1.000[a]	1.000[a]	1.000[a]	1

[a]Correlation is significant at p<0.01.

that a lower IC_{50} value of sample extract indicates higher antioxidant activity. *A. dioica* fruit extract showed lower IC_{50} (DPPH, ABTS and H_2O_2) values in comparison to that of *O. alismoides* fruit extract indicating stronger antioxidant capacity in *A. dioica* fruit (Table **5**). Higher FRAP value obtained in *A. dioica* fruit extract also showed stronger antioxidant power in contrast to *O. alismoides* fruit (Table **6**). It is notable that all the four assays *viz*. DPPH, ABTS, H_2O_2 and FRAP used for the assessment of antioxidant activities indicated that the methanolic extract of *A. dioica* fruit showed better antioxidant capacities than *O. alismoides* fruit extract. Further, *A. dioica* fruit exhibited higher TPC, TFC and vitamin C content than *O. alismoides* fruit (Table **6**) which supported the stronger antioxidant activity in *A. dioica* fruit. Fruits and vegetables are very good sources of polyphenols, flavonoids, ascorbic acid, and several other compounds, and show favourable effects on human health [31, 37]. Polyphenols and flavonoids in higher amounts correspond to stronger antioxidant capacity and they have various indispensable roles in reducing the risk of many human related diseases especially oxidative stress related diseases [31].

The study of antioxidant potentials in the two wild fruits showed a very good positive correlation of DPPH assay with ABTS assay and H_2O_2 assay at p<0.01 significantly (Table **7**). This study also presented a strong positive correlation of ABTS with H_2O_2, FRAP with TPC, TFC, and vitamin C which is in agreement with the study on some cultivated and wild blueberries of Romania reported by Bunea *et al*. [38]. Similarly, a positive correlation of FRAP assay with TPC and TFC was also reported by Ku *et al*. [39]. This study also showed a good correlation of TPC with TFC and vitamin C, and TFC also with vitamin C. Many studies reported a good correlation of TPC and TFC with the antioxidant activity and the contribution of these phenolic and flavonoid compounds to the total antioxidant capacity of plant extract is due to their proton donating capacities and redox properties [31, 37-40].

6. CONCLUSION

In this study, the wild edible fruits *viz*. *A. dioica* and *O. alismoides* showed variations in proximate and mineral compositions. Phytochemical screening of the fruit extracts indicated the presence of many bioactive compounds which have importance for pharmacological uses. The study exhibited that *A. dioica* fruit had higher antioxidant activity than *O. alismoides* fruit displaying superior DPPH, ABTS and H_2O_2 scavenging activities, better FRAP value, and higher TPC, TFC and vitamin C content. A strong positive correlation of FRAP assay with TPC, TFC, and vitamin C content was observed indicating that these phytochemical constituents are responsible for antioxidant activities of the fruits. This study suggests that the fruits can play positive roles for combating the oxidative stress related human diseases.

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