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Research Article

Effect of Solvent Extraction System on the Antioxidant Activities of Some Selected Wild Edible Plants Used by the Ethnic People of Arunachal Pradesh

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ABSTRACT

Recently, the interest on plant- derived antioxidants has grown due to the several draw- backs of the synthetic and commercially available synthetic antioxidants. The aim of present study is to investigate the antioxidant activities of four different solvent extracts of five wild edible plants e.g. *Allium hookeri*, *Cardamine macrophylla*, *Sarcochlamys pulcherrima* , *Eryngium foetidum* and *Bambusa balcooa* consumed by the ethnic people of Arunachal Pradesh state in India. The extracts of the plants were examined for their antioxidant activities by using free radical 1,1-diphenyl-2-picryl hydrazyl (DPPH) scavenging method, ABTS radical scavenging ability, reducing power capacity, estimation of total phenolic content, flavonoid content and flavonol content.. The result showed that the total phenolics, flavonoids and flavonols of the different extracts of the investigated samples ranged from 9.52 ± 3.66 - 82.43 ± 1.25 mg gallic acid equivalents **(**GAE)/g dry extract, 19.64±0.19 -67.99±0.50 mg rutin equivalent /g dry extract and 9.73±1.12 to 128.15±1.38 mg quercetin equivalent /g dry extract respectively. Furthermore the plant extracts exhibited good free radical scavenging capacity. The solvent systems used were benzene, chloroform, acetone and methanol. The different levels of antioxidant activities were found in the solvent systems used. The results indicate that these wild edible plants could be utilized as natural antioxidant.

Keywords : Antioxidant activity , Arunachal Pradesh, , Different solvent extracts, Wild edible plant

INTRODUCTION

Oxidation is a chemical reaction involving the loss of electrons which can produce free radicals. Antioxidants are synthetic or natural substances that may inhibit the oxidation of other molecules. As antioxidants have been reported to prevent oxidative damage caused by free radical, it can interfere with the oxidation process by reacting with free radicals, chelating catalytic metals and also by acting as oxygen scavengers[1]. Reactive oxygen species affect living cells and these radicals are responsible for many chronic diseases in human being such as atherosclerosis, parkinson's disease, arthritis, alzheimer's disease, stroke, chronic inflammatory diseases, cancers, and other degenerative diseases[2]. Plant materials are rich sources of active constituents of varied chemical characteristics. Studies on herbal plants, vegetables, and fruits have indicated the presence of active components viz. phenolic compounds, flavones, isoflavones, flavonoids, anthocyanin, coumarin, lignans, catechins and isocatechins and they have been reported to have multiple biological effects, including antioxidant activity[3]. Antioxidants from plant materials terminate the action of free radicals thereby protecting the body from various diseases. The antioxidant activities of plants are strongly dependant on the polarity of the solvents and plant parts used for the complete extraction of active components[4-5]. Solvents, such as methanol, ethanol, acetone, chloroform, ethyl acetate and water have been widely used for the extraction of antioxidant compounds from various plants and plant based foods and medicines. Therefore, the objective of present study was to highlight some of the ethnobotanical notes and to investigate the effect of different extracting solvents with different polarity on the antioxidant activities of five wild edible plants used by the tribal people of Arunachal Pradesh, India *viz Allium hookeri*, *Cardamine macrophylla*, *Sarcochlamys pulcherrima*, *Eryngium foetidum and Bambusa balcooa*. In present communication we also attempt to highlight some of the ethnobotanical notes of the plants collected from the different parts of Arunal Pradesh. Thus the results from this preliminary study will provide a better understanding of the antioxidant properties of these plants and would be enabling to develop natural antioxidant.

MATERIALS AND METHODS

Plant materials

The five plant materials e.g *Allium hookeri*, *Cardamine macrophylla*, *Sarcochlamys pulcherrima*, *Eryngium foetidum and Bambusa balcooa* were collected from different market of Arunachal Pradesh state, India on June 2014 and authenticated in our office. The voucher specimens were preserved in the Plant Chemistry

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Table 1: Extractive value of wild edible plants collected from Arunachal Pradesh using different solvents

Sl No	Name of the plant	Parts used	Extractive value (g / 100g dry material)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	0.6±0.01	1.07±0.06	0.825±0.04	8.02±0.02
2	*C. macrophylla*	leaves	0.6±0.04	0.65±0.04	1.375±0.02	7.9±0.07
3	*S. pulcherrima*	leaves	0.3±0.03	0.35±0.01	0.7±0.01	4.0±0.03
4	*E. foetidum*	leaves	0.70±0.02	0.9±0.03	1.40±0.03	5.9±0.04
5	*B. balcooa*	Young shoot	0.87±0.02	1.00±0.03	1.25±0.03	4.75±0.05

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

Table 2: Total phenolic content in the wild edible plants collected from Arunachal Pradesh using different solvents

Sl No	Name of the plant	Parts used	Total phenolic content (GAE mg / g dry extract)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	7.05±1.85	9.30±1.03	26.10±2.69	64.19±0.21
2	*C. macrophylla*	leaves	3.84±1.82	15.38±3.41	16.59±1.23	79.89±0.84
3	*S. pulcherrima*	leaves	14.10±3.70	28.57±3.17	22.52±1.58	154.80±2.77
4	*E. foetidum*	leaves	6.04±1.58	16.80±1.88	4.39±0.79	25.92±0.28
5	*B. balcooa*	Young shoot	4.83±1.26	9.35±2.31	14.15±0.88	22.48±0.48

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

department of our office under registry no BSITS 76, BSITS 77, BSITS 78, BSITS 79, BSITS 80 respectively. The plant parts were shed-dried, pulverized and stored in an airtight container for further extraction.

Chemicals

1,1-Diphenyl-2-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), butylated hydroxytoluene (BHT), ascorbic acid, quercetin were purchased from Sigma Chemical Co. (St. Louis, MO, USA)., Folin-Ciocalteus's phenol reagent, gallic acid, potassium ferricyanide, potassium per sulphate, Aluminium chloride, $FeCl_3$ and sodium carbonate were from Merck Chemical Supplies (Damstadt, Germany). All the chemicals used including the solvents, were of analytical grade.

Ethnobotanical notes of wild edible plants

Allium hookeri Thw. belonging to the family Alliaceae is widely distributed in Tawang, east and west Kamang and upper Dibang valley of Arunachal Pradesh state in India and it is called 'Talap' by the Nyishi tribe of the state. The bulb of this plant are consumed as vegetable, soup and pickles. The plant is used by the different ethnic people to get relief from cough and cold. The bulbs of the plant with oil are reported to use for the treatment of different types of skin diseases[6].

Cardamine macrophylla Willd belonging to the family Brasicaceae is widely distributed in the different parts of Arunachal Pradesh and Meghalaya State in India. The plant is known as 'pimtale' among the Nyishi community of Arunachal Pradesh. The leaves are consumed as vegetable[7].

Sarcochlamys pulcherrima (Roxb.) Gaud. belonging to the family Urticaceae is well-known edible and medicinal plant distributed in the North East India. The various ethnic community of North East India consider this plant as sacred and used for the treatment of various diseases viz. worm infection, diarrhoea, dysentry boils, fever etc. The leaves and tender shoots are reported to consumed as vegetable by the different tribal people of Meghalaya and Arunachal Pradesh[8].

Eryngium foetidum L. belonging to the family Apiaceae is a popular wild edible plant reported to be found in the different parts of North East India. The plant is known as 'Ori' among the 'Nyshi' community of Arunachal Pradesh. The leaf paste of the plant are used for the treatment of epilepsy[9]. The whole plant is eaten by the Zeliang tribe of Nagaland as spice and condimens. The decoction of the plant in water is reported as diuretic[10].

Bambusa balcooa (Roxb.) Kuntze belonging to the family Poaceae is known as 'Eii' among the Nyshi community of Arunachal Pradesh. The young new shoots of bamboo are cooked and eaten by tribal people of North East India as vegetable. Bamboo extract is used to treat various inflammatory conditions ulcer and wounds

Extraction of plant material (Benzene, chloroform, acetone and methanol)

One gram of each plant material were extracted with 20 ml each of benzene, chloroform, acetone and methanol with agitation for 18 -24 h at ambient temperature. The extracts were filtered and diluted to 50 ml and aliquot were analyzed for their total phenolic, flavonoid and flavonol content, reducing power and their free radical scavenging capacity.

Estimation of total phenolic content

The amount of total phenolic content of crude extracts was determined according to Folin-Ciocalteu method[11]. 20 - 100 µl of the tested samples were introduced into test tubes. 1.0 ml of Folin-Ciocalteu reagent and 0.8 ml of sodium carbonate (7.5%) were added. The tubes were mixed and allowed to stand for 30 min. Absorption at 765 nm was measured (UV-visible spectrophotometer Shimadzu UV 1800). The total phenolic content was

Table 3: Total flavonoid content in the wild edible plants collected from Arunachal Pradesh using different solvents

Sl No	Name of the plant	Parts used	Total flavonoid content (Rutin equivalent mg / g dry extract)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	14.01±0.13	14.93±0.11	16.51±0.09	63.13±0.15
2	*C. macrophylla*	leaves	40.94 ±2.75	56.81±4.28	23.56±1.21	70.68±0.35
3	*S. pulcherrima*	leaves	54.27±0.66	61.30±1.13	40.85±1.28	91.30±2.94
4	*E. foetidum*	leaves	26.33±0.40	41.79±0.35	32.56±0.43	79.51±3.17
5	*B. balcooa*	Young shoot	17.24±0.42	17.65±0.24	14.71±0.13	61.65±1.01

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

Table 4: Total flavonol content in the wild edible plants collected from Arunachal Pradesh using different solvents

Sl No	Name of the plant	Parts used	Total flavonol content (Quercetin equivalent mg / g dry extract)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	9.60±0.49	7.26±0.27	39.14±0.35	74.57±0.36
2	*C. macrophylla*	leaves	31.71±0.49	37.12±0.45	21.63±0.21	127.63±0.56
3	*S. pulcherrima*	leaves	83.84±1.96	86.44±1.68	50.51±0.24	164.40±1.12
4	*E. foetidum*	leaves	44.43±1.75	37.96±0.37	28.04±0.24	69.72±0.76
5	*B. balcooa*	Young shoot	22.91±0.33	34.33±0.29	23.38±0.23	106.65±2.70

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

expressed as gallic acid equivalents (GAE) in miligram per gram (mg/g) of extract using the following equation based on the calibration curve $y = 0.0013x + 0.0498$, $R^2 = 0.999$ where y was the absorbance and x was the Gallic acid equivalent (mg/g).

Estimation of total flavonoids

Total flavonoids were estimated using the method of Ordonez *et al*., 2006 [12]. To 0.5 ml of sample, 0.5 ml of 2% $AlCl_3$ ethanol solution was added. After one hour, at room temperature, the absorbance was measured at 420 nm (UV-visible spectrophotometer Shimadzu UV 1800). A yellow color indicated the presence of flavonoids. Total flavonoid contents were calculated as rutin equivalent (mg/g) using the following equation based on the calibration curve: $y = 0.0182x - 0.0222$, $R^2 = 0.9962$, where y was the absorbance and x was the Rutin equivalent (mg/g).

Estimation of total flavonols

Total flavonols in the plant extracts were estimated using the method of Kumaran and Karunakaran, 2006 [13]. To 2.0 ml of sample (standard), 2.0 ml of 2% $AlCl_3$ ethanol and 3.0 ml (50 g/L) sodium acetate solutions were added. The absorption at 440 nm (UV-visible spectrophotometer Shimadzu UV 1800) was read after 2.5 h at 20°C. Total flavonol content was calculated as quercetin equivalent (mg/g) using the following equation based on the calibration curve: $y = 0.0049x + 0.0047$, $R^2 = 0.9935$, where y was the absorbance and x was the quercetin equivalent (mg/g).

Measurement of reducing power

The ability of the extracts to reduce iron (III) was assessed by the method of Oyaizu, 1986 [14]. Extracts (100 µl) of plant extracts were mixed with phosphate buffer (2.5 ml, 0.2 M, *p*H 6.6) and 1% potassium ferricyanide (2.5 ml). The mixture was incubated at 50°C for 20 min. Aliquots of 10% trichloroacetic acid (2.5 ml) were added to the mixture, which was then centrifuged at 3000 rpm for 10 min. The upper layer of the solution (2.5 ml) was mixed with distilled water (2.5 ml) and a freshly prepared ferric chloride solution (0.5 ml, 0.1%). The absorbance was measured at 700 nm. Reducing power is given in ascorbic acid equivalent (AAE) in milligram per gram (mg/g) of dry material using the following equation based on the calibration curve: $y = 0.0023x - 0.0063$, $R^2 = 0.9955$ where y was the absorbance and x was the ascorbic acid equivalent (mg/g).

Determination of DPPH free radical scavenging activity

The free radical scavenging activity of the plant samples and butylated hydroxyl toluene (BHT) as positive control was determined using the stable radical DPPH (1,1-diphenyl-2-picrylhydrazyl)[15]. Aliquots (20 - 100 µl) of the tested sample were placed in test tubes and 3.9 ml of freshly prepared DPPH solution (25 mg L^{-1}) in methanol was added in each test tube and mixed. 30 min later, the absorbance was measured at 517 nm (UV-visible spectrophotometer Shimadzu UV 1800). The capability to scavenge the DPPH radical was calculated, using the following equation:

DPPH scavenged (%) = {(Ac – At)/Ac} x 100

Where Ac is the absorbance of the control reaction and At is the absorbance in presence of the sample of the extracts. The antioxidant activity of the extract was expressed as IC_{50}. The IC_{50} value was defined as the concentration in mg of dry material per ml (mg / ml) that inhibits the formation of DPPH radicals by 50%. Each value was determined from regression equation.

Values are presented as mean ± standard error mean of three replicates. The total phenolic content, flavonoid content, flavonol content, reducing power and IC_{50} value of each plant material was calculated by using Linear Regression analysis.

Scavenging activity of ABTS radical cation

Table 5: Reducing power (ascorbic acid equivalent) of the wild edible plants collected from Arunachal Pradesh using different solvents

Sl No	Name of the plant	Parts used	Reducing power (Ascorbic acid equivalent mg / g dry extract)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	24.69±1.59	13.78±0.89	30.25±2.87	97.47±2.38
2	*C. macrophylla*	leaves	28.32±2.63	35.61±2.89	19.73±4.47	16.64±0.16
3	*S. pulcherrima*	leaves	67.51±3.19	87.88±4.74	96.22±3.62	114.94±1.56
4	*E. foetidum*	leaves	63.61±4.04	46.65±1.06	17.57±0.25	29.90±0.80
5	*B. balcooa*	Young shoot	16.93±1.80	20.97±0.62	28.37±1.53	28.44±0.47

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

Table 6: Free radical scavenging ability of the wild edible plants collected from Arunachal Pradesh by the use of a stable DPPH radical (antioxidant activity expressed as IC_{50})

Sl No	Name of the plant	Parts used	Free radical scavenging ability IC_{50} mg / g dry extract			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	1.94±0.66	0.70±0.03	0.74±0.03	0.55 ±0.01
2	*C. macrophylla*	leaves	0.76±0.06	0.32±0.01	1.24±0.14	0.30±0.001
3	*S. pulcherrima*	leaves	0.20±0.01	0.13±0.01	0.14±0.02	0.017±0.01
4	*E. foetidum*	leaves	0.60±0.02	0.32±0.01	0.44±0.03	0.29±0.03
5	*B. balcooa*	Young shoot	0.79±0.03	0.29 ±0.01	0.65±0.18	0.22±0.03

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

The 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) radical cation ($ABTS^{\cdot+}$)-scavenging activity was measured according to the method described by Re *et al*.[16]. ABTS was dissolved in water to a 7 mM concentration. The ABTS radicals were produced by adding 2.45 mM potassium persulphate(final concentration).The completion of radical generation was obtained in the dark at room temperature for 12–16 h. This solution was then diluted with ethanol to adjust its absorbance at 734 nm to 0.70 ± 0.02. To determine the scavenging activity, 1 ml of diluted $ABTS^{\cdot+}$ solution was added to 10 µl of plant extract (or water for the control), and the absorbance at 734 nm was measured 6 min after the initial mixing, using ethanol as the blank. The percentage of inhibition was calculated by the equation:

ABTS scavenged(%) = $(A_{cont} - A_{test}) / A_{cont} \times 100$

where A_c and A_s are the absorbencies of the control and of the test sample, respectively. From a plot of concentration against % inhibition, a linear regression analysis was performed to determine the IC_{50} value of the sample.

RESULTS AND DISCUSSION

Extractive value

The extractive value of the tested wild plants with four different solvents are depicted in Table 1. The result shows that, methanol is the most suitable solvent to obtain the maximum extract from all the plants under investigation in comparison to the other solvents like benzene, chloroform and acetone used for extraction. The bulb of *A. hookeri* give maximum yield (8.02±0.02 g/100g) when it is extracted with methanol and the least amount is observed with benzene. Likewise, the extract of other plant materials also followed the same order of *A. hookeri* extracts. The differences in the extractive value of the plant materials may be due to the varying nature of the chemical components present and the polarities of the solvent used for extraction[17].

Total phenol, flavonoid and flavonol content of the extracts

The screening of the benzene, chloroform, acetone and methanol extracts of five wild plants revealed that there is a wide variation in the amount of total phenolics ranging from 3.84±1.82 to 154.80±2.77 mg GAE/g dry extract (Table 2).

The highest amount of phenolic content is found in the methanol extract of *S.pulcherrima* (154.80±2.77 mg GAE/g dry extract) followed by the same solvent extract of *C. macrophylla* (79.89±0.84 mg GAE/g)**,** while lower amount is observed in the benzene extract of *C. macrophylla* (3.84±1.82 mg GAE/g). The chloroform extract of *S. pulcherrima* and methanol extracts of *A.hookeri*, *E. foetidum* and *B. balcooa* are found to contain a very good amount of phenolic compounds.

The flavonoid contents of the extracts in terms of rutin equivalent are found between 14.01±0.13 to 91.30±2.94 mg/g dry extract (Table 3).

The highest amount of flavonoid (91.30±2.94 mg/g dry extract) is found in the methanol extract of *S. pulcherrima* and the benzene, chloroform and acetone extract of this plant also contain a very good amount of flavonoids. The benzene, chloroform, acetone and methanol extract of other four plants under investigation also contain a very good amount of flavonoids.

The flavonol contents in the different extracts of plant materials are evaluated in terms of quercetin equivalent (Table 4).

Table 7: Free radical scavenging ability of the wild edible plants collected from Arunachal Pradesh by the use of a stable ABTS radical cation (antioxidant activity expressed as IC_{50})

Sl No	Name of the plant	Parts used	Free radical scavenging ability IC_{50} mg / g dry extract)			
			Benzene	Chloroform	Acetone	Methanol
1	*A. hookeri*	Bulb	1.48±0.31	0.38±0.01	0.53±0.04	0.28 ±0.04
2	*C. macrophylla*	leaves	0.43±0.04	0.29±0.01	0.34±0.01	0.22±0.01
3	*S. pulcherrima*	leaves	0.17±0.01	0.08±0.01	0.08±0.04	0.012±0.001
4	*E. foetidum*	leaves	0.50±0.07	0.26±0.01	0.27±0.01	0.25±0.001
5	*B. balcooa*	Young shoot	0.72±0.04	0.37 ±0.007	0.76±0.02	0.22±0.003

Each value in the table was obtained by calculating the average of three experiments and data are presented as Mean ± SEM

The highest amount of flavonol is observed in the methanol extract of *S. pulcherrima* (164.40±1.12 mg/g dry extract). A very good amounts of flavonol are also found to contain in the benzene, chloroform, acetone and methanol extract of *C. macrophylla* , *E. foetidum* and *B. balcooa*.

It has been established that phenolic compounds are the major plant compounds with antioxidant activity and this activity is due to their redox properties. Phenolic compounds are a class of antioxidant agents which can adsorb and neutralize the free radicals [18]. Flavonoids and flavonols are regarded as one of the most widespread groups of natural constituents found in the plants. It has been recognized that both flavonoids and flavonols show antioxidant activity through scavenging or chelating process [19]. The results strongly suggest that phenolics are important components of these plants. The other phenolic compounds such as flavonoids, flavonols, which contain hydroxyls are responsible for the radical scavenging effect in the plants. According to our study, methanol was the most suitable solvent to isolate the phenolic compounds and the flavonoids and flavonols from the plant materials. The high content of the phenolic compounds in *A. hookeri*, *S. pulcherrima*, *C. macrophylla*, *E. foetidum* and *B. balcooa* can explain their high radical scavenging activity.

Measurement of reducing power

The reducing powers of the five wild vegetables are evaluated as mg AAE/g dry extract as shown in Table 5.

The highest reducing power was exhibited by the methanol extract of *S. pulcherrima* (114.94±1.56 mgAAE/g dry extract) which also contain a very good amount of flavonoids and flavonols. The benzene extract of *B. balcooa* showed lowest activity in terms of ascorbic acid equivalent (16.93±1.80 mg/g AAE). In this assay, the presence of antioxidants in the extracts reduced Fe^{+3}/ferricyanide complex to the ferrous form. This reducing capacity of the extracts may serve as an indicator of potential antioxidant activities through the action of breaking the free radical chain by donating hydrogen atom[20].

DPPH radical scavenging activity

The evaluation of anti-radical properties of five wild edible plants were performed by DPPH radical scavenging assay. The 50% inhibition of DPPH radical (IC_{50}) by the different plant materials was determined (Table 6), a lower value would reflect greater antioxidant activity of the sample. DPPH stable free radical method is an easy, rapid and sensitive way to survey the antioxidant activity of a specific compound or plant extracts [21]. The antioxidant effect is proportional to the disappearance of the purple colour of DPPH in test samples. Thus antioxidant molecules can quench DPPH free radicals by providing hydrogen atom or by electron donation and a colorless stable molecule 2,2- diphenyl-1-hydrazine is formed and as a result of which the absorbance (at 517 nm) of the solution is decreased.

Hence the more potent antioxidant, more decrease in absorbance is seen and consequently the IC_{50} value will be minimum. In the present study the highest radical scavenging activity was shown by the methanol extract of *S. pulcherrima* (IC_{50} = 0.017±0.01 mg dry extract), whereas the benzene extract of *A. hookeri* showed lowest activity (IC_{50} = 1.94±0.66 mg dry extract). A strong inhibition was observed for the chloroform and acetone extract of *S. pulcherrima*. The methanol extracts of *C. macrophylla*, *E. foetidum* and *B. balcooa* also showed potent radical scavenging activities. The high radical scavenging property of these plants may be due to the presene of hydroxyl groups that can provide the necessary component as a radical scavenger.

ABTS radical scavenging activity

ABTS scavenging activities in various extracts of five wild edible plants using ABTS assay was shown in Table 7. The antioxidant effect is proportional to the disappearance of the colour of ABTS in test samples. Concentration of sample that could scavenge 50 % free radical (IC_{50}) was used to determine antioxidant capacity of sample compared to standard. Sample that had IC_{50} < 50 ppm, it was very strong antioxidant, 50-100 ppm strong antioxidant, 101-150 ppm medium antioxidant, while weak antioxidant with IC_{50} > 150 ppm[15]. In the present study the highest radical scavenging activity was shown by the methanol extract of *S. pulcherrima* (IC_{50} = 0.012±0.001 mg dry extract), whereas the benzene extract of *A. hookerii* showed lowest activity (IC_{50} =1.48±0.31 mg dry extract). The chloroform and acetone extracts of *S. pulcherrima* exhibited potent radical scavenging activities. A strong inhibition was also observed for the methanol extract of *C. macrophylla*, *E. foetidum* and *B. balcooa*.

The benzene, chloroform, acetone and methanol extracts of all of the edible plants under investigation exhibited

different extent of antioxidant activities and thus provide a valuable source of nutraceutical supplements.

CONCLUSION

The result of present study showed that the methanol extract of *S. pulcherrima*, which contain highest amount of phenolic compounds exhibited the greatest radical scavenging activity. The benzene, chloroform, acetone and methanol extract of all plants under investigation contain a very good amount of flavonoids and flavonols also showed strong radical scavenging activity in both ABTS and DPPH method. The radical scavenging activities of the selected plants extracts are still less affective than the commercial available synthetic like BHT and trolox. As the plant extracts are quite safe and the use of synthetic antioxidant has been limited because of their toxicity, therefore, these wild edible plants could be exploited as antioxidant additives and supplements for the diseases associated with oxidative stress. In addition, naturally antioxidants have the capacity to improve food quality and stability and also act as nutraceuticals to terminate free radical chain reaction in biological systems, and thus may provide additional health benefits to consumers.

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