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Research Article

Phytochemical Screening and Antioxidant Activity of Selected Wild Plants in Liliaceae Family Growing Syria

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ABSTRACT

There is currently an upsurge of interest in phytochemicals as a new source of natural antioxidants to be used in foods and pharmaceutical preparations to replace synthetic antioxidants, which are being restricted due to their potential health risks and toxicity. The objective of the present study was to evaluate the phytochemical constitution and antioxidant activity of methanolic extracts of dried bulbs and aerial parts of selected wild plants in Liliaceae family growing in Syria *Allium ampeloprasum.*, *Allium stamineum*, *Asparagus acutifolius and Ornithogalum umbellatum* . phytochemical screening was performed by the well-known tests protocol available in the literature using standard. The antioxidant properties of methanol extracts of bulbs and aerial of selected plants were evaluated, through determination of total phenolics and flavonoids content, as well as DPPH• (1,1-diphenyl-2-picrylhydrazyl) radical scavenging. The phytochemical screening revealed the presence of phenols, flavonoids, tannins, saponins, steroids and terpenoids in bulbs and aerial parts of studied plant, but none contain coumarins, while cardiac glycosides only parsent in bulbs of *Allium stamineum*, *Allium ampeloprasum* and *Ornithogalum umbellatum*. Aerial parts extracts of *Asparagus acutifolius* showed greater DPPH radical scavenging activity (IC50 = 0.15), as well as total phenolic (36.10 mg gallic acid equivalent/g of dry weight) and flavonoid content (114.28 mg rutin equivalent/g of dry weight. Consequently, the members of Liliaceae plants would be considered as promising sources of antioxidant phytochemicals.

Keywords: Liliaceae species, Phytochemical screening, total phenolic content, total flavonoids content, DPPH, antioxidant activity.

INTRODUCTION

Free radicals are chemical species which contains one or more unpaired electrons due to which they are highly unstable and cause damage to other molecules by extracting electrons from them in order to attain stability. Free radicals are continuously produced in the human body, as they are essential for energy supply, detoxification, chemical signaling and immune function[1]. Ultraviolet light, ionizing radiation, chemical reactions and metabolic processes can induce the production of reactive oxygen species (ROS) in the cells. Free radicals can initiate the oxidation of bio molecules, such as protein, lipid, amino acids and DNA which will lead to cell injury and can induce numerous diseases[2]. The imbalance between production of reactive oxygen species (ROS) like O_2, H_2O_2, OH^-, ROO^- and the capacity of the normal detoxification system in favor of the oxidants lead to oxidative stress, which itself lead to cellular damage caused by the interaction of ROS with cellular constituents. Tissue damage resulting from oxidative stress has been implicated in the pathology of a number of disorder diseases such as (cancer, inflammatory joint disease, cardiovascular diseases, and cataract) and could play a role in neurodegenerative diseases and ageing processes[3]. As a result of this, much attention has been focused on the use of antioxidants, especially, natural antioxidants to inhibit lipid peroxidation and to protect from damage due to free radicals[4]. Antioxidant refers to a compound that can delay or inhibit the oxidation of biomolecules by inhibiting the initiation or propagation of oxidative chain reactions and which can thus prevent or repair damage done to the body's cells by reactive oxygen species[5]. However, synthetic antioxidant like butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), propylgallate (PG) and tertiary butyl-hydroquinone (TBHQ) are known to ameliorate oxidative damages but they have been restricted due to their carcinogenic and harmful effect on the lungs and liver[6]. Thus, in order to protect human beings against oxidative damage, recently, there have been great efforts to find safe and potent natural antioxidants from various plant sources. As harmless sources of antioxidants, for example as *Allium* and *Lilium* species[7,8]. Natural antioxidants mainly come from plants in the form of phenolic compounds (flavonoids, phenolic acids and alcohols, stilbenes, tocopherols, tocotrienols) ascorbic acid and carotenoids. The quest for natural antioxidants for dietary, cosmetic and pharmaceutical uses has become a major industrial and scientific research[9].

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Many plant extracts have been reported to have multiple biological effects, including antioxidant properties due to their phytoconstituents including phenolics. Within the antioxidant compounds, flavonoids and phenolics with a large distribution in nature have been studied[10]. Phytochemical components, especially polyphenols are known to reduce oxidative stress. Phenolic compounds are secondary metabolites are known to be responsible for the antioxidant activity of plants. These compounds are suggested to contribute to the health-promoting properties. In addition to nutritive dietary components plants are a good source of different classes of polyphenolic components as well as flavan-3-ols, hydroxybenzoic and hydroxycinnmic acids, anthocyanins, stilbenoids and other flavonoids[11]. The Liliaceae family has over 250 genera and nearly 3700 species of plants widespread all over the world, these plants can tolerate unfavorable conditions, that is, winter and dryness due to resist: bulbs, tubers and rhizomes. The most plants of Liliaceae family have been used as vegetables and spices, and as folk medicines for curing various diseases. As well as, they contain a wide array of bioactive compounds, which include organo-sulphur compounds, phenolic compounds, non-structural and soluble carbohydrates, various amino acids, saponins, terpenoi and organic acids[12,13]. There are awide range of reported therapeutic effects for Liliaceae species as, antimicrobial, antiatherosclerotic, antiviral, antiparasitic, anti-diabetic, antioxidant, anticarcinogenic effects and immuno-modulatory properties[14,15]. In the recent years a large number of endemic plant species in Syria as *Cistus* and *Celtis* species have been screened as a viable source of phenolic antioxidants[16,17]. As a part of a systematic study of the chemical composition of Syrian flora plants, we selected four wild species from Liliaceae family which include about 34 genera and 149 species in Syria[18]. *Allium stamineum Bioss* is a species of onion found in the Middle East. The whole plant is toxic and contains volatile oil (rich in sulphurated compounds) and saponins. In animals the main symptoms are anemia and jaundice. The plant has antimicrobial activity and produces a depressing effect on the heart[19,20]. *Allium ampeloprasum* L. is a medicinal plant well known for its pharmaceutical potential. It is mostly called as great-headed garlic, elephant garlic or pearl onion. The wild plant is commonly known as (Broadleaf) Wild Leek. It has a very long folk medicinal history of use in a wide range of diseases, being mentioned by Dioscorides in the 1st century AD and also in some modern ethnobotanical works for their perceived antihelmintic, diuretic, antimicrobial, anti-inflammatory, antihypertensive and antioxidant properties, or digestive properties[13,21]. *Asparagus acutifolius L.*, the common name is wild asparagus, is a native plant species widely distributed throughout the mediteranean areas. The young shoots are consumed as vegetables in Turkey. It is used as diuretic, antrheumatic, antineuralgicm liver disorder, dysentery in traditional medicine[22,23]. *Ornithogallum umbellatum L.* (common name is Star of Bethlehem, Dove's Dung) is perennial herb distributed in Grassy places. Studies conducted on isolated compounds and/or crude extracts of *Ornithogalum* species revealed a wide range of biological activities as possess antimicrobial, cytotoxic, cytostatic, anticancer, antioxidant, mound-inhibiting and insect deterrent properties[24,25]. In particular, despite widespread of these plants, the literature contains few reports of antioxidant activity and chemical composition of these plants. In present study, we carried out a systematic record of chemical composition and The antioxidant activity through determination of total phenolics and flavonoids content, as well as DPPH• radical scavenging of selected wild plants in Liliaceae family growing in Syria.

MATERIALS AND METHODS

Chemicals and Instruments

Chemicals

Methanol GR (Eurolab,UK), Gallic acid (Prolab,Spain), Folin-ciocalteu (Sohariab SL, Spain), anhydrous sodium carbonate (Pareac quimica sau medien, Spain), Methanol GR (Eurolab, UK), Folin-ciocalteu phenol reagent (Sigma-Aldrich, Switzerland), Sodium Carbonate anhydrous (PAREAC QUIMICA SAU, Spain), Gallic acid (Titan biotech LTD., India), Rutin (Extrasynthese Genay, France), Aluminum Chloride Hexahydrate (Scharalau Chemie, Spain), DPPH and BHT (Sigma-Aldrich, USA). Distilled deionized water (dd. H_2O**.** All other chemicals unless and otherwise mentioned were obtained from Research Laboratories in department of pharmacognosy, Faculty of Pharmacy, University of Aleppo, Syria.

Instruments

Sensitive balance (Sartorius TE214, Germany), Rotary evaporator (Heidolph Instruments, Germany), UV-1800 spectrophotometer (Shimadzu, Japan), Ultrapure TM water purification system (Lotun Co., Ltd., Taipei, Taiwan).

Plant Materials

Fresh parts of four wild plants, *Allium stamineum Bioss*. (Bulbs, aerial parts), *Allium ampeloprasum L.* (Bulbs, aerial parts), *Ornithigalum umbellatum L*. (Bulbs, aerial parts), *Asparagus acutifolius L*. (aerial parts) were collected from different regions of Edlib in north of Syria. The plant materials were authenticated by an expert at Faculty of Agriculture- University of Aleppo, Syria. The plant materials were shade dried until all the water molecules evaporated and plants became well dried for grinding. After drying, ground well using mechanical blender into fine powder and transferred into airtight containers with proper labeling for future use.

Preparation of plant extracts

The extraction method was adapted from[26]. The prepared plant materials bulbs and aerial parts (30 g) were extracted three times for 30 min with methanol in ultrasonic bath. The temperature was maintained at 20°C. Ratio of plant material and solvent was 1:10. The extracts were filtered through a paper filter (Whatman, No.1) and evaporated to dryness under reduced pressure by the rotary evaporator. The obtained crude extracts were stored in dark glass bottles for further processing.

Preliminary phytochemical screening

phytochemical screening of the two parts of selected plants were performed to investigate the presence or absence of the

different phytochemical constituents such as were subjected to different tests for the active constituents viz. phenols, flavonoids, saponins, tannins, steroids, terpenoids, coumarins, cardiac glycosides and. Chemical tests were carried out on the methanolic, aqueous extract and the powdered specimen using standard procedures[27-30].

Test for phenols (Ferric Chloride Test): methanolic or aqueous extracts were treated with 3-4 drops of ferric chloride solution. Formation of bluish black colour indicates the presence of phenol.

Test for flavonoids

Shinoda test: Crude extract was mixed with few fragments of magnesium ribbon and concentrated HCl was added drop wise. Pink scarlet color appeared after few minutes which indicated the presence of flavonoids.

Alkaline reagent test: Crude extract was mixed with 2ml of 2% solution of NaOH. An intense yellow color was formed which turned colorless on addition of few drops of diluted acid which indicated the presence of flavonoids.

Test for tannins (Ferric chloride test) **:** A portion of the water extract was diluted with distilled water in a ratio of 1:4 and few drops of 10% ferric chloride solution was added. A blue or green color was indicated the presence of tannins.

Test for terpenoids (Salkowski test): 5 ml of extract was mixed with 2 ml of chloroform and 3 ml of concentrated H_2S0_4 was carefully added to form a layer. A reddish brown colouration of the inter face was formed to show positive results for the presence of terpenoids.

Test for saponins: Crude extract was mixed with 5 ml of distilled water in a test tube and it was shaken vigorously. Add some drops of olive oil. The formation of stable foam was taken as an indication for the presence of saponins

Test for steroids: 2 ml of acetic anhydride was added to 0.5 ml methanolic extract of plant sample with 2 ml H_2S0_4. The color changed from violet to blue or green in samples indicates the presence of steroids.

Test for cardiac glycosides (Keller-Kiliani test): 5 ml of extract was treated with 2 ml of glacial acetic acid containing one drop of ferric chloride solution. This was underlayed with 1 ml of concentrated H_2SO_4. A brown ring of the interface indicates a deoxy sugar characteristic of cardenolides. A violet ring may appear below the brown ring, while in the acetic acid layer, a greenish ring may form just gradually throughout thin layer.

Test for coumarin: 10 % NaOH was added to the extract and chloroform was added for observation of yellow color, which shows the presence of coumarin.

Determination of total phenol content (TPC)

Total phenolic content (TPC) was determined using the Folin–Ciocalteu reagent according to Stanković[31], with little modifications. Methanolic solution of the extract in the concentration of 1 mg/ml was used in the analysis. The reaction mixture was prepared by mixing 0.5 ml of methanolic solution of extract, 2.5 ml of 10% Folin-Ciocalteau's reagent dissolved in water and 2.5 ml 7.5% $NaHCO_3$. Blank was concomitantly prepared, containing 0.5 ml methanol. The samples were thereafter incubated in a thermostat at 45ºC for 45 min. The absorbance was determined using spectrophotometer at λmax = 765 nm. The same procedure was repeated for the standard solution of gallic acid and the calibration line was constructed. Based on the measured absorbance, the concentration of phenolic was read (mg/ml) from the calibration line. The content of phenolic was expressed in terms of milligrams of gallic acid equivalents (GAE) per gram of dry weight of plant (mg GAE/g DW).

Determination of total flavonoid content (TFC)

Total flavonoid content was determined by spectrophotometric method with $AlCl_3$ reagent, based on measuring the absorbance of complexes of flavonoids and aluminum. The reaction mixture was prepared according to the colorimetric method[31]. The sample contained 1 ml of methanol solution of the extract in the concentration of 1 mg/ml and 1 ml of 2% $AlCl_3$ solution dissolved in methanol. The samples were incubated for an hour at room temperature. The absorbance was determined using spectrophotometer at $^{\lambda}$max=415 nm. Based on the measured absorbance, the concentration of flavonoids was read (mg/ml) on the calibration line; then, the Total flavonoid content was expressed in terms of rutin equivalent per gram of plant's dry weight (mg RUE/g DW).

Evaluation of antioxidant activity (DPPH radical scavenging assay)

The hydrogen atom or electron donation ability of the corresponding extracts and some pure compounds was measured from the bleaching of the purple-colored methanol solution of DPPH. The stable 1, 1-diphenyl-2-picryl hydrazyl radical (DPPH) was used for determination of free radical-scavenging activity of the extracts[21]. The effect of the extracts on the scavenging of DPPH radical was determined according to the method adapted from Adedapo *et al*.[4] with slight modifications. A solution of 0.135 mM DPPH in methanol was prepared and 1.0 ml of this solution was mixed with 1.0 ml of extract in methanol containing 0.02–0.1 mg of the extract. The reaction mixture left in the dark at room temperature for 30 min. The absorbance of the mixture was measured spectrophotometrically at 517 nm. Lower the absorbance of the reaction mixture indicates higher free radical scavenging activity[32]. BHT was used as a standard and the same concentrations were prepared as the test solutions. Inhibition of DPPH free radical in percentage was calculated by the formula: Percentage (%) of DPPH radical scavenging = $[(A_0 - A_1) /A_0 \times 100)$, where A_0 was the absorbance of the control, A1 was the absorbance of the plant species or standards.

RESULTS AND DISCUSSION

This paper provides the first documentation on the chemical composition and antioxidant capacity of 4 wild plants growing in Syria .

Preliminary phytochemical screening

Phytochemicals are the core of phytomedicines; their therapeutic efficiency directly correlates with the presence of various phytochemicals[33]. The screening of bulbs and aerial parts of selected plants namly *Allium stamineum*, *Allium ampeloprasum*, *Ornithigalum umbellatum*. *Asparagus acutifolius* for phytochemical constituents was performed using generally accepted technique for

qualitative determination. The study indicated that phenols, flavonoids, tannins, saponins, terpenoids, steroids were present in all studied plant parts, but none contain coumarins , while cardiac glycosides only parsent in bulbs. The phytochemical characteristics were summarized in the (Table 1). Identification of plant chemical constituents is desirable because such information will be value for synthesis of complex chemical substances. Previous reports about species of Liliaceae family demonstrate the presence as phytochemicals in plants of current study is correlated with specific biological activity as immunological adjuvant, human platelet anti-aggregation, anti-inflammatory, adaptogenic, antibacterial and antioxidant activities[19-25]. The plant products over synthetic compound in the treatment of diseases are needed, because it does not have a deleterious effect in higher plants and animals including man. The results obtained in this study thus suggest the identified phytochemical compounds may be the bioactive constituents and these plants are proving to be an increasingly valuable reservoir of bioactive compounds of substantial medicinal merit.

Total phenos content

Phenolic compounds are high level antioxidants because they have the ability to absorb and neutralize free radicals.The mechanism of action of phenol compounds as antioxidants is based on scavenging and chelating process[26]. The levels of total phenols in methanol extracts of bulbs and aerial parts of selected wild plants according to the Folin–Ciocalteu method. The total phenols were expressed as mg/g gallic acid equivalent using the standard curve equation ($y = 6.6104x + 0.0108$), $R_2 = 0.9939$). In this study, the absorbance of series concentrations of gallic acid was plotted to their concentration to yield a linear calibration curve of gallic acid (Figure 1). According to the results present in (Table 2), The amount of total phenols varied from 21.80 to 36.10 and 5.50 to 11.03 mg GAE/g DW for aerial parts and bulbs extracts, repectively. It is clear that aerial parts extract contan total phenol content higher than the bulbs once.The methanolic *Asparagus acutifolius* aerial parts extracts possessed higher concentration of total phenols (36.10 mg GAE/g DW) than the other tested extracts. Results of this study showed different TPC between bulbs and aerial parts extracts, this is reported previously[21-24]. The difference in amounts of phenols is probably related to Folin assay which gives a crude estimate of the amount of phenolic compounds present in an extract. It is not specific to polyphenols but many interfering compounds may react with the reagent, giving elevated apparent phenolic concentrations. Moreover, various phenolics compounds respond differently in this assay, depending on the number of phenolic groups they have and total phenolics content does not incorporate necessarily[3]. The total phenolic content in aerial parts extracts is higher than 20 mgGAE/g dry weight could be considered as very high[34]. On the basis of this, the methanol extracts of aerial parts must be considered as good sources of phenolic compounds. Also, all tested methanolic extracts exhibit highest phenolic content and highset antioxidant activity, this suggest that the effectiveness of the antioxidant activity of plant extract is probably related to their phenolic contents which have hydroxyl groups in phenolics[21].

Total flavonoid content

Flavonoids are the most common group of plant polyphenols. Different studies have shown that these compounds are used for prevention and cure of many diseases. Flavonoids transfer hydrogen atom to free radicals, leading to interruption of free radical reactions[26]. The content of flavonoids bulbs and aerial parts extracts was compiled in (Table 3). The calibration curve of rutin to determine flavonoid content was shown in (Fig. 2). As in the case of total phenolics, the concentration of flavonoids in aerial parts extracts (ranged from from 52.30 to 114.30 mg RUE/g DW) were higher than the bulbs extracts (ranged from 1.82 to 11.80 mg RUE/g DW). In this case too, the aerial parts *Asparagus acutifolius* extracts yielded the highset flavonoid content (114.30 mg RUE/g DW). This method has also showed increases of antioxidant activity with concentration increasing. According to Liu et al. (2008), all plant parts parts extracts could be considered as a plant material with a high total flavonoid content (>20 mgRE/g). The same authors reported a great variation (from 0.0 to 157.67 mg RE/g) in the total flavonoid content of the different Chinese herbals[35]. Studies have shown that formation of flavonoids has been shown to be light dependent. In addition, higher amounts of flavonoids may be required in the leaf for protection against environmental stresses[36]. The variation in total phenols and flavonoids content among species could be due to various intrinsic and extrinsic factors, one of such factors may be the genetic potential of individual species for polyphenol biosynthesis. Apart from the genetic background, the environment and maturation stage may also be critical in this respect this may due to or a various intrinsic and extrinsic factors, one of such factors may be the genetic potential of individual species for polyphenol biosynthesis. Apart from the genetic background, the environment and maturation stage may also be critical in this respect[16,17].

DPPH radical scavenging activity

DPPH radical scavenging is a widely used method to evaluate the free radical scavenging ability of various materials[37]. DPPH is a stable nitrogen-centred free radical, the colour of which changes from violet to yellow upon reduction by either the process of hydrogen- or electron-donation Substances which are able to perform this reaction can be considered as antioxidants and, therefore, radical scavengers[38]. The radical scavenging activities of bulbs and aerial parts extracts were estimated by comparing the IC_{50} value of the extracts and BHT (IC_{50}= 0.017 mg/ml), (Fig 3). IC_{50} value, defined as the concentration of antioxidant required for 50% scavenging of DPPH radicals in this specified time period. The smaller IC_{50} value, the higher antioxidant activity of the plant extracts[39]. The IC_{50} value of bulbs and aerial parts extracts and positive controls was shown in (Table 4). IC_{50} for DPPH radical scavenging activity ranges from (0.40 to 0.96 and from 0.15 to 0.29) mg/ml for the bulbs and aerial parts, respectively. The phytochemicals which might be responsible for the scavenging activity in this species is

Table 1: Phytochemical analysis of bulbs and aerial parts.

Constituents	*Allium stamineum*		*Allium ampeloprasum*			*Ornithogalum umbellatum*	*Asparagus acutifolius*
	Aerial arts	bulbs	Aerial arts	bulbs	Aerial parts	bulbs	Aerial parts
Flavonoids	+	+	+	+	+	+	+
Phenols	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+
Terpenoids	+	+	+	+	+	+	+
Saponins	+	+	+	+	+	+	+
steroids	+	+	+	+	+	+	+
Cardic glycosides	-	+	-	+	-	+	-
Coumarins	-	-	-	-	-	-	-

Table 2: Total phenolic contents of bulbs and aerial parts extracts.

Plant	TPC (mg GAE g/ g of DW)	
	Bulbs	Aerial parts
Allium stamenium	11.03	21.80
Allium ampeloprasum	6.48	26.55
Ornithogalum umbellatum	5.50	23.04
Asparagus acutifolius	-	6.10

Table 3: Total flavonoid contents of bulbs and aerial parts extracts.

Plant	TFC (mg RUE/g of DW)	
	Bulbs	Aerial parts
A. stamenium	11.80	58.13
A. ampeloprasum	5.18	59.80
Ornithogalum umbellatum	1.82	52.30
As. acutifolius	-	114.30

Table 4: IC50 value of bulbs and aerial parts extracts and positive control.

Plant	IC50 mg/ml	
	Bulbs	Aerial parts
Ornithogalum umbellatum	0.96	0.29
Allium ampeloprasum	0.61	0.23
Allium stamenium	0.40	0.28
Asparagus acutifolius	-	0.15
BHT	0.017	

phenolic and flavonoid constituentsIt. It was found that the radical-scavenging activities of most bulbs and aerial parts extracts increased with increasing concentration. High total phenol and flavonoid contents of aerial parts of plant may be a reason for its higher DPPH-scavenging activity than that of the bulbs, supporting the opinion that plant extracts have a potent antioxidant activity mainly due to their richness of phenolic compounds. Flavonoids, including flavonols, flavones and condensed tannins, are a class of plant phenolics, which contain hydroxyl groups, are responsible for the radical scavenging and chelating properties[40]. It has been reported that the antioxidant ability of flavonoid molecules with polyhydroxylated substitution on rings A and B, is related to their ability to donate hydrogen atoms and thereby scavenge the free radicals produced during lipid peroxidation[41,42]. The results presented above in (tables 2 ,4) showed that the contents of the phenolic compounds in aerial parts extracts of are have stronger antioxidant activity in comparison bulbs eatracts. This may be explained by the fact that different types of phenolic compounds possess different antioxidant capacities which is related to their chemical structure. For example, the previous researches showed that phenolic compounds with ortho- and para-dihydroxylation or a hydroxy and a methoxy group or both have stronger antioxidant activity, than simple phenolics[43] and also the presence of double bond conjugated and ketone groups in the whole molecule might play different polarities in the structure of the antioxidants and can be attributed to their antioxidant activity[44]. The other factors may be lead to this results, is related to the sensitivity of Folin-Ciocalteu reagent to a broad range of phenolic compounds whereas the DPPH free radicals show different sensitivity to various antioxidants. The Folin-Ciocalteu reagent react both free phenolics and bound phenolics in extracts and other samples, but the DPPH assay just determined free antioxidants and phenolics[45]. In conclusion, the amount of phenolics, flavonoids and related total antioxidant activity of some Syrian medicinal plant parts were evaluated. Antioxidant activity varied greatly among the different plant parts used in this study, but it was correlated with the content of phenolic and flavonoids compounds. So, further studies are needed for the isolation and elucidation of the structure of these components and also more investigations are necessary for better understanding of their mechanism of action as antioxidants.

CONCLUSIONS

The preliminary phytochemical analysis and *in vitro* antioxidant activity were studied in four wild plants from Liliaceae family in Syria. *Allium stamineum*, *Allium ampeloprasum*, *Ornithogalum unbellatum* and *Asparagus acutifollius*, had revealed the presence phenols, flavonoids, tannins, terpenoids, saponins, steroids in bulbs and aerial parts, while cardiac glycosides only present in bulbs by positives reaction with the respective test reagent. Results

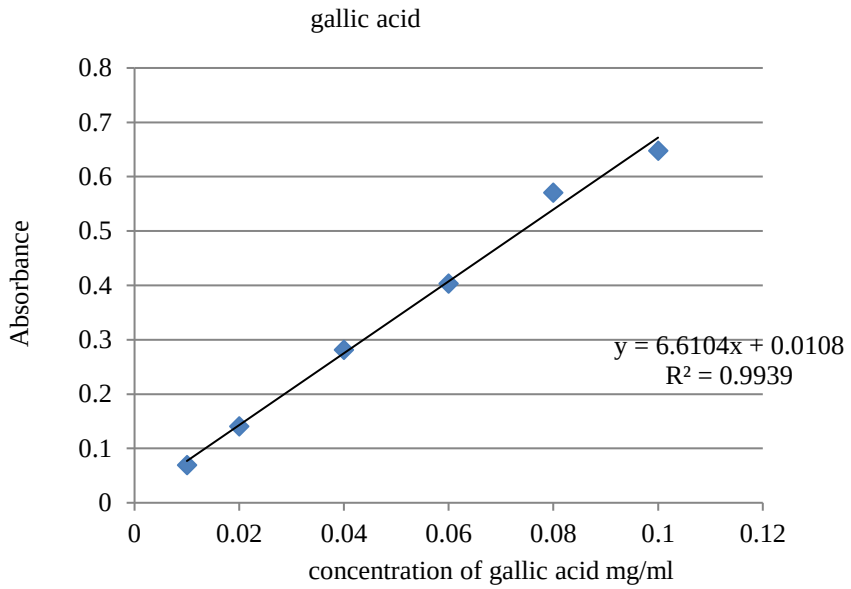

Figure 1: The calibration line for gallic acid.

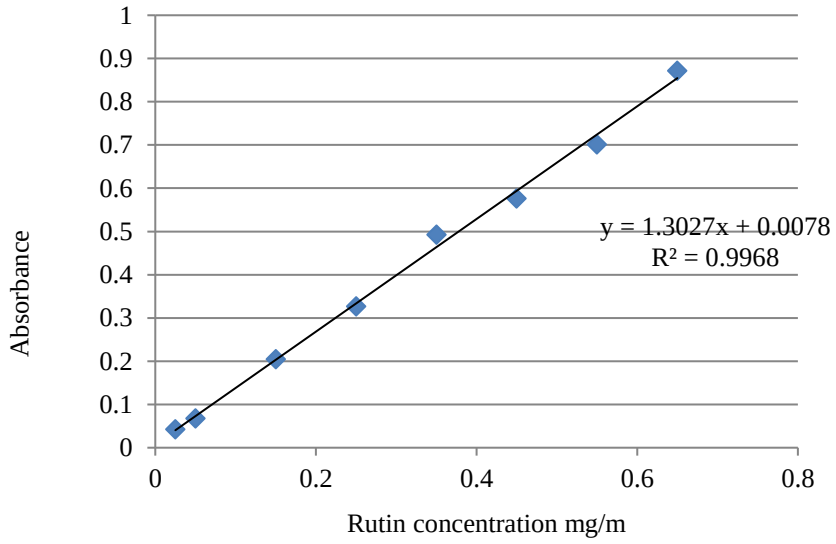

Figure 2: Calibration curve of Rutin.

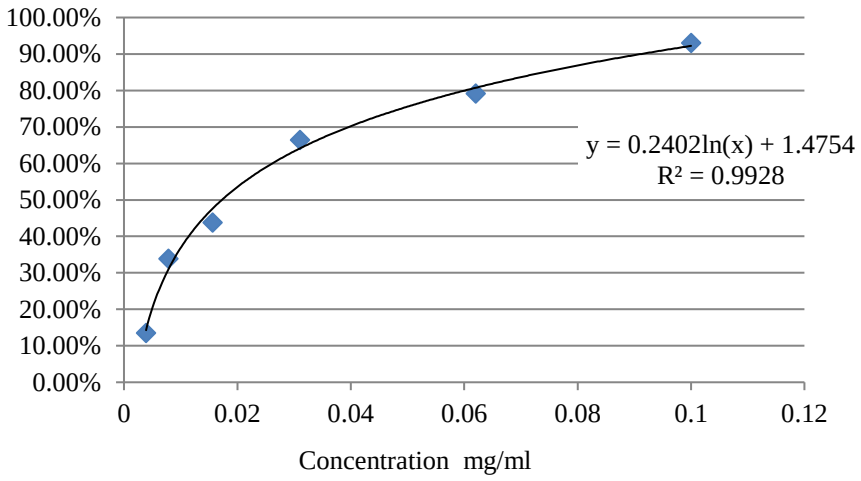

Figure 3: Scavenging activity of the standard BHT.

obtained in this investigation indicate that *Asparagus acutifolius aerial parts* extract, rich in phenolics and flavonoids exhibited highest antioxidant. It was observed that the aerial parts extracts contained high level of phenolic and flavonoid contents that might have accounted for the strong activity observed against DPPH radicals. Our data indicate that the aerial parts and bulbs of *studied plants* are potential sources of secondary metabolites and their methanolic extracts possess good antioxidant activity. However, further studies are needed to evaluate the *in vivo* potential of these extracts in animal models and also isolation and characterization of the active antioxidant compounds.

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