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Short Communication

Estimating Total Phenolics in *Taraxacum officinale* (L.) Extracts

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Abstract

This study focuses on evaluating total phenolic contents (TPC) in *Taraxacum officinale* (L.), a member of the family Asteraceae (compositae). The TPC were estimated by Folin-Ciocalteu's reagent and gallic acid was taken as standard. The amount of phenolics was communicated as gallic acid equivalent (GAE). The TPC varied from 41.47 mg/g to 691.6 mg/g in the *Taraxacum officinale* (L.) extracts. The maximum phenolic contents were found in hydro-alcoholic extract (691.6 mg/g GAE) in comparison with aqueous extract. These extracts have a significant role as antibacterial and antimicrobial agents.

Keywords: phenolic, Asteraceae, medicinal, *Taraxacum officinale,* Gilgit-Baltistan

Introduction

South Asia is a region that is considered home for Ayurveda treatment along with other very traditional systems. Medicinal plants are the central resources for health care systems and more than 6,000 plant species have been reported for medicinal purpose in the region [1]. The plant-driven medicines have been used on a large scale owing to their safe nature and cheap availability [2]. These phytochemicals, to some extent, act as an inspirational source for novel drug development [3]. Mountainous regions provide a naturally conducive environment for medicinal flora [4]. According to Noor et al. [5] the knowledge of medicinal plants and their methods of use are confined to aged persons above 50-60 years old. Some of the plants have been tested for their antimicrobial activity and were found to be positive [6-9].

Taraxacum officinale (L.) is the common dandelion – a flowering herbaceous perennial herb found mostly in temperate regions around the world. *Taraxacum officinale*

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Fig. 1. *Taraxacum officinale* showing habitat and roots.

produces stems that are typically 5-40 cm tall, though in some cases it may grow up to 70 cm high. The foliage may be upright-growing or horizontally spreading. The plant is characterized by hairy stems, milky latex, and basal leaves (Fig. 1) with one single flower head. The flower heads are ligulate and bisexual. The leaves are obovate in shape with strident or gentle teeth [10].

Although in general *Taraxacum officinale* is regarded as a weed, it is highly valuable for medicinal applications. Mainly it is considered a diuretic, laxative tonic for rheumatic problems and a blood purifier. Dandelion is one of the few apomictic plants that can reproduce asexually and survive practically anywhere [11-16]. Extensive research on the role of free radicals as both toxic and beneficial species has been conducted. There are various activities in which free radicals are generated in our environment. Their presence in higher concentrations can damage all macromolecules and eventually cause cell death. Free radicals have applications in a variety of ways and for curing multiple diseases like atherosclerosis, cancer, and heart disease [17-19]. Aerobic life has an evolved mechanism to protect them from destroying actions of free radicals. Oxidative stress and free radical overproduction has been the cause of numerous diseases. The phytochemicals possess multiple bioactive properties, including antioxidant potential owing to the presence of phenolic compounds. The need of the hour is to understand the mechanism of action, the establishment of therapeutic doses, the occurrence of biochemical inter-relations, bioavailability, and bio-efficacy of theses phytochemicals [20-22]. The purpose of our current study was to estimate TPC of *Taraxacum officinale* quantitatively using Folin-Ciocalteu's reagent.

Materials and Methods

The plant specimens were collected from different localities in Gilgit-Baltistan and plant extracts were prepared in two different ways, i.e., pure water and a 1:1 mixture of water with ethanol. For hydro-alcohol extract, 20 g of the powdered plant material (leaves) was extracted with 250 ml of ethanol:water (1:1) mixture) for 8 hours with reflux at 50ºC. After filtration it was evaporated to dryness, to give the crude extract and the same was repeated for aqueous extract.

Procedure for Determining TPC

TPC was determined quantitatively following the procedure described in Lim et al. [23]. Different concentrations (0.01, 0.02, 0.03, 0.04, and 0.05 mg/ml) of gallic acid and plant extracts (0.1 and 1 mg/ml) were prepared in methanol. 0.5 ml of each sample was mixed with 2.5 ml of (10 times dilute) Folin-Ciocalteu's reagent and 2 ml of (7.5%) sodium carbonate (Na_2CO_3) and stabilized for half an hour at ambient temperature. The absorbance was measured at 760 nm spectrophotometrically in triplicate [24-25]. The standard gallic acid curve was prepared through a similar procedure. Stock solution was prepared by dissolving 10 mg of gallic acid in 10 ml methanol. 0.8, 1.6, 3.12, 6.25, 12.5, and 25 µg/ml concentrations were managed from this stock solution. The absorbance of each solution was measured in a similar way as mentioned above. The TPC of the extracts were calculated by the regression equation of the calibration curve ($y = 0.024x + 0.370$; R^2).

Table 1. Absorbance measurement of Gallic Acid.

S. No.	1	2	3	4	5	6
Concentration of solution (µg/ml)	0.128	0.256	0.499	1.0	2.0	4.0
Absorbance λ_{max} = 760 nm	0.3393	0.3506	0.4613	0.548	0.8066	0.899

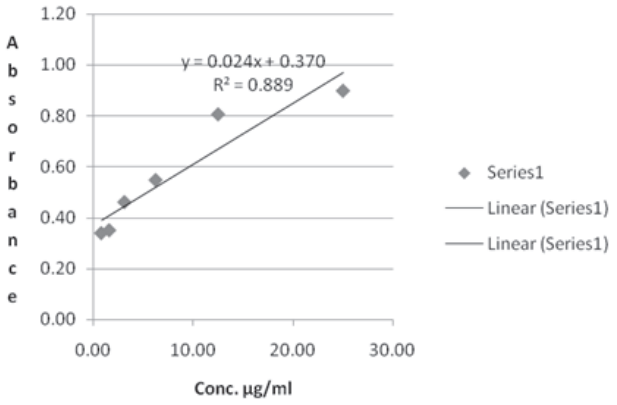

Fig. 2. Standard curve of gallic acid.

Results and Discussion

The medicinal plant *Taraxacum officinale* (L.) was analyzed for antioxidant activity through TPC determination using a UV-visible spectrophotometric technique based on Folin-Ciocalteu's phenol reagent. The activity was calculated as GAE. The absorbance of gallic acid solutions is shown in Table 1.

The Gallic acid standard curve was obtained by plotting the absorbance on y-axis and concentration (µg/ml) on x-axis. The absorbance of gallic acid increases with increased concentration and a straight line is obtained. The standard curve of gallic acid is shown in (Fig. 2). *Taraxacum officinale* was examined for phenolic content using Folin-Ciocalteu's method. According to the results, the hydro-alcoholic extract showed high value of phenolic content, whereas aqueous extract showed a comparatively low value in phenolic content (Table 2).

The total phenolic contents were expressed as mg/g GAE. The standard curve equation is y = 0.024x+0.370, R^2 = 0.889, where y is absorbance at 760 nm and x is total phenolic content in different extracts (Fig. 2). Phenolics are a large group of antioxidants that act as a free radical terminator [26-30]. Table 1 shows the disparity of absorbance with gallic acid concentration.

Table 2 shows the TPC in *Taraxacum officinale,* ethanolic–aqueous (50-50), and aqueous extracts. The TPC exhibited variation between 20.73±4.98 to 38.45±3.92 µg/ml in the extracts that were 41.47 mg/g and 691.6 mg/g GAE, respectively. The results showed the difference in values of TPC of *Taraxacum officinale* in hydro-alcoholic and aqueous extracts. The hydro-alcoholic extract has contained high values of phenolics content (691.6mg/g), whereas the aqueous extract had low values of TPC (41.47mg/g).

Malek and Legath [31] also determined the antioxidant capacity. They found 362.14 ± 6.76 µM quantities of total phenolics in the extracts of *Taraxacum officinale*. Ivanov [32] found maximum quantities of TPC in 50% ethanol extract of *T. officinale* leaves: 33.90 ± 0.57 mg GAE/g dry weight. This value is near our TPC value in aqueous extract, i.e., 41.7 mg/g GAE.

Today it is vital to develop reliable and cost-efficient antimicrobial agents for a safe environment and good health. It has become a real necessity to examine and look to the characteristics and mechanisms of action of newly developed antimicrobial components. One of the drawbacks of currently available medicines in the market is the development of resistance by pathogenic microorganisms against them. Plants are considered a rich source of antimicrobial agents that have been shown to be effective against a variety of pathogens. Taraxacum officinale is one of the many herbal plants that have antioxidant potential and can be considered a potential source for the removal of microbial agents [33-41].

Conclusions

The antioxidant activity of *Taraxacum officinale* has been evaluated from the determination of TPC in hydro-alcoholic and aqueous extracts. The results declared that hydro-alcoholic extracts exhibited the greatest antioxidant activity as compared to aqueous extracts. The high foraging characteristics may be associated with the presence of hydroxyl groups (OH^{1-}) in the phenolic compounds. The phenolic contents of *Taraxacum officinale* portray the fact that the extract from this herbal plant may help discover new antibiotic substances for chemotherapy and control of chronic infectious diseases.

Conflict of Interest

The authors declare no conflict of interest.

Table 2. Total phenolic contents of *Taraxacum Officinale* L.

S. No.	Extract	Quantity (µg/ml)	Absorbance	Phenolic contents mg/ml	Mean and standard deviation	Phenolic contents (mg. GAE/g)
1	Ethanolic-Aqueous (50:50)	1000	1.40	42.9166	38.458 SD ± 3.92176	691.6 mg/g
			1.22	35.5416		
			1.26	36.9166		
2	Aqueous	1000	0.73	15.0833	20.736 S.D. ± 4.976	41.47 mg/g
			0.91	22.6666		
			0.96	24.4583		

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