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Original Research Article

Antioxidant Activity of Plant Extracts at Chattogram Hill Tracts, Chattogram, Bangladesh

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Abstract: In recent years, researchers have focused on natural antioxidants because they are good for human health. Most scientists believe that around two-thirds of the plants in the world have medicinal value and good antioxidant activity. The goal of this work was to estimate antioxidant activities of plant extracts, collected from Chattogram Hill Tracts, Chattogram. Different types of Plant leaves were extracted with different solvents like water, ethanol, methanol, and Pet ether. These extracts were then tested to see if they have any antioxidant properties using a method called DPPH radical scavenging. The present study found that all plant extracts exhibited remarkable antioxidant activity among them water extract of plants had the highest level of antioxidants followed by ethanol followed by methanol then Petroleum ether extracts. The high antioxidant activity of these might be due to the presence of hydroxyl groups containing substance in polar solvent extract and these hydroxyl groups can damage free radicals and possess the necessary resources for radical scavenging. This study confirms that many plant extracts have very strong antioxidant activity, which can help treat diseases caused by free radicals in the body.

Keywords: Plant Extracts, Chattogram Hill Tracts, Antioxidant Activity, Free Radical Scavenger, Reactive oxygen species (ROS) & DPPH method.

1. INTRODUCTION

From ancient age people used medicinal plants without knowing of their active ingredients. According to the World Health Organization (WHO), about 75% of people around the world still use plant-based medicines to meet their primary healthcare [1]. Due to higher safety margins and lower cost developing countries used herbal medicines for primary healthcare [2]. Medicinal plants possess a diverse array of bioactive compounds, including alkaloids, flavonoids, steroids, and glycosides, rendering them a significant reservoir of therapeutic agents [3]. Due to health benefits and longevity, plant extracts are used as active ingredients for some important drug formulations in modern medicine and improve the immune system against different diseases and infections [4]. About 50% of modern drug development, natural products, or natural product-originated compounds are used as raw materials in the pharmaceutical industry [5].

Free radicals are chemical entities characterized by their high reactivity, which renders them capable of inducing cellular damage, hastening the aging process, and causing disease. In general, free radicals have been proven to be less stable than non-radicals. In living organisms, xenobiotics produce free radicals or reactive oxygen species (ROS), which have the potential to impair physiological processes at the cellular level [6]. Reactive oxygen species (ROS), also known as free radicals, have been implicated in the development of several degenerative illnesses, including cancer, atherogenesis, and neurological diseases [7].

Antioxidants are chemical entities that protect vital cellular components and can mitigate or prevent the deleterious effects of oxidative stress caused by free radicals and other reactive oxygen species (ROS) within the body [8]. Natural products act as common antioxidant agents with recognized potential in sedate revelation and improvement [9]. Several researchers

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have established a coordinated relationship between the phenolic content of therapeutic plant extracts and their antioxidant activity [10,11]. Polyphenols have antioxidant activity due to their ability to scavenge free radicals by donating hydrogen atoms, electrons, or chelate metal cations [12,13].

Plants being vital sources of common antioxidants, their significance for utilization as nourishment-added substances or dietary supplements has as of now been built up [14]. The look for secure and viable happening antioxidants is presently centered on consumable plants particularly flavors and herbs [15].

There are still numerous plants in the Chattogram Hill Tracts that have not been examined for their potential therapeutic uses such as antioxidant activity. In the current study, we examined the comparative antioxidant activity of diverse plant extracts with distinctive solvents by using the DPPH free radical scavenging method. To our knowledge, this is the novel work that has been done to join with plant extracts present in Chattogram Hill Tracts and hence we accept it'll be an adequate expansion on the current information around medicinal plant of Chattogram Hill Tracts.

2. EXPERIMENTAL

Plant Material

Fresh leaves of different plant materials were gathered from Chattogram Hill Tracts, Chattogram, Bangladesh, during January-March 2022. The plant's taxonomy was confirmed by the BCSIR Chattogram Laboratories (Industrial Botany Research Division). To eliminate debris, the gathered leaves were rinsed under flowing tap water. The samples were sun-dried for ten to fifteen days to attain a consistent weight. Then the samples were pulverized with the help of a mechanical grinder into a coarse powder and immediately immersed in the suitable solvents for extraction.

Extraction

About 200 gm of each powder sample was taken in a clean, conical flask and soaked in 1000 mL of suitable solvents (95% Ethanol, Methanol, Pet ether, Water) for 2 weeks at ambient temperature accompanying occasional shaking. After that, the entire mixture was filtered through Whatman 0.45 mm filter paper, and a rotary vacuum evaporator (Rotavapor R-300, Buchi, Switzerland) was used to concentrate the filtrate (solvent extract) to get a viscous residue. The viscous residue was then kept at 40 °C in a vacuum oven until we got a dried extract. The yield of these extracts ranged from 20.30% to 32.70% of the total, and these extracts were stored in powder form at ambient temperature.

Antioxidant Activity

The medicinal plant shows antioxidant activity, this activity was assessed by determining the DPPH (2, 2-diphenyl-2-picrylhydrazyl) free radical scavenging activity of the plant leaves, as outlined in the methodology proposed by Brand-Williams *et al*., (1995) [16]. In a 100 mL volumetric flask, 4 mg of DPPH (1,1-Diphenyl-2-picrylhydrazyl) was dissolved with methanol to prepare (0.004% w/v) DPPH solution in a dark place, and this volumetric flask covered with aluminum paper. 1 mg of Standard Ascorbic acid was dissolved in 50 mL of methanol to prepare 20 µg/mL ascorbic acid solution [17]. Then different concentration (10 µg/mL, 5 µg/mL, 2.5 µg/mL, and 1.25 µg/mL) of ascorbic acid solution was prepared by serial dilution. To evaluate the antioxidant activity of various plant extracts, a 5.12 mg/mL solution of each extract is prepared by dissolving 256 mg of the sample in 50 mL of methanol. Then performed serial dilution, to prepare different concentrations (2560 µg/mL, 1280 µg/mL, 640 µg/mL, 320 µg/mL, 160 µg/mL, 80 µg/mL, 40 µg/mL and 20 µg/mL) of solution. 2 mL of a methanolic solution containing ascorbic acid or various plant extracts of different concentrations was taken into a test tube. Then 3 mL of DPPH solution was added to the test tube. Finally, the test tube was incubated in a dark place at room temperature for 30 minutes to complete the reaction. To prepare the control add 2 mL methanol to 3 mL DPPH solution containing test tube. Then, the absorbance at 517 nm was measured using a UV Spectrophotometer. The free radical scavenging activity of different plant extracts was calculated by the following equation:

$$\text{Inhibition \%} = [(A_0 - A_1)/A_0] \times 100$$

Where A_0 represents the absorbance value of control and A_1 represents the absorbance value of different plant extracts.

The IC_{50} value, representing the 50% inhibition of antioxidant activity, was calculated by analyzing the graph that depicted the relationship between inhibition percentage and sample concentration using a tradeline equation.

3. RESULT & DISCUSSION

The concept of half-maximal inhibitory concentration (IC_{50}) refers to the concentration of a chemical at which it exhibits half of its maximum inhibitory action. This value, which is connected with drug potency-the lower the IC_{50} value, the higher the drug potency-is commonly used to describe the efficacy of an antagonist chemical.

Table 1: Determination of Antioxidant activity (IC_{50}) of different plant extract in various solvent by DPPH free radical scavenging method

Name of the Plants	Extracts	IC_{50} Values (µg/mL)
Barringtonia acutangula	Water	161.86
	Ethanol	511.27
	Methanol	2535.00
	Petroleum ether	5177.10
Acacia nilotica	Water	120.60
	Ethanol	156.67
	Methanol	249.50
	Petroleum ether	527.20
Polygonum hydropiper	Water	91.50
	Ethanol	117.07
	Methanol	716.00
	Petroleum ether	3985.00
Aegle marmelos	Ethanol	488.00
	Petroleum ether	7167.00
Acacia arabica	Ethanol	61.80
	Petroleum ether	7954.00
Sapium indicum	Ethanol	508.94
	Petroleum ether	6798.70
Melia azedarach	Ethanol	2796.67
	Petroleum ether	7569.60
Paederia foetida	Ethanol	651.80
	Petroleum ether	5347.90
Ascorbic Acid	Standard	9.10

Table 1 shows the results, water, methanol, and ethanol extract of different plant samples showed significant antioxidant activity but pet ether extract showed lower antioxidant activity. Among them, *Acacia nilotica* showed the highest antioxidant activity for all solvent extracts. Ethanol extract of *Acacia arabica* showed a comparable IC_{50} value of 61.80 µg/mL with a standard Ascorbic Acid IC_{50} value of 9.10 µg/mL. In an overall comparison of different extracts, water extract demonstrated the highest antioxidant activity followed by ethanol followed by methanol followed by petroleum ether extract of different plant samples. The antioxidant activity expresses a positive correlation with the increased phenolic content seen in the various solvent extracts and the methanol and ethanol extract contain a higher number of phenolic content than Petroleum ether extract [18]. Ethanol is favored for the extraction of antioxidant compounds primarily because of its less toxicity [19].

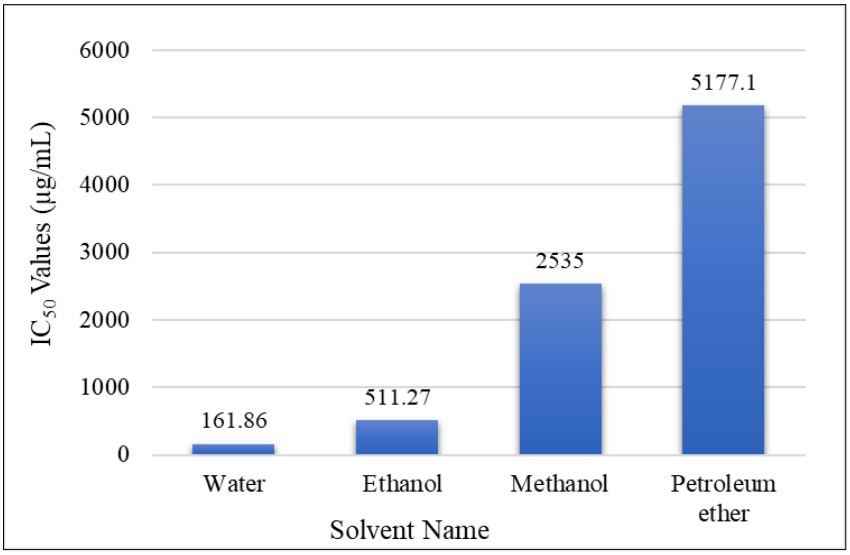


Fig. 1: Antioxidant activity of *Barringtonia acutangula* in different solvents

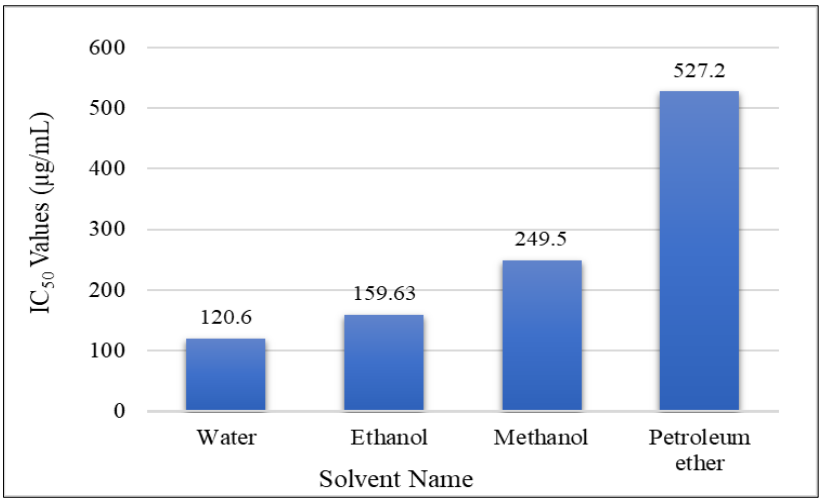


Fig. 2: Antioxidant activity of *Acacia nilotica* in different solvents

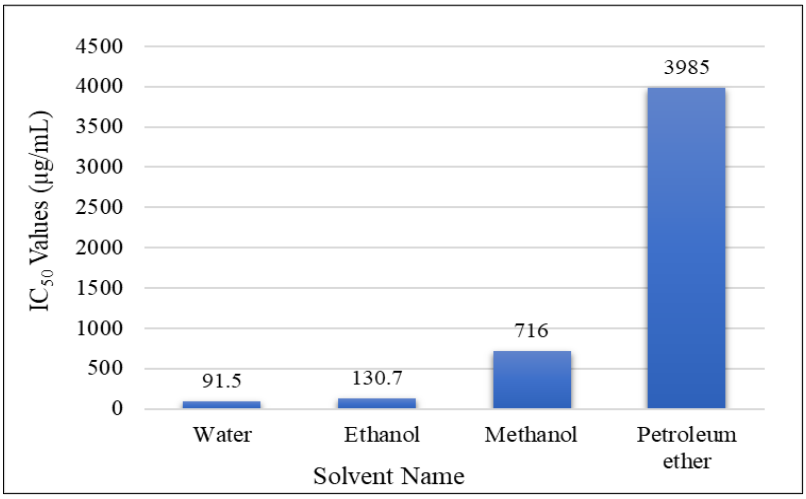
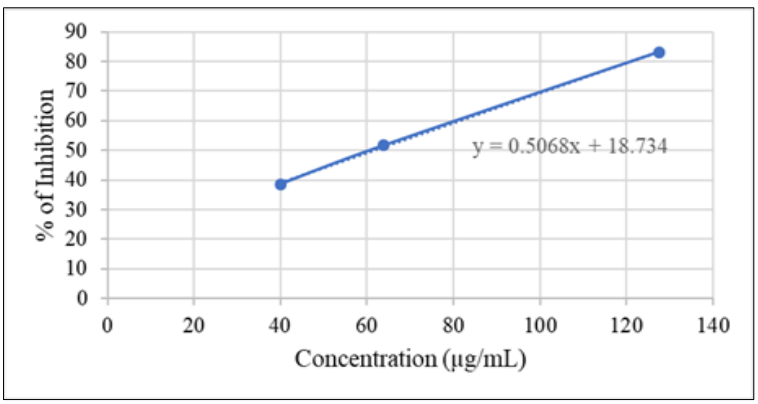
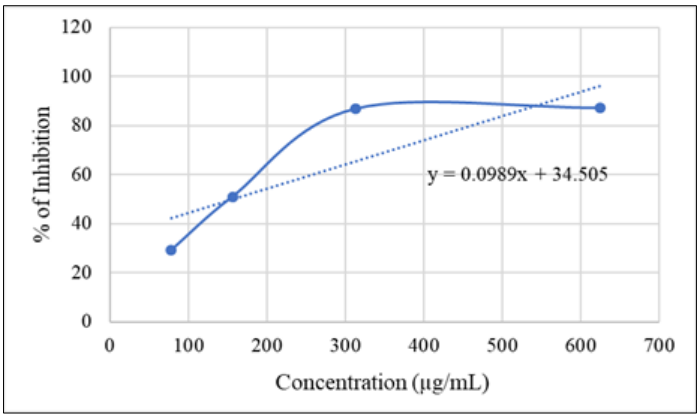


Fig. 3: Antioxidant activity of *Polygonum hydropiper* in different solvents

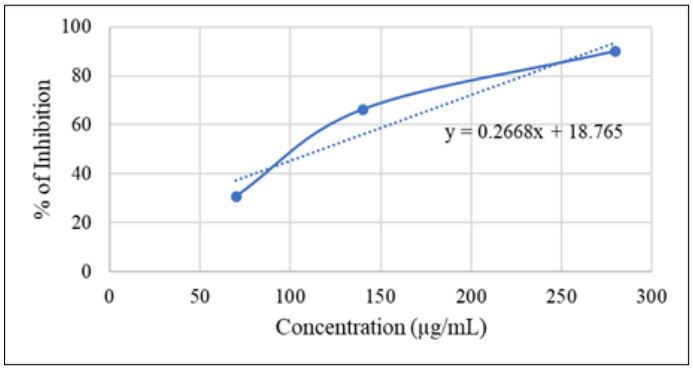
Figure 1 shows the IC_{50} (µg mL^{-1}) values of *Barringtonia acutangula* in various solvents. The antioxidant activity decreased in the following order: water > ethanol > methanol > petroleum ether extract of *Barringtonia acutangula*. Similarly, Fig. 2 & Fig. 3 show the IC_{50} (µg mL^{-1}) values of *Acacia nilotica* & *Polygonum hydropiper* respectively in various solvents. In all those cases three polar solvent extracts (water, ethanolic, and methanolic) showed low IC_{50} value and non-polar petroleum ether extract showed high IC_{50} value due to the extraction of similar types of compound from plant materials. Polyphenols or phenolic types compounds showed significant antioxidant activity when extracted from plant materials using polar solvents (water, ethanol, methanol) [18].



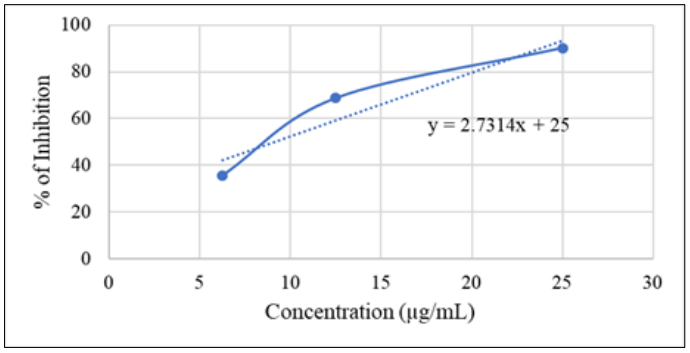
Ethanol extract of *Acacia arabica*



Ethanol extract of *Acacia nilotica*



Ethanol extract of Polygonum hydropiper



Ascorbic Acid

Fig. 4: DPPH radical scavenging activities of plant extract in different concentrations

Figure 4 shows that the inhibition percentage increases with the increase of sample concentration and after maximal inhibition there are no changes of inhibition percentage with increases of sample concentration.

4. CONCLUSION

The present study on determining the antioxidative properties of leaf extract of various plant materials in the region of Chattogram Hill Tracts, Chattogram, Bangladesh, by DPPH free radical scavenging method helped to explore the benefits of plant extracts. The result of this investigation showed that the ethanol extract of maximum plants demonstrated good antioxidant activity and other solvent extracts showed remarkable antioxidant activity. This activity could be attributed to the plant's several key phytoconstituents, such as flavonoids and other phenolic substances that are present in the plant. The findings of this study indicate that the ethanol extract derived from *Acacia arabica* demonstrated the most pronounced antioxidant activity, which can be attributed to the presence of hydroxyl groups within the phenolic compounds. Additional research should be focused on the isolation and characterization of the antioxidant active compounds derived from these plant extracts which could be accountable for the observed high antioxidant activities.

Data Availability Statement: Requests for the data utilized in this study can be directed to the corresponding authors.

Conflicts of Interest: It is declared by the authors that they have no conflicts of interest.

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