Research Article

Phytochemical evaluation and antioxidant activities in flower and leaves of *Cassia fistula* and *Terminalia arjuna*

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Abstract: The plants *Cassia fistula* and *Terminalia arjuna* are medicinally important and produce leaves and colorful blossoms that belong to the Caesalpinioideae of the legume family and the family of Combretaceae. The antioxidant, hydrogen peroxide, and phytochemical assessment (qualitative and quantitative) of methanolic and ethanolic extracts of *Cassia fistula* and *Terminalia arjuna* flowers and leaves were investigated in this work. In qualitative phytochemical evaluation, the presence of ten different chemicals of varying degrees and classes was observed, and alkaloids, steroids, tannis, glycosides, saponins, flavonoids, and terpenoids were confirmed during qualitative screening. During quantitative analysis, the *Cassia fistula* L. leaves showed the highest TFC ($32.783^A \pm 0.073$) and the TPC was observed highest in *Terminalia arjuna* flowers ($42.800^A \pm 0.028$). The highest DPPH percentage was recorded in *C. fistula* flowers ($21.825^A \pm 0.069$) compared to its lowest value observed in *C. fistula* leaves ($10.660^B \pm 0.053$). The highest hydrogen peroxide (H_2O_2) scavenging activity among both plants was found in *C. fistula* ($12.526^A \pm 0.146$) and the lowest in its leaves ($7.1470^B \pm 0.045$). The methanolic extracts showed promising antioxidant activity. The presence of bioactive components in the leaves and flowers of *Terminalia arjuna* and *Cassia fistula* suggests that these flowers and leaves might be used as a phytochemical source and are also effective and safe as natural remedies. The biochemical analysis proved that the extracts of *Cassia fistula* and *Terminalia arjuna* plants have glycosides, flavonoids, and alkaloids that play a role in antioxidant activity.

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1. Introduction

Nature has provided a variety of animal and plant resources, many of which offer therapeutic advantages for all living things [1-7]. Animals and plants are a fundamental portion of all the living organisms on earth, as food [8-10], medicine [11-14], clothing, shade, clean air, and shelter are provided by plants [15]. The use of plants in the management and treatment of infections began with life. In later years, with impressive exploration, it has been tracked down that numerous plants do surely have therapeutic qualities [16]. All plants considered curative by traditional and official medicine or used for that purpose are referred to as medicinal plants. Their application begins in the distant past, because treatment with plants is as old as humanity itself. To survive in nature, man demands food. Besides, they used the plants in their diet, and the man had en-

countered their medicinal properties. The knowledge of the healing effects of these plants came with experience, and lessons learned in empirical ways were transmitted from generation to generation. The value of medicinal plants in the treatment of human illnesses that have plagued mankind throughout history cannot be emphasized enough [17]

Terminalia arjuna, ordinarily known as "arjuna", planted throughout the plains, in gardens and as a roadside tree in Pakistan. It is one of the restoratively significant ever-green trees that are used in a variety of herbal compositions and has cytotoxic, antimicrobial, antidiabetic, antidysentric, antidiarrheal, and hepatoprotective activities [18]. *Terminalia arjuna* has a massive influence on ayurvedic medicine formulations [19]. Polyphenols (flavonoids, phenolics, consolidated and hydrolysable tannins) in *Terminalia arjuna* are significant bioactive molecules responsible for the prevention of chronic illnesses and medical services, among other synthetic ingredients [20]. Likewise, *Cassia fistula* found regularly east of the Indus in the plains and continuing north into the Himalayas to a height of around 1200 meters. It is grown across Pakistan's plains region [1]. *Cassia fistula* has traditionally been used to treat used as an antiparasitic, antifungal, antimicrobial, antipyretic, emollient, diuretic, and mitigating agent [21]. *C. fistula* contains significant bio-natural constituents which are exceptionally valuable in essential medical services. *C. fistula* fixings are set up "sickness executioner" and are utilized for readiness of Ayurvedic medications for the avoidance of illnesses.

Phytochemicals are compounds that are found in nature's plants and have medical importance. These are known as optional metabolites, and they can be produced on a regular basis by modifying designed pathways from essential metabolites or by providing substrates derived from essential metabolites [22-24]. Phytochemicals are bioactive compounds found in plants that function in conjunction with supplements and dietary fibre to keep you healthy. Carotenoids and flavonoids are examples of phytochemicals that have antioxidant properties and reduce the risk of infection (present in leafy foods). Natural antioxidants are significant for treating and preventing chronic and degenerative diseases such as atherosclerosis, heart and brain ischemia, carcinogenesis, neurological diseases, diabetes, pregnancy, rheumatoid arthritis, DNA damage, and ageing [25,26]. However, phytochemical screening of leaves and flowers of *Cassia fistula* and *Terminalia arjuna* will be very helpful to find out the specific bioactive compounds for treating and preventing chronic and degenerative diseases. The main objectives of this study are to identify total phenolic content, total flavonoid content, total antioxidant inhibition percentage, Hydrogen peroxide inhibition percentage, and the phytochemicals antioxidant activity in the leaves and flowers of *Cassia fistula* and *Terminalia arjuna*.

2. Materials and Methods

Description of study area

During March to June 2021, the current study was conducted in Cholistan desert area of Bahawalpur, southern Punjab, Pakistan. The Cholistan desert occupying area of approximately 2.6 million hectares lies between the latitudes of 27°-80' and 29°-50' north, and the longitudes of 70°-54' and 72°-50' east [27](Mohsinet al., 2019). It present in the dry subtropical continental monsoonal zone with annual rainfall varying from less than 100 mm in the west to more than 200 mm in the east, with monsoon rains accounting for the majority of rainfall (July to September). The most notable aspect of this has been aridity, with dry and rainy years happening in clusters. Summers are hot, while winters are moderate with little frost. The average summer temperature (May-July) is 34-38 degrees Celsius, with the maximum reaching 51.6 degrees Celsius. This desert's flora is made up of xerophytes that have adapted to low moisture, high heat, and increased salt, as well as a wide range of edaphic conditions. The scant vegetation of Cholistan is primarily by perennial plants with a few scattered trees. Some ephemeral and annual species arise af-

ter rain, complete their life cycle in a short period of time, and then die after producing seeds. Many species have a surprising ability to reproduce even when there is little rain [28].

Identification and collection of plant leaves and flowers

We selected two plant species for pharmacological studies i.e., *Cassia fistula* (Leguminosae family) and *Terminalia arjuna* (Combretaceae family). The plants were recognized by an experienced taxonomist from the Forestry Laboratory (Forestry, Range, and Wild Life Management). The research activities were held in the Phytochemical Laboratory, Department of Forestry, Range and Wildlife Management in the Islamia University of Bahawalpur. The antioxidant experiment was conducted in the laboratory of Pharmacy department, IUB Bahawalpur.

Fresh leaves of both selected plants were collected from the Nursery of The Islamia University of Bahawalpur. The leaves were washed with distilled water and then were dried in the shade for 2-3 days. After those leaves were put in the oven at temperature ranging from 40-45°C for the period of 4-5 days until fully dried. Then dried leaves were grinded in the electrical grinder to make powder. The powdered leaves were stored in sealed containers for onward chemical analysis. In May 2021, fresh blossoms of *C. fistula* and *T. arjuna* plants were taken from the above-mentioned collection area. The flowers were cleaned and kept under shade for a day, after which were dried in the oven at temperature range of 40-45°C for 2-3 days. Then dried flowers were grinded in the electrical grinder to make powder. This powder was stored in containers for analysis.

Fig. 1 Flowers, dry leaves, and dry flowers of *Cassia fistula* and *Terminalia arjuna*.

Preparation of extracts

Two (extractant) chemicals, methanol and ethanol, were used to make extracts of leaves and flowers of collected plants.

Preparation of Methanol Extract of Leaves & Flowers of plants

Due to its high polarity, methanol can extract a wide range of polar and non-polar compounds such as alkaloids, sterols, flavonoids, and carbohydrates; therefore, it was used for extraction. Maceration extraction process was used to make the methanol extract. 30g of leaf powder and flower powder was soaked in the apparatus containing 260ml of methanol for one week. The extraction process was continued for a week or till the solvent become prepared. Each preparation was filtered through a sterilized Whatman No. 1 filter paper. The obtained extract was then evaporated at room temperature until it was reached the 1/3 volume of the original extract. The aqueous extract of the leaves and blossoms was also produced and kept in the refrigerator at 4°C for further use.

Preparation of Ethanol Extract of Leaves & Flowers of Plants

The ethanol extract was prepared by maceration extraction method. For this purpose, 25gm of leaf and flower powder was soaked in the apparatus containing 200ml of ethanol for one week or until the solvent had changes the color. A sterilized Whatman No. 1 filter paper was used to filter each preparation. After that, the extract was evaporated at room temperature until it was 1/3 the volume of the original extract. The aqueous extract of the leaves and blossoms was also produced and kept in the refrigerator at 4°C for later usage.

PHYTOCHEMICAL ANALYSIS

Phytochemical analysis of the test sample was carried out according to standard methods.

Phytochemical Analysis (Qualitative)

Standard techniques were used to check for the presence of bioactive components in the leaves and flower extracts of *Cassia fistula* and *Terminalia arjuna*. An extract of leaves and flowers of both plant species contains a few pieces of magnesium turnings. Drop by drop, concentrated HCl was added. The presence of flavonoids is indicated by the appearance of a pink-scarlet color after a few minutes. The sample was combined with 2 mL of an FeCl₃ solution at a ratio of 2%. The presence of phenols and tannins is indicated by a blue-green or black color. 5 ml of distilled water in a test tube with the extract was being stirred rapidly. The presence of saponins is determined by the formation of a stable foam. 2 ml of 1% HCl was added to 2 ml of crude extract and gently heated. To the mixture, Mayer's and Wagner's reagents were added. The presence of alkaloids is determined by the turbidity of the resultant precipitate [29](Seasotiya *et al.*, 2014). The crude extract was dissolved in 2 ml of chloroform. H₂SO₄ was added to the mixture and it was mixed. The presence of glycosides is indicated by the formation of a reddish-brown color. 3–4 drops of Molisch's reagent were added to 2 ml of extract and thoroughly mixed. The walls of the test tube added strong sulfuric acid to it. The presence of carbohydrates is indicated by the appearance of a purple or blue ring between the two layers. After being treated with 0.2 percent Ninhydrin, 2 ml of extract were boiled for 5–10 minutes. The presence of proteins is indicated by the color blue. 2 ml of chloroform was added to the plant extracts. On the sidewalls of the test tube, 2 ml of concentrated H₂SO₄ was added, and the bottom chloroform layer was examined for red color. 3 ml of chloroform was used to dissolve the crude plant extract. This was then evaporated to dryness before adding 2ml of concentrated H₂SO₄ and heating for 3 minutes. The presence of terpenoids was indicated by a grey color[30].

Quantitative Phytochemical Analysis

Determination of total flavonoid content

For the determination of total flavonoid content, the Aluminium chloride colorimetric method was applied. 1 mL plant extracts with different concentrations were mixed with 3 mL hexane, 0.2 mL of Aluminium chloride, 0.2 mL of 1 mol/L potassium acetate, and 5.6 mL of distilled water and placed at room temperature for next 30 minutes. The reaction mixture absorbance was calculated at 415 nm with a spectrophotometer against a blank. Methanol served as the blank. The total flavonoid content in the plant methanol extracts in quercetin equivalents was calculated by the following equation:

$$C = (C \times V) / m$$

Where "C" is the total content of flavonoid compounds, mg/g plant extract, in quercetin equivalent, c is the concentration of quercetin established from the calibration curve in mg/mL, V is the volume of extract in mL, and m is the weight of crude plant extract in g [31].

Determination of total phenolic content

Total Phenol Content (TPC) in extracts was determined by Folin-Ciocalteu's colorimetric method. The extracted solution (0.3 mL in triplicate) was mixed with 1.5 mL of 10% Folin-Ciocalteu's reagent and 1.2 mL of 7.5% (w/v) sodium carbonate. The mixture was kept in the dark for 30 min, and absorbance was measured at 765 nm. Quantification was done on the basis of a standard curve of gallic acid. The results were expressed as gallic acid equivalents (GAE), that is, mg of gallic acid per 100 mL. All tests were performed in triplicate [32] (Kulkarni et al., 2015).

Antioxidant Evaluation

DPPH

The radical scavenging activity of DPPH (1, 1-diphenyl-2-picrylhydrazyl) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) was measured. Extract solutions were prepared by dissolving different dry extracts in methanol to produce a solution of 10 mg/mL. In this experiment, 600 µM of DPPH was dissolved in 300 mL of methanol and used as a stock solution. The plant extract in methanol at various concentrations (1, 2, 3, 4, and 5 mg) whose final volume was maintained at 1 mL was mixed with an aliquot of 2 mL of 600 µM of DPPH solution in methanol and incubated at 25°C for 30 min. The absorbance of the test mixture was read at 517 nm using a spectrophotometer against a DPPH control containing only 1 mL of methanol in place of the extract. All experiments were performed thrice, and the results were averaged. Ascorbic acid was used as a standard. DPPH scavenging effect was calculated by the following equation given by [33];

$$\text{DPPH scavenging effect} = \left(\frac{\text{Absorbance of sample} - \text{Absorbance of blank}}{\text{Absorbance of sample}} \right) \times 100$$

Hydrogen Peroxide H₂O₂

The optimum conditions were chosen as the best for the reaction catalyzed by the horse radish peroxidase. When plant extracts were added to these systems to test their ability to scavenge H₂O₂ molecules, these conditions were maintained. Phenol (12 mM) and 4-aminoantipyrene (0.5 mM) were chosen and utilized for all of the aforementioned experiments since they were the most effective. The resulting chromophore had the highest intensity due to the concentrations. Plant extracts and conventional antioxidants were used to calculate the percentage inhibition (percent I) of H₂O₂ induced by them. The reaction mixture, which included the test sample (plant extract/standard antioxidant; 350 µL), phenol solution (12 mM, 350 µL), 4-aminoantipyrene (0.5 mM, 100 µL), H₂O₂ (0.7 mM, 160 µL), and HRP (1 U/mL), was incubated at 37°C for 30 minutes [34]. At 504 nm, the absorbances of the resultant solutions were compared to a reagent blank made out of

phosphate buffer instead of plant extract/standard antioxidant and phenol. Plant extract was substituted with phosphate buffer in the control, which was prepared using the same reagents. The following steps were taken to reduce interference from plant extracts in the assay: Background subtraction samples were produced using plant extract with additional reagents substituting phenol with phosphate buffer for each concentration of plant extract. The original absorbance reading was subtracted from each of the resultant absorbance values. Different kinds of plant extracts that are known for their antioxidant characteristics were evaluated for their H₂O₂ scavenging capabilities. The percentage inhibition of hydrogen peroxide was calculated by the equation as described for many antioxidant assays.

$$\% \text{Inhibition} = \left(\frac{\text{Absorbance of sample} - \text{Absorbance of blank}}{\text{Absorbance of sample}} \right) \times 100$$

Statistical Analysis

For statistical analysis, the collected data was subjected to an analysis of variance, and Tukey's HSD test was used to separate the means.

3. Results

Quantitative Phytochemical Analysis Experiment

DPPH Inhibition assay of *Cassia fistula* and *Terminalia arjuna*

Analysis of variance parameters shown in Fig. 2 revealed that the percentage of DPPH inhibition in the flowers and leaves of *C. fistula* and *T. arjuna* was statistically highly significant ($P < 0.01$). The results showed a significantly higher inhibition percentage in the flowers of *C. fistula* ($21.825^A \pm 0.069$) and *T. arjuna* ($17.634^A \pm 0.053$) as compared to its leaves, which demonstrated a lower percentage ($10.660^B \pm 0.533$) in *C. fistula* and ($11.890^B \pm 0.533$) in *T. arjuna* as indicated in table 4.1.1(b).

Fig.2 Graphical representation of DPPH Inhibition assay percentage in flowers and leaves of *C. fistula* (C.F.) and *T. arjuna* (T.A).

Total phenolic content (TPC) of *Cassia fistula* L. and *Terminalia arjuna*

The TPC of flowers and leaves of *C. fistula* and *T. arjuna* was observed to be statistically highly significant using one-way ANOVA ($P < 0.01$) (Fig. 3). The results showed that higher TPC was observed in *T. arjuna* flowers ($42.800^A \pm 0.028$) and leaves ($39.333^B \pm 0.088$) as compared to leaves ($35.067^C \pm 0.334$) and flowers ($34.657^C \pm 0.086$) of *C. fistula*, which demonstrated less TPC as indicated in Fig. 3.

Fig.3 Total Phenolic Content (TPC) of flowers and leaves of *C. fistula*(C.F.) and *T. arjuna* Total flavonoid content (TFC) of *Cassia fistula* and *Terminalia arjuna*

Analysis of variance parameters given in Fig. 4 depicted that total flavonoid content in flowers and leaves of *Cassia fistula* and *Terminalia arjuna* was observed to be statistically highly significant ($P < 0.01$). The results showed the highest TFC ($32.783^A \pm 0.073$) in *C. fistula* leaves was followed by *T. arjuna* flowers ($31.647^B \pm 0.049$), *T. arjuna* leaves ($27.043^C \pm 0.097$), and the lowest TFC in *C. fistula* flowers ($25.325^D \pm 0.102$) as indicated in Fig. 4

Fig. 4 Graphical representation of Total Flavonoids Content (TFC) of *C. fistula*(C.F.) and *T. arjuna* (T.A).

Hydrogen peroxide (H_2O_2) scavenging activity of *Cassia fistula* L. and *Terminalia arjuna* Hydrogen peroxide (H_2O_2) scavenging activity in flowers and leaves of both *Cassia fistula* and *Terminalia arjuna* was found to be highly significant ($P < 0.01$) as shown in table Fig. 5. The results showed that higher hydrogen peroxide (H_2O_2) scavenging activity was observed in *C. fistula* ($12.526^A \pm 0.146$) and *T. arjuna* ($10.550^B \pm 0.127$) flowers as compared to *T. arjuna* ($8.729^C \pm 0.163$) and *C. fistula* ($7.147^D \pm 0.045$) leaves, which demonstrated less activity as indicated in Fig. 5. Furthermore, the results confirmed that H_2O_2 scavenging activity was higher in flowers than in leaves.

Fig.5 Graphical representation of Hydrogen peroxide (H₂O₂) scavenging activity of *C. fistula* (C.F.) and *T. arjuna* (T.A).

Qualitative phytochemical analysis

Flavonoids, saponins, glycosides, alkaloids, proteins, carbohydrates, terpenoids were present in both methanol and ethanol extracts of *C. fistula* flowers (Table 1). Tannins and phenolic compounds were absent in both methanol and ethanol extracts. While steroids were only present in ethanol extracts of *C. fistula* flowers. Likewise, saponins, glycosides, and carbohydrates were present in both methanol and ethanol extracts of *C. fistula* leaves (Table 1). Only protein was absent in both the methanol and ethanol extracts. Tannins, flavonoids, alkaloids, and phenolics were only present in ethanolic extracts. On the other hand, steroids and terpenoids were only present in methanolic extracts of *C. fistula* flowers.

Glycosides, steroids, terpenoids, carbohydrates, tannins, and phenolic compounds were present in both methanol and ethanol extracts of *T. arjuna* flowers (Table 2). Alkaloids were present in ethanolic extracts. While saponins were only present in methanol extracts of *T. arjuna* flowers (Table 2). Likewise, glycosides, carbohydrates, tannins, and phenolic compounds were present in both methanol and ethanol extracts of *T. arjuna* leaves (Table 2). Alkaloids and steroids were present in methanol extracts. While terpenoids were only present in extracts of *T. arjuna* leaves (Table 2). Proteins and flavonoids were absent in both methanol and ethanol extracts of the flowers and leaves of *T. arjuna*.

Table 1. Phytochemical analysis of the flowers and leaf extracts of *Cassia fistula*

S.NO	Phytochemical	F. Methanol	F. Ethanol	L. Methanol	L. Ethanol
1	Carbohydrate	+	+	+	+
2	Phenol	-	-	-	+
3	Tanins	-	-	-	+
4	Flavinoids	+	+	-	+
5	Saponins	+	+	+	+
6	Glycosides	+	+	+	+
7	Steroids	-	+	+	-
8	Terpinoids	+	+	+	-

9	Alkaloids	+	+	+	+
10	Proteins	+	+	-	-

+ = Present; – = Absent

Table 2. Phytochemical analysis of the flowers and leaf extracts of *Terminalia arjuna*

S.NO	Phytochemical	F. Methanol	F. Ethanol	L. Methanol	L. Ethanol
1	Carbohydrate	+	+	+	+
2	Phenol	+	+	+	+
3	Tanins	+	+	+	+
4	Flavonoids	-	-	-	-
5	Saponins	+	-	-	+
6	Glycosides	+	+	+	+
7	Steroids	+	+	+	-
8	Terpinoids	+	+	-	+
9	Alkaloids	-	+	+	-
10	Proteins	-	-	-	-

+ = Present; – = Absent

4. Discussion

The main purpose of the recent research was to evaluate the flavonoid content, phenolic content, total antioxidant inhibition percentage, and hydrogen peroxide inhibition percentage. Phytochemicals are bioactive substances that have a variety of health-promoting properties. Advances in medicinal plant research have opened new possibilities in the quest for useful medicines derived from natural sources. That is why the chemical variety of plants is constantly being studied. The presence of a wide range of phytochemicals in our study enhanced the therapeutic effects they offered. Total phenolic, flavonoid, glycoside, alkaloids, carbohydrates, and tannin content give baseline data for various bioactivities. According to several research studies [35,36], phenolic molecules are one of the most essential components for medicinal plant antioxidant action.

As demonstrated by our research, *T. arjuna* has a considerable quantity of phenol, as well as carbohydrates and tannin, which might be considered contributory components to the flowers' medicinal qualities. According to previous work, flavonoids are physiologically active components that have been used to treat a variety of human diseases in the past, most notably cardiovascular disease. Tannins have been related to a variety of health advantages, including antioxidant, antibacterial, and anti-mutagenic properties [35]. Panda, *et al.* [37] reported the presence of alkaloids, saponins, triterpenoids, carbohydrates, glycosides, flavonoids, protein, and amino acids in methanolic leaf extracts of *C. fistula*. These results are confirmed by our findings.

The various compounds were shown to be present or absent in both the solvents of methanol and ethanol in the flowers and leaves of *C. fistula* and *T. arjuna* (Fig. 6). In *C. fistula*, carbohydrates, saponins, glycosides, and alkaloids were detected in high quantities. Carbohydrates, phenol, tannins, and glycosides were also found in high concentrations in *T. arjuna*. These findings can be compared with those of Mahendran and Rahman

[35], who reported that floral extracts from *Cassia fistula*, *Lagerstroemia speciosa*, and *Delonix regia* were rich in various phytochemicals.

Fig.6 Extract of leaves and flowers of *Cassia fistula* and *Terminalia arjuna*

The total phenolic contents of the test fraction were determined using gallic acid. The largest quantity of phenols was detected in *T. arjuna* flowers, followed by *T. arjuna* leaves, *C. fistula* leaves, and *C. fistula* flowers in n-hexane extract. The maximum amount of phenols in *T. arjuna* methanolic extract was higher than in *C. fistula*. The findings of recent field research can be compared with Shahriar, *et al.* [38], who determined the TPC using Folin-Ciocalteu reagent.

The total flavonoid content of *C. fistula* and *T. arjuna* extracts was determined using a technique called Aluminium chloride colorimetric. The TFC is highest in *C. fistula* leaves followed by *T. arjuna* flowers, *T. arjuna* leaves, and *C. fistula* flowers in n-hexane extract. These findings can be compared with those of Shahriar, Akhter, Hossain, Haque and Bhuiyan [38], who found the highest number of flavonoids in the methanolic extract of *T. arjuna*. Flavonoids are key components of plants' antioxidant systems. Flavonoids' antioxidative effects are attributable to a variety of processes, including scavenging free radicals, chelation of ions of metals like iron and copper, and inhibition of enzymes that generate free radicals. A high concentration of these phytochemicals can explain its strong radical scavenging assay.

Our present study reveals that the flowers and leaves of *C. fistula* and *T. arjuna* show the highest DPPH radical scavenging assay in methanolic extract of *C. fistula* flowers than in *C. fistula* leaves. The findings of recent field research can be compared with those of [39,40] who reported that the EC₅₀ values of *Cassia fistula* fruit and seed extract were 0.915 mg/mL and 1.088 mg/mL in the DPPH inhibition assay experiment, respectively, while the IC₅₀ value of an 80 percent methanolic extort of *Lagerstroemia speciosa* flower was 3.23 g/ml. Several earlier studies have revealed the antioxidant activity of various plant components. Recent research demonstrates the importance of flowers as an antioxidant source. Antioxidants help to minimize the negative effects of oxidative stress, which has been linked to a variety of ailments. Natural antioxidants aid in the protection of the human body from free radicals, thus minimizing the emergence of a variety of illnesses.

5. Conclusions

The plants *Cassia fistula* and *Terminalia arjuna* are medicinally important and produce leaves and colorful blossoms that belong to the Caesalpinioideae of the legume family and the family of Combretaceae. The antioxidant, hydrogen peroxide, and phytochemical assessment (qualitative and quantitative) of methanolic and ethanolic extracts of *Cassia fistula* L. and *Terminalia arjuna* flowers and leaves were investigated in this work. The presence of ten different chemicals of varying degrees and classes was observed, i.e.,

alkaloids, steroids, tannis, glycosides, saponins, flavonoids, and terpinoids were confirmed during qualitative screening. During quantitative analysis, the *Cassia fistula* leaves showed the highest TFC ($32.783^A \pm 0.073$) and the TPC was observed highest in *Terminalia arjuna* flowers ($42.800^A \pm 0.028$). The highest DPPH percentage was recorded in *C. fistula* flowers ($21.825^A \pm 0.069$) compared to its lowest value observed in *C. fistula* leaves ($10.660^B \pm 0.053$). The highest hydrogen peroxide (H_2O_2) scavenging activity among both plants was found in *C. fistula* ($12.526^A \pm 0.146$) and the lowest in its leaves ($7.1470^B \pm 0.045$). The methanolic extracts showed promising antioxidant activity. The presence of bioactive components in the leaves and flowers of *Terminalia arjuna* and *Cassia fistula* suggests that these flowers and leaves might be used as a phytochemical source and are also effective and safe as natural remedies. The biochemical analysis proved that the extracts of *Cassia fistula* and *Terminalia arjuna* plants have glycosides, flavonoids, and alkaloids that play a role in antioxidant activity.

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