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Phytochemical screening, antioxidant power and quantitative analysis by HPLC of isolated flavonoids from Rosemary

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Abstract

The aim of this study was to evaluate of phytochemical, total phenolic content, total flavonoid content, total alkaloid content, total saponins content, total tannin content, the antioxidant activity and quantitative analysis of the isolated flavonoids by HPLC of Rosemary. The plant is known to contain phenolic chemicals, flavonoids, tannins, glycosides, alkaloids, terpenes, sterols, and saponids, according to preliminary phytochemical results. After quantitative estimation of secondary metabolites, the greatest concentration of total phenolic content 166.8 mg/100g, flavonoids 84.9 mg/100g, total alkaloids content 4.58 %, total tannins content 3.66 % and total saponins content 1.25 %. Results of HPLC showed p-coumaric acid 80.25 ppm, apigenin 30.59 ppm, kaempferol 44.8 ppm, ferulic acid 12.98 ppm, quercetin 51.58 ppm, sinapic acid 12.6 ppm, and rosmaric acid 30.9 ppm. Results showed the Rosemary have a reducing power capable of reducing Scavenge free radicals compared to ascorbic acid.

Introduction

The use of plants in herbal medicine is becoming increasingly common among medical professionals. This is because plants have more side effects, are naturally sourced, have favorable benefits with low toxicity, and are generally less expensive than synthetic medications [1,2]. For thousands of years, medicinal plants have been used for several purposes, such as medicines, alternative medicine, food preservation, and complementary and alternative medicine [3]. Medicinal plants are the richest bio-resource on drugs of traditional systems of medicine, modern medicines, food supplements, pharmaceutical intermediates, nutraceuticals, folk medicines, and chemical entities for synthetic drugs [4]. Medicinal plants are a safer substitute for synthetic medications, which may have toxic or dangerous side effects [5].

The fact that secondary metabolites of plants are used in dyes, fabrics, adhesives, waxes, oils, flavouring employees, medications, and fragrances makes them interesting as well. Additionally, they may serve as the basis for new natural remedies, antibiotics, herbicides, and insecticides [6,7].

The utilization of medicinal plants has gained popularity all around the world, and fresh research is uncovering their health benefits for the creation of new medications. Natural substances can offer novel and important results toward a variety of pharmacological targets on the current state of research on *Rosmarinus officinalis* L., clarifying what compounds and biological functions

are most important, dependent on their extensive ethnopharmacological applications, which inspired current research in drug discovery. The pharmacological properties of rosemary, including "rosemary," "Rosmarinus officinalis plant," "rosmarinic acid," "carnosol," and "carnosic acid," were thus identified. These references state that there has been a rise in research in this plant's medicinal qualities, particularly those related to carnosic acid, carnosol, rosmarinic acid, and the oil that it contains [8].

Commonly referred to as rosemary, *Rosmarinus officinalis* L. (rosemary] is a member of the Lamiaceae family of medicinal plants [9]. In addition to being used as a spices and flavour extender in food preparation, rosemary is a plant that is used to treat a number of ailments [10]. In medical traditions, rosmarinus plants have been used for the treatment of renal colic, obesity, menstrual cramps cardiac problems, respiratory issues, and ailments with antirheumatic, carminative, and antispasmodic qualities [11]. Rosemary is utilized in medicine because it has bioactive substances such as rosmarinic acid, carnosic acid, and carnosol that are well-known for their remarkable efficacy as essential antioxidant. Moreover, essential oils, fragrances, and perfumes may be made from the flowers, stems, and leaves of rosemary by methods of extracting [12,13].

The current study aims to analyze the phytochemical components of rosemary and quantify its antioxidant capacity and secondary metabolites.

Materials and Methods

Each substance used in this investigation is extremely purified and of analytic grade; it comes from Aldrich has, Sigma, and BDH products. Rosmarinus was bought from the Salahaddin, Iraq, marketplace in the city of Samarra City. dried for one hour at 40 °C in a warm air oven. After being dried, the plant was ground into a coarse powder with the help of a mixer grinder and kept in a sealed bag.

Plant preparation

The rosemary was acquired from neighboring marketplaces inside Samarra city. After that, the plant was trimmed, carefully removed, and dried for 40 minutes at 40 °C. Afterwards, the plant material was ground, and the ground powder was then put into containers for the desired use.

Flavonoids isolation

A modified procedure was used to extract flavonoids [9]. 20 g of powdered rosemary herb was mixed with 200 ml of 80% ethanol. The mixture was then continually stirred for two hours while immersed in a hot water bath. After then, it was let to stand for six days before being cooked once again. After that, filtering was applied to the mixture. After the remaining material was removed using Rotary evaporator, the filtrate was moved to glass dish and dried at a temperature of 25°C. After that, the powder was preserved by being kept in plastic containers.

Preliminary Phytochemical screening

Ten grams of rosemary leaves were soaked in one hundred ml of petroleum ether, cyclohexane, watery ethanol, and metahanol to create five extracts. After that, the mixture was shaken for 24 hours at 25 °C in a bar with magnets. Subsequently, filter paper and Buchner were used to filter the extracts. The resulting filtrates were kept at 4 °C until chemical analysis, after being concentrated at 60 °C in a hot air oven. Standard operating protocols were followed in the chemical compound experiments to determine the phytochemical components present in each of the five rosemary extracts. The existence of primary and secondary metabolites such as protein, carbohydrates, lipids,

phenolic compounds, flavonoids, glycosides, alkaloids, tannins, terpenoids, saponins, and phytosterols was qualitatively assessed in the extracts.

Total phenolic content

Phenolic content of rosemary was assayed using the Folin-Ciocalteu reagent [14]. The total phenol content was estimated in triplicate instances, and a formula as follows was used to determine the total phenols: TPC = C × V/m; Where, TPC =Total phenols compounds in mg/g sample; C = concentration of gallic acid established from the calibration curve in mg/ml; V = volume of extract in ml; m= weight of plant extracting in g; GAE = gallic acid.

Total flavonoids content

Using the aluminum chloride calorimetric technique, the total flavonoids content of rosemary was determined [15]. The formula that follows was used to get the total of the flavonoids: The total flavonoids were calculated by using the formula; TFC = C × V/m; Where, TFC =Total flavonoids content in mg/g sample; C = concentration of quercetin established from the calibration curve in mg/ml; V = volume of extract in ml; m = weight of plant extract in g; QUE = quercetin.

Total alkaloids content

After dissolving some of the extraction residual in 2N HCl, the reaction failed. After transferring 1 ml of this solution to a replacement funnel, 10 ml of chloroform was used for washing. This solution's pH was brought to neutral using 0.1 N NaOH, this solution was mixed with 5 ml of a buffered phosphate and 5 ml of Bromocresol Green (BCG) solutions [16].

Preparation of standard curve

Atropine standard solution was precisely measured in aliquots of 0.4, 0.6, 0.8, 1 and 1.2 ml, and then transferred to several reparatory funnels. Next, 5 ml of pH 4.7 phosphate buffer and 5 ml of BCG solution were combined, and the resulting mixture was agitated with 1, 2, 3, and 4 ml of chloroform extract. After that, the extracts were taken apart in a 10 ml volumetric container then diluted with chloroform to optimize the solution. The complex's absorbency in chloroform was calculated using a UV Spectrophotometer (SHIMADZU UV-1800) at a wavelength of 470 nm in comparison to the blank, which was made in the same way without the atropine's.

Total saponins content

The gravimetric technique of double extracting was used to determine the saponin content of the samples [17]. In a flask, 50 ml of a 20% aqueous ethanol solution was combined with 5g of the measured weight of the powdered material. After 90 minutes of heating at 55 degrees Celsius in the water bath, the mixture was passed through using Whatman filter paper (No. 42). The residue was extracted using 50 ml of 20% ethanol. The two extracts were combined and reduced to around 40 ml at 90 degrees Celsius. The mixture was then moved to a separating funnel, filled with 40 ml of diethyl ether, and rapidly shaken. Partitioning and re-extraction were carried out frequently until the aqueous layer's color become transparent. The saponins were extracted using sixty ml of regular butanol. After being cleaned with 5% aqueous sodium chloride (NaCl) solution, the mixed extracts were dried in a preweighed evaporate dish. After chilling in a desiccator, it was weighed again and dried at 60ºC in the oven. To obtain an average, the procedure was carried out twice more.

The content of saponins was ascertained via difference and computed as a proportion of the initial sample in this way: Percentage of saponins = (W2 – W1 / Wt. of sample) X 100.

W1= weight of evaporating dish, W2 = weight of evaporating dish + sample

Total tannin content

Samples extract weighing two grams were combined with water and ethanol [20:80] and cooked in a water bath. After the mixture was filtered, the filtrate was mixed with ferric chloride. Tannins are present when the solution is dark green in color. Five ml of 1% gelatin solution were combined with one ml of extract, two ml of 2% sodium chloride, and a filter. The presence of tannin is indicated by a precipitate. and the absorption measurement at 540 nm [18].

DPPH free radical scavenging assay

The 40 mg of 1,1-diphenyl-2-picrylhydrazyl (DPPH) The solution was dissolved to a DPPH concentration of 400 ug/ml in 100 ml of methanol. 100 milliliters of methanol and distilled water were combined with 0.5 grams of vitamin C and the sample to create the standard solution that was used. The dilution law was utilized to generate a standard solution, which had a concentration of 5000 µg/ml.) (30, 60, 120, 250, 500 µg/ml) from vitamin C and sample. About 1 ml of DPPH solution was added to 3 ml of the samples with different concentrations (30, 60, 120, 250, 500 µg/ml). For the control test, the same amount of ethanol was added. After giving the mixture a good shake, it was let to remain at room temperature for half an hour, using a UV-VIS Shimadzu spectrophotometer, absorbance was measured at 517 nm. The IC 50 value of the sample, or the concentration of sample needed to inhibition 50% of the DPPH free radical, was determined using the equation below [19]. All experiments were performed in triplicate.

% Inhibition of DPPH = [(Ac-As) ÷Ac] × 100

Where absorbance of control = total radical activity without inhibitor and absorbance of Test = activity in the presence of test compounds.

Reducing power assay

Reducing power assay was followed by the method of Oyaizu (1986) [20]. Calculating Reducing Power Using Fe3+. Reduction as a Basis of reaction. Fe3+ reduction is frequently employed as a measure of the electron-donating activity, a crucial indicator of the capacity to reduce phenol [19]. A ferric ferrous combination that peaks in absorbance at 700 nm is formed when extracts. Mix potassium ferrocyanide ($Fe^{2+)}$ with the potential for reduction to get potassium ferricyanide (Fe^{3+}). Ferric chloride is then reacted with by this later component. Different extract concentration (25, 50, 100, 150, 200 µg/ml)) were diluted in 1 ml of Methanol, 1 ml of phosphate buffer (0.2 M, pH 6.6), and 1 ml of potassium ferricyanide solution (1%), to create the reaction solution. For 20 minutes, the resultant solution was incubated at 50°C. After that, the reaction was stopped with the addition of 1 ml of 10% trichloroacetic acid, and cooling was applied to the tube for five minutes under the surface of flowing water. After that, the mixture was centrifuged for ten minutes at 3000 rpm. After removing an aliquot of 2 ml from each top layer of each solution, 0.4 ml of ferric chloride solution (0.1%) and 2 ml of distilled water were added. At 700 nm, the absorbance of the solution was measured. A rise in the reaction mixture's absorbance signifies a rise in the reducing power.

Quantitative analysis of the isolated flavonoids by HPLC

Reversing phase HPLC chromatography was used to quantify individual phenolic compounds. The apparatus used was a SYKAMN HPLC chromatographic systems with a UV the detector, Chemstation, a Zorbax Eclipse Plus-C18-OSD.25 cm, column of 4.6 mm. 30°C was the column's temp. Using eluents A (methanol) and B (1% formic acid in water (v/v)), the gradual eluted procedure was carried out as follows: beginning 0–4 min, 40% B; 4–10 min, 50% B; and 0.7

mL/min rate of flow. 100 µL of the sample and standards had been injected and the result was done automatically using autosampler, the spectra were acquired in the 280 nm.

Results and Discussion:

Phytochemical screening

Inferential detections were conducted on the primary and secondary metabolic compounds of the rosemary plant in five extracts: (aqueous, ethanolic, methanol, petroleum ether, and cyclohexane). The results showed a clear variation in the components of each extract depending on the type of solvent used, as in Table 1.

Table 1: Results of qualitative detection of secondary metabolic compounds present in rosemary plants.

Detection of metabolic compounds	Detection type	Aqueous extract	Ethanolic extract	Methanolic extract	Petroleum ether extract	Cyclohexae extract
Phenols and Tannins	Dichromate	++	+	++	-	+
	Ferric chloride	++	++	++	-	+
Flavonoids	Shenoda	+	+	+	-	-
	Basic solution	+	+	+	++	++
	Ferric chloride	+	+	+	-	-
Terpenes	Trim Hill	+	+	+	+	+
	Lieberman	+	-	-	+	++
Alkaloids	Drakendorff	+	+	+	+	++
	Mayer	-	+	+	++	++
Saponids	Foam	+	+	++	++	+
	Mercury chloride	-	++	++	+	+
Proteins and amino acids	Biuret	-	-	-	-	-
	Ninhydrin	-	-	-	-	-
Glycosides	Killerclean	+	+	+	+	+
	NaOH	+	+	+	++	-
Sterols	Salkovsky	-	+	+	+	+
	Lieberman	++	++	++	+	+

The results of preliminary tests indicated that the rosemary plant contains phenolic compounds, flavonoids, terpenes, alkaloids, soaps, glycosides, sterols, amino acids and proteins. The results showed that the rosemary plant contains phenolic compounds and tannins, and the results gave a positive result for all extracts using dichromate and ferric chloride detectors, with the exception of petroleum ether, which gave a negative result for the two tests, All extracts of the rosemary plant contained large amounts of flavonoids for the detection of basic solution and ferric chloride, with the exception of the petroleum extract and cyclohexane in ferric chloride, which gave a negative value similar to the detection of Shinoda. While the terpenes gave a positive result for the Trim Hill test, while Lieberman gave a negative result for the alcoholic extract, as for the alkaloids, they gave a high positive result for the petroleum extract and cyclohexane, and a positive result for all extracts for the Druckendorff test, and the Mayer test gave a negative result for the aqueous extract and a

positive result for the other extracts, and the results showed that it contained coriander plant extracts. Applying soaps to detect foam, while mercuric chloride detection gave a positive result for all extracts, except for the aqueous extract, which gave a negative result, while sterols gave a high positive result with Lieberman's reagent for the aqueous and alcoholic extracts, and a positive result for the rest of the extracts. It also gave a positive result with the Salkowski detection of all extracts, except for the aqueous extract, which gave a negative result, while all the extracts for detecting glycosides gave a positive result compared with the aqueous extract for detecting sodium hydroxide, with the exception of the cyclohexane extract, which gave a negative result. The results showed that the rosemary plant extracts did not contain amino acids.

The results of preliminary tests indicated that the rosemary plant contains phenolic compounds, phenols, tannins, flavonoids, terpenes, alkaloids, soaps, glycosides, and sterols. Many studies have proven that secondary metabolic compounds are more abundant in plants. Rosemary also contains phenolic compounds such as flavonoids, tannins, and polyphenols in large quantities, and this is consistent with many studies [21-23]. Our study proved that rosemary contains flavonoids, tannins, alkaloids, saponins, and glycosides, and this agrees with R.K. Sangeetha and his group [24]. The plant also contains rosmarinic acid, mineral components, vitamins A and C, and other components of main importance that are due to their antioxidant properties provided by antioxidants such as phenols, which are natural antioxidants that work to eliminate or reduce oxidative stress in living organisms. Which is a major danger because it causes various tumors. It is used medically to strengthen blood circulation and the nervous system. Moreover, it is used to control cancer and regulate blood pressure [25].

Since phenolic compounds have an extensive list of biological activities that are primarily attributed to their antioxidant properties in reducing oxidative damage, and transition metals for ion exchange, hydrogen peroxide, hydroxyl radical, and superoxide, they are essential to its hydroxyl radical reusing and the antioxidant effects in plants. Reactive oxygen species (ROS), nitric oxide, and peroxynitrite [26].

The quantitative contents of secondary metabolites

The quantitative contents of secondary metabolites of total phenolic content, flavonoids, total alkaloids content, total saponins content, and total tannins content are displayed in table 2, where the total phenolic compounds (166.8 mg/100 gm) has the greatest content. this is followed by the total quantity of flavonoids (84.9 mg/100 gm), total alkaloid contents (4.58%), total tannin content (3.66%), and total saponin contents (1.25%), as in table 2:

No	Total content	Concentration
1	Total phenolic content (mg / 100 gm)	166.8
2	Total flavonoid content (mg / 100 gm)	84.9
3	Total alkaloid content %	4.58
4	Total tannin content %	3.66
5	Total saponins content %	1.25

Quantitative content of the isolated flavonoids by HPLC

The quantitative content of the compounds found in isolated flavonoids from rosemary was estimated using high-pressure liquid chromatography (HPLC) technology, seven standard compounds (phenolic compounds) were used to characterize the compounds present in the plant.

The diagram of HPLC showed that the retention times (Rt) of the compounds found in the isolated flavonoids was completely identical to the standard compounds used for comparison.

The results showed the presence of seven compounds in isolated flavonoids, which are identical to the standard compounds used in diagnosis, as in Figure 1 and table 3. This compounds are p-coumaric acid (Rt 2.18 min.) compared to standard p-coumaric acid (Rt 2.15 min.), rosmaric acid (Rt 3.00 min.) compared to standard rosmaric acid (Rt 3.08 min.), ferulic acid (Rt 4.01 min.) compared to standard ferulic acid (Rt 4.02 min.), sinapic acid (Rt 5.77 min.) compared to standard sinapic acid (Rt 5.78 min.), quercetin (Rt 6.04 min.) compared to standard quercetin (Rt 6.05 min.), apigenin (Rt 7.00 min.) compared to standard apigenin (Rt 7.08 min.) and kaempferol (Rt 8.20 min.) compared to standard kaempferol (Rt 8.25 min.), as in Figure 1.

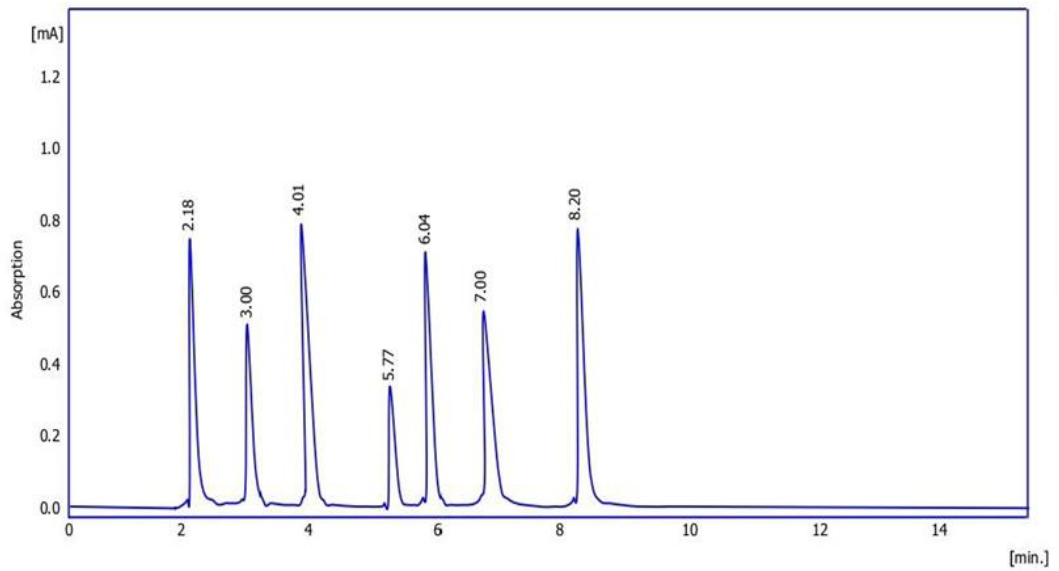

Figure 1: HPLC of compounds present in isolated flavonoids from rosemary.

Table 3: HPLC results of compounds present in isolated flavonoids.

No	Name compounds	Retention times (Rt)	Concentration
1	p-Coumaric acid (ppm)	2.18	80.25
2	Rosemaric acid (ppm)	3.00	30.9
3	Ferulic acid (ppm)	4.01	12.98
4	Sinapic acid (ppm)	5.77	12.6
5	Qurcetine (ppm)	6.04	51.58
6	Apigenin (ppm)	7.00	30.59
7	Kaempferol (ppm)	8.20	44.8

The results of the current study showed that the rosemary plant contains a high percentage of flavonoids, and this agrees with Al-Samarrai et al, as she indicated in her study that rosemary leaves and the flavonoids isolated from it contain different types of flavonoids such as rosemaric acid, qurcetine, apigenin, and other metabolic compounds. secondary school [21]. Our study also agreed with the study of Miljanović et al that rosemary contains rosmaric acid. [27], She also agrees with Sadia et al on the presence of alkaloids in plants [28].

This study agrees with Zeghad, N et al on the presence of Qurcetine in plants [29], and our study does not agree with JAFARI-SALES A on the presence of saponins, Sinapic acid, Kaempferol, and Ferulic acid [30]. Also, the study agrees with T.P. Durgawale and his group and D.J. Turley et al confirmed the presence of tannins in the rosemary plant, which has an important role in human health because it is an antioxidant and soluble in water and can be used in tanning leather and formulating ink [31,32].

DPPH Free Radical Scavenging Assay

The isolated flavonoids from rosemary is one of the plants that has strong antioxidant power, results showed rosemary is had inhibition % of DPPH radical scavenging activity more than vitamin C as a standard, and IC 50 of rosemary is 78.47 µg/ml compared with 160.2 µg/ml for vitamin C. This study agreed with the study of Esati and La, who indicated in his study that the rosemary plant has a high antioxidant capacity [33]. As in Figure 2.

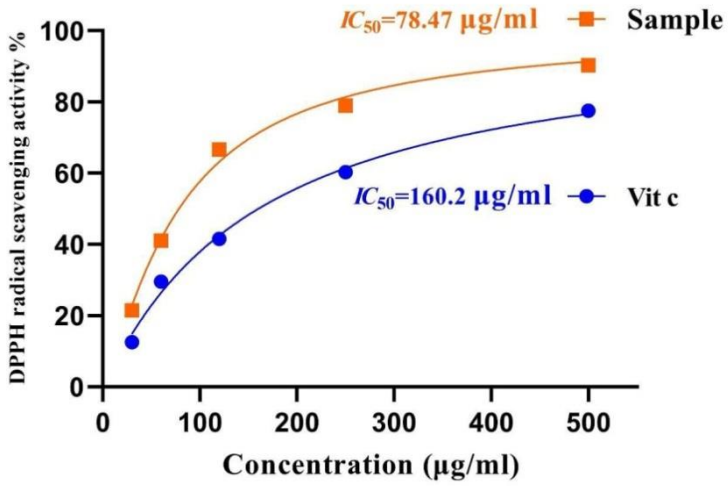

Figure 2: Inhibition % of DPPH Radical scavenging.

Our findings concur with earlier research on the antioxidant potential of isolated flavonoids from rosemary. The essential oil extracted from the rosemary, as shown in the work by Kadri et al. [34], was comparable to the rosemary that we studied in terms of its chemical makeup and free radical scavenging activities. The wide range of IC50 values seen across investigations can be attributed to the varying chemical compositions of rosemary. Recent research has demonstrated that the rosemary leaves rich chemotype has the highest level of antioxidants [35].

In the investigation, which evaluated and compared RO's capacity to scavenge free radicals along with three of its constituents, RO demonstrated higher antioxidant activity and a lower IC50 value than each of its constituents as well as the artificial antioxidants Ascorbic acid [36]. This does not align with Wang W's group's findings. This implies that small constituents may potentially considerably influence the action of RO in addition to the larger molecules.

Reducing power assay

The Reducing power activity of isolated flavonoids was measured by the reducing power assay, the results shown in figure 3 indicate the reducing power of isolated flavonoids from rosemary compared to ascorbic acid as a standard substance.

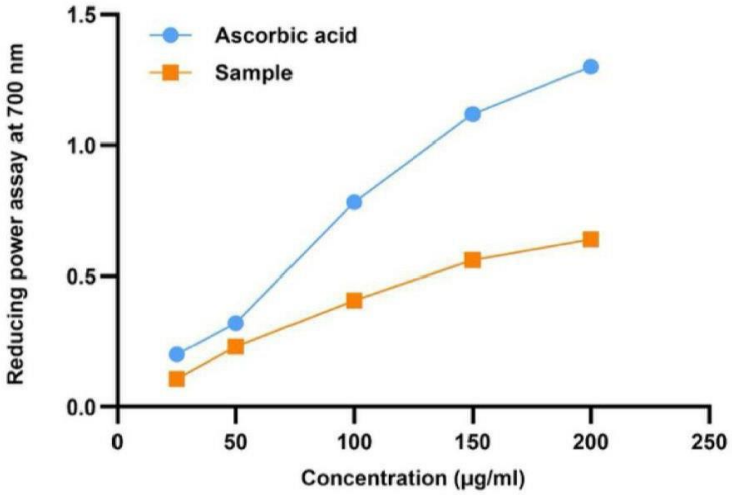

Figure 3: Reducing Power assay.

It turns out that the reductive power of isolated flavonoids is less than that of ascorbic acid, as shown in figure 3, because the natural antioxidants found in fruits and vegetables have a more positive effect against toxic effects than synthetic antioxidants, as Sadia B et al indicated that flavonoids and phenols have antioxidant activity, so they are considered natural antioxidants [28,37]. Studies confirm that phenols extracted from rosemary give different and powerful antioxidants compared to other plants, which leads to the elimination of free radicals and thus leads to scavenging these radicals and protecting the cell [38].

As Rubila and Ranganathan pointed out, the antioxidant content of a plant is a significant indication that the plant possesses antioxidant capacity, which is believed to have the ability to neutralize the effect of free radicals and suppress the effect of single and dual oxygen radicals [39].

Flavonoids can donate hydrogen atoms to convert ferric acid to ferrous iron, which act as reductants. Increasing the concentration of flavonoids leads to an increase in the reducing power, including compounds that can be reductants in larger quantities if a higher concentration is used. Diterpenoids are including carnosic acid, carnosol, rosmanol, and epirosmanol are among the antioxidants found in R. officinalis [40]. Phenolic chemical compounds from R. officinalis extract have been linked to antioxidant properties by scavenging hydroxyl radicals as well as singlet oxygen, and peroxyl radicals in lipids [41].

It has been found that one of the primary mechanisms of antioxidant activity displayed by polyphenol phytochemicals is believed to be the strong scavenging ability of rosemary extract of various forms of reactive oxygen and nitrogen species, predominantly free radicals, according to Moreno et al [42]. Food that has been preserved naturally rather than with artificial additives is becoming more and more popular. Because of its bioactive qualities, natural extracts from the Lamiaceae family, including rosemary, have been researched in this area. According to a number of research, rosemary extracts exhibit biological properties such hepatoprotection, antifungal, insecticidal, antioxidant, and antibacterial properties. It is commonly known that phenolic chemicals are primarily responsible for rosemary's biological qualities. But it's important to remember that these biological characteristics rely on a variety of factors. Their flavor, color, and odor make them less useful in food preparation. Because of this, commercial processes for making colorless, odorless antioxidant molecules from rosemary are being developed [42].

Additionally, phenolic acids, flavonoids, and diterpenoids are the main types of antioxidant compounds found in rosemary extract [43]. There are more derivatives of caffeic acid in the rosemary extracts. These chemicals react with the metal ions that are already present, forming bonds with. These bonds with then react with peroxide radicals, stabilizing the oxygen radicals in the process [44]. These chemicals' mode of action has been extensively discussed in some of study [45,46], that rosemary's antioxidant qualities are due to the abundance of isoprenoid quinones, which function as chelators of ROS and chain terminators of free radicals. Furthermore, according to Gordon [47], the phenolic compounds found in commercialized rosemary extract function as primary antioxidants when they combine with hydroxyl and lipid radicals to produce stable products.

Fang and Wada [48] noted that these substances might function as metal ion chelators (Fe^{+2}) in a basic way, lowering the ratio at which oxygen-derived reactive compounds develop. As stated by Löliger [49], carnosic acid and carnosol are effective peroxide radical scavenger. This fact clarifies the findings of Chen et al. [50], who established that both substances had a greater effect on membrane lipid peroxidation than do synthetic antioxidants like beta hydroxybutanoic acid (BHA), Butylated hydroxytoluene (BHT), and propyl gallate [51]. According to Inatani et al., rosmanol exhibited an antioxidant capacity in linoleic acid that was four times more than that of synthetic antioxidants. In addition, this study described the antioxidant action of rosmanol and carnosol via TBA and ferric thiocyanate methods. Its related the association between activity and chemical structure as an antioxidant [52].

Aruoma and associates [53] investigated rosemary's pro- and anti-oxidant properties.Carnosic acid and carnosol are the primary compounds having antioxidant characteristics, accounting for 90% of the properties. They both lower cytochrome c, scavenge hydroxyl radicals for use, and suppress lipid peroxidation in liposomal and microsomal systems. They are also effective scavengers of CCl3O2 (peroxyl radicals). In particular, carnosic acid scavenges H_2O_2, but it may also function as an enzyme system substrate. Fruiting stages influence antioxidant properties: an increase in polyphenols concentration during the fruiting stage, such as rosmarinic acid, the compound hes and carnosol, is directly linked to an increase in the antioxidant capacity of the extracts. Scientific publications that Cui et al. published in the past lend credence to this assertion [54].

Conclusions

Our findings show that rosemary not only possesses antioxidants such as rosmarinic acid, apigenin that turcetine, p-coumaric acid, ferulic acid, sinapic acid, and kaempferol, but also demonstrates free radical scavenging ability which measured by the DPPH free radical scavenging assay, and enjoys reducing power.

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الفحص الكيميائي النباتي وقوة مضادات الأكسدة والتحليل الكمي بواسطة كروماتوغرافيا السائل ذات الاداء العالي للفلافونيدات المعزولة من إكليل الجبل

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البحث مستل من اطروحة دكتوراه الباحث الاول

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الكلمات المفتاحية:
اكليل الجبل، مضادات الاكسدة، الايض، الثانوية، الفرفونيدات

معلومات المؤلف

الايميل:
الموبايل:

الخلاصة:

الهدف من هذه الدراسة هو تقييم المركبات الكيميائية النباتية، المحتوى الفينولي الكلي، محتوى الفلافونويد الكلي، محتوى القلويدات الكلي، محتوى الصابونين الكلي، محتوى التانين الكلي، نشاط مضادات الأكسدة والتحليل الكمي للفلافونويدات المعزولة بواسطة HPLC لإكليل الجبل. من المعروف أن النبات يحتوي على مواد كيميائية فينولية، وفلافونويدات، وعفص، وكليكوسيدات، وقلويدات، وتربينات، وستيرولات، وصابونيدات، وفقا للنتائج الكيميائية النباتية الأولية. بعد التقدير الكمي لمركبات الايض الثانوية،كان أعلى تركيز للمحتوى الفينولي الكلي 166.8 ملغم/100 غرام، الفلافونويدات 84.9 ملغم/100 غرام، إجمالي محتوى القلويدات 4.58%، إجمالي محتوى التانين 3.66%، إجمالي محتوى الصابونينات 1.25%. أظهرت نتائج HPLC حامض الكوماريك بي 80.25 ppm ، أبيجينين 30.59 ppm ، كيمبفيرول 44.8 ppm ، حامض الفيروليك 12.98 ppm ، كيروسيتين 51.58 ppm ، حمض السينابيك 12.6 ppm ، وحامض الروزماريك 30.9 ppm. أظهرت النتائج أن اكليل الجبل يتمتع بقدرة مخفضة قادرة على تقليل الجذور الحرة مقارنة بحامض الأسكوربيك.