Research Article

Phytochemical Screening of Five Medicinal Herbs: Aparajita, Oregano, Thyme, Ashwagandha, and Rosemary

Ayushi Kaushik[1*], Anushka Pundir[1], Prashant Saini[1], Anshul Sheel Kumar[2], Vinod Kumar Gupta[2#]
[1]Department of Biotechnology, Keral Verma Subharti College of Science (SVSU), Meerut-250005, India.
[2]Rapture Biotech International Pvt. Ltd. Noida, Uttar Pradesh-201301, India.
***Corresponding author's E-mail:** *aayushi.ap355@gmail.com, #research.rapturebio@gmail.com

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ABSTRACT

This study investigates the phytochemical composition of five medicinal herbs: Aparajita (*Clitoria ternatea*), Oregano, Thyme, Ashwagandha, and Rosemary. Extracts were made using a method that mixes one part herb with five parts ethanol, and then tests were done to check for 24 active compounds using standard biochemical methods. The analysis revealed notable variations in phytochemical presence across the herbs. Aparajita exhibited high concentrations of flavonoids, tannins, phenols, and alkaloids, while Oregano and Thyme were rich in volatile oils, saponins, and diterpenes. Ashwagandha contained significant terpenoid levels, whereas Rosemary demonstrated a diverse range of bioactive compounds, including coumarins and phenols. These findings highlight the medicinal potential of these herbs, supporting their use in traditional and modern therapeutic applications. By identifying key secondary metabolites, this study provides valuable insights for pharmaceutical research, potentially aiding in the development of natural drug formulations.

Keywords: Phytochemical screening, *Clitoria ternatea*, Oregano, Thyme, Ashwagandha, Rosemary, bioactive compounds.

INTRODUCTION

Medicinal plants have long been acknowledged for their therapeutic properties due to the presence of bioactive compounds, which exhibit antioxidant, anti-inflammatory, antimicrobial, and neuroprotective effects[1,2]. Growing global interest in plant-based medicine has driven extensive research into various herbs recognized for their health benefits. The medicinal properties of plants are primarily attributed to their secondary metabolites, including alkaloids, flavonoids, tannins, and terpenoids, which have been widely studied for their pharmacological significance[3].

For centuries, herbal medicine has played a crucial role in traditional healing systems such as Ayurveda, Traditional Chinese Medicine (TCM), and Unani medicine[4]. These practices utilize plant-derived treatments to manage a broad range of health conditions, from digestive issues to neurological disorders. With increasing concerns over antibiotic resistance and the adverse effects of synthetic drugs, medicinal plants are being explored as potential sources of safe, natural, and sustainable alternatives[5]. This resurgence of interest in plant-based remedies highlights the necessity for scientific validation to establish their efficacy and safety[6]. For example, recent studies on lemongrass (*Cymbopogon citratus*) have demonstrated its rich phytochemical profile and notable pharmacological activities, including antioxidant, antibacterial, and anti-inflammatory properties, further supporting the need for comparative phytochemical investigations across diverse medicinal herbs[7].

Among the many medicinal plants, Aparajita, Oregano, Thyme, Ashwagandha, and Rosemary are well-known for their pharmacological properties. Aparajita is traditionally valued for its cognitive-enhancing and neuroprotective effects[8]. Oregano and Thyme are widely recognized for their antimicrobial and antioxidant activities, making them beneficial in food preservation and disease prevention[9]. Ashwagandha, a well-documented adaptogen, is renowned for its ability to reduce stress and inflammation[10]. Meanwhile, Rosemary is known for its antimicrobial effects and memory-enhancing propertiess[11].

Although these herbs have well-documented medicinal benefits, comparative phytochemical studies on them remain limited. This study aims to address this gap by conducting a detailed phytochemical analysis, identifying key bioactive compounds in each herb. The results of this research will contribute to a more profound understanding of their pharmacological potential, reinforcing their therapeutic relevance and providing a basis for future clinical studies.

The primary objective of this study is to qualitatively assess the phytochemical constituents of five medicinal herbs—Aparajita, Oregano, Thyme, Ashwagandha, and Rosemary—to evaluate their medicinal potential. By identifying the key bioactive compounds, this research provides valuable insights into their comparative phytochemical profiles and their significance in herbal medicine. Additionally, these findings can serve as a scientific reference for future pharmacological research, guiding the development of herbal formulations and potential therapeutic applications[1].

Through qualitative phytochemical screening, this study also aims to support the scientific validation of traditional medicinal knowledge. Many modern pharmaceuticals

originate from plant-based compounds, making the exploration of phytochemicals crucial for drug discovery and development[1]. The results from this research may contribute to optimizing the extraction, bioavailability, and therapeutic efficacy of herbal bioactive compounds, providing a foundation for future in-depth pharmacological investigations[1].

MATERIALS AND METHODS

Plant Materials: Dried powdered forms of Aparajita, Oregano, Thyme, Ashwagandha, and Rosemary. The appearance of these powdered herbs is shown in Figure 1.

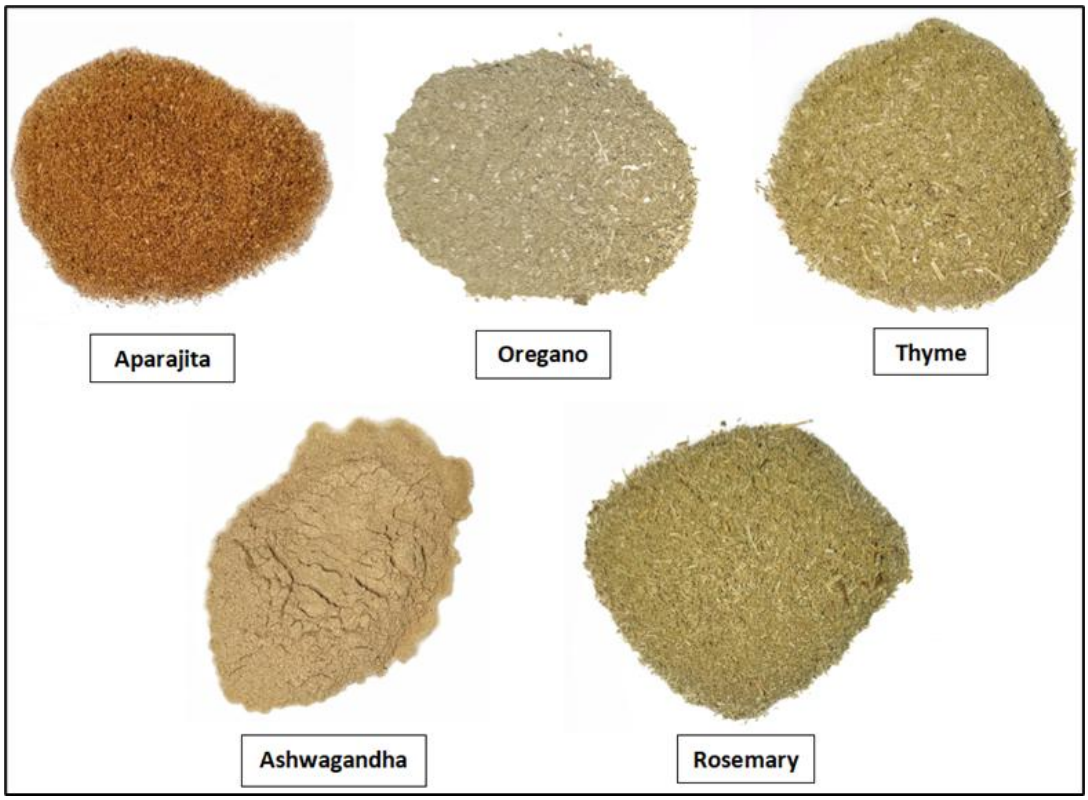

Figure 1: Dried powdered forms of Herbs.

Extraction Method

We used the cold maceration method to get the bioactive compounds out of the plant material. The solvent was ethanol (70–80%, which is more polar than pure ethanol) in a 1:5 (w/v) ratio. This method involves soaking the plant material in a solvent at room temperature for an extended period to ensure optimal phytochemical extraction. Cold maceration is widely utilized in herbal research due to its ability to preserve heat-sensitive compounds while efficiently extracting both polar and non-polar constituents[1,6]. The 1:5 ratio of plant material to solvent is commonly adopted in herbal extraction processes, as it allows for adequate compound dissolution while maintaining extraction efficiency[12]. Ethanol was selected as the solvent due to its effectiveness in extracting a broad spectrum of phytochemicals, including flavonoids, tannins, alkaloids, and phenolic compounds[13]. Ethanol may evaporate during the extraction, and solvent adjustments may be necessary[14]. Methanol is more polar than ethanol, but due to its cytotoxic nature, it is unsuitable for extraction in certain kinds of studies as it may lead to incorrect results[14].

PROCEDURE

The selected herbs underwent extraction using the cold maceration method with ethanol as the solvent. First, 5 grams of each powdered herb was accurately measured and placed in separate sterile containers. Ethanol (70–80%) was then added to each sample in a 1:5 (w/v) ratio, totaling 25 mL per herb. The mixtures were continuously shaken at room temperature for 72 hours to facilitate the release of bioactive compounds[15]. Following the extraction period, filtration was carried out using Whatman No.1 filter paper to separate the liquid extract from solid residues. Since ethanol naturally evaporates during the process, additional ethanol was added during filtration to ensure a final volume of 15 mL for consistency. The filtered extracts were then transferred into five sterile test tubes and stored under suitable conditions for subsequent phytochemical analysis. The qualitative phytochemical screening of these extracts was performed using established protocols, as summarized in Table 1.

Table 1: Phytochemical Tests and Procedures.

S. No	Phytochemical	Test Name	Reagents Required	Procedure (Using 500 µL Extract)	Positive Result / Negative Result
1.	**Alkaloids**	Dragendorff's Test[1]	Dragendorff's reagent	Add 500 µL of extract + 2-3 drops of Dragendorff's reagent	Orange-red precipitate / No precipitate
2.	**Flavonoids**	Alkaline Reagent Test[1]	NaOH solution	Add 500 µL extract + 2 drops NaOH	Yellow color, disappears with acid / No color change
3.	**Tannins**	Ferric Chloride Test[1]	$FeCl_3$ solution	Add 500 µL extract + 2 drops $FeCl_3$	Green-black or blue-black color / No color change
4.	**Saponins**	Froth Test[4]	Distilled water	Shake 500 µL extract + 2.5 mL water for 5 minutes	Stable foam / No foam
5.	**Phenols**	Ferric Chloride Test[1]	$FeCl_3$ solution	Add 500 µL extract + 2 drops $FeCl_3$	Deep blue or black color / No color change
6.	**Terpenoids**	Salkowski Test[6]	Chloroform + H_2SO_4	Add 500 µL extract + 250 µL chloroform + 500 µL H_2SO_4	Reddish-brown ring / No ring
7.	**Glycosides**	Keller-Killiani Test[1]	$FeCl_3$ solution + H_2SO_4	Add 500 µL extract + 3 drops $FeCl_3$ + 3 drops H_2SO_4	Blue-green ring / No ring
8.	**Carbohydrates**	Benedict's Test[1]	Benedict's reagent	Heat 500 µL extract + Benedict's reagent	Brick red precipitate / No precipitate
9.	**Proteins**	Biuret Test[1]	NaOH + $CuSO_4$	Add 500 µL extract + 1 mL NaOH + 2 drops $CuSO_4$	Violet color / No color change
10.	**Anthraquinones**	Ammonia Test[1]	Ammonia solution	Shake 500 µL extract + 500 µL ammonia	Pink or red color / No color change
11.	**Volatile Oils**	Spot Test[1]	Filter paper	Place 500 µL extract on filter paper	Oily spot remains / No oily spot
12.	**Reducing Sugars**	Fehling's Test[6]	Fehling's solution A & B	Heat 500 µL extract + Fehling's solutions	Brick red precipitate / No precipitate
13.	**Cardiac Glycosides**	Keller-Killiani Test[1]	$FeCl_3$ solution + H_2SO_4	Add 500 µL extract + $FeCl_3$ + H_2SO_4	Blue-green ring / No ring
14.	**Lignins**	Labat Test[1]	Alcohol + HCl	Add 500 µL extract + alcohol + HCl	Green-blue color / No color change
15.	**Quinones**	NaOH Test[1]	NaOH solution	Add 500 µL extract + NaOH	Red color / No color change
16.	**Carotenoids**	UV Test[1]	UV Light	Observe 500 µL extract under UV light	Orange fluorescence / No fluorescence
17.	**Phlobatannins**	HCl Test[1]	HCl solution	Boil 500 µL extract + HCl	Red precipitate / No precipitate
18.	**Resins**	Acetone Test[6]	Acetone + Water	Add 500 µL extract + acetone + water	Turbidity / No turbidity
19.	**Coumarins**	UV Light Test[1]	UV Light	Observe 500 µL extract under UV light	Green/ blue fluorescence / No fluorescence
20.	**Chalcones**	$FeCl_3$ Test[1]	$FeCl_3$ solution	Add 500 µL extract + 2 drops $FeCl_3$	Green/blue color / No change
21.	**Polyphenols**	NaOH Test[1]	NaOH solution	Add 500 µL extract + NaOH	Yellow-brown color / No color change
22.	**Diterpenes**	Salkowski Test[6]	Chloroform, H_2SO_4	Add 500 µL extract + 250 µL chloroform + 500 µL H_2SO_4	Reddish-brown ring / No ring
23.	**Leucoantho cyanins**	Acid Hydrolysis Test[1]	HCl solution	Boil 500 µL extract + HCl	Red color / No color change
24.	**Xanthoproteins**	NaOH Test[6]	NaOH solution	Add 500 µL extract + NaOH	Orange color / No color change

RESULT AND DISCUSSION

A detailed results table presents the strong presence (+++), moderate presence (++), mild presence (+), or absence (-) of phytochemicals in each herb, as shown in Table 2.

Table 2: Phytochemical Test Results.

Phytochemical	Test Name	Aparajita	Oregano	Thyme	Ashwagandha	Rosemary
Alkaloids	Dragendorff's Test	+++	+++	+++	+	+++
Flavonoids	Alkaline Reagent Test	+++	+	+	+	+
Tannins	Ferric Chloride Test	+++	+++	+++	-	+++
Saponins	Froth Test	-	+++	++	-	+++
Phenols	Ferric Chloride Test	+++	+++	+++	-	+++
Terpenoids	Salkowski Test	-	+	+	+++	-
Glycosides	Keller-Killiani Test	-	-	+	-	-
Carbohydrates	Benedict's Test	+++	-	+++	-	-
Proteins	Biuret Test	+	+	+	-	+
Anthraquinones	Ammonia Test	++	-	-	-	-
Volatile Oils	Spot Test	-	+++	++	-	+++
Reducing Sugars	Fehling's Test	-	-	+	-	-
Cardiac Glycosides	Keller-Killiani Test	-	-	+	-	-
Lignins	Labat Test	-	+	+	-	-
Quinones	NaOH Test	+	+++	+	-	+
Carotenoids	UV Test	+++	-	-	-	-
Phlobatannins	HCl Test	+++	-	+	-	-
Resins	Turbidity Test	-	+++	++	++	++
Coumarins	UV Light Test	-	++	++	++	+++
Chalcones	$FeCl_3$ Test	+++	+++	+++	-	+++
Polyphenols	NaOH Test	+++	++	++	-	++
Diterpenes	Salkowski Test	+++	+++	+++	+++	+++
Leucoanthocyanins	Acid Hydrolysis Test	+++	-	++	-	-
Xanthoproteins	NaOH Test	+++	+	-	-	-

(- = Absent; + = Slightly present; ++ = Moderate present; +++ = Highly present)

DISCUSSION

1. Alkaloids (Dragendorff's Test)

Significance: Alkaloids are known for their pharmacological effects, including pain relief, antimicrobial properties, and potential cognitive benefits. These compounds also play a role in stress adaptation and neurological health by modulating neurotransmitters[10].
Comparison: A strong alkaloid presence was observed in Aparajita, Oregano, Thyme, and Rosemary (+++), while Ashwagandha showed a weaker presence (+). This suggests that most of these herbs may contribute to mental clarity and stress management, but Ashwagandha might rely on other compounds for its therapeutic effects.

2. Flavonoids (Alkaline Reagent Test)

Significance: Flavonoids are potent antioxidants that help protect cells from oxidative damage, support cardiovascular health, and exhibit anti-inflammatory effects[1]. They also contribute to immune modulation and neuroprotection[11].
Comparison: Aparajita showed the highest flavonoid content (+++), while Oregano, Thyme, Ashwagandha, and Rosemary had a lower presence (+). This indicates that Aparajita is the richest source of antioxidants among these herbs.

3. Tannins (Ferric Chloride Test)

Significance: Tannins are beneficial for gut health due to their antimicrobial and astringent properties. They also contribute to wound healing and anti-inflammatory responses[1]. Tannins have been shown to inhibit bacterial growth and support gastrointestinal **function**[6].

Comparison: A strong tannin presence was noted in Aparajita, Oregano, Thyme, and Rosemary (+++), while Ashwagandha showed no presence (-), indicating that the first four herbs may offer more digestive health benefits.

4. Saponins (Froth Test)

Significance: Saponins are known for their immune-boosting, cholesterol-lowering, and anti-inflammatory properties[4]. They have been reported to modulate immune response, support heart health, and exhibit antimicrobial properties[16].
Comparison: Oregano (+++), Thyme (++), and Rosemary

(+++) contained significant saponins, while Aparajita and Ashwagandha tested negative (-). This suggests that Oregano and Rosemary may contribute more to immune modulation and cardiovascular health.

5. Phenols (Ferric Chloride Test)

Significance: Phenolic compounds exhibit strong antioxidant activity, helping to neutralize free radicals and reduce oxidative stress. They play a role in the prevention of chronic diseases, including neurodegenerative disorders and cardiovascular diseases[1]. Phenols also possess anti-inflammatory and antimicrobial properties, making them beneficial in various medicinal applications[1].

Comparison: Aparajita, Oregano, Thyme, and Rosemary (+++) showed significant phenol content, whereas Ashwagandha tested negative (-), suggesting it has a lower antioxidant capacity compared to the others.

6. Terpenoids (Salkowski Test)

Significance: Terpenoids contribute to anti-inflammatory, antimicrobial, and anticancer activities. They are known to modulate the immune response, inhibit microbial growth, and even induce apoptosis in cancer cells. In addition, terpenoids are responsible for the characteristic aroma of many medicinal herbs and play a role in plant defense mechanisms[10].

Comparison: Ashwagandha (+++) had the highest terpenoid presence, while Oregano and Thyme showed mild levels (+)**.** Aparajita and Rosemary lacked terpenoids (-), suggesting Ashwagandha has a unique role in anti-inflammatory action.

7. Glycosides (Keller-Killiani Test)

Significance: Glycosides, particularly cardiac glycosides, are important for heart function regulation. They influence heart rate and contractility, making them valuable in the treatment of cardiovascular conditions[4]. These compounds are also known for their antioxidant and antimicrobial properties, supporting overall cardioprotective benefits.

Comparison: Only Thyme (+) tested positive for glycosides, while all other herbs were negative (-). This suggests that Thyme may provide cardiovascular benefits that are absent in the other herbs.

8. Carbohydrates (Benedict's Test)

Significance: Carbohydrates are an essential energy source for metabolism. In medicinal plants, they contribute to cellular function, metabolic pathways, and bioavailability of active compounds[6]. Some complex carbohydrates also enhance immune function and digestive health by serving as prebiotics[1].

Comparison: Aparajita (+++) and Thyme (+++) contained high carbohydrate levels, while Oregano, Ashwagandha, and Rosemary tested negative (-)**.** This suggests that Aparajita and Thyme may provide additional metabolic support compared to the other herbs.

9. Proteins (Biuret Test)

Significance: Proteins play a crucial role in cellular function, enzyme activity, and metabolic processes. They are essential for tissue repair, immune function, and enzymatic reactions that regulate various biochemical pathways[1]. Some plant-derived proteins also exhibit antimicrobial and antioxidant properties, contributing to their therapeutic potential[1].

Comparison: Aparajita, Oregano, Thyme, and Rosemary showed a mild presence of proteins (+)**,** while Ashwagandha tested negative (-)**.**

10. Anthraquinones (Ammonia Test)

Significance: Anthraquinones are known for their laxative, antimicrobial, and anti-inflammatory properties. They function as natural gastrointestinal stimulants, promoting bowel movement and digestive health[4]. In addition, anthraquinones have been reported to exhibit antibacterial and antifungal effects, making them useful in traditional medicine[1].

Comparison: Aparajita (++) tested positive, while the other herbs were negative (-), indicating its unique potential for digestive health.

11. Volatile Oils (Spot Test)

Significance: Volatile oils, also known as essential oils, are responsible for **the** characteristic aroma and antimicrobial properties of many medicinal plants. These oils contain bioactive terpenes and phenolic compounds, which contribute to antibacterial, antifungal, and anti-inflammatory effects[9]. Certain essential oils have also been studied for their potential therapeutic effects in respiratory and immune health[11].

Comparison: Oregano (+++), Thyme (++), and Rosemary (+++) showed a high presence of volatile oils, while Aparajita and Ashwagandha tested negative (-)**.** This suggests that Oregano and Rosemary are particularly valuable for antimicrobial applications.

12. Reducing Sugars (Fehling's Test)

Significance: Reducing sugars play an essential role in plant metabolism, energy storage, and cellular respiration. They serve as a primary energy source and contribute to the synthesis of secondary metabolites[1]. Some reducing sugars also function as precursors for bioactive compounds that support immune and metabolic functions[6].

Comparison: Only Thyme (+) tested positive, suggesting it contains a different sugar profile compared to the other herbs.

13. Cardiac Glycosides (Keller-Killiani Test)

Significance: Cardiac glycosides are plant-derived compounds known for their role in regulating heart rate and contraction strength. They are widely used in treating cardiovascular conditions such as heart failure and arrhythmias[4]. These compounds work by inhibiting the

sodium-potassium ATPase pump, leading to increased intracellular calcium levels and improved cardiac contractility[17].

Comparison: Thyme (+) tested positive for cardiac glycosides, while the other herbs were negative (-), suggesting Thyme may provide cardiovascular benefits.

14. Lignins (Labat Test)

Significance: Lignins are complex polyphenolic compounds that provide structural support to plant cell walls. Beyond their structural role, lignins exhibit antimicrobial properties by inhibiting the growth of various pathogens, making them valuable in plant defense mechanisms and potential pharmaceutical applications[1]. Some studies suggest that lignins also possess antioxidant and anti-inflammatory properties, contributing to their biological relevance[1].

Comparison: Oregano (+) and Thyme (+) tested positive for lignins, while the other herbs were negative (-). This suggests that Oregano and Thyme may have additional antimicrobial benefits.

15. Quinones (NaOH Test)

Significance: Quinones are bioactive compounds recognized for their potent antimicrobial and anticancer properties. They exert their effects by producing reactive oxygen species (ROS) that disrupt bacterial and cancer cell metabolism[6]. Quinones are also studied for their antiviral and antifungal properties, making them valuable in alternative medicine[1].

Comparison: Oregano (+++) had the highest quinone content, while Aparajita, Thyme, and Rosemary exhibited a mild presence (+). This suggests that Oregano may have stronger antimicrobial activity compared to the other herbs.

16. Carotenoids (UV Test)

Significance: Carotenoids are natural pigments that serve as powerful antioxidants, protecting cells from oxidative stress and free radical damage. They play a crucial role in vision health, immune function, and skin protection[10]. Additionally, carotenoids contribute to anti-inflammatory and neuroprotective effects, making them significant for long-term health.

Comparison: Aparajita (+++) was the only herb that tested positive for carotenoids, highlighting its potential benefits for eye health, immune support, and antioxidant defense.

17. Phlobatannins (HCl Test)

Significance: Phlobatannins are a subclass of tannins that exhibit strong antioxidant and antimicrobial properties. These compounds are known to scavenge free radicals, reducing oxidative stress and supporting anti-inflammatory functions[1]. Additionally, phlobatannins contribute to plant defense mechanisms by inhibiting bacterial and fungal growth[1].

Comparison: Aparajita (+++) and Thyme (+) tested positive, while the other herbs were negative (-). This indicates that Aparajita has the highest potential for antioxidant and antimicrobial benefits among these herbs.

18. Resins (Turbidity Test)

Significance: Resins are bioactive plant exudates that possess wound-healing, antimicrobial, and anti-inflammatory properties. They are commonly used in traditional medicine for treating infections, ulcers, and skin conditions[6]. Resins also exhibit antioxidant effects, supporting their role in immune function and tissue repair[4].

Comparison: Oregano (+++), Thyme (++), Ashwagandha (++), and Rosemary (++) tested positive, while Aparajita was negative (-)**.** This suggests that Oregano has the highest resin content, making it valuable for wound healing and antimicrobial applications.

19. Coumarins (UV Light Test)

Significance: Coumarins are plant-derived secondary metabolites that possess anticoagulant, antimicrobial, and anti-inflammatory properties. They have been widely studied for their blood-thinning effects, making them useful in circulatory health and cardiovascular disease prevention. Additionally, coumarins show antibacterial and antifungal activity, contributing to their role in natural medicine[1].

Comparison: Rosemary (+++), Oregano (++), Thyme (++), and Ashwagandha (++) tested positive, indicating that these herbs may support circulatory health and immune function.

20. Chalcones ($FeCl_3$ Test)

Significance: Chalcones are polyphenolic compounds that exhibit potent antioxidant, anti-inflammatory, and antimicrobial effects. They are considered precursors to flavonoids, contributing to their strong free radical scavenging abilities[1]. Research has shown that chalcones also play a role in inhibiting bacterial growth and modulating inflammatory responses[10].

Comparison: All herbs except Ashwagandha tested positive (+++), emphasizing their strong antioxidant and antimicrobial properties.

21. Polyphenols (NaOH Test)

Significance: Polyphenols are bioactive compounds known for their strong antioxidant, neuroprotective, and anti-inflammatory effects. They play a crucial role in neutralizing free radicals, reducing oxidative stress, and supporting cognitive function[1]. Polyphenols have also been associated with cardiovascular benefits and immune modulation[1].

Comparison: Aparajita (+++), Oregano (++), Thyme (++), and Rosemary (++) showed polyphenol presence, while Ashwagandha tested negative **(-)**, suggesting it may rely on other bioactive compounds for its therapeutic effects.

22. Diterpenes (Salkowski Test)

Significance: Diterpenes are phytochemicals with antimicrobial, anti-inflammatory, and anticancer properties. They have been widely studied for their role in immune regulation, cell signaling, and inhibition of bacterial

growth[6]. Certain diterpenes have also shown potential in cancer treatment by inducing apoptosis in malignant cells[18].

Comparison: All five herbs contained diterpenes (+++), confirming their broad therapeutic potential. This suggests their possible use in antimicrobial formulations and inflammatory disease management.

23. Leucoanthocyanins (Acid Hydrolysis Test)

Significance: Leucoanthocyanins belong to the flavonoid family and are potent antioxidants that help maintain vascular health by improving capillary strength and reducing oxidative damage[10]. These compounds have also been associated with anti-aging effects and cardiovascular protection[1].

Comparison: Aparajita (+++) and Thyme (++) tested positive, while the other herbs tested negative (-). This suggests that Aparajita may be particularly beneficial for vascular health and oxidative stress management.

24. Xanthoproteins (NaOH Test)

Significance: Xanthoproteins are formed when proteins containing aromatic amino acids (such as tyrosine and tryptophan) undergo nitration, typically during the xanthoproteic reaction[1,3]. They contribute to various metabolic processes and may serve as precursors for enzymatic reactions and protein synthesis. The presence of xanthoproteins suggests potential nutritional and functional protein content in medicinal herbs [3].

Comparison: Aparajita (+++), Oregano (+), and Thyme (-) showed varying levels, indicating differences in protein composition and potential bioavailability among the tested herbs.

CONCLUSION

The qualitative phytochemical analysis of Aparajita, Oregano, Thyme, Ashwagandha, and Rosemary highlights their diverse bioactive compounds, each contributing to different health benefits. Aparajita exhibited a strong presence of flavonoids, tannins, phenols, carotenoids, and chalcones, indicating its potential as a powerful antioxidant and neuroprotective agent. Oregano and Rosemary were rich in volatile oils, saponins, and phenols, suggesting strong antimicrobial and anti-inflammatory properties. Thyme contained cardiac glycosides, carbohydrates, and lignins, which may support cardiovascular and metabolic health. Ashwagandha showed a high concentration of terpenoids, reinforcing its adaptogenic and anti-inflammatory properties.

These findings emphasize the therapeutic potential of these herbs in promoting gut health, immune function, mental well-being, and inflammation management. The results serve as a basis for further quantitative studies and biological activity assessments to explore their applications in herbal medicine and functional food formulations.

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