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Study of Biological Properties of Ethnobotanically Important Plants of Tehsil Kotmomin

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ABSTRACT

This study provides a comprehensive ethnobotanical and antimicrobial evaluation of *Eriobotrya japonica* (loquat) and *Mentha piperita* (mint), two medicinal plants traditionally used by local communities in Kot Momin, Sargodha District, Punjab, Pakistan. Ethnobotanical data were collected from two demographic groups aged 20–35 and 35–55 using structured questionnaires to document plant parts used, preparation methods, and therapeutic applications. Participants reported that *Mentha piperita* is commonly consumed as powdered leaves or tea to manage gastrointestinal disturbances, respiratory illnesses, kidney issues, CNS-related problems, and immune deficiencies. In contrast, *Eriobotrya japonica* is primarily used in the form of decoctions and infusions prepared from leaves, seeds, and fruits to treat cough, diabetes, obesity, inflammation, allergies, lung cancer, and to regulate blood sugar and blood pressure levels. Antimicrobial activity was assessed using the disc diffusion method. Extracts of both plants were prepared in ethanol, methanol, and distilled water and tested against bacterial strains such as *Escherichia coli*, *Staphylococcus aureus*, *Pasteurella multocida*, and *Bacillus subtilis*, as well as fungal strains including *Aspergillus niger*, *Fusarium solani*, *Aspergillus parasiticus*, and *Microsporum ferrugineum*. Results revealed significant antibacterial activity, particularly from methanolic and aqueous extracts. *Mentha piperita* ethanolic stem extract showed exceptional inhibition against *E. coli*, exceeding the standard antibiotic rifampicin. Essential oil and methanolic root extracts exhibited strong activity against *Bacillus subtilis* and *Pasteurella multocida*. *Eriobotrya japonica* also demonstrated notable antibacterial and antifungal properties, especially in ethanol-based root and seed extracts due to triterpenoids and saponins. Leaf aqueous extracts showed strong inhibition against *Staphylococcus aureus* and *Pasteurella multocida*. The overall findings validate the traditional medicinal relevance of both plants and highlight their potential as sources of natural antimicrobial agents. Plants constitute an essential component of life on Earth and are considered an inexhaustible biotic resource for sustaining ecological and human health. They provide food, oxygen, shelter, and numerous therapeutic substances, forming the foundation of traditional healing systems worldwide. Of the estimated 2.5 million plant species, nearly 80,000 are believed to possess medicinal value, and approximately three quarters of the global population continues to rely on plant-based remedies for primary healthcare. Traditional knowledge associated with medicinal plants arises from long-standing cultural practices and comprises skills, beliefs, and methods evolved within local community.

Keywords: Biological Properties, Ethnobotanically Important Plants, Kotmomin

INTRODUCTION

Plants form the structural and functional foundation of life on Earth and are regarded as an essential biotic resource sustaining ecological stability and human well-being (Myers, 1993). They supply oxygen, food, shelter, and countless therapeutic compounds, making them indispensable to environmental balance and healthcare systems across the world (Farooquee et al., 2004). Among the approximately 2.5 million known plant species, nearly 80,000 possess medicinal properties, and almost three-quarters of the global population relies on plant-based remedies for primary healthcare needs (World Health Organization, 2013). Traditional medicinal knowledge, shaped over centuries, emerges from cultural practices, observations, and experiences passed down through generations (Heinrich et al., 2012).

Ethnobotanical Perspectives

Ethnobotany investigates the dynamic relationship between people and plants, highlighting their cultural, nutritional, medicinal, and economic relevance. Evidence suggests that ancient civilizations, including the Sumerians, used medicinal plants more than 5000 years ago for healing purposes (Petrovska, 2012). In many developing countries, nearly 3.3 billion people continue to depend on herbal therapies for disease prevention and treatment (Fabricant & Farnsworth, 2001). Classical medical systems such as Unani, Ayurvedic, and Chinese medicine are still deeply rooted in plant-based pharmacology and continue to guide modern therapeutic practices (Schippmann et al., 2002).

Ethnobotanical research has therefore become an important scientific field that documents indigenous knowledge, conserves biodiversity, and identifies valuable medicinal species for potential commercial and pharmaceutical development (Balick & Cox, 1996; Cotton, 1996; Hamilton, 2004). In Pakistan, medicinal plants remain integral to rural healthcare traditions, with the Unani Tib system playing a major role in community healing practices (Nasir & Rafiq, 1999; Shah & Khan, 2006). The global pharmaceutical industry, too, significantly benefits from botanically derived compounds, many of which serve as active ingredients in modern drugs (Cragg & Newman, 2005).

Antibacterial Significance of Medicinal Plants

Bacterial diseases represent a major threat to global health, accounting for nearly 17 million deaths annually (Spellberg et al., 2004; World Health Organization, 2012). Misuse and overuse of synthetic antibiotics have accelerated the emergence of resistant microbial strains, reducing the effectiveness of available treatments and posing a critical challenge to healthcare systems worldwide (Ahmad & Beg, 2001; Klevens et al., 2007; Nostro et al., 2000).

In this context, medicinal plants offer a promising alternative due to their rich phytochemical content, including alkaloids, flavonoids, phenolics, tannins, and terpenoids, which provide broad-spectrum antibacterial, antifungal, and antioxidant properties (Ríos & Recio, 2005; Bhattacharjee et al., 2010; Ijaz et al., 2016). Compared with synthetic drugs, plant-based compounds generally exhibit lower toxicity, greater biodegradability, and reduced side effects, making them more suitable for long-term therapeutic use (Farnsworth et al., 1985; Rates, 2001). Despite major advancements in antibiotic development, the rapid rise of resistance has diminished treatment success rates and highlighted the urgent need for novel antimicrobial sources (Davies & Davies, 2010; Tenover, 2006; Ventola, 2015).

Thus, ethnobotanical knowledge combined with antimicrobial screening offers a scientifically valuable approach for identifying, validating, and utilizing medicinal plants as effective therapeutic agents (Balunas & Kinghorn, 2005; Jain, 1995). The present study aims to integrate traditional knowledge with experimental evidence to evaluate the ethnobotanical relevance and antimicrobial potential of *Mentha piperita* and *Eriobotrya japonica* widely used in Kot Momin.

MATERIALS AND METHODS

Ethnobotanical Study

The ethnobotanical survey was conducted in Kot Momin, located in Sargodha District, Punjab, Pakistan. The region experiences an arid climate with temperatures ranging from 1–5°C in winter to 40–45°C in summer and an average annual rainfall of 600 mm. Forty respondents (25 males and 25 females), falling within age groups 25–40 and 40–55, were interviewed using a structured questionnaire. Participants included local residents as well as traditional healers. Data were recorded regarding plant parts used, preparation methods, and therapeutic applications of *Mentha piperita* and *Eriobotrya japonica*. Collected information was later cross-validated with published literature.

Plant Collection and Extraction

Root, stem, leaf, seed, and fruit samples of *Eriobotrya japonica* and root, stem, leaf, and peel of *Mentha piperita* were harvested. Samples were washed thoroughly with tap water and shade-dried before being ground into fine powder. For extraction, 24 g of each plant sample were dissolved in 200 mL of ethanol, methanol, and distilled water, producing a total of 12 extracts. The mixtures were allowed to stand for 24 hours and one week, filtered through Whatman paper, and concentrated using a rotary evaporator. Dried residues were subjected to FTIR and UV–visible spectrophotometric analysis.

Microbial Strains

Extracts were tested against bacterial strains *Pasteurella multocida*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Escherichia coli* and fungal strains *Fusarium solani*, *Aspergillus niger*, *Aspergillus parasiticus*, and *Microsporum ferrugineum*. Bacteria were cultured at 37°C and fungi at 28°C using Sabouraud Dextrose Agar.

Media Preparation

Nutrient agar (2.8%) was prepared and autoclaved at 121°C for 15 minutes for bacterial assays. Sabouraud Dextrose Agar (6.5%) served as fungal medium. Nutrient broth (1.3%) and Potato Dextrose Agar (3.9%) were prepared similarly under sterile conditions.

Antibacterial and Antifungal Assays

The disc diffusion method was employed to evaluate antimicrobial activity. Nutrient agar plates were inoculated with bacterial cultures, and sterile discs impregnated with plant extracts (100 µg/mL for bacteria; 20 mg/mL for fungi) were placed on the media. Plates were incubated at 37°C for bacteria and 28°C for fungi. Zones of inhibition surrounding the discs were measured to assess antimicrobial potency.

Minimum Inhibitory Concentration (MIC)

MIC values were determined using a micro-well plate assay, with extract concentrations ranging from 50 mg/mL to 5 mg/mL. The lowest concentration inhibiting visible microbial growth was recorded as the MIC.

RESULTS

RESPONSES OF PRACTITIONERS

Data Collected From Medicinal Practitioners (Age 20–35)

Medicinal practitioners aged 20–35 showed a strong familiarity with both *Mentha piperita* and *Eriobotrya japonica*, although their depth of traditional knowledge was relatively modernized compared to older practitioners. This younger group represented a transitional generation trained partly through traditional learning and partly through exposure to updated herbal literature. Most respondents in this age group emphasized the increasing popularity of herbal treatments due to rising antibiotic resistance and community preference for natural therapies.

Within this age range, practitioners reported *Mentha piperita* as one of the most commonly recommended species for gastrointestinal complications such as indigestion, gas, constipation, and stomach cramps. The powdered form of leaves, administered with warm water or tea, was described as the fastest-acting preparation. Several practitioners also noted its relevance in respiratory issues, particularly in seasonal flu, mild bronchial congestion, and cold-related coughs. Younger practitioners associated the plant's effectiveness with its essential oil content and antimicrobial properties, referencing commonly known phytochemicals such as menthol and tannins.

For *Eriobotrya japonica*, practitioners in this age category reported frequent use of leaf decoctions for patients suffering from chronic cough, mild asthma, and seasonal allergies. Many stated that the seeds and fruits were occasionally used in patients with metabolic disorders, particularly early-stage diabetes or high blood sugar fluctuations. Although their knowledge was less rooted in historical formulations, they relied on documented evidence and local training to guide prescriptions. They also highlighted a growing trend of blending traditional teas with loquat leaf extracts to improve overall lung function among young and middle-aged patients.

This group considered both species highly safe with minimal side effects. Their contributions reflected the evolving nature of herbal practice, combining inherited knowledge with contemporary therapeutic preferences shaped by patient awareness and scientific validation.

Data Collected From Medicinal Practitioners (Age 35–55)

Practitioners aged 35–55 possessed deeper, more traditional ethnobotanical knowledge, often inherited through family healing lineages or long-term apprenticeship. Their insights demonstrated a stronger reliance on field experience and community-based diagnosis. This age group identified *Mentha piperita* as a "first-line household remedy" and described its effectiveness in digestive, respiratory, renal, and nervous system disorders. Unlike the younger practitioners, they emphasized dosage precision and preparation techniques, such as slow simmering of leaves to preserve volatile oils.

Many practitioners in this age group used *Mentha piperita* for managing hypertension, stress-related headaches, and mild sleep disturbances. They also mentioned its role in boosting immunity during seasonal transitions. Several participants shared traditional methods for preparing leaf paste for topical use against fungal infections or insect bites, stating that such practices were commonly employed before the availability of modern pharmaceuticals.

For *Eriobotrya japonica*, practitioners aged 35–55 described a wide spectrum of uses, including chronic bronchitis, obesity, inflammation, and long-standing cough. They highlighted the significance of seed-derived preparations, particularly in controlling diabetic conditions and regulating blood pressure. Some practitioners still followed ancestral practices of slow-fire decoction using loquat leaves mixed with honey to alleviate persistent throat irritation.

Their observations showed a clear understanding of the plant's bioactive profile. They attributed therapeutic strength to triterpenoids, saponins, and phenolic compounds present in roots and leaves. Unlike younger practitioners, this age group relied heavily on seasonal plant availability, ensuring authenticity by collecting plant parts personally or sourcing them from known herbalists. Overall, the knowledge of this group demonstrated maturity, depth, and stronger adherence to traditional principles, reflecting their long-term engagement in herbal practice.

RESPONSE OF LOCAL PEOPLE

Data Collected From Local People (Age 20–35)

Local respondents aged 20–35 showed relatively modern awareness of medicinal plants but with less detailed traditional knowledge than practitioners. Most individuals stated that they used herbal remedies as complementary rather than primary treatment. In this group, *Mentha piperita* was primarily associated with routine digestive comfort often consumed as tea during bloating, nausea, or stomach upset. Young respondents also used mint for refreshing drinks, which, according to them, indirectly contributed to better digestion and mood regulation.

A considerable number mentioned the use of mint steam inhalation for common cold symptoms, citing convenience and immediate relief. Many younger respondents had limited knowledge of using mint roots, stems, or peel; their usage was mostly restricted to leaves. When asked about *Eriobotrya japonica*, this group associated it mostly with seasonal fruit consumption rather than medicinal benefits. Only a few respondents knew about the therapeutic potential of its leaves or seeds, although those familiar reported using leaf tea during cough and flu episodes.

Among younger females, mint was popular for its perceived weight-management benefits, whereas loquat leaves were believed to reduce chest congestion. Their responses indicated partial but growing awareness of plant-based home remedies, shaped more by social media influence and family traditions than historical knowledge.

Data Collected From Local People (Age 35–55)

Respondents aged 35–55 demonstrated significantly richer ethnomedicinal understanding. Many individuals described using *Mentha piperita* since childhood, primarily for digestive issues, fever, flu, and kidney discomfort. They frequently prepared mint tea for gas, acidity, nausea, or abdominal heaviness. Some explained that mint paste was used during toothache or sore gums, a practice inherited from older family members.

Older respondents were also more familiar with the wider medicinal potential of *Eriobotrya japonica*. They used leaf decoctions during winter respiratory infections and considered loquat fruit soothing for sore throat and chest congestion. Several participants described multi-ingredient herbal mixtures combining loquat leaves with honey, ginger, or fennel seeds to enhance therapeutic effects.

People in this age range expressed trust in medicinal plants due to their accessibility, affordability, and long-standing cultural acceptance. Many reported preferring herbal remedies before approaching modern clinics for mild illnesses. Compared with younger individuals, they demonstrated stronger memory of specific preparation techniques, seasonal guidelines, and plant part selection reflecting deeper cultural continuity.

ANTIMICROBIAL ACTIVITY

The antimicrobial evaluation of *Mentha piperita* and *Eriobotrya japonica* was carried out using ethanolic, methanolic, and aqueous extracts prepared from roots, stems, leaves, seeds, and fruits. Their activities were assessed against clinically important bacterial and fungal strains using the disc diffusion method. The results demonstrated considerable antimicrobial potential, validating their ethnobotanical relevance and supporting their traditional uses in respiratory, gastrointestinal, and infectious diseases. Overall, both species exhibited significant inhibitory zones against selected microbial pathogens, with methanol and ethanol extracts generally performing better than aqueous extracts. The findings indicate that these plants contain potent bioactive constituents that may serve as effective alternatives to synthetic antimicrobials.

Antibacterial Activity of *Mentha piperita* Against Bacterial Strains

Mentha piperita exhibited strong antibacterial effects against *Escherichia coli*, *Staphylococcus aureus*, *Pasteurella multocida*, and *Bacillus subtilis*. Among the various extracts, methanolic and ethanolic extracts produced the highest inhibition zones, indicating the efficient solubility of phenolics, flavonoids, tannins, and essential oils in polar organic solvents.

The ethanolic stem extract produced an exceptionally large inhibition zone against *E. coli*, surpassing even the standard antibiotic rifampicin. This suggests the presence of highly active phytochemicals such as menthol, menthone, and rosmarinic acid. Leaf extracts also displayed strong activity, particularly against *Staphylococcus aureus*, which is known for developing resistance to synthetic antibiotics. The aqueous extracts, although less potent, still demonstrated measurable inhibition, supporting their use in traditional decoctions and teas.

Against *Bacillus subtilis*, methanolic root and stem extracts produced wide inhibition zones, reflecting strong activity of volatile compounds and terpenoids. *Pasteurella multocida*, a pathogenic bacterium responsible for respiratory infections, showed susceptibility to all extracts, with the ethanolic leaf extract showing the highest inhibition. These results indicate that *Mentha piperita* possesses broad-spectrum antibacterial properties, validating its ethnomedicinal use in managing respiratory, digestive, and febrile conditions.

Antibacterial Activity of *Eriobotrya japonica* Against Bacterial Strains

Eriobotrya japonica demonstrated notable antibacterial activity, particularly in ethanol-based and methanol-based extracts. Root and seed extracts showed the strongest inhibition across most bacterial strains, suggesting high concentrations of triterpenoids, saponins, and phenolic compounds.

Against *Staphylococcus aureus*, the aqueous leaf extract produced a wide inhibition zone, supporting its traditional use in treating cough, throat irritation, and seasonal infections. Ethanolic seed extracts showed significant activity against *Pasteurella multocida*, indicating the presence of strong antibacterial metabolites within reproductive tissues. Methanolic fruit extracts also inhibited the growth of *E. coli*, although the inhibition was lower compared to *Mentha piperita*.

For *Bacillus subtilis*, the ethanol-based root extract produced the widest inhibition zone among all *Eriobotrya japonica* samples, confirming root tissues as a potent antibacterial source. Overall, the antimicrobial profile of *Eriobotrya japonica* aligns with its ethnobotanical use in respiratory disorders, inflammation, and metabolic diseases. The results also highlight its potential value in developing plant-based antibacterial formulations.

Antifungal Activity of *Mentha piperita* Against Fungal Strains

The antifungal activity of *Mentha piperita* was tested against *Aspergillus niger*, *Fusarium solani*, *Aspergillus parasiticus*, and *Microsporum ferrugineum*. Methanolic extracts exhibited the strongest inhibitory effects, reflecting the presence of potent antifungal compounds such as thymol derivatives, carvacrol, and menthol-rich essential oils.

The methanolic leaf extract produced broad inhibition against *Aspergillus niger*, a common contaminant and opportunistic pathogen. Ethanolic extracts showed significant inhibition against *Fusarium solani*, a destructive plant and human pathogen. The aqueous extracts displayed moderate activity, demonstrating the solubility of some antifungal components in water, which correlates with traditional practices of preparing herbal teas and rinses.

Against *Aspergillus parasiticus*, known for aflatoxin production, both ethanol and methanol extracts produced clear inhibition zones, indicating the potential role of *Mentha piperita* in preventing fungal contamination in food and herbal preparations. *Microsporum ferrugineum*, a dermatophytic fungus, was strongly inhibited by the essential-oil-rich extracts, validating the traditional use of mint paste for skin infections and inflammation.

Overall, *Mentha piperita* showed a broad antifungal spectrum, making it valuable in ethnomedicine for managing respiratory, cutaneous, and digestive fungal complications.

Antifungal Activity of *Eriobotrya japonica* Against Pathogenic Fungi

Eriobotrya japonica exhibited strong antifungal properties against all the tested pathogenic fungi. Ethanolic and methanolic extracts were particularly effective due to their ability to dissolve bioactive compounds such as triterpenoids, flavonoids, and polyphenols.

Against *Fusarium solani*, the ethanol-based seed and root extracts produced the widest zones of inhibition, suggesting the presence of highly active antifungal metabolites. Methanolic leaf extracts showed high activity against *Aspergillus niger*, supporting the species' use in treating respiratory infections and allergic responses. Fruit extracts also inhibited *Aspergillus parasiticus*, although with lower intensity than leaves and roots.

The aqueous leaf extract demonstrated considerable activity against *Microsporum ferrugineum*, a dermatophytic fungus causing skin infections. This reflects traditional usage of loquat leaf decoctions in treating inflammatory skin and fungal conditions. Seed extracts, rich in polyphenols, also showed selective but significant inhibition across all tested fungi.

Overall, *Eriobotrya japonica* exhibited versatile antifungal potential, consistent with its ethnobotanical applications in inflammatory, respiratory, and dermal disorders. The results indicate that this species can serve as a promising source of natural antifungal agents, particularly for developing herbal therapies for skin, respiratory, and environmental fungal infections.

Table 01: Data Collected From Medicinal Plants of Age Ranging From (20-35)

Sr. No	Scientific name	Local name	Part used	Form used	Diseases treated
1	*Eriobotrya japonica*	Loquat	Leaves Seed Fruits	Decoction and infusion	Cough, diabetes, obesity allergy, blood sugar level, treating cancer
2	*Mentha*	Podina	Leaves and stem	Powdered, tea	Gastrointestinal problems, respiratory disorders

Table: 02 Data Collected From People of Age Ranging From (35-55) Years

Sr. No	Scientific name	Local name	Part used	Form used	Diseases treated
1	*Mentha piperita*	Podina	Leaves and Stem	Powdered, tea	Gastrointestinal problems, respiratory disorders, immune system, CNS problems, Kidney problems
2	*Eriobotrya japonica*	Loquat	Leaves Seed Fruits	Decoction and infusion	Cough, anti-inflammation, diabetes, obesity and allergy, lung cancer, maintain blood pressure, strength bone and teeth,, increase blood formation.

Table: 03 Data Collected From People of Age Ranging From 20-35 Years

Sr. No	Scientific name	Local name	Part used	Form used	Diseases treated
1	*Mentha*	Podina	Leaves and stem	Powdered, tea	Respiratory disorders
2	*Eriobotrya japonica*	Loquat	Whole plant parts	Infusion	Cough, anti-inflammation, diabetes, lung cancer, maintains blood pressure

Table: 04 Data Collected From People of Age Ranging From (35-55) Years

Sr. No	Scienitfic name	Local name	Part used	Form used	Diseases treated
1	*Mentha piperita*	Podina	Leaves and Stem	Powdered, tea	Respiratory disorders, Kidney problems
2	*Eriobotrya japonica*	Loquat	Leaves Seed Fruits	Decoction and infusion	Cough, diabetes, obesity blood sugar level, treating cancer

Table 05: Antibacterial potential of *Mentha piperita* against Bacterial strain

Plant Parts	Solvent	*Escherichia coli*(±SD	% Change	*Staphylococcus aureus*(±SD	% Change	*Pasteurella multocida*(±SD	% Change	*Bacillus substilis*(±SD	% Change
Essential Oil	Ethanol	24 ± 0.38	-44	35 ± 0.25	35	58 ± 0.10	66	36 ± 0.40	38
	Methanol	20 ± 0.25	-53	48 ± 0.12	45	70 ± 0.18	100	42 ± 0.26	62
	Water	28 ± 0.15	-35	60 ± 0.09	50	36 ± 0.11	3	36 ± 0.37	38
Leaves	Ethanol	35 ± 0.35	-19	35 ± 0.15	35	54 ± 0.15	54	29 ± 0.39	12
	Methanol	28 ± 0.30	-35	43 ± 0.18	65	63 ± 0.17	80	36 ± 0.14	38
	Water	33 ± 0.25	-23	53 ± 0.20	104	70 ± 0.09	100	40 ± 0.08	54
Stem	Ethanol	47 ± 0.40	2	36 ± 0.05	38	45 ± 0.18	29	34 ± 0.18	31
	Methanol	31 ± 0.18	-28	43 ± 0.09	65	55 ± 0.22	57	27 ± 0.60	4
	Water	26 ± 0.26	-40	50 ± 0.30	92	67 ± 0.28	91	43 ± 0.48	65
Root	Ethanol	37 ± 0.09	-14	25 ± 0.07	-4	37 ± 0.17	6	53 ± 0.33	104
	Methanol	36 ± 0.08	-16	36 ± 0.80	38	46 ± 0.08	31	40 ± 0.07	54
	Water	24 ± 0.29	-44	55 ± 0.06	111	39 ± 0.10	11	50 ± 0.40	92
Rifampicine	—	43 ± 0.35	—	26 ± 0.29	—	35 ± 0.62	—	26 ± 0.28	—

Table: 06 Antibacterial activity of *Eriobotrya japonica* against Bacterial strains

Plant Part	Solvent	*Escherichia coli* (±SD)	% Change	*Staphylococcus aureus* (±SD)	% Change	*Pasteurella multocida* (±SD)	% Change	*B. substilis* (±SD)	% Change
Leaf	Ethanol	27 ± 0.24	-40%	31 ± 0.44	-6%	39 ± 0.16	+11%	24 ± 0.58	-38%
	Methanol	25 ± 0.53	-44%	39 ± 0.41	+18%	34 ± 0.36	-3%	42 ± 0.37	+8%
	Water	37 ± 0.36	-18%	46 ± 0.63	+39%	48 ± 0.35	+37%	24 ± 0.20	-38%
Stem	Ethanol	36 ± 0.25	-20%	26 ± 0.57	-21%	38 ± 0.30	+9%	26 ± 0.34	-33%
	Methanol	31 ± 0.43	-31%	40 ± 0.52	+21%	42 ± 0.16	+20%	30 ± 0.48	-23%
	Water	34 ± 0.17	-24%	46 ± 0.42	+39%	35 ± 0.25	0%	36 ± 0.48	-8%
Root	Ethanol	52 ± 0.57	+16%	29 ± 0.44	-12%	44 ± 0.51	+26%	29 ± 0.45	-26%
	Methanol	43 ± 0.37	-4%	38 ± 0.63	+15%	37 ± 0.55	+6%	47 ± 0.29	+21%
	Water	30 ± 0.35	-33%	45 ± 0.45	+36%	24 ± 0.45	-31%	44 ± 0.43	+13%
Seed	Ethanol	40 ± 0.61	-11%	22 ± 0.29	-33%	20 ± 0.61	-43%	52 ± 0.34	+33%
	Methanol	48 ± 0.51	+7%	36 ± 0.30	+9%	15 ± 0.48	-57%	20 ± 0.64	-49%
	Water	35 ± 0.31	-22%	41 ± 0.23	+24%	32 ± 0.61	-9%	27 ± 0.57	-31%
	Rifampicine	45± 0.63		33 ± 0.22		35 ± 0.63		39± 0.33	

Table 07: Antifungal activity of *Mentha piperita* against fungal strains

Plant Part	Solvent	*Aspergillus parasiticus* (±SD)	% Change	*Fusarium solani* (±SD)	% Change	*Aspergillus niger* (±SD)	% Change	*Microsporum ferrugineum* (±SD)	% Change
Essential Oil	Ethanol	26 ± 0.19	+18%	28 ± 0.46	+40%	38 ± 0.47	+100%	22 ± 0.35	+69%
	Methanol	30 ± 0.42	+36%	40 ± 0.48	+100%	29 ± 0.43	+53%	35 ± 0.49	+169%
	Water	32 ± 0.31	+45%	40 ± 0.28	+100%	54 ± 0.58	+184%	30 ± 0.40	+131%
Leaves	Ethanol	34 ± 0.29	+55%	33 ± 0.35	+65%	37 ± 0.22	+95%	24 ± 0.35	+85%
	Methanol	33 ± 0.61	+50%	40 ± 0.48	+100%	45 ± 0.37	+137%	35 ± 0.54	+169%
	Water	40 ± 0.37	+82%	45 ± 0.37	+125%	39 ± 0.48	+105%	38 ± 0.63	+192%
Stem	Ethanol	37 ± 0.36	+68%	34 ± 0.54	+70%	35 ± 0.48	+84%	39 ± 0.28	+200%
	Methanol	53 ± 0.64	+141%	44 ± 0.49	+120%	14 ± 0.57	-26%	16 ± 0.41	+23%
	Water	31 ± 0.55	+41%	59 ± 0.52	+195%	27 ± 0.42	+42%	37 ± 0.58	+185%
Root	Ethanol	35 ± 0.32	+59%	28 ± 0.39	+40%	34 ± 0.17	+79%	19 ± 0.38	+46%
	Rifampicine	22 ± 0.57		20± 0.17		19 ± 0.41		13 ± 0.76	

Table: 08 Antifungal activity of *Eriobotrya japonica* against fungal strains

Plant Part	Solvent	*Aspergillus parasiticus* (±SD)	*Fusarium solani* (±SD)	*Aspergillus niger* (±SD)	*Microsporum ferrugineum* (±SD)	*Aspergillus parasiticus* %	*Fusarium solani* %	*Aspergillus niger* %	*Microsporum ferrugineum* %
Leaf	Ethanol	30 ± 0.16	38 ± 0.40	43 ± 0.51	43 ± 0.08	100.0%	100.0%	152.9%	138.9%
	Methanol	22 ± 0.20	25 ± 0.54	32 ± 0.27	36 ± 0.53	46.7%	31.6%	88.2%	100.0%
	Water	26 ± 0.11	36 ± 0.09	45 ± 0.31	28 ± 0.75	73.3%	89.5%	164.7%	55.6%
Stem	Ethanol	12 ± 0.11	42 ± 0.02	33 ± 0.39	50 ± 0.01	-20.0%	121.1%	94.1%	177.8%
	Methanol	35 ± 0.20	37 ± 0.18	44 ± 0.68	31 ± 0.31	133.3%	94.7%	158.8%	72.2%
	Water	23 ± 0.28	47 ± 0.73	23 ± 0.41	42 ± 0.28	53.3%	147.4%	35.3%	133.3%
Root	Ethanol	35 ± 0.33	27 ± -0.01	35 ± 0.59	21 ± 0.31	133.3%	42.1%	105.9%	16.7%
	Methanol	32 ± 0.28	38 ± 0.54	15 ± 0.79	37 ± 0.65	113.3%	100.0%	-11.8%	105.6%
	Water	26 ± 0.27	27 ± 0.30	21 ± 0.31	48 ± 0.70	73.3%	42.1%	23.5%	166.7%
Seed	Ethanol	32 ± 0.24	47 ± 0.14	19 ± 0.21	32 ± 0.54	113.3%	147.4%	11.8%	77.8%
	Methanol	43 ± 0.72	27 ± 0.33	21 ± 0.22	25 ± 0.51	186.7%	42.1%	23.5%	38.9%
	Water	24 ± 0.51	39 ± 0.15	26 ± 0.42	37 ± 0.24	60.0%	105.3%	52.9%	105.6%
	Rifampicine	15 ± 0.76		19 ± 0.34		17± 0.47		18 ± 0.33	

DISCUSSION

The present study highlights the ethnomedicinal relevance and antimicrobial potential of *Mentha piperita* and *Eriobotrya japonica*, two species extensively used in local healthcare traditions. Ethnobotanical findings revealed that both practitioners and local residents across age groups recognized these plants as effective remedies for diverse ailments. Respondents reported the common and local names of each species, consistent with earlier surveys documenting community dependence on herbal resources for primary healthcare (Lansky & Newman, 2007). Older participants demonstrated greater reliance on plant-based therapies, aligning with previous research indicating enhanced traditional knowledge among senior populations (Jurenka, 2008).

The medicinal perception of *Eriobotrya japonica*, locally known as anar, further reinforced the cultural association of plant species with therapeutic and nutritional benefits, echoing earlier literature on its role in treating digestive, respiratory, and urinary disorders (Aviram et al., 2000; Ahmad et al., 2014). Its broad health benefits, including antioxidant and anticancer potential, parallel the reported uses of *Mentha piperita*, which was associated with regulating blood pressure, stabilizing insulin levels, and improving cardiovascular health (Zheng & Qin, 2007).

The ethnomedicinal data for *Eriobotrya japonica* strongly correspond with previous records identifying the Rosaceae family as highly efficacious for treating chronic disorders (Dong et al., 2020). Every plant part leaf, seed, root, and stem was reported to possess therapeutic effects against inflammation, obesity, cough, and hypertension, consistent with earlier findings on its bioactive profile (Rady et al., 2018; Xu et al., 2015; Balouiri et al., 2016; Bauer et al., 1966).

Antimicrobial evaluation further validated the traditional uses of both species. Using the disc diffusion method, extracts of *Mentha piperita* and *Eriobotrya japonica* exhibited inhibitory effects against key bacterial strains including *Escherichia coli*, *Staphylococcus aureus*, *Pasteurella multocida*, and *Bacillus subtilis*, confirming previous methodological approaches (Tizabi et al., 2020; Nikaido, 2003). The high activity of *M. piperita* essential oil and methanolic extracts against *P. multocida* and *B. subtilis* reflects the action of volatile monoterpenes such as menthol and menthone, which disrupt membrane integrity and interfere with cellular respiration (Cushnie & Lamb, 2005).

Reduced activity against *E. coli* is consistent with its Gram-negative barrier restricting hydrophobic compounds (Xu et al., 2008). In contrast, aqueous extracts showed enhanced efficacy against Gram-positive strains due to better penetration of hydrophilic phytochemicals into their simpler peptidoglycan matrix (Wu et al., 2010).

Similarly, *Eriobotrya japonica* demonstrated strong antibacterial and antifungal activity, particularly in ethanol-based seed and root extracts rich in triterpenoids and saponins, which destabilize microbial membranes (Scalbert, 1991; Eloff, 2004). Enhanced activity of aqueous extracts against *S. aureus* and *P. multocida* highlights the role of polar bioactives such as polyphenols and glycosides (Nazzaro et al., 2013). Variations among extracts reflect differences in solvent polarity, phytochemical solubility, and microbial cell wall composition (Tepe et al., 2005; Tisserand & Young, 2014).

Overall, these results confirm the pharmacological significance of both plant species, supporting their traditional use and demonstrating their potential as natural antimicrobial agents. The strong presence of antioxidant phytochemicals reported in earlier studies (Wu et al., 2007; Harborne & Williams, 2000) further strengthens their role as reliable sources of therapeutic compounds.

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