

REVIEW ARTICLE

Bioactive Compounds in some Medicinal Plants from Different Habitats in KSA

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ABSTRACT

Aim: Ethnobotanical and phytochemical studies are beneficial to discover new drugs and exploited as a treatment. The aim of this review is to summarize and document the existing and recent knowledge of ethnomedicine in Kingdom of Saudi Arabia.

Methods: For detection of active biological compounds, Phytochemical screening is an important step in traditionally used medicinal plants. Some bioactive chemicals obtained from traditional plants have shown to be capable of reversing antimicrobial resistance and improving antibiotic synergy.

Results: Secondary metabolites such as glycosides, terpenoids, tannins, alkaloids, and volatile oil, are responsible for the medicinal characteristics of plants, and their extracts represent a rich reserve of crude pharmaceuticals with therapeutic properties. This study could aid in the development of methods for the long-term usage of medicinal plants, which are among the Kingdom's most endangered natural resources in folk medicine. These plants were found to have therapeutic potential in the treatment of a wide range of ailments, including bone fractures, respiratory tract infections, diseases of skin, rheumatism, asthma, diabetes, fever, constipation, eye and ear problems, colds, measles, bladder and urinary diseases, liver and spleen disorders anemia, epilepsy, typhoid, toothache, hypertension, carcinoma, tuberculosis, stomach problems, and nervous problems.

Conclusion: This work provided a solid foundation for future pharmacological research on these plants' extracts.

Keywords: Ethnomedicine, bioactive constituents, anti-oxidants, antibacterial activities, therapeutic properties

INTRODUCTION

Plants considered as crucial constituent due to its active medicinal ingredient to treat diseases. The treatment of cold, cough, parasitic infection and inflammation have been done by indigenous plants from a long time. Plants comprises of bioactive constituents such as phytochemicals compounds which offer plenty of health benefits for human well-being. Alkaloids, polyphenols, terpenes are several biological substrates of the phytochemical, which exhibit medicinal properties such as alkaloids reported as beneficial, constitute anti-asthmatic and anti-cancer. In genetic engineering, the advancement has enabled scientists to develop a variety of chemicals utilized in medicine production, while tissue culture has aided advancements by promulgating and cultivating medicinal plants and a variety of desirable bioactive compounds¹.

In ancient times, Islamic medication and traditional Arab medicines is recognized as famous healing system that are cheaper than synthetic drugs. These fundamental folk medicines used multidomain dietary knowledge, practices, herbal medication, spiritual therapies, applied and manual techniques that are applicable in singular or combination to prevent sickness and treatment of ailments. The kingdom of Saudi Arabia has rich flora diversity reserves of medicinal value in which some are endemic in nature ranges from ecosystem of mountain, desert and semidesert. It also includes several elements from the terrestrial domains of Afrotropical, Indo-Malayan and Palearctic. Local communities mostly dependent on folk medication in spite of existence of advanced allopathic medicines and well-equipped medical staff.

Ethnomedicinal knowledge is beneficial to cure several health problems from mild to chronic illness such as including respiratory tract infections, diseases related to skin, bone fracture, Diabetes mellitus also known as DM, constipation, stomach problems, rheumatism, problems of eyes and ears, colds, anemia, fever, measles, toothache, bladder and urinary diseases, tuberculosis, spleen and liver sickness, typhoid, epilepsy, asthma, hypertension, nervous problems, carcinoma. It also helps to treat tropical diseases such as schistosomiasis, leishmaniasis and malaria, and other such as snake bites and scorpion stings².

Phytochemical studies of these bioactive compounds lead towards discovery of new useful drugs. The most important preliminary screening and detection of the bioactive constituent present in medicinal plants. Several ethnobotanical investigations show that the medicinal importance of the plant depends upon existence of the biochemical compounds in various parts of plant

body to produce a certain type of physiological active response in human. These bioactive components are naturally present in plants and classified into primary and secondary metabolites. As the name indicates, primary metabolites involved in primary metabolic process of cell building and retention in plant body, widely distributed among nature in all organisms. In higher plants these are present in seeds and other vegetative storage organs and have tremendous applications in food and raw industrial resources such as fatty foods carbohydrates or food additives. Therefore, secondary metabolites are important due to presence of bioactive compounds having medicinal value in plant body mainly derived from primary metabolites.

Depending upon the chemical structure and substitutional group attached, classification of secondary metabolites could range distinctly in terms of the ecological function performed. The vital phytochemical groups that are well-known due to medicinal value are flavonoids, glycosides, resins, tannins, saponins, and alkaloids. It is important to mention that every bioactive component present in a plant may differ from plant diversity. Human experience different kind of physiological response from each bioactive component³.

The secondary metabolites which are produced by the indigenous plants, such as tannins, flavonoids, alkaloids, terpenoids, volatile oil and glycosides possess the medicinal properties. The extracts from medicinal plants have therapeutic properties used for number of medicinal purposes. According to World Health Organization, about 80% of the world population dependent on traditional medication from plant extracts which are interesting and have medicinal potential. A variety of other biological active substitutes such as fruits, herbs and multigrain have tremendous importance, possess fundamental biological activities including antidiabetes, antioxidant, antileishmanial, antimentia, antimalarial, antimutagenic, antianalgesic, inflammation inhibitory effect, antitumor, antimicrobial and anticancer characteristics. Antioxidants are class of compounds that reduce the risk associated with different cardiovascular diseases, anti-cancer properties, anti-aging and anti-diabetic functionality. In nature, enormous source of antioxidants is recognized as plants and several herbs in laboratories analysis⁴.

In order to treat different ailment, Indigenous knowledge (IK) and practice of plants of Saudi Arabia is ancient and still available among the tribal and local community and homoeopaths (Hakim). However, due to modernization and development the traditional use, indigenous knowledge and practice are getting scarce. So,

there are urgent efforts required to facilitate this diverse knowledge reserve and documentation through ethnobotanical surveys all over the Kingdom before their disappearance from the region.

Traditional medicinal flora of KSA: Deserts and low biodiversity are the characteristics for which the Arabian Peninsula known for and also for being arid. The kingdom of Saudi Arabia KSA boasts a variety of flora along with number of herbs, shrubs and as well as edible and medicinal plants. The broad expanses of geographical regions and climate is what Kingdom of Saudi Arabia known for. Therefore, plants are widely distributed around the KSA. There is an interrelation between the use of medicinal plants and the traditional practices of healing, diet use by different cultures in KSA. There are some species which are mostly used to treat diseases (inflammations, pains, respiratory and skin diseases) are Asteraceae, Fabaceae, Chenopodiaceae, Poaceae, Lamiaceae, Euphorbiaceae, Solanaceae, Asclepiadaceae, Polygonaceae, Apiaceae, Brassicaceae, Amaranthaceae, Boraginaceae, and Apocynaceae.

In southwest, Arab Peninsula is located which consist of Kuwait, KSA, Yemen, Qatar, UAE and the largest part is covered by KSA. There are number of habitats present such as valleys, mountains, meadows, lava areas, rocky and deserts. There are 2 zones named as rain fed and arid region. As KS located in area with temperate and tropical climatic transitions so it leads towards the diversity in flora. Back in 1987 and 2000, 2 volumes related to the medicinal plants were published which described that KSA was enriched with 132 families of medicinal plants with 2253 species.

20 % of these plants were new and rare. Currently, KSA contains, 89 families with 471 species of plants. These plants possess many medicinal purposes and have been used for treating and healing diseases. Almost every Saudi practice these medicinal traditions that it has become fashion ⁵.

In Jeddah, a compound called tannins is used most commonly. It is used to heal wounds and inflamed mucosal membrane as it has stringent effects. The tannin is used as an antiseptic, astringents, diuretics, anti-inflammatory and hemostatic pharmaceutical to treat diarrhea, stomach issues. Other compounds such as flavonoids, alkaloids are also used in Jeddah and alkaloid is used for nervous system as it contains sedative properties ⁵.

Jeddah: In Jeddah 85 plant species from 37 families were screened to identify the existence of flavonoids, glycosides, alkaloids, saponins, tannins glycosides, and resins. All these metabolites were found in the seeds of *Pimpinella anisum* L., *Cuminum cyminum* L., and *Trigonella foenum-graecum* L. The quantitative analysis of these compounds in 85 species should be carried out to identify their importance in the medicinal field. Different parts of the plants were tested ⁵.

Aljumum: In Aljumum region, it was reported that 82 species which belong to 34 families were present. These medicinal plants possess anti-inflammatory, antiaromatic properties and species: *Calotropis procera*, *Panicum turgidum*, and *Aerva javanica*, families: Fabaceae, Poaceae, Asteraceae and Brassicaceae were mostly found there ⁶.

Table 1: Different phytochemical compounds and their percentage in specific number of species in Jeddah

Sr#	Phytochemical compound	Percentage %	No. of species contain compounds	Quantity of Phytochemical compound in different parts of plant
1	glycosides	82%	70	Leaves > seeds > fruits
2	tannins	68%	58	Leaves > fruits > seeds
3	alkaloids	56%	48	seeds > Leaves > fruits
4	saponins	52%	44	Leaves > seeds > fruits
5	flavonoids	35%	30	seeds > fruits > roots
6	Resins	31%	26	seeds > Leaves > resins

Table 2: Bioactive constituents and their Ethnomedicinal use in Saudi Arabia

No.	Scientific Name	Active component	Family	Parts Used	Folk Medicinal Uses
1.	<i>Abutilon figarianum</i> Webb	Citric acid, Suberic acid, trihydroxy-9-octadecenoic acid, Dihydroalobocycline, Gingerol, flavonoid, alkaloid, phenolic acid	Malvaceae	Whole	Help to relieve pain of muscles, as a remedy for wasp stings and use for the healing of wounds. It is also used to relieve the depression of central nervous system ⁶ .
2.	<i>Glycyrrhiza glabra</i> (liquorice)	Glycyrrhizic acid 18b-glycyrrhetic acid, glabrin A and B, isoflavones	Fabaceae	Whole	antibacterial, anti-inflammatory, antiviral, antioxidant, and anti-diabetic activities ⁷ .
3.	<i>Nerium Oleande</i>	Oleandrin - cardenolide and pregnatriene compounds	Apocynaceae	Whole	Arrange heart beats disorder - toxic effect ⁸ .
4.	<i>Peganum harmala</i>	b-carboline alkaloids	Nitrariaceae	Whole	bradycardia, diminished vessel function, systemic blood - toxic effect are the cardiovascular impacts can be treated by these medicines ⁹ .
5.	<i>Strychnos ipecacuanha</i>	Strychnos indole alkaloids	Rubiaceae	Whole	Anti-tumor alkaloids ⁹ .
6.	<i>Aerva javanica</i> (Burm.f.) Juss. ex Schult.	aervolanine, ervoside, methylaervine, betulin, lupeol, ervoside, Quercetin, aervine, kaempferol,	Amaranthaceae	Whole	Tooth ache ⁴ .
7.	<i>Alternanthera paronychioides</i> A.St.-Hil.	Stigmasterol, β -carotene, myristic, stearic, palmitic, linoleic and oleic acids, α -spiraterol, uronic acid, ricinoleic acid, cyclo eucalenol, choline, oleanolic acid, lupeol, β -sitosterol	Amaranthaceae	Leaves	Treat hepatitis, tight chest, bronchitis, asthma and other lung troubles ⁴ .
8.	<i>Bougainvillea spinosa</i> (Cav.) Heimerl	Phenolic compounds, 2',4'-dihydroxychalcone and 2', 4'-dihydroxy-3'-methoxychalcone	Nyctaginaceae	Whole	antidiabetic, antihepatotoxic, antihyperlipidemic, antioxidant, and antiulcer properties. It is also an Anticancer, anti-inflammatory, antimicrobial ⁶ .
9.	<i>Cadaba farinose</i> Forssk.	alkaloids (capparisinine, capparisine, stachydrine, isocodonocarpine), phenolics, flavonoids, sterols	Capparaceae	Whole, leaves	anti-inflammatory, anthelmintic, emmenagogue. For treatment of dysentery, fever, lungs problem, cough hypolipidemic, antioxidant, hepatoprotective, and anticonvulsant, purgative, antispasmodic, anti-tumor, anti-diarrheal ⁶ .
10.	<i>Citrullus colocynthis</i> (L.) Schrad.	choline, almitic acid, stearic acid, linoleic acid, oleic acids, catechin, myricetin, α -tocopherol, c-tocopherol, β -carotene	Cucurbitaceae	Leaves, fruits	Analgesic, skin infections, a laxative, diuretic, or for insect bites ⁴ .

11.	<i>Echinops viscosus</i> DC.	thiophenes and terpenes. Flavonoids, phenolic compounds, alkaloids, lipids, phenylpropanoids	Asteraceae	Whole	Anti-inflammatory, depurative, diuretic, hemostatic, hypoglycemic and vasoconstrictor ⁶ .
12.	<i>Ipomoea batatas</i> (L.) Lam.	lanine and leucine, 7-O-β-Dglucopyranosylidihydroquercetin-3-O-α-Dglucopyranoside	Convolvulaceae	Whole	hypertension, constipation, arthritis, hydrocephaly, inflammations, Diabetes, dysentery, fatigue, rheumatoid diseases, and meningitis ⁴ .
13.	<i>Jasminum grandiflorum</i> L.	iridoid-type compounds, secoiridoid glucosides, triterpenes, flavonoids, lignans	Oleaceae	Whole	Wounds, skin diseases, ulcers of the oral cavity, gingivitis, headache, erectile dysfunction and eye diseases ⁶ .
14.	<i>Lantana camara</i> L.	squalene, β-caryophyllene, lantanilic acid, lantadene B, lantadene A, lantanilic acid, lantoic acid, Eicosane, β-ionone, caryophyllene oxide, hexanoic acid, tiglic acid, camaric acid, oleanolic acid,	Verbenaceae	Whole	Antipyretic, antimicrobial and antimitagenic ⁴ .
15.	<i>Lycium shawii</i> Roem. & Schult.	lyciumaside, β-sitosterol glucopyranoside, gallic acid, p-coumaric acid, ferulic acid, catechin, emodin, betulinic acid, quercetin, rutin,	Solanaceae	Whole	Antimicrobial ⁴ .
16.	<i>Moringa peregrina</i> (Forssk.) Fiori	flavonoids, carotenoids, phenolic acids, alkaloids	Moringaceae	Seeds	Febrifuge, Analgesic, Headache, Abdominal pain, Anti-inflammatory, Burns, Laxative, Constipation ⁶ .
17.	<i>Oryza sativa</i> L.	apigenin, catechin, epicatechin, and tricetin	Poaceae	Whole	Used for the treatment of burns and eye infection ⁶ .
18.	<i>Rhazya stricta</i> Decne.	Quercetin, Quercetin-3-rhamnoside, Acacetin, phenolic acid	Apocynaceae	Leaves	Used as an anti-insomnia, aphrodisiac and pain killer. For treatment of tumors, rheumatism and allergy ⁶ .
19.	<i>Solanum incanum</i> L.	alkaloids, saponins, flavonoids, glycosides, terpenoids, and steroids	Solanaceae	Leaves, Roots, Fruits.	The pain in stomach, head, liver treated by using these medicines. It is also used for the sore throat, angina, menstruation pain, pneumonia and rheumatism ⁴ .
20.	<i>Tetraena simplex</i> (L.) Beier & Thulin	alkaloids, flavonoids, saponins, glycosides, steroids	Zygophyllaceae	Leaves, Fruits	The leaves infusions are used for cleansing of skin ⁴ .

In family of Solanaceae, a bushy specie is present called *Nicotiana glauca* is found in Al-Baha region of Saudi Arabia at the south west. It is reported that it causes the degradation of the soil therefore it can be exploited and used for the medicinal purposes as it contains alkaloids, flavonoids, tannins and steroid in their leaves, stems and flowers. In roots only alkaloids were present and flower extracts contain saponins. In past the leaves of the plants were used to for headache, sore throat and painful feet. Different studies indicate that *Nicotiana glauca* is used as an insecticide and other properties of its secondary metabolites are that: anti-inflammatory, antiasthma, antimalarial, anti-allergic. These are also used for the control of weed and results from different experiment showed that it contains antibacterial activity against pathogens. The bioactive properties of this plant species supported its exploitation from mountains for the medicinal purposes ⁷.

Three plant species were collected from the Jabalal-Lawaz (JAE) and Wadi-e-Disa (WDE) for the phytochemical analysis. The leaf extract from the *Retama raetam* *Salsola inermis*, *Hyoscyamus albus* and *Fagonia* showed the presence of phenols, alkaloids, flavonoids, terpenoids, carbohydrates and tannins. The concentration of phytochemical compounds was lower in WDE plants while higher in plants of JAE. The concentration of

flavonoids was higher in *Salsola inermis* from WDE. The results showed that the plants species from the JAE are enriched in phytochemical compounds and can be used for the treatment of degenerative diseases and many disorders. These plants can be used for the medicinal purposes and there is need for the further studies to identify the greater use of these species ⁸. In the Asir region, *Tamarix aphylla* and *Aerva javanica* were used and to identify their medicinal use these plants were chemically, biologically and ethnobotanically studied. The antioxidant activity was measured and the results showed that it contains it contains therapeutic properties which can be used to treat different ailments ⁹.

Antimicrobial activities of these constitutes: The bioactive compounds produced by these plants are known as antimicrobial agents. The virulence factors can be inhibited by the use of bioactive compounds produced by the medicinal plants. The synergetic action of currently used antibiotic agents can be improved by these bioactive compounds and have ability to converse the resistance by antibiotics and this kills the pathogenic microorganisms. Thus, the treatment of infections which are resistant to the antibiotic can be treated by the pharmacological agents which are bioactive based.

Table 3: Plant species and their antibacterial activity

Sr#	Plant specie	Common name	Compounds	Bacteria	Extract	MIC (mg/ml)	Zone of inhibition (mm)	Reference
1.	<i>Rosemarinus officinalis</i>	Rosemary	saponins, anthocyanins, Flavonoids, steroids, Saudi Arabia	<i>B. subtilis</i> , <i>S. aureus</i> , <i>M. roseus coli</i> , <i>K. pneumoniae</i> , <i>S. dysenteriae</i> , <i>P. aeruginosa</i>	Ethanollic	0.05–0.2	8.0–29.0	10
2.	<i>Solanum incanum</i> L.	Thron apple	p-cumaric acid, cinnamic acid, Phenolic acid	<i>P. aeruginosa</i> , <i>S. aureus</i> , <i>E. coli</i> , <i>Acinetobacter</i> sp., <i>K.</i>	Ethanollic	12.5	8.46-22.33	10
3.	<i>Ricinus communis</i> L.	Caster bean	Ferulic acid, catechin, sinapic acid	<i>Pneumoniae</i> , <i>S. epidermidis</i> , <i>proteus</i> sp., <i>micrococcus</i> sp., <i>B. subtilis</i>	Ethanollic	10	17.46-27.22	10
4.	<i>Lawsonia inermis</i> Linn	Henna	Flavonoids, saponins, steroids, anthocyanins	<i>B.vsubtilis</i> , <i>S. aureus</i> , <i>M. roseus</i> ins <i>E. coli</i> , <i>K. pneumoniae</i> , <i>S.</i>	Aqueous	0.05-0.2	8-29	10

5.	Plicosepalus acaciae		Alkaloids, flavonoids, tannins	p. aeruginosa	chloroform		10	10
6.	Thymus vulgaris	thyme	Rosmerinic acid, caffeic acid, carnosol, flavonoids	S. aureus, B. cereus, L. pneumophila	Ethanol	2-4%		10
7.	Conocarpus erectus L.	Button wood	Tannins	S. cerevisiae	Alcoholic		14.3	10
8.	Curcuma longa	Turmeric	Tannins	S. pyogenes	Aqueous		11	11
9.	R. stricta	Senhwar	Phenolic, alkaloids, flavonoids, saponins	S. aureus	Ethanol	1.17	20	3
10.	A. fragrantissima	Fragrant wintergreen	Phenolic, flavonoids	S. aureus, E. coli and K. pneumonia	Methanol	0.78	15	3

The phenolic acids, terpenoids, steroids, alkaloids, stilbenes, quinones, flavonoids are the secondary metabolites classes which have antimicrobial properties. Through different mechanism such as by controlling formation of biofilm, inhibiting production of bacterial capsule, weakening of cellular metabolism and microbial membrane disturbance these compounds perform antimicrobial activity. Generally, these secondary metabolites are divided into 3 groups, i) phenolic compounds, ii) terpenes, iii) alkaloids. A number of studies reported that the active compounds from the extract of the plants have a potential to inhibit the formation of biofilm and the construction of cell wall. The replication of microbial DNA, synthesis of energy, toxins of bacteria to the host are inhibited by the antimicrobial activity of these plants¹².

The result from the investigation about the pathogens tested by antimicrobial activities of extracts included root extract of *A. javanica* and bark extract of *Aphylla* showed the weak to moderate activity. The studies by Mufti et al., and Sharif et al., also showed the same results. It is suggested through these results that the other than antimicrobial activities these species may be attributing biological properties. The extract from the aerial part contains flavonoids and triterpenes while extract from roots contains saponins and alkaloids. These constituents prove the biological activity of these plants and also support to use for the treatment of various diseases⁹.

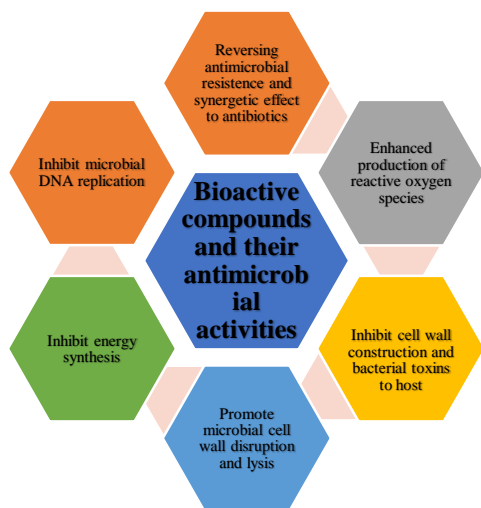


Figure 1: Mechanism of Bioactive compounds and their antimicrobial activities

The total 24 extracts were prepared by the 4 Saudi traditional plants named as *Cadaba glandulosa*, *Euphorbia inaequilatera*, *Jatropha pelargonifolia*, and *Cadaba rotundifolia*. Two different methods were used to extract the plant material in 6 organic solvents. These extracts were used against 3 gram-positive bacteria and 4 gram-negative bacteria. Result showed that these extracts possess great antibacterial efficiency. There

was the significant difference in the potency of the antimicrobial activity of the extracts by using different extraction solvent. The acetone was the most effective solvent for extraction. Furthermore, the 70% Ciprofloxacin antibacterial activity was recovered in the tested plant extracts¹³.

The liquid-liquid extraction method was used to prepare the chloroform, ethyl acetate and n-butanol extract of 2 plants. These 2 plants named as *Dodonaea viscosa* and *Capparis spinosa* were collected from the Shuda Mountain. These phytochemical screening of these extract showed the presence of alkaloids, tannin, flavonoids, carbohydrates. The antimicrobial activity of these extracts was tested contrary to 1 fungal and 5 bacterial species. The results showed that the *Dodonaea viscosa* species zone of inhibition ranges from 30-18 mm for ethyl acetate and 15-10 mm for n-butanol while for *Capparis spinosa* the zone of inhibition varies from 20-16mm and 16-10 mm for ethyl acetate and n-butanol. It shows the wide range difference of antimicrobial activity between the species¹⁴.

Role in risk of disease reduction: In endocrine gland, Diabetes Mellitus is the dominant disease caused either by the low insulin secretion or by resistance of insulin in liver and peripheral tissues. This disease causes acute and chronic effects such as ketoacidosis, neuropathy, renal failure. The number of people suffering from Diabetes Mellitus are increasing in Saudi Arabia (30% of total population), higher rate in men. Globally, number of plants are used for the treatment of diabetes. The species used for the treatment of DM are *U. dioica*, *H. salicornicum*, *A. cepa*, *T. oliverianum*, *A. herbaalba*, *Sesamum indicum*, *Teucrium polium*, and *Z. spina-christi*. These plants are available worldwide and mostly leaves are used along with roots, stems, flower, seed for the curing. The flavonoid, vitamins, alkaloid, phenol, amino acids are the most common active constituents which target the metabolic pathway⁴.

Overall benefits: Alkaloids perform antimicrobial activity by interpolating into the bacterial cell wall and DNA. The replication of human immunodeficient virus called cytomegalovirus inhibited by benzylisoquinoline alkaloid also called Papaverine. There are different secondary metabolites that can be used to mitigate the bacterial resistance as they act as resistance modifying agents and some secondary metabolites also used synergistically with common antibiotics¹².

The use of food and beverages which are enriched in flavonoids can help to reduce the risk of cardiovascular diseases. It is suggested by different studies that the flavonoid have wide range of effective biological activities. It is essential to evaluate the amount of flavonoid in food sources as the intake antioxidants is directly linked to the flavonoids. Different studies stated that the use of flavonoids is effective to control coronary heart disease¹⁵.

Diseases such as dermatitis, eye problems, rheumatism are treated by using *R. graveolens*. It is also used as antioxidant, anti-inflammatory, antidiabetic, antifungal. It is also used for different skin conditions, tendon strains, dislocations. The *Ficus carica* is a very nourishing food and commonly named as "fig". Dried fig contains copper, fiber, magnesium and many other nutrients. It also contains antioxidants and also flavonoids, xanthotoxol,

glycosides. It is used to treat many disorders such as cardiovascular diseases, inflammatory, gastrointestinal respiratory¹⁶.

The review of the literature revealed that the flora contains 254 species divided in 7 families: Solanaceae, Apocynaceae, Euphorbiaceae, Amaranthaceae, Labiatae, Polygonaceae and Cappariaceae, are represented in the flora. The study showed that 86 species out of these 254 are medicinal. Many of these are being used by local and tribal people. Many therapeutic therapists used these to treat 150 ailments. In the wild, out of these 49 are classed as uncommon and endangered and 13 are indigenous to Arabian Peninsula. In Arabian Peninsula, 13 species out of these are endemic and 49 are classified as rare and endangered. The medicinal use, occurrence with the Arabic name of species are described below.

1 Amaranthaceae

- *Achyranthes aspera* L.; Mahwat; used as a diuretic, antiperiodic, astringent, alterative, and purgative. Leaf juice: for treatment of stomachache, boils, skin eruption. Roots: induce abortion and for labor pain.
- *Aerva javanica* (Burm. f.) Juss. ex Schult.; Arwa, Ra, Tarafa, Tuwwaym; present in eastern and European regions. As a remedy for toothache
- *Amaranthus caudatus* L.; Kaf-Almehana; used as a demulcent and diuretic. In Sri Lanka used for the cystitis treatment.
- *Amaranthus spinosus* L.; Da'ad; used as a diuretic and strangury, blood purifier, treatment of piles and leaves used as an abortifacient in south Africa.
- *Amaranthus viridis* L.; Shae, Santeen; the other medicinal uses and characteristics are Antipyretic, diuretic, laxative, stomachic. Root extract: given in gonorrhoea. For the treatment of constipation and jaundice, the roots of these plants boiled and given to the children.
- The medicinal uses and properties of *Aerva lanata* (L.) Juss. ex Schult.; Al-Athlab; are antipyretic, emollient, alexiteric, diuretic, leucorrhoea expectorant, laxative, used for the treatment of leucorrhoea and leprosy and also for the improvement of appetite.

2. Apocynaceae

- The sap and bark of *Adenium arabicum* Balf. f.; Adnah; are used to treat bone dislocation skin infection and wounds. It is an endemic plant species, rarely found on the mountains of southern region.
- The treatment of fever, stomachache, toothache is carried out by using *Carissa edulis* Vahl; Karisa Arm; in many regions and it is found rarely in mountains. It is also used as an anthelmintic, antiscorbutic, astringent.
- The *Catharanthus roseus* (L.) G. Don; Vinica, Winica; is used to treat diabetes, stomachache, toothache. It is also used as an anthelmintic, emetic, digestive, hypotensive, laxative, sedative
- The roots and leaves of *Nerium oleander* L.; Dafila; are used to treat skin diseases. It is an endangered species.
- The leaf extract of *Rhazya stricta* Decne.; Harmal; are used to treat sorethroat and fever.

3. Cappariaceae

- The leaf juice of *Cadaba farinose* Forssk.; Asaf, Sarh, Azan-al-arnab; is used as a remedy for dysentery, cough, fever and it is found rarely in coastal rocky areas. In Africa, Arabia and India, it is also used to treat lung diseases.
- In southern regions, *Capparis cartilagnia* Decne.; Shafallah, Lusf; found commonly and used as a tonic for wounds, an antiseptic, anti-inflammatory.
- *Capparis deciduas* (Forssk.) Edgew.; Tandhab, Sodad; frequent in both the S and E regions. Anthelmintic, analgesic, aphrodisiac, carminative, diaphoretic, emmenagogue, and laxative are some of the medicinal characteristics and applications. Asthma and cough are treated with bark extract. On boils and swellings, the pest of young leaves and branches is placed as a plaster.
- *Capparis spinosa* L.; Asaf, Kabar, Shafallah; analgesic, anthelmintic, emmenagogue, aperient, tonic and diuretic are some of the medicinal qualities and applications. The extract of root is

used to treat rheumatism, paralysis, as well as enlargement of the spleen and tubercular glands.

- *Cleome amblyocarpa* Baratte and Murb.; Khunayzah, ufaynach; widely distributed in the northern hemisphere. Antimicrobial characteristics and applications. Antibiotics are drugs that are used to treat bacterial infections.
- *Cleome arabica* L.; Zafrah-Amal, Zambel, Shajarat-Aluahsh; is an endemic, uncommon; only found in the northwestern mountainous area. Carminative, appetiser, carminative. In folk formularies, decoction of the plant is used to make tonics.
- *Cleome brachycarpa* Vahl ex DC.; Birbran; is only found in rocky places in the southern lowlands. Some of the medicinal qualities and uses are Appetizer, carminative. The plant is utilized in for the preparation of tonic.
- *Cleome chrysantha* Decne.; Safaira'a; is an endemic and rare in western parts, on rocky hill slopes and stony wadi beds. Anthelmintic, antiseptic, and poisonous qualities and uses in medicine.
- *Cleome viscosa* L.; Om-Hanif; widespread in the north and south Hijaz. Carminative, anthelmintic, antibiotic, sudorific, irritating, acric, febrifuge, and vesicant are some of the medicinal qualities and applications. Leaf juice mixed with water or ghee is used as an ear drop for earaches and middle ear inflammation, while leaf paste is administered to boils.
- In southern region *Dipterygium glaucum* Decne.; Alqa, Alanda; is widely spread. Analeptic and asthmatic qualities and uses in medicine. Asthma is treated using this herb.
- In southern regions *Maerua crassifolia* Forssk.; Sarh, Maru; are prevalent. One of the medicinal uses is febrifuge. Toothache and intestinal diseases are treated by using solution of leaves.
- *Maerua oblongifolia* (Forssk.) A. Rich.; Maru, Kasif; is an endemic plant and use for hypocholesterolemic.

4. Euphorbiaceae

- The treatment of bronchitis, asthma is done by using *Acalypha indica* L. It is found rarely in southern heights. Some of the medicinal uses are emetic, expectorant, laxative.
- *Andrachne aspera* Spreng.; Kamash is used for the treatment of eye problems and found in in plains rocky areas.
- In Egypt, *Chrozophora oblongifolia* (DC.) A. Juss. ex Spreng.; Tannoum, Haidqaan, Neela is used as a medicine for its hypoglycemic properties.
- The leaves of *Chrozophora plicata* (Vahl) A. Juss.; Tanoom are used for the treatment of leprosy. Other medicinal uses are depurative and purgative.
- The medicinal use of *Euphorbia granulata* Forssk.; Lebbein, Lebbeide, Um-lebbain, Labnah is anthelmintic, diuretic, purgative.
- The juice of *Euphorbia helioscopia* L.; Emaiah is used as remedy for rheumatism and neuralgia. It is commonly found as a weed in south Hijaz and Najd areas.
- The treatment of asthma and bronchitis is done by *Euphorbia hirta* L.; and it is found in commonly in scattered localities. Antiasthmatic, febrifuge, narcotic are its other medicinal uses.

5. Labiatae

- The flowers of *Lavandula dentata* L.; Dhurm; are used to treat the kidney stones removal, urine retention. It is found only Asir.
- For the antibacterial activity *Lavandula coronopifolia* Poir; L. stricta Del.; Dikta, Kataah, Zeeta; is used.
- In cases of headache and cold the *Lavandula pubescens* Decne.; Attan, Fariqa, Hashirah, Sanayb, Shau; is used and other medicinal properties and uses are antimicrobial, yield essential and aromatic oil.
- The extract from the *Mentha longifolia* (L.) L.; Naana, Habak; is used to treat cough and breathing problems. It is found in western mountain region.
- The medicinal uses of *Mentha microphylla* C. Koch; Niena'a barri-niena'a; are analeptic, appetizer, carminative.

➤ In the region of south the *Nepeta deflersiana* Schweinf. ex Hedge; Firuwak, Fardak, Khausha; is found rarely and use as a tranquillizer.

➤ The paste from the leaves of *Ocimum americanum* L.; *O. canum* Sims is made to treat parasitic skin diseases in India.

➤ Only in Asir the *Teucrium yemense* Defl.; Rechal Fatima, Istaqtas grow and it is used to treat kidney problems.

6. Polygonaceae

➤ The endemic specie of plant called *Calligonum comosum* L'Her.; Arta'a is used for antimicrobial purposes. It is threatened for overexploitation and overgrazing.

➤ The boiled leaf of *Emex spinosa* (L.) Campd.; Hambaz, Hambaizan, Rasha are used to increase appetite, treat dyspepsia and biliousness. It commonly grows in winter and an endemic specie.

➤ *Polygonum argyrocoleum* Steud. ex Kunze; Abu-Zalaf, Qorda'b is used for the treatment of stomach diseases. It is widely spread weed.

➤ The extracts of *Rumex nervosus* Vahl; Aathrab are used to treat skin diseases. It found rarely in south western heights and Asir.

➤ In northern and eastern deep sand areas *Rumex pictus* Forssk.; Hamsees, Hambasees; found rarely and used as a sedative, spasmogenic and antimicrobial.

➤ The extract from the *Rumex steudelii* Hochst. ex A. Rich.; syn. *R. nepalensis* Spreng.; Tabal are used for the abdominal pain and used as a purgative and astringent.

➤ *Rumex vesicarius* L.; Hamaedh; it is found in southern and eastern regions in winter season and use for the toothache, nausea, to increase appetite and for the treatment of dysentery.

➤ Solanaceae *Datura innoxia* Mill.; Binj; is toxic and poisonous therefore use for the production of drugs in different regions of the world.

➤ *Datura metel* L. syn. *D. fastosa* L.; Binj; This plant is rarely found in eastern region and used to treat asthma, skin diseases, diarrhoea. The other medicinal uses are astringent, febrifuge, parasiticide.

➤ The medicinal use of *Datura stramonium* L.; Binj-Daturah; are anodyne, narcotic, antispasmodic and in many countries, it is used to treat ailments, asthma, cough and hair fall. It is found in southern and eastern region.

➤ In northern regions *Hyoscyamus muticus* L.; As-sakran; found rarely and used for the treatment of toothache, asthma, seas sickness and antispasmodic.

➤ The *Hyoscyamus pusillus* L.; Babekh safaree; is used as a stimulant and only found in northern regions.

➤ A widely spread plant specie *Lycium shawii* Roem. and Schult.; Osaje; use as an antibacterial.

➤ In north Hijaz *Nicotiana rustica* L.; Al-tabag, Al-khadar; found rarely and it is an antispasmodic, used for the treatment of skin diseases, chronic giddiness, fainting, rheumatic.

➤ The endangered species called *Physalis minima* L.; rarely found in south area used as a remedy for earache, purgative, tonic.

➤ The treatment of ulcer is done by using decoction of plant species called *Solanum forsskalii* Dunal; Nashbah. it is scattered all over the country.

➤ Many heart diseases, jaundice, fever, diarrhoea are treated by *Solanum nigrum* L.; Enab-Alzeeb, kharma; which is a common weed. It is used to prepare syrup and cardiac tonic.

➤ The plant *Solanum surattense* Burm. f.; Bankum-Bakini; is used to promote female fertility and it is found in south and Farasan island. It is also used to treat fever, asthma and sexual diseases.

➤ Different parts of *Withania somnifera* (L.) Dunal; Sem Alfa'ar, Obeeb plant are used to treat cough, loss of appetite. It is also used as an abortifacient, alternative, anthelmintic^{17,18}.

Demerits: There are some plants species which cause bad effects to human health. It can be due to the contamination or alteration in soil, plant location, or other environmental impacts. In India the

medicinal plants used as a war tactic, murder and suicide. The cardiac glycosides are present in oleander plants which cause the cardiotoxicity. In middle east and north Africa, a plant named as *Peganum harmala* grows and it is very toxic, cause digestive and nerve syndrome. This plant contains high amount of active chemical compounds in roots and seeds. It was also used to stimulate abortion. Medicinal plants are both source of life and death and it depends on the dose given to the living organism^{19,20,21}.

CONCLUSION

However, further work regarding the separation and identification, documentation of biological active compounds responsible for strong antioxidant activity of these medicinal plants should be carried. In Kingdom of Saudi Arabia, despite the modernization of medical facilities, tribes still consider folk medicine to be a viable therapeutic option for some health problems. In provinces of Saudi Arabia there is need of more research to gather ethnomedicine knowledge and practice, encompassing all types of helpful plants. This should lead to improved MP management, cultivation (domestication), and trading in Saudi Arabia, resulting in additional job opportunities for the country's rural people. The use and medical value of plant species and families for the treatment of various illness was also highlighted in the study. It has been identified that a number of secondary metabolites and derivatives of plants are potential antibacterial agents. Alkaloids and polyphenols have showed high antibacterial action among the secondary metabolites investigated. Polyphenols are a large and diverse category of secondary metabolites, and their antioxidant characteristics form the foundation for antimicrobial actions. Alkaloids supplied the foundation for the development of a number of antibiotics with various modes of action. The capacity of some plant secondary metabolites to behave as resistance-modifying agents is a promising field for preventing bacterial resistance from spreading. A variety of other biological active substitutes such as fruits, herbs and multigrain have tremendous importance, possess fundamental biological activities including antimicrobial, antidiabetes, antioxidant, antitumor, antianalgesic, antedementia, antitumor, anticancer, antimutagenic, antileishmanial, antimalarial and inflammation inhibitory effect, characteristics. On the other hand, through Sustainable environmental management these natural resources must be protected, necessitating the formation of conservation programs to safeguard the natural diversity of plant species in this region. Researchers will have a greater grasp of how multiple environmental variables affect a single plant species, allowing them to investigate the effects of diverse habitats on therapeutic advantages and take use of the region's biological variety.

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