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Antimicrobial and antidiabetic evaluation of local flora of medicinal plants of Pakistan: A review

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Abstract

Pakistan has variety of medicinal herbs, shrubs, and other plants, useful to treat wide range of diseases. Medicines obtained from plants have fewer side effects and are inexpensive. Natural products obtained from the biologically active plants extract are being used to explore new antibiotics to treat infectious diseases. Plants extracts are comprised of herbal antioxidants which help to boost immunity against diabetes by inhibiting peroxidation chain reaction. Alkaloids, flavonoids, and other biologically active compounds extracted from the different parts of medicinal plants have great potential to inhibit α -glucosidase.

Keywords: Antimicrobial, antidiabetic, phytochemicals and medicinal plants

Introduction

Pakistan has variety of climates, topographical regions and ecological zones (Hussain *et al.*, 2008) [23]. The flora of Pakistan is also very diverse, due to this reason this area is of great interest. Almost 6000 flowering species of plants are said to be found in Pakistan (Shinwari, 1996) [43]. Uses and discovery of medicinal plants is as old as their use as food, medicines and nutraceutical (Ibrar, 2002) [24]. Large variety of plants is being used by local population for the treatment of many diseases in Pakistan. This is being practiced as a profession in many areas of Pakistan. Ethnobotany of medicinal herbs, shrubs and other useful plants has been studied at the large scale throughout the world, and many studies have been conducted in this regard (Khan *et al.*, 2013) [31]. In developing countries almost 80 percent of the population is dependent on the medicinal plants for the health care for human as well as animals. Allopathic system is widely used in developing countries via using plants extracts for the treatment of many diseases (Rashid, & Arshad, 2002) [40]. The main advantages of obtaining medicines from plants are; these can easily obtained by nature and comparatively have less side effects. Unani system as well as ethno-medicinal plants is used for the treatment of many diseases (Ahmad *et al.* 2003) [2]. Due to revolution of the traditional culture, aboriginal knowledge of herbal plants is being decreased (Hussain *et al.*, 2008) [23]. The people residing in the areas rich with such medicinal plants are using 90% of these plants (Baquar, 1989) [9]. There are different species of bacterial organisms classified as Gram +ve and Gram -ve bacteria that cause severe infections in People. Because of their multiple environmental habitats, these bacterial organisms have the ability to exit in such intolerant condition (Ahameethunisa & Hopper, 2010) [1]. Because of human friendliness nature of biologically active plant extracts these natural products have obtained unbelievable success in the serving for new antibiotics discovery. For example, Berberine (Berberis) and Quinine (cinchona) are plant based antibiotics that are highly favorable against microorganisms like *E. coli* and *Staphylococcus aureus* (Bibi *et al.*, 2011) [11]. Plants are comprised of herbal antioxidants (nutritional vitamins, flavonoids and tannins etc.) that may grant safety towards diabetes by forestalling the destruction of β -cells with the aid of inhibiting peroxidation chain reactions (Aslan *et al.*, 2010) [7].

Ethnobotanical Study of Local Flora

A survey was conducted in Jalal Pur Jattan town, District Gujrat (Punjab, Pakistan), in order to get ethnobotanical information and the medicinal uses of local flora. Information was obtained through interviews and questionnaires from native people. They were identified with common names. Their scientific names and family names were arranged with correct nomenclature. 88 plants were ethnobotanically recognized by local people, were correctly taxonomically described (Hussain, *et al.*, 2010) [22].

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Inhabitants of Kotli, District of Azad Kashmir, were interviewed via questionnaire in order to get ethno-botanical information about herbaceous plants in 2010-2011. 93 species of herbaceous plants were selected, belonging to 46 different families of Angiosperm. It was observed people used these species not only as vegetables, and food but also used these herbs as medicine to treat many diseases such as jaundice, impotency, gonorrhoea, eczema, hypertension, and rheumatism in human, and hemoglobinuria, anemia, septicemia, hemorrhagic diseases in cattle. It was discovered that 58.06% herbs were utilized as 6.45% as stem, 6.45% as fruit, 18.27% as root, 1.07% as inflorescence, 10.75%. 11 species of Poaceae family, 4 species of Amaranthaceae family, 7 species of Asteraceae family, 8 species of Labiatae were most common (Ajaib *et al.*, 2014) ^[3, 4].

The ethno-botanical data obtained through questionnaire from 50 species of 32 families from native people of Tehsil Kharian and district Gujrat. These plants are reported to be used as shelter, medicines, food, and fuel. Asteraceae and Poaceae families were most commonly found species in this area (Ajaib *et al.*, 2014) ^[3, 4].

Data about the medicinal plants used in traditional methods of treatment was collected in Mangowal, Gujrat district (Punjab, Pakistan). The ethno-botanical survey was done via interviews of native people and questionnaires. Interviews involved 20 females, 40 males, tabibs and hakims of different age groups, comprising 50-80 years. Ethno-botanical survey was conducted in 2013, between January to March. Almost 40 species from 22 different families studied which were used by inhabitants to treat many diseases like ulcer, stomach pain, asthma, skin diseases, piles, and gonorrhoea. Medicinal plants consist of compounds in combination to the desired compounds, which neutralize side effects. Different parts of plants are used to prepare herbal medicine. Fruits, barks, seeds, fruits, leaves, and sometimes whole plant is used (Parvaiz, 2014) ^[26].

Research work on aquatic plants was performed focusing on their ethno-botany and medicinal uses. That research was performed in district Sialkot (Pakistan), aquatic plants were collected from all over the Sialkot. 18 species belonging to 13 different species having different locations and habitats were collected for research work. Interviews of native people were performed to get information about the ethno-botany and the common names of those plants. 40 native people were interviewed including 15 males and 25 females. Old females were preferred as they were more knowledgeable, experienced, and skilled in the field of ethno-botany. Polygonum species are used in summer pickle treatment, Mentha for digestive problems, and Pistia for skin treatment (Ikram *et al.*, 2014) ^[26].

Sarai Alamgir, the area of Gujrat district, was surveyed ethnobotanically in 2015 during March to November. In that survey, use of medicinal plants as ethno-medicine by the native people as traditional method was investigated. For that investigation, questionnaire method was chosen to check the knowledge of native people about medicinal plants. Interviews of native people, Hakim's, were conducted as they were the main user of medicinal plants, having the knowledge of ethno-botany (Khan *et al.*, 2016) ^[30].

Solanaceae Family

Fifteen plant species of Solanaceae family were investigated for the ethnobotanical study in the area of Muzaffarabad Division. Roots of *Withania somnifera* are used for the early treatment of Arthritis and rheumatism. Leaves are used

against tumor and its fruit is diuretic. *Solanum surratense* berries are used as demulcent and roots extract is used in cough, asthma powder of whole plant is beneficial for toothache, gonorrhoea and rheumatism. Fruit is taken after the bite of scorpion and scabies. *Nicotiana tabacum* Seeds mixture with Nariyl is used as Anthelmintic. Its paste applied on area of dog bite to keep away from rabies. *Capsicum annum* L. leaves and fruit are used for the pain of dog bite and skin diseases. *Datura stramonium* seeds extracts is used as the remedy of eczema. Juice of flower and leaves are used in wounds and sore. Fruit paste is beneficial to reduce pain of rheumatism and whooping cough and muscles fatigue (Awan, & Murtaza, 2013) ^[8].

Petuna axillararis flowers extract is used to reduce skin diseases in the horses. *Atropa acuminata* leaves are used to reduce pain and cough. Leaves and roots are mydriatic and diuretic. *Lycopersicon esculentum* pulp is used to treat rheumatism and headaches. Powder is used as insecticide. Fruits are useful in constipation, anorexia, skin treatment and stomach ulcer. *Solanum melongena* fruit is cardiotoxic. Leaves extract is useful in asthma, cholera, fever and bronchitis. Decoction of root is useful for inflammation and for ulcer while roots are used as laxative and to reduce pain (Awan, & Murtaza, 2013) ^[8].

Pests cause huge losses in crops, and many are carrier of diseases. Nowadays, scientists are paying attention to control insect populations through secondary plant metabolites such as alkaloids, terpenoids, glycoalkaloids, alcohols and organic acids. These secondary plant metabolites can affect their physiological and cellular processes such as changing redox balance, neuronal signalization, hormonal regulation, or reproduction in exposed insects. Toxic effects are caused by secondary plant metabolites at lethal and sub lethal levels, also cause repellence effect. Solanaceae family plants containing many economically and ecologically important species contain different compounds that can harm most of herbivorous insects and other pests. Many compounds possess molluscicides, nematocides, acaricides, bactericides and fungicides properties along with insecticidal properties (Chowanski *et al.*, 2015).

Steroidal alkaloids and glycoalkaloids compounds are toxic, mainly formed in the species of Solanaceae family. These secondary metabolites plant act as a chemical barrier for broad range of pathogens and pest. These steroidal alkaloids are anti-nutritional factors in human and animals as they affect absorption of nutrients from food and the digestion and even cause poisoning (Cárdenas *et al.*, 2015) ^[12].

The family of Solanaceae is also called as nightshades family, a family of flowering plants. Many species of it have important alkaloids. The tropanes are the most common alkaloids in the Solanaceae. Scopolamine, hyoscyamine, atropine, and nicotine are also found. Plants of Solanaceae are important to provide a wide range of culinary, medicinal (Yadav *et al.*, 2016) ^[49]. Roots, leaves and stem and callus of *Withania somnifera* alkaloid content were analyzed by spectrophotometer. Total alkaloid content in medicinal plants is determined by simple spectrophotometric method through the reaction with bromocresol green. As a result yellow complex forms, which is easily extractable with chloroform at 4.7 pH (Trivedi *et al.*, 2016) ^[47].

Steroidal glycoalkaloids are derivatives of cholesterol formed in solanaceae species, which act against pathogens defense but they are also anti-nutritional compounds as these are toxic to humans. In *Nicotiana tabacum* and *Catharanthus roseus* Alkaloid production is regulated by APETALA2/Ethylene

Response Factor, glycoalkaloid metabolism 9 (GAME9). It controls steroidal glycoalkaloids biosynthesis (Cárdenas *et al.*, 2016).

Tropane alkaloids occur largely in Solanaceae plants may cause anticholinergic poisoning where they are present as contamination during the consumption of medicinal plant, mostly occurs during harvest. Herbs and herbal teas contaminated by tropane alkaloids can cause a serious health risk because alkaloids are heat stable and may be present in large quantities. DNA barcoding is used to eliminate the contaminants and product substitution (Chan, 2017) [13].

Cucurbitaceae Family

Cucurbitaceae family is a well-known source of secondary metabolites, mostly triterpenoids. These cucurbitane metabolites exhibit a wide range of biological actions especially anti-inflammatory, antidiabetic, cytotoxic, antiparasitic effects, and hepatoprotective (Shah *et al.*, 2014) [42].

Cucurbits are edible crops of family Cucurbitaceae which are generally moist vines and are distributed in the eastern and western hemispheres. The plants of this family are excellent fruit crops having large concentration of the vitamins, essential nutrients, and minerals. Leaves, stem, root or tuber, fruit and seeds of the Cucurbitaceae plants have been used in medicines. *Lagenaria siceraria*, *Corallocarpus epigaeus*, *Mukia maderaspatana*, *Citrullus colocynthis*, *Trichosanthes cucumerina*, *Citrullus lanatus*, *Solena amplexicaulis*, *Kedrostis foetidissima*, *Coccinia indica*, *Cucumis sativus*, *Cucurbita pepo*, *Luffa acutangula*, *Luffa cylindrica*, *Momordica charantia*, and *Trichosanthes dioica* all are medicinally important compounds (Jamuna *et al.*, 2015) [28].

Seeds extracts of *Momordica dioica*, *Citrullus colocynthus* & *Cucumis melo* species from cucurbitaceae family showed genoprotective, and antioxidant activities and evaluated to identify phenolic components present in these species by the Liquid Chromatography- Electrospray Ionization Mass Spectrometry /Mass Spectroscopy analysis. The samples had total phenols of yield 16–40% as Gallic acid equivalents (GAE) and the yield was 20 to 41%. Comparison of it with Acidified methanol in methanol solvent showed 1.4 to 10 folds increase in extraction yield, higher DPPH radical quenching, Phenolic contents were in the range from 149.5 ± 1.2 to 396.4 ± 1.9 mg GAE/g (Yasir *et al.*, 2016) [50].

The species of Cucurbitaceae family have proven to show potential about their biological activities. *Bryonia alba* and *Ecballium elaterium* have been used in treatment of homeopathic (Ielciu *et al.*, 2016) [25]. Huge number of crops like cucumbers, and melon are included in Cucurbitaceae family, and are also used as medicinal plants. Plants from this family have many nutritional benefits and medicinal importance. The main elements present Glycosides, Saponins, Terpenoids, Steroids, Tannins, Resins, and Carotenoids etc. are the phytochemicals. The terpenoid substances are mostly called Cucurbitacins (Rajasree *et al.*, 2016) [39].

Apocynaceae Family

Calotropis procera is member of Asclepidaceae family. It is commonly found in India and also found in other dry and warm places, such as tropical Africa, Warizistan, Egypt, and Afghanistan. Madar, Akanal, and Akra are its common names. Its leaves are said to be important for treating mumps, snake bite, sinus fistula, body pain, ailment, and burn wounds. *Calotropis procera* leaves are additionally useful for treating jaundice. Its leaves were dried in air and then air dried powder

was further extracted in different solvents such as chloroform, petroleum ether, benzene, ethanol and water (Murti *et al.*, 2010) [36].

Calotropis gigantea is prominently known as the milkweed or swallowwort and is utilized in traditional system of medicine as best drug to treat different sicknesses. The objective of this investigation is to screen the phytochemicals of ethanol fraction present in its flowers extracts. This study was further performed on GC-MS. 10 g of ethanol extract was obtained from flowers extract. The outcomes demonstrated the presence of phytochemical of tannins, quinines, flavonoids, alkaloids, phenol, sterols, proteins and anthraquinones in the ethanol extract (Dhivya, & Manimegalai, 2013) [17].

Many sterols were isolated from *C. procera*. Structures of sterols such as urs-19(29)-en-3-yl acetate, β -sitosterol and stigmaterol, multiflorenol, urs-19(29)-en-3- β -ol and 3β , 27-dihydroxy-urs-18-en-13, 28-olide were confirmed through analytical methods such as ultraviolet/ visible (UV), infrared spectroscopy (IR), mass spectrometry (MS), proton nuclear magnetic resonance (^1H NMR), and carbon nuclear magnetic resonance (^{13}C NMR) confirmed their structures (Chundattu, *et al.*, 2016) [15].

Asparagaceae Family

Antibacterial activity against gram positive and negative bacteria are tested by ethanol, hexane and chloroform extracts of *A. americana* leaves, *Albizia lebbek* seeds, whole plant of *Abutilon indicum* and *Achyranthes aspera*. Mild antibacterial activities are shown by ethanol and chloroform extract *Albizia lebbek*. *Achyranthes aspera* separated by vacuum liquid chromatography exhibited against bacteria *Pseudomonas aeruginosa*, *Escherichia coli* and *Bacillus subtilis*. *Abutilon indicum*. Ethanol extract exhibited better antibacterial activities than organic fractions with other solvent systems. *A. americana* exhibited chronic and acute irritant activity on implementation of its ethanol and chloroform extracts on the male albino rabbits' inner ear (Khan *et al.*, 2010) [32].

A comparison of hazard ratios between diabetic and non-diabetic patients was performed on the basis of smoking status sex, age, and body mass index showed patients of diabetes were more likely to develop cancer of pancreas, liver, ovary, lungs, breast, bladder, and colorectum. Diabetes is also a cause of pneumonia, mental disorders, liver diseases, infectious diseases, pulmonary diseases, nervous system disorders, and digestive disorders (Emerging risk factors collaboration, 2011) [18].

An important medicinal plant *Asparagus racemosus* is. Its medicinal usages have been reported in pharmacopoeias of Indian. Bioactive compounds are analyzed in crude extract through preliminary phytochemical analysis. Column chromatography was used for the separation of the pure compounds and purified by thin layer chromatography (TLC) with suitable visualizing reagents and solvent systems. IR, UV-Visible, Mass spectroscopy and ^1H NMR techniques are used for structure elucidation of the obtained compound. Steroidal saponins are analyzed in the leaves extract of *Asparagus racemosus* through spectral analysis and phytochemical analysis (Verma *et al.*, 2013) [48].

Agave genus is reported to have high concentrations of phenols, which has much important biological applications. The important phenolic compound found in genus agave is phenolic acids, flavonoids, and homoisoflavonoids etc. These phenolic compounds show variety of biological activities like antinematod, antifungal, immu nomodulatory, antioxidant,

and antibacterial activities. These phenols are also used as chemotaxonomic markers (Almaraz-Abarca *et al.*, 2013) [6].

Phytochemical Found in Medicinal Plants

A flavonoid compound, kaempferitrin (kaempferol-3, 7-*O*-(*R*) dirhamnoside), from the leaves of *Bauhinia forficata* was extracted in n-butanol fraction was investigated, to check its antioxidant potential *in vitro* and *in vivo*. Oral intake of kaempferitrin showed considerable decrease in glucose level both in alloxan induced as well as in normal diabetic rats. Hypoglycemic effect was observed in normal rats only after one hour of the oral intake of dose 200 mg/kg of kaempferitrin. Doses of 50 and 100 mg/kg were also given to normal diabetic rats; kaempferitrin was successful to lower blood glucose level at these concentrations. Kaempferitrin was fail to lower blood glucose level, in glucose fed normal rats having higher level of blood sugar (Sousa *et al.*, 2004) [16].

Herbal products, therapies and medicines are of great interest. Diabetic patients commonly use herbal therapies. 400 volunteer diabetic patients from Kayseri (Turkey) were interviewed in 2003 between January to May. 400 patients of diabetes voluntarily were involved in this study. The herb species used, demographic characteristics of users, ratio of the herb used, pattern of nonusers users were calculated. From 400 patients, 25% were using herbs. The common herbs used by diabetic patients were jujube, thyme, nettle, and parsley were 12%, 27%, 28% and 12% respectively. Herb use was mostly 74% by taking their extract in hot drinking water 12% by using them in food. 39% of patients themselves reported that their blood glucose level reduced after using herbs (Inanç *et al.*, 2007) [27].

The scientific classification of species of alpine *Primula* has for some time been in contest as a result of a few hybridizations and high morphologic fluctuation. In *Primula* species, the trichome tallness and the shade of hair tips are normally shown as diacritic characters but this isn't satisfactory. This study, concentrated on *Primula daonensis*, *Primula auricula*, and *Primula hirsuta* thusly proposes the utilization of other morphologic trichome parameters (dimensional ratio and size of stalk, gland head and neck). Phytochemical examinations about the flavonoid composition (vacuolar and epicuticular) of leaves, as taxonomic markers, have likewise been performed. The seclusion and recognizable proof of kaempferol 3-*O*-(2-*O*- α -L-rhamnopyranosyl-6-*O*- β -D-xylopyranosyl- β -D-glucopyranoside) and Isorhamnetin 3-*O*-(2, 6-di-*O*- β -D-glucopyranosyl- β -D-glucopyranoside) which are flavonol glycosides. Size and dimensional ratio of the three trichome components (stalk, glandular head and neck) are specific for specie being analyzed. The flavonoid profile well describes the substances under examination. Three unique profiles have been gotten with both vacuolar and epicuticular flavonoids (Fico *et al.*, 2007) [20].

Alkaloids are group of elements having nitrogen atom as hetero atom in heterocyclic ring. It is diverse group of compounds. According to the skeletal structure of carbon different alkaloids are classified into groups. Alkaloid are biosynthesized by multistep catalytic reaction, these reactions are catalyzed by enzymes composed of different types of protein. The modern alkaloid biosynthetic enzymes are characterized in terms of biotechnological applications, structural biochemistry, and molecular and cell biology is the center of research over many years (Ziegler, 2008) [51].

Pakhanbhed herb which is commonly found in Nepal is commonly used for diabetes treatment for hundreds of years. *In vitro* studies examined anti diabetic activity and anti-diabetic compounds were separated from Pakhanbhed. (-)-3-*O*-galloyl catechin and (-)-3-*O*-galloyl epicatechin are active against diabetes and are isolated through fractionation and extraction. These seclused mixes exhibited huge portion subordinate catalyst inhibitory exercises against rodent intestinal α -glucosidase and porcine pancreatic an amylase. IC50 esteem for sucrose, maltase and an amylase were 560, 334 and 739 IM, individually for [(-) - 3-*O*-galloyl epicatechin] and 297, 150 and 401 IM, separately for [(-) - 3-*O*-galloyl catechin]. This study uncovered the counter diabetic capability of Pakhanbhed and this investigation could be useful to create therapeutic arrangements or nutraceutical and utilitarian sustenance's for diabetes and related indications (Bhandari *et al.*, 2008) [10].

Bulb of *Allium porrum*; a member of Liliaceae family, tubers from *Helianthus tuberosus*; member of Asteraceae family and leaves of *Cydonia oblonga*; a member of Rosaceae family have been traditionally used in medicines to treat diabetes. Plants extract (250 and 500 mg/Kg) given orally to the rats. Glucose oxidase was used to measure level of blood glucose. Spectrophotometric methods were used to determine TBARS (thiobarbituric acid reactive substance), GSH level (reduced glutathione) in heart, liver and kidney tissues, and antioxidant activity. Blood glucose levels decreased by 18.0% and 33.8% when extracts of *Allium porrum* of dose 500 mg/kg and *Cydonia oblonga* of dose 500 mg/kg were given orally to the diabetic rats for five days (Aslan *et al.*, 2010) [7].

Bioactive substances obtained from plants play a vital role in modern medicine. Their use is limited as some medicinal plants source may not be easily available. Secondary metabolites are obtained through plant cell cultures. Commercially very a few examples are known. Only few examples of their commercial use are known. The reason behind is, secondary metabolites are not sufficiently produced and cultivation costs are high. Traditional methods can increase plant cell cultures performance by one/two order of magnitude by using highly productive strains selection, medium composition optimization, elicitation, and secondary metabolite biosynthesis precursor's addition. New means of cell culture production expanded with the advancement in molecular biology techniques dependent on metabolic engineering methods. Bacteria and yeasts are genetically transformed with plant gene in order to produce secondary metabolites found in plants (Nosov, 2012) [37].

Fruits and roots extract of *Leptadenia pyrotechnica* was explored to show antibacterial activity against *S. aureus* and *Staphylococcus epidermidis* by utilizing agar well diffusion test *in vitro*. Sample of plants was gathered from Thal desert of Pakistan. These extracts were prepared in eight solvents *viz.* methanol, ethanol, water, n-hexane, acetone, ethylacetate, chloroform and butanol. *S. aureus* was susceptible by all extracts made in different solvents and showed antibacterial activity against *S. aureus*. Both parts of plant *i.e.* roots and fruits were effective against both bacteria but extracts from roots showed more effectiveness against pathogens. Methanol extracts of these two sections created the best outcomes by restraining development of the two pathogens. By varying solvents and concentration of solvents activities against pathogens were also changed (Munazir *et al.*, 2012) [35].

Natural products utilization is common in under developed countries because these are commonly available and inexpensive as compared to modern pharmaceuticals. In

industrial countries, use of herbal products is being increased on the basis of scientific researches. Their efficiency has been widely improved. From last twenty years, scientific research is focusing natural remedy uses to treat diabetes. The increasing urge in natural remedies was because the type 2 diabetes mellitus (T2DM) has become an epidemic health issue globally. Existing drug therapy is not much effective as it carries side effect, this is the motivation for the reevaluation of old remedies and to find out new natural products having anti diabetic effect. Recent research on natural products has provided possible mechanism of anti-diabetic action. Many researchers are focusing on variety of possible anti diabetic action and giving details of anti-hyperglycemic action caused by the compounds isolated from the crude extract of plants (Salimifar *et al.*, 2013) [41].

Amaryllidaceae is subfamily of Amaryllidoideae family. It has alkaloids which are pharmaceutically important. Galanthamine alkaloid is obtained from the Amaryllidaceae family and Alzheimer's disease is treated with an acetyl cholinesterase inhibitor, is obtained commercially from cultivated plants. Many other alkaloids from Amaryllidaceae are used as anti-cancer drugs. From physiological, molecular and ecological aspects, Amaryllidaceae family and its alkaloids are not much explored and their alkaloids are not identified completely, the biosynthetic genes identity for alkaloid is still unknown (Takos, 2013) [46].

Therapeutic compounds are chiefly present in plants, and they have many applications in Pharmaceuticals. In this study, 61 plants of medicinal importance were studied to evaluate antioxidant and antimicrobial activities, and the compounds responsible for these activities present in chloroform, methanol, and aqueous fractions. Five fungal and six bacterial strains were used to evaluate their antimicrobial activities. Antioxidants present in these fractions were studied through 2, 2-diphenyl-1-picrylhydrazyl (DPPH), total antioxidant capacity (TAC), and reducing power (RP) free radical scavenging assay. From these 61 plants, 2 plants were antifungal and 6 plants showed antibacterial activity. In methanol/chloroform extracts, total phenolic content (TPC) were in the range of 20.2 to 85.6 mg/g of dry weight, and in aqueous extracts TPC was in the range of 5.5 to 62.1 mg/g in dry weight. In methanol/ chloroform extracts, total flavonoid content (TFC) was estimated to be in the range of 2.9 to 44.5 mg (QE)/g dry weight (DW), and in aqueous fraction TFC was in the range of 2.4 to 37.1 mg quercetin equivalent/gram in dry weight (Akhtar, & Mirza, 2015) [5].

Cannabis sativa (Marijuana) is known to have cannabinoids properties like Δ^9 -tetrahydrocannabinol, cannabichromene, cannabinal, and cannabigerol, having antibacterial. These have shown antibacterial activity against *Staphylococcus aureus* strain (Appendino, 2008). Among endocrine disorders diabetes is most common disorder which results into mortality and morbidity. Chronic diseases including diabetes had been widely treated with natural remedies throughout the world. Mounting evidence proposed the mechanism of action of these natural remedies, according to mounting evidence, these natural products show therapeutic action on diabetes mellitus patients through many cellular mechanisms such as gluconeogenesis, limiting glycogen degradation, antiapoptosis, anti-inflammatory, regeneration of pancreatic β -cell, antioxidative stress, and immunoregulatory (Farzaei *et al.*, 2017) [19].

Experimental studies showed the anti-diabetic effect of many Cucurbitaceae species such as *Coccinia grandis*, *Momordica charantia*, *Lagenaria siceraria* in a different animal model.

Significant anti-diabetic activity was observed by these three plants ($p < 0.05$). When activity of these plants was compared with standard drug glibenclamide, *M. charantia* showed comparative maximum hypoglycemic activity of 98.08 ± 2.69 mg/dl. *siceraria* (86.33 ± 0.38 mg of GAE/gm) than other plant extracts. *Lagenaria siceraria* has free radical scavenging activity of IC50 value of 99.05 ± 0.81 μ g/ml. Alkaloids, saponins, flavonoids, phytosterols, glycosides, phenols, tannins, fats and fixed oils were also detected by Phytochemical screening (Kibria *et al.*, 2017) [33].

Leaf extract of *Coccinia indica* give *in vitro* activities of membrane stabilizing, antimicrobial, antioxidant, and thrombolytic. The ethanol soluble fraction showed activity of $45.36 \pm 0.45\%$ & red blood cells showed activity of $64.05 \pm 0.22\%$ (Sultana *et al.*, 2018) [44]. Raw herbal materials are converted in to specific formulation by using herbal drug technology to use them as a medicine. High Performance Liquid Chromatography (HPLC) and Thin layer Chromatography (TLC) are applied to prove promising composition of herbal preparation for Antioxidant activity (Ghosh *et al.*, 2017) [21].

Alkaloids such as Terpenoids, Flavonoids and Saponins are extracted from the seeds and leaves of *Luffa acutangula*, *Momordica charantia*, *Cucurbita moschata* and *Luffa aegyptiaca*. Their methanol, ethanol and water extracts were prepared for this purpose (Suradkar *et al.*, 2017) [45].

Hairy root culture of *Prezowskia tanguitica* is used to get high yield of tropine. These are developed in the alpine plant sustainability was developed through *Agrobacterium* strain. The hypocotyl stimulates the hairy root culture more than that of the cotyledon. HPLC analysis revealed that hairy root culture lines give an astonishing yield of atropine. Its yield is 229.88 mg/100 g, anisodamine yield is 12.85 mg/100 g, anisodine yield is 4.09 mg/100 g, and scopolamine yield is 10.69 mg/100 g (Lei *et al.*, 2018) [34].

Albizia myriophylla is used traditionally as medicinal herb for diabetes and other diseases in Thailand. Evaluation of biological activities of ethanol extract and different fraction of *A. myriophylla* wood was investigated by *in vitro* α -glucosidase inhibition through spectrophotometer. The ethanol extract and other fractions exhibited concentration dependant α -glucosidase inhibition. Highest inhibition percentage against α -glucosidase was 69.30%, shown by dichloromethane fraction of ethanol extract of its wood. Consequently, α -glucosidase inhibition test showed that 3, 4, 7, 3'-tetrahydroxyflavan, indenoic acid, and 8-methoxy-7, 3',4'-trihydroxyflavone were responsible for antidiabetic effect of *A. myriophylla* (Joycharat *et al.*, 2018) [29].

Conclusion

Phytochemicals present in organic and aqueous fractions of medicinal plants' extract have potential to treat diabetes and many infectious diseases due to their inhibitory effect towards α -glucosidase enzyme, bacterial and fungal strains. Various analytical techniques i.e. GC-MS and FTIR etc. are being used to identify the phytochemicals present in the extract responsible for antimicrobial and hypoglycemic activity. This review provides an overview of the important plants families and their species responsible for the antidiabetic and antimicrobial activities in Pakistan. Further researches should be performed to separate these biologically active phytochemicals present in the extracts for plants having potential to inhibit microbes and α -glucosidase enzyme.

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