Ethnopharmacological survey of herbal remedies used in the treatment of hepatitis

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Databases and Inventories

Abstract
Background: Hepatitis is a serious illness and can be fatal, which has caused a dangerous ratio round the globe especially in the developed and under-developing countries. About 1.4 million deaths are reported each year from different types of hepatitis especially hepatitis B virus (HBV) and hepatitis C virus (HCV) which cause 90% mortality and the other 10% deaths are caused due to all other hepatitis types.

Methods: By using different online databases such as Google scholar, Science Direct Navigator, ISI Web of Knowledge, Elsevier, springer link, Test databases, research gate and PubMed, data were retrieved by giving different keywords. Various keywords were used on plants used traditionally to treat hepatitis.

Results: A total of 128 medicinal plant species were identified, belonging to 108 genera and 61 botanical families by reviewing 220 research articles. From the study, it showed that the medicinal plants used are from the very ancient time to cure hepatitis worldwide. These medicinal plants are used in different parts of the world as a traditional herbal medicine for the control of hepatitis.

Conclusion: Our literature review will help the scientific communities to identify anti-hepatitis plant in order to isolate novel anti-hepatitis natural products.

Keywords: Hepatitis, medicinal plants, treatment, ethnopharmacological, survey

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Background

The liver is an organ and paramount importance. It aids in the metabolism of ingested substances like food, alcohol, dietary substances and most medications (Govind and Pandey 2011, Thomas et al. 2011). There are many causes of liver disorders, but the major causes are various toxic chemicals, some antibiotics, alcohol, and food. In addition, liver disorders are also caused due to the infections of various kinds of parasites, viruses, fungi or bacteria. Different liver disorders like hepatitis, jaundice, inflammation of liver, cirrhosis (a digestive disorder that is the result of liver fibrosis), and liver cancer also be caused by autoimmune disturbances (Govind & Pandey 2011). The word hepatitis originates from two Greek words, hepta that refers to liver and it is meaning inflammation. Hepatitis is present in many forms such as including virus hepatitis, autoimmune hepatitis, fatty liver hepatitis, alcoholic hepatitis and toxin induced hepatitis all these types of hepatitis are identified as a hepatitis virus that attack and harm liver cells (Khan et al. 2010).

The Hepatitis B virus was first studied in 1963 (Cusheri 2002) and it is estimated that more than two billion people have ate some point been infected with HBV on global level (World Health Organization 2000. About, 520000 patients annually from hepatitis type B and C (International consensus conference 2002). Hepatitis C was first cloned (Choo et al. 1989, Alamo et al. 2013). About 170 million people are affected by hepatitis C virus, according to World Health Organization (WHO), which causes liver cirrhosis or hepatocellular carcinoma (Chen & Morgan 2006). The percentage of prevailing HBV and HCV infections among the people of Pakistan is 35–38% and 4-14% respectively (Hakim et al. 2008). Pakistan is confronting a huge burden of these diseases. Almost 30 genotypes of HCV have been describing until now (Kato 2000). HCV causes a chronic liver disease responsible 8000-10000 deaths in Pakistan per year (Moyer et al. 1999).

All hepatitis viruses have different ways of transmission. For instance, the hepatitis A virus is easily transmitted under unhygienic condition and in poor sanitation. Hepatitis B virus (HBV) is transmitted via blood and also in some case it transmitted from the blood-derived products (Seeger et al. 2020).

There is a complex biological and cultural relationship between plants and human beings (Balick 1996) and herbal medicines have a great role in the discovery of different drugs, and they are used for the cure of different disorders all over the world. Usually these sources are available in abundance and traditional medicines benefits 80 percent of population on earth (Gewali & Awake 2008, Wangchuk et al. 2011). In modern pharmacopoeia, almost 25 percent of all drugs were derived from plants (Phytomedicines) and other are synthetic analogous of natural products (Pseudo natural products) built on prototype compounds derived from plants (Bandaranayake 2006). Several medicinal plants and their formulations have been used around the world for the treatment of liver diseases and this has encouraged the scientific community to research the effect of these medicinal plants which can treat HCV in a comprehensive manner (Ashfaq & Idress 2014). Many drugs have been reported against HCV until date and many of them are found successful in clinical trials, but viral resistance and the negative effects of these drugs have made their therapeutical application against HCV limited (Kitazato et al. 2007). The effect of Accacia nilotica (AN) in inhibition of HCV and of other plants e.g. against herpes simplex virus (HSV), poliovirus type 1, coxsackievirus B5 and Echovirus have been confirmed (Konowalchuk and Spears 1976). Our study aims to elicit plant species used against liver disorders especially hepatitis.

Materials and Methods

By using different online database such as Google scholar, Science Direct Navigator, ISI Web of Knowledge, Elsevier, springer link, Test databases, research gate and PubMed, date were retrieved by using different keywords in order to derive detailed information of plants and their ethnopharmacological studies of various regions of the world (Adnan et al. 2014). With the help of taxonomic literature, botanical names of plants and their families were verified (Ullah et al. 2018).

Data analysis

Data were compared using Venn diagrams and calculating the Jaccard (similarity) Index (JI) of each
To determine the similarity between two sets, the following formula was used:

Jaccard Index = (the number in both sets) / (the number in either set) * 100

The formula in notation is as follows:

\[ J(X, Y) = \frac{|X \cap Y|}{|X \cup Y|} \times 100 \]

Moreover, the recorded data were also compared with the wild food ethnobotanical literature of Pakistan in order to assess their possible novelty (Abbas et al. 2020, Ahmad and Pieroni 2016, Ahmad et al. 2019).

**Family Importance Value**

FIV represents the comparative position of families. It provides the regional prominence of the species. The intention was to compel the percentage that came from informants who mentioned the family as follows:

\[ FIV = \frac{FC}{N} \times 100 \]

Where FC is the sum of informers revealing the family, while N is the sum of informants who participated in the research.

**Results and Discussion**

**Diversity of the medicinal flora**

During the current review, a total of 128 taxa belonged to 108 genera, from 66 plant families were documented to be consumed as medication for hepatitis diseases all over the world (Fig. 1).

There was only one family of fungi, pteridophytes, and gymnosperms with one species each, and 125 species belonging to 63 angiosperm families. Plant species were laterally registered with the corresponding family, botanical names, local names, part used, preparation of different remedies, route of administration, and medicinal uses as mentioned in Table 1.

**Plant Parts Used**

Based on a total of 191 citation reports, the part of the plants most frequently used for curing hepatitis were leaves (27%), followed by aerial parts (18%), fruit (16%), fruit (15.7%), flower (11%), root (10%), seed (7%), stem (5%), bulb, bark, rhizome each (1%), fruiting body and flower top (1%) as shown in Figure 2. The least reported plant part used bulb, bark, rhizome each (1%), fruiting body and flower top each with 1 percent.

**Family Importance Value**

The importance of a plant family increases with the increase in the frequency of citations of its all species. Table 1 represents 66 plant families with maximum FIV, amongst which Asteraceae was the dominant family (13.8%), followed by Fabaceae (7.8%), Euphorbiaceae (2.7%), Cucurbitaceae (2.5%) and Gentianaceae (2.0%). Acanthaceae, Amaryllidaceae, Apioaceae, Brassicaceae and Poaceae had (1.5 %) family importance values. Rest of the families had less than (1.5%) family importance values as shown in Figure 3.

![Figure 1. Diversity of medicinal flora used for the treatment of hepatitis](image-url)
| Family          | Plant Name                                      | Part used              | Chemical constituents                                                                 | Uses                                                | Citation                                |
|-----------------|------------------------------------------------|------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------|
| Acanthaceae     | Acanthus ilicifolius L.                         | Leaves                 | Aceteoside, isoaceteoside, acanthaminoside                                             | Used for hepatitis, and also for anti-ulcer activities | Samani & Kopaei, 2018, Kumar & Choyal, 2012 |
|                 | Justicia adhatoda L.                            | Roots                  | Alkaloids, polyphenolics, glycosides.                                                   | Decotion of its roots is taken by the patients for one month in the treatment of jaundice. | Kumar & Choyal, 2012, Medeiros et al., 2012 |
|                 | Justicia schimperiana (Hochst. ex A. Nees) T. Anderson | Leaves, Stem           | Alkaloids, lignans, flavonoids, and terpenoids                                          | Chopped and used to take a smoke bath; boiled and used as a body wash; leaves and stems are crushed and pounded and then taken orally | Kpodar et al. 2015, Corrêa & Alcântara, 2012 |
| Adiantaceae     | Adiantum capillus-veneris L.                     | Leaves                 | Flavonoids, terpenoids, tannins, mucilioge, volatile oils, gallic acid                  | Used for hepatitis and also for inflammatory diseases | Jan et al. 2017, Prajapati et al. 2006 |
| Aizoaceae       | Trianthema portulacastrum L.                    | Aerial parts           | Trianthenol, 3-acetylaleuritic acid, leptomorol, 3,4-dimethoxy cinnamic acid, 5-hydroxy-2-methoxybenzaldehyde, p-methoxybenzoic acid | Liver infections                                    | Zaman et al. 2018, Mahmood et al. 2013, Shivhare et al. 2012 |
| Amaryllidaceae  | Allium cepa L.                                  | Bulb                   | Guercetin, fructose, quercetin-3-glucoside, isorhamnetin-4-glucoside, xylose, galactose, glucose, mannose, organosulfur compounds, allylsulfides, | Bulb is dried and ground powder is used for cure of jaundice problem | Ulah et al. 2020, Marrelli et al. 2019, Medeiros et al. 2012 |
|                 | Allium satium L.                                | Bulb                   | Flavonoids, flavenols, S-alk(en)yl cysteine sulfoxides, cycloalliin, selenium, thiosulfonates, and sulfu | Bulb is dried and ground powder is used as hepatodepurative | Ceuterick et al. 2008 |
|                 | Ruscus aculeatus L.                             | Leaves                 | P-coumaric and caffeic acids and rutin                                                    | Liver depurative                                    | Pieroni et al. 2014, Hadžifejzović et al. 2013 |
| Amaranthaceae   | Achyranthes aspera L                           | Root                   | Triterpenoid, saponins, alcohol and 17-penta triacontanol,                                | Used for treatment of jaundice                      | Barkatullah, et al. 2015, Srivastav, 2011 |
|                 | Amaranthus graecizans subsp. thellungianus (Nevski) Gusev | Aerial parts           | Brenan, trolox and gallic acid                                                           | Liver tonic                                         | Yaseen et al. 2015, Ishiq Le et al. 2014, Pieroni et al. 2005 |
| Anacardiaceae   | Pistacia integerrima L.                        | Aerial parts           | Alkaloids, flavonoids, tannins, saponins and sterols                                    | Used for treatment of jaundice                      | Jan et al. 2017, Bibi et al. 2015 |
| Plant Family | Species | Part Used | Components | Uses | References |
|-------------|---------|-----------|------------|------|------------|
| **Pistacia chinensis** Bunge | Leaves, bark | Sitosterol, alnusiodiol, gallic acid, naringenin and amentoflavone | Leaves and bark decoction to cure jaundice | Ali *et al.* 2018a, Uddin *et al.* 2011 |
| **Apiaceae** | *Coriandrum sativum* L. | Leaf, seed, fruit | Aromatic acid containing 2-decenoic acid (30.8%), capric acid (12.7%), undecanoic acid (7.1%), linalool (37.7%), gernyl acetate (17.5%), gama-terpinene (14.4%) | Liver disorders | Al-Snafi Ali Esmail 2016 |
| **Pleurospermum candollei** (DC.) Benth. ex C.B. Clarke | Aerial parts | A decoction of the whole plant is made and taken twice a day | | Abbas *et al.* 2016, Agelet *et al.* 2003 |
| **Oenanthe japonica** (Blume) DC. | Leaves | Longiborneol, geranyl linalool and T-cadinol | Powder of leaves is used for cure of hepatitis b | Samani & Kopaei, 2018, Pattram *et al.* 2011 |
| **Trachyspermum ammi** (L.) Sprague | Leaves | V-terpinene, p-cymene, and thymol | Used for treatment of hepatitis B | Samani & Kopaei 2018, Gandomi *et al.* 2014 |
| **Apocynaceae** | *Carissa spinarum* L | Leaves | Triterpenes, cardiac glycosides, sesquiterpenes, monoterpenes, flavonoids,lignans, fatty acids and esters | Used for treatment of jaundice | Rashid *et al.* 2018, Wangteeraprasert *et al.* 2012 |
| **Aracea** | *Colocasia esculenta* (L.) Schott | Bulb | Active phytoconstituents such as flavonoids, sterols, glycosides, and other micronutrients | The bulb of this plant cooked as vegetable And dried bulb is cut in to pieces and then crushed to make powder which is used for the treatment of jaundice | Kidane *et al.* 2018, Kumar & Choyal 2012, |
| **Asparagaceae** | *Asparagus adscendens* Roxb. | Root | Essential oils, asparagine, arginine, tyrosine, flavonoids (kaempferol, quercetin, and rutin), resin, and tannin. | Extract of root is used for treatment of jaundice | Fawad 2016, Yaseen *et al.* 2015, Negi *et al.* 2010 |
| **Asteraceae** | *Artemisia campestris* L. | Flowers | B-pinene, spathulenol, α-pinene, limonene and o-cymene | Hepatic protector | Al-Jahid *et al.* 2017, Asadi *et al.* 2015 |
| *Artemisia genipi* Stechm. | Whole plant | Sesquiterpene lactones | For the treatment of inflammation of jaundice | Vitalini *et al.* 2013, Appendino *et al.* 1982 |
| *Ageratum conyzoides* | Leaves | Alkaloids, flavonoids, tannins, saponins, and cyanic acid | Lease paste is used for treatment of Jaundice | Zaman *et al.* 2018, Okunade 2002 |
| *Carthamus oxyacantha* M.Bieb | Flowers | Linoleic oil, palmitic acid, stearic acid, oleic acid, linoleic acid | Flowers are used for the cure of Jaundice | Zaman *et al.* 2018, Ahmad *et al.* 2009, Ahmad *et al.* 2007 |
| Species                          | Part          | Constituents                                                                 | Uses                                                                 | References                                      |
|---------------------------------|---------------|------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------|
| *Calendula officinalis* L.      | Flowers       | Flavonoids, particularly patulitrin and patuletin                           | Infusion is used to cure liver diseases                               | Pieroni *et al.* 2012, Mulley *et al.* 2009      |
| *Cynara scolymus* L.            | Leaves, flowers | Cynarin, cynaroside, scolymoside, ferulic and caffeoylquinic                 | Leaves and flowers hepatitis                                          | Samani & Kopaei 2018, Ceuterick *et al.* 2011, Pieroni *et al.* 2004, Lutz *et al.* 2011 |
| *Eclipta prostrata* (L.) L.     | Aerial parts  | Glycosides eclalbasaponin I and eclalbasaponin II                           | Decoction of boiled whole parts is used for the treatment of Jaundice, hepatitis and other liver disorders | Zaman *et al.* 2018, Shinwar *et al.* 2016, Mahmood *et al.* 2012 |
| *Matricaria chamomilla* L.      | Aerial parts  | Essential oils, glycoside, flavonoids, tanacetamide,5-demethylnobiletin     | Aerial parts powder is used for the treatment of hepatitis            | Samani & Kopaei, 2018, Egea *et al.* 2015, Singh *et al.* 2011 |
| *Tanacetum artemisioides* L.    | Aerial parts  | Flavonoids, tanacetamide,5-demethylnobiletin                                | To cure hepatitis B                                                   | Hussain *et al.* 2018, Hussain *et al.* 2013    |
| *Taraxic officinale* L.         | Leaves        | Proteins, fatty acid, potassium, calcium                                     | For the treatment of inflammation of jaundice                         | Samani & Kopaei 2018, Jan *et al.* 2017, Pieroni *et al.* 2014, Hussain *et al.* 2012, Ikram & Hussain1978, Escudero *et al.* 2003 |
| *Taraxacum campylodes* G. E. Haglund | Rhizome     | Taraxin, taraxacerine, inun, vitamin C                                      | Decoction of boiled rhizome is used for the treatment of Jaundice, hepatitis and other liver disorders | Samani & Kopaei 2018, Prajapati *et al.* 2006   |
| *Silybum marianum* L.           | Leaf, fruit, seed | Flavoligrans, silybin, isosiybin and silymarin (6%), Flavolagnans, silybin, silydanin, silychristine | To cure jaundice and hepatitis                                       | Samani & Kopaei, 2018, Khan *et al.* 2016, Foster 1991 |
| *Sonchus asper* (L.) Hill       | Aerial parts  | N-Hexane, alkaloids, saponins, flavonoids, phenols and tannins              | To cure hepatitis B                                                   | Ali *et al.* 2020, Hussain *et al.* 2018        |
| **Berberidaceae**               |               |                                                                             |                                                                      |                                                 |
| *Berberis lycium* Royle.        | Fruit, root   | Alkaloids, cardioactive glycosides, saponins, tannins, anthocyanins, vitamins, carbohydrates, proteins, lipids, fiber content, β carotein, cellulose, phytic acid and phytate phosphorous. | For the treatment of jaundice                                       | Ali *et al.* 2018b, Rashid *et al.* 2018, Ahmad *et al.* 2017 Shabir *et al.* 2012, Tyler *et al.* 1981 |
| Family                  | Plant Name                          | Part                  | Chemical Constituents                                      | Use                                               | References                                      |
|------------------------|-------------------------------------|-----------------------|------------------------------------------------------------|--------------------------------------------------|------------------------------------------------|
| Berberidaceae          | Berberis pseudumbellata R. Parker   | Seeds, flower, fruits | Alkaloids, steroids, glycosides, flavonoids, saponins, terpenoids and reducing sugar | Seeds and fresh fruits are eaten while a flower decoction is recommended three times a day | Yasil & Inal 2019, Khan et al. 2016 |
| Boraginaceae           | Onosma hispida Wall. & G. Don.      | Aerial parts          | Naphthaquinones, alkaloids and phenolic compounds         | The whole plant is cooked in water as a vegetable and taken twice a day as needed | Yeşil & Inal 2019, Kumar et al. 2012          |
| Brassicaceae           | Brassica rapa L.                    | Flowers               | β-sitosteryl-3β-glucopyranoside-6'-O-fatty acid esters, β-sitosterol, chlorophyll and phytol fatty acid esters | Used for treatment of hepatitis                   | Ragasa et al. 2016, Barkatullah, et al. 2015 |
| Lepidium sativum L.    | Leaves                              | Hexadecadienoic acid, heneicosanoic acid, 10-octadecenoic acid, 15-tetracosenoic acid, hexadecanoic acid and steric acid | Leaves powder is used to treat hepatitis           | Samani & Kopaei, 2018, Gokavi et al. 2004       |
| Rhaphanus sativus L.   | Root                                | Raphanin, glycosinolates, enzymes, trace elements, anthocyanin, pectin, protein, and Vitamin C | Decoctions of its roots are recommended for the treatment of jaundice. Fleshy part and its juice is used for treatment of jaundice | Ong & Kim 2014, Prajapati et al. 2006,         |
| Burseraceae            | Boswellia carterii Birdw.           | Stem (resin)          | Essential oils, pyrolysates **boswellic** acids | Resin is used for cure of hepatitis C              | Samani & Kopaei 2018, Moussaeiff et al. 2008 |
| Caryophyllaceae        | Herniaria glabra L.                 | Leaves                | Triterpene, saponins: herniaria saponins, gypsogen, flavonoids and hydroxycoumarins | For jaundice (anti-icterus)                       | Alsanfi 2018, Rigat et al. 2007              |
| Chenopodiaceae         | Chenopodium album L.                | Aerial parts          | Phenols, tannins, phytic acid phytate phosphorus, alkaloids | For the cure of hepatic disorders                | Zaman et al. 2018, Jan et al. 2017, Alsanif 2015, Ceuterick et al. 2008 |
| Chenopodium ambrosioides L. | Leaves, flowers | Cymene, alpha-terpinene and limonene | Hepatodepurative | Ceuterick et al. 2011, Barros et al. 2013 |
| Convolvulaceae         | Ipomoea paniculata Burm. f          | Aerial parts          | Tetracosane, myristic acid, β-sitosterol, beta-carotene, daucosterol and quercetin | Liver cirrhosis                                   | Ahmad et al. 2018, Heiurich et al. 1998    |
| Crassulaceae           | Rhodiola kirilowii (Regel) Maxim.   | Root                  | Arbutin, epigallocatechin gallate, rhodiocaynocide, lotaustral | Root powder is used to cure hepatitis C           | Samani & Kopaei 2018, Wiedenfeld et al. 2007 |
| Plant Family | Scientific Name | Part Used | Chemical Constituents | Uses |
|-------------|-----------------|-----------|-----------------------|------|
| Cucurbitaceae | *Citrullus colocynthis* (L.) Schrad. | Stem, flowers | Arbohydlate, protein, separated amino acid, tannins, saponins, phenolic, flavanoids, flavones glucosides, terpenoids, alkaloids, anthranol, steroids, cucurbitacins, saponarin, cardiac glycoloids | For the cure of hepatitis |
| | | | | Zaman et al. 2018, Gurudeeban et al. 2010, Gewali et al. 2008 |
| | *Cucumis sativus* L. | Fruit | Methyl-phytosterol, amyrrin, adenosine trialcohol | Fresh fruit slices used for the treatment of jaundice and hepatitis and also for skin diseases |
| | | | | Prajapati et al. 2006, Chen et al. 1992 |
| | *Cucumis melo subsp. agrestis* Naudin | Fruit | Lipids, arginine, aspartic and glutamic acids while limiting amino acids were methionine and lysine | For the cure of hepatitis disease |
| | | | | Yasil et al. 2019, De melo et al. 2000 |
| | *Momordica charantia* L. | Fruit | Proteins, polysaccharides, flavonoids, saponins | For hepatitis |
| | | | | Ahmad et al. 2017, Kumar & choyal 2012 |
| | *Ecballium elaterium* (L.) A. Rich | Fruit | Flavonoids such as rutin, narcissin and kaempferol | For the cure of hepatitis disease |
| | | | | Touihri et al. 2019, G`unes et al. 2017 |
| Cuscutaceae | *Cuscuta reflexa* Roxb. | Aerial parts | Scoparone, melanetin, quercitin, caffeoylquinic. | Paste from whole plant of is taken orally to cure jaundice |
| | | | | Ahmad et al. 2017, Prajapati et al. 2006 |
| Cupressaceae | *Juniperus phoenicea* L. | Leaves | Lipids, sugars, flavonoids, gallic acid and minerals like Na, K | Hepatic anti-inflammatory |
| | | | | Nasri et al. 2011, Agellete & Valles 2003 |
| Dioscoreaceae | *Dioscorea deltoidea* Wall. | Leaves | glycosides, flavonoids, phenols, resin and tannins | For the treatment of jaundice |
| | | | | Hussain et al. 2013, Haq et al. 2011 |
| Euphorbiaceae | *Euphorbia hirta* L. | Leaves, Stem | Alkanes, triterpenes, phytosters, tannins, polyphenols, and flavonoids | Stem and leaf extracts are used in jaundice. |
| | | | | Ali et al. 2018, Kumar & Choyal 2012 |
| | *Euphorbia prostrata* Ait | Aerial parts | 2-phenylethanol, tannins, allic acid, corilagin, 1,2,3-tri-O-galloyl-D-glucose, geranin, tellimagradin I, II, and rugosin | Decoction is used for the treatment of jaundice |
| | | | | Rasid et al. 2018, Shah et al. 2016, Yaseen et al. 2015, Chen et al. 1992 |
| | *Jatropha curcas* L. | Seeds | Essential oil, o-epi-cadinol, pulegone, chrysanthenyl acetate | Powdered dry seed is mixed with sugar and water for the treatment of hepatitis |
| | | | | Samani & Kopaei, 2018, Adebowale et al. 2006 |
| | *Phyllanthus emblica* L. | Fruit | Alanine, aspartic acid, glutamic acid, proline, fats and Fe | Powdered dry fruit is mixed with sugar and water for the treatment of jaundice |
| | | | | Ashfaq et al. 2014, Prajapati et al. 2006 |
| Genus                          | Species                        | Part              | Active Constituents                                                                 | Diseases                        | References                                                                 |
|-------------------------------|--------------------------------|-------------------|------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------|
| Phyllanthus                   | niruri L.                      | Root              | Phyllanthine, flavonoids, quercetin, isoquercetin,                                  | Liver diseases                  | Farooq et al. 2019, Prajapati et al. 2006                                 |
| Equisetaceae                  | Hippochaete debilis (Roxb. ex Vaucher) | Aerial parts      | Ash, Lipid, protein, Ca, Ascorbic acid, and niacin                                   | For hepatitis                   | Tareen et al. 2010, Hakim et al. 2008, Mangario et al. 1995               |
| Fabaceae                      | Acacia nilotica L.             | Flowers, bark     | Amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes | Used for jaundice                | Samani & Kopaie 2018, Zaman et al. 2018, Banso 2009, Haq et al. 2011       |
|                               | Acacia jacquemontii Benth      | Leaves            | Ester-cetyl triacontanoate along with n-triacontanol, n-octacosanol, β-sitosterol and stigmasterol | Extract of leaves is used for jaundice | Yaseen et al. 2015, Singh et al. 2010                                     |
|                               | Argyrolobium roseum (Cambess.) Jaub. & Spach | Aerial parts      | Favonoids, glycoside, and vitexin, D-pinitol                                        | Used for liver diseases          | Ram et al. 2007, Gupta et al. 2005                                         |
|                               | Cassia fistula L.              | Leaves, flower    | Gum containing arabin, tannic and galic acid                                       | Hepatitis                       | Iqbal et al. 2016, Adnan et al. 2014                                      |
|                               | Glycyrrhiza glabra L.          | Root              | Glycyrrhitic acid, multiple flavonoids, isoflavonoids, sterols                      | Hepatitis                       | Mahmood et al. 2013, Dhiman et al. 2005                                   |
|                               | Mimosa pudica L.               | Aerial parts      | Alkaloids, flavonoid C-glycosides,sterols, terpenoids, tannins, saponin and fatty acids | The crude powder of prevents liver cell necrosis and lysosomal latency | Qadir et al. 2017, Umair et al. 2017                                       |
|                               | Prosopis cineraria (L.) Druce   | Flowers           | Methyl heptacosanoate, heicicosanoic acid,hydroxybenzoic acid, methyl 4-hydroxycinnamate and methyl 2-methoxy-5-hydroxycinnamate | The crude powder of flowers prevents liver disorders | Zaman et al. 2018, Khan et al. 2006                                       |
|                               | Tamarindus indica L.           | Root, fruit       | β-amyrin, compesterol, β-sitosterol and seven hydrocarbons. The aerial parts of this plant have demonstrated the presence of tartaric acid, acetic acid, and succinic acid, gum, pectin, sugar, tannins, alkaid, flavonoids, sesquiterpenes, and glycosides. | A decoction of its roots is used in the treatment of Jaundice, hepatitis and other liver disorders. Fruit also act as a remedy for the treatment of jaundice | Kidane et al. 2018, Kumar & Choyal, 2012                                   |
| Family               | Species                          | Part(s)      | Chemical Constituents                                                                 | Uses                                                                 | References                                      |
|----------------------|----------------------------------|--------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------|
| **Trigonella foenum** | graecum (Nevski) Afan. & Gontsch. | Seeds        | N,N'-dicarbazyl, glycerol monopalmitate, stearic acid, beta-sitosteryl glucopyranoside, ethyl-alpha-D-glucopyranoside, D-3-O-methyl-chiroinositol and sucrose | Seeds are used to cure hepatitis                                   | Samani & Kopaei 2018, Shang et al. 2002         |
| **Sophora flavescens** | Aiton                            | Root         | Maackiain; trifolinhizin 6'-monoacetate, formononetin, 2,4-dihydroxy benzoic acid and beta-sitosterol | Root decoction is used for the cure of hepatitis C                  | Samani & Kopaei 2018, Li et al. 2004            |
| **Fagaceae**         | Quercus infectoria G. Olivier    | Seeds        | Syringic, gallic and ellagic acids                                                   | Seeds are rusted in hot ash used for the control of hepatitis C     | Samani & Kopaei 2018, Ikram & Nowshad, 1977     |
| **Fumaraceae**       | Fumaria indica (Hausskn.) Pugsley | Leaves, flowers | Alkaloids, oxyhydrastinine, noroxyhydrastinine, fumaramiine, stylopine, bisnorargemonine and fumaritine | Mixture powder of leaves and flowers used for cure of hepatitis     | Shah et al. 2016; Gupta et al. 2012 Asia        |
|                      | Fumaria officinalis L            | Aerial parts | Allocryptopine, chelidonine, protopine, bicuculline, sanguinarine, cheleritrine, stylopine and hydrastine | For the treatment of jaundice                                        | Ahmad et al. 2017, Paltinean et al. 2016, Bhatia et al. 2014 |
| **Ganodermataceae**  | Ganoderma lucidum (Curtis) P. Karst | Fruiting body | Triterpenoids and polysaccharides                                                    | Fruiting body cooked and useful for hepatitis B                     | Samani & Kopaei, 2018, Boh et al. 2007          |
| **Gentianaceae**     | Centaurium erythraea Rabin.       | Leaves       | Loganin, copaene, selinene, and alpha-cadinol                                       | For the treatment of jaundice                                        | Mustafa et al. 2012, Yöney et al. 2010          |
|                      | Swertia petiolata D. Don          | Aerial parts | Flavonoids, steroids, triterpenoids, alkaloids, glycosides, carbohydrates, tannins, phenolic compounds e | For the treatment of jaundice                                        | Samani & Kopaei, 2018, Ahmad et al. 2017, Bader et al. 2017 |
|                      | Swertia chirayita (Roxb.) Buch.-Ham. ex C.B. Clarke | Leaves | Stigmasterol 4 and 1,5-dihydroxy-3-methoxyxanthone-8-O-β-D-glucopyranoside          | For the treatment of hepatitis B                                     | Samani & Kopaei 2018, Negi et al. 2011          |
|                      | Swertia patens Burkill            | Aerial parts | Elucidated, angelone, gentiogena, erythrin, erythrocentaurin, gentianine, swertiakoside, swertiamarin, acetylswertiamarin, and amarogentin | For the cure of hepatitis B                                          | Samani & Kopaei 2018, He et al., 2015           |
| Family               | Species                        | Part(s)          | Constituents                                                                                           | Uses                                                                                       | References |
|---------------------|--------------------------------|------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------|
| Hippocastanaceae    | *Aesculus indica* (Wall. ex. Cambl.) Hook.f. | Seeds            | Flavonols, phenols ree α-amino acids and carbohydrates                                                 | Used for the treatment of jaundice                                                         | Paterska et al. 2017, Haq et al. 2011 |
| Hypericaceae        | *Hypericum perforatum* L.     | Aerial parts     | Flavonoids, rutin, hyperoside, isoquercetin, quercitrin, quercetin, amentoflavone, biapigenin, astilbin, myricetin, miquelianin, kaempferol, luteolin, phenolic acids | Infusion is used for liver diseases                                                         | Paterska et al. 2017, Egea et al. 2015, Nahrstedt et al. 1997 |
| Lamiaceae           | *Ajuga bracteosa* Wall. ex Benth | Leaves          | Exacosanol, B-sitosterol, tetracosanoic acid and B-sitosterol-B-D-glucoside                          | Used for liver jaundice                                                                    | Ali et al. 2018, Haq et al. 2011, Riaz et al. 2007 |
|                     |                                |                  |                                                                                                       |                                                                                           |            |
| Mentha longifolia (L.) L. |                            | Leaves          | Pulegone, isomenthone, 1,8-cineole, borneol and menthol                                              | Used for the treatment of hepatitis A                                                       | Samani & Kopaei 2018, Mkadde 2009 |
| Ocimum basilicum L.  |                                | Leaves, flowers tops | Eugenol and linalool                                                                                  |                                                                                           | Samani & Kopaei 2018, Govindarajan et al. 2013 |
| Salvia bucharica M. Pop |  | Flowers          | Terpenoids, bucharsiade and buchariol                                                              | Infusion of flowers are useful in jaundice                                                  | Bibi et al. 2014, Ahmad et al. 1999 |
| Rosmarinus officinalis L |  | Leaves          | Phenolic compounds, di- and triterpenes and essential oils                                         | Leaves pase is used for the treatment of jaundice                                           | Idm'hand et al. 2020, Andrade et al. 2018 |
| Lythraceae          | *Lagerstroemia speciosa* (L.) Pers | Leaves, flowers | Corosol acid⁶, lageracetal, amyl alcohol, ellagic acid, gallic acid, 4-hydroxyl benzoic acid, beta sitosterol, Asiatic acid, alphitolic acid | For the treatment of jaundice                                                             | Ong & Kim 2014, Bai et al. 2008 |
| Malvaceae           | *Abutilon indicum* L.         | Leaves, flowers | Carbohydrates, steroids, glycosides, flavonoids, tannins and Phenolic compounds               | For cure of liver diseases                                                                 | Yaseen et al. 2015, Kuo et al. 2008 |
|                     |                                |                  |                                                                                                       |                                                                                           |            |
| Alcea rosea L       |                                | Whole plant     | Flavonoid , salicylic, vanillic, furelic, syringic, caffeic, p-hydroxybenzoic, p-coumaric, and p-hydroxyphenylacetic acid | Whole plant is powder and decoction is used for jaundice                                    | Ullah et al. 2020, Ammar et al. 2013 |
| Corchorus depressus (L.) Stock | Aerial parts |                  | Flavonol glycosides, flavonoids, steroids                                                             | Liver tonic                                                                                | Yaseen et al. 2015, Zahid et al. 2002 |
| Family          | Species                        | Part(s)     | Constituents                                                                 | Uses                                                                                       | References                               |
|-----------------|--------------------------------|-------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------|
| **Meliaceae**   | *Melia azedarach* L.           | Leaves      | Quercetin, astragalin and 2-methoxy-4-(2-propenyl)phenyl β-D-glucoside       | Used for the treatment of jaundice                                                        | Bibi *et al.* 2014, Kumar & Choyal 2012,  |
|                 |                                |             |                                                                              |                                                                                            | Hadjiakhoondi *et al.* 2006              |
| **Menispermaceae** | *Stephania abyssinica* Dillon and A. Rich | Leaves, flowers | Oxoxylopine, liriodenine, atherospermidine,                                  | The leaf part is boiled, and about 1 cup is drunk for liver disease                        | Tuasha *et al.* 2018, Omole *et al.* 2014 |
|                 | *Tinospora cordifolia* (Wild) Miers. | Stem        | Terpenoid, alkaloid, lignans, steroids.                                     | Fresh stem decoction is considered good for the treatment of jaundice and seminal weakness. | Kumar & Choyal 2012                      |
|                 | *Peumus boldus* Molina         | Leaves      | Trans-sabinene, pinocarveol, pinocarvone, 4-terpineol, ascaridole, piperitone oxide, and limonene dioxide | Hepatodepurative, liver ailments, combined with lemon juice, to balance the harmful properties should not be taken during more than one week, 3 leaves/cup, 3 times/day | Ceuterick *et al.* 2011, Ceuterick *et al.* 2008, Mazutti *et al.* 2008 |
| **Moraceae**    | *Morus alba* L.                | Fruit       | Ascorbic acid, carotene, vitamin D, glutathione, Ca, Cu, Zn, Volatile oil, nicotinic acid | Crushed fruits are used to cure jaundice and hepatitis                                      | Zaman *et al.* 2018, Bhatia *et al.* 2014, Pieroni 2008a, Haq & Hussain *et al.* 2007, Ercisli & Orhan 2007 |
|                 | *Morus nigra* L.               | Fruit       | Oiccanolic acid, apigenin, cyclocommunol., morusin and cyclomorusin          | To cure jaundice                                                                          | Wang *et al.* 2007, Kassoye *et al.* 2006 |
| **Myrsinaceae** | *Embelia schimperi* Vatke      | Fruit       | Alkaloid benzoate, oxacillin, embelin and tetracycline                      | Fruit is used to cure hepatitis C                                                          | Samani & Kopaei 2018, Van Damme & Kokoska 2015 |
| **Nyctaginaceae** | *Boerhavia diffusa* L.        | Aerial parts | B-Sitosterol, a-2-sitosterol, palmitic acid, ester of b-sitosterol, tetracosanoic, hexacosanoic, stearic, arachid acid, urosilic acid, Hentriacontane, b-ecdysone, triacantanol | Used to treat of jaundice                                                                  | Malede *et al.* 2020, Malty *et al.* 2015, |
| **Myrtaceae**   | *Syzygium aromaticum* (L.) Merr. & L.M. Perry | Flower bud  | Kaempferol, myricetin, rhamnocrin, gallic acid, oleanolic acid, ellagic acid, and flavonoids | Used to treat of hepatitis C                                                               | Batíha *et al.* 2020, Samani & Kopaei 2018 |
| **Oleaceae**    | *Olea europaea* L.             | Aerial parts | Caffeic acid, verbascoside, oleuropein, luteolin 7-O-glucoside, rutin and apigenin | Hepatoprotective                                                                         | Pieroni *et al.* 2014, Periera *et al.* 2007 |
| Family            | Genus                  | Part(s) | Active Constituents                                                                 | Use                                      | Reference(s)                                      |
|-------------------|------------------------|---------|------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------|
| Oxalidaceae       | Oxalis comiculata L.   | Leaves  | Flavonoids, vitamin C and β-carotene, minerals like calcium, potassium              | For the cure of hepatic disorders        | Jan et al. 2017, Srikanth et al. 2012            |
| Papaveraceae      | Papaver somniferum L.  | Fruit   | Codeine, morphine, noscapine, papaverine, and thebaine                             | Used for liver diseases                  | Ullah et al. 2020, Da Cheng et al. 2015          |
| Phyllanthaceae    | Phyllanthus emblica L. | Fruit   | Flavonoids                                                                         | For cure of jaundice                     | Habib-ur-Rehman 2007, Kadir et al. 2007          |
| Piperaceae        | Piper cubeba Bojer     | Root    | Terpinen-4-ol (42.41%), α-copaene (20.04%), and γ-elemene                          | For the cure of hepatitis B             | Rigat et al. 2007, Blick 1996                    |
| Poaceae           | Desmostachya bipinnata (L.) Stap | Root | Camphene, isobornyl acetate, caryophyllene diepoxide, β-eudesmol, eseroline and calarene | Juice of the root about 4 teaspoons three times a day is given in case of jaundice. | Malla et al. 2015, Kumar et al. 2010             |
|                    | Hordeum vulgare L.     | Seed    | Arginine, Histidine, lysine, tyrosine, methionine                                  | Dried seeds are used for hepatitis      | Prajapati et al. 2006                            |
|                    | Saccharum officinarum L. | Stem   | Flavonoids: naringenin, tricin, apigenin and luteolin derivatives                  | Juice extracted from stem considered     | Kumar & Choyal 2012                              |
| Portulacaceae     | Portulaca quadrifida L.| Leaves  | Gallotannins, omega-3 fatty acids, ascorbic acid, α-tocopherols, kaempferol, quercetin, and apigenin | For cure of hepatic                      | Zaman et al. 2018, Zhou et al. 2015              |
| Podocarpaceae     | Podocarpus falcatus (Thunb.) Mirb | Stem, leaves | Nagilactones, dilactones and derivates                                          | The shoot is boiled, and 1 cup is drunk; oozing liquid from the stem is mixed with cold water and is drunk for cure of liver disease | Tuasha et al., 2018, Addo et al., 2015            |
| Polygonaceae      | Rumex hastatus D. Don  | Aerial parts | Triterpenoids, stilbene glycosides, tannic acid, saponins, resveratrol, sterols, amino acids, alkaloids, phenolic compounds and vitamin | For treatment of jaundice               | Haq et al. 2011, Liang et al. 2010, Pieroni et al. 2008 |
|                    | Rumex nepalensis Spreng. | Aerial parts | Torachrysone, rumexoside, orientaloside, orcinol glucoside, aloesin and lycosinosol | For the treatment of liver disease       | Liang et al. 2010, Giday et al. 2009,           |
| Punicaeae         | Punica granatum L.     | Fruit, seed | Citric acid, sorbitol, mannitol, pelleterine, isoquercetin, glucose, sucrose, maltose, and oxalic acid | Seeds of P. granatum are grounded together along with sugar dissolved in water can be used for hepatitis | Ouelbani 2016, Ikram & Hussain 1978             |
| Ranunculaceae     | Anemone hepatica L.    | Leaves  | Triterpenoids, saponins, steroids, lactones, fats and oils, saccharides, and alkaloids | Infusion is used for protection of liver | Hao & Xio. 2017, Bonet et al. 1999              |
| Family | Species | Part(s) | Components | Uses | References |
|--------|---------|---------|------------|------|------------|
| | **Nigella sativa** L. | Seeds | Thymoquinone (TQ), thymohydroquinone (THQ), dithymoquinone, thymol, carvacrol, α and β-pinene, d-limonene, d-citronellol, p-cymene volatile oil | Decoction is used for jaundice | Kidane et al. 2018, Forouzanfar et al. 2014 |
| Rhamnaceae | **Ziziphus jujuba** Mill. | Fruit | Sterols, flavonoids, cerebrosides | Used for treatment of jaundice, hepatitis, and other liver disorders | Kumar & Choyal 2012 |
| | **Ziziphus mauritiana** Lam. | Leaves | Betulonic aldehyde, betulonic acid, ceanethic acid, frangufoline, spinosin and stearic acid | For cure of hepatic disorders | Zaman et al. 2018, Guo et al. 2014 |
| Rosaceae | **Prunus domestica** L. | Fruit | D-galactose, D-mannose, L-arabinose, D-xylose, glucoronic acid, prudumestin | Extract of dried fruit of P. domestica soaked are used for hepatitis. | Prajapati et al. 2006, Pieroni et al. 2014 |
| | **Rubus ellipticus** Smith | Fruit | Gallic acid, catechin, chlorogenic acid and caffeic acid | | |
| | **Prunus jacquemontii** Hook. f. | Fruit | Proanthocyanidin, epicatechin | For the cure of hepatitis C | Hussain et al. 2018, Pant et al. 1992 |
| | **Prunus spinosa** L. | Fruit | Anthocyanin, hydroxycinnamic acids | Hepatoprotector' | Sabatani et al. 2020, Pieroni et al. 2004 |
| Rubiaceae | **Aegle marmos** (L.) Correa | Leaves, roots | Tannin, flavonoids, and steriods | Decoction of leaves and unripe fruit is used for treatment of jaundice and other liver disorder. | Kumar & Choyal 2012 |
| | **Morinda citrifolia** L. | Fruit | Scopoletin, octanoic acid, potassium, vitamin C, terpenoids, alkaloids, anthraquinones, nordamnacanthal, morindone, rubiadin | For the cure of hepatitis | Samani & Kopaei, 2018, Su et al. 2005 |
| | **Rubia cordifolia** L. | Roots | Anthraquinone, lucidin primeveroside, ruberythric acid and three new anthraquinones, | Decoction is used for liver problems | Ahmad et al. 2017, Itokawa 1983 |
| Rutaceae | **Citrus sinensis** (L.) Osbeck | Fruit | Atripilside B, β-sitosterol, and β-sitosterol-3-O-β-D-glucopyranoside | For the cure of hepatitis C | Samani & Kopaei, 2018, Ceuterick et al. 2008, Saleem et al. 2010 |
| | **Citrus limon** (L.) Osbeck | Fruit | β-Pinene, Limonene, Linalool and α-Terpineol | Dink the juice with honey for liver infections | Hsouna et al. 2017, Ellena et al. 2012 |
| Family                | Species                  | Part     | Compounds/Actions                                                                 | Refs                                                                 |
|----------------------|--------------------------|----------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Saxifragaceae        | Saxifraga melanocentra   | Aerial   | Kaempferol (1), quercetin, kaempferol, beta glucoside, quercetin, -D-glucoside    | For the cure of hepatitis C                                         |
|                      | Franch                   |          |                                                                                   | Samani & Kopaei, 2018, Zuo et al. 2005                                |
| Scrophulariaceae     | Picrohiza kurooa Royle   | Rhizome  | Kutkin, a bitter glycoside which contains two C-9 iridoid glycosides-             | Rhizome powder is used in the treatment of liver troubles and jaundice |
|                      | ex. Benth                |          | Picroside I and Kutakoside.                                                       | Kumar & Choyal 2011                                                  |
| Solanaceae           | Solanum nigrum L.        | Leaves   | Gentisic acid, luteolin, apigenin, kaempferol, m-coumaric acid.                   | To cure hepatitis, A, B, C                                           |
|                      |                          |          | anthocyanidin                                                                     | Hussain et al. 2016                                                  |
| Urticaceae           | Arietaria judaica L.     | Leaves   | Piperitone, camphor and ethyl cinnamate                                            | Used as antiviral                                                   |
|                      |                          |          |                                                                                   | Maxia et al. 2008                                                   |
| Zingiberaceae        | Curcuma longa L.         | Root     | Ar-turmerone, β-sesquiphellandrene and curcumenol, *curcumin*                     | Decoction is used for hepatitis C                                   |
|                      |                          |          |                                                                                   | Abduel-Lateef et al. 2016, Sandhu et al. 2005                       |
|                      | Zingiber officinale      | Root     | 6-gingerol, 6 shogaol, and 6-paradol, zingiberene and bisabolene, gingerols and   | Decoction is used for jaundice                                      |
|                      | Roscoe                   |          | shogaols                                                                          | Feng et al. 2011, Heinrich et al. 1998                              |
In order to assess how geographical and ecological factors may have affected indigenous practices, the recorded data were subjected to regional comparison. The medicinal plants were divided into four groups (a) Pakistan (b) Asia (c) Europe (d) Rest of the world. Jaccard’s similarity index was applied to determine similarities on the medicinal flora used for the cure of different types of hepatitis in different cultural communities all over the world. According to the Jaccard’s index of similarity, the Pakistani communities used sum total of 58 species, Asia 56 species, Europe 24 species and rest of the world 18 species for the cure of hepatitis. Between Pakistani and Asia community’s 14 species (12%) were found to be the same while between Asia and Europe 5 species (6.2 %) were found in common. The similarity between Pakistan and Europe communities was 7 species (11%). The current study documented 6 species (7.8 %) similarity between Pakistan and rest of the world and 5 species (6.2%) were shared between Asia and Europe. The similarity between Asia and Rest of the world were recorded as 4 (5.4%) Figure 4. The maximum similarities were observed between Pakistan and Asia (12%).
Figure 4. Venn diagram showing the comparison among the four studied regions (number of recorded plant species).

*Silybum marianum* (Milk thistle) has been used to treat liver diseases since the 16th century. Its major constituents are the flavonoids silibinin, silidianin, silichristin, and isosilibinin of which silibinin is the biologically most active compound and used for standardization of pharmaceutical products (Wagner et al. 1976). The pharmacological profile of Silymarin has been well defined and hepatoprotective properties of Silymarin were investigated both in vitro and in vivo. Glycyrrhizin is an extract of the *Glycyrrhiza glabra*, used in medicine traditionally to relieve bronchitis, gastritis and jaundice. The compounds present in glycyrrhizin are glycyrrhetic acid, flavonoids, hydroxycoumarins, and beta-sitosterol. For treatment of chronic hepatitis, a standardized extract containing glycyrrhizin, cysteine and glycine is organized as Stronger Neo-Minophagen C (Stickel & Schuppan 2007). The plants of the genus *Phyllanthus* are found in most tropical and sub-tropical countries and have long been used to treat chronic liver diseases. Phyllantins, hypophyllantins and several polyphenoles are major constituents of which chemical and pharmacological properties are well described (Calixto et al. 1998). The active compounds within Phyllanthus showed anti-viral activities against hepatitis B virus infection through mRNA transcription and replication (Venateswaran et al. 1987). Recently, a number of trials were evaluated regarding *Phyllanthus* extract preparations in a systematic review which led to clinical evidences for the treatment of chronic hepatitis B (Liu et al. 2001). To cure liver disorders numerous herbal mixtures are identified through search in traditional Oriental Medicine Database (Chen et al. 1998). Among these, extracts from *Plantago asiatica* appear to exert hepatoprotective activity without significant toxicity. In United States, for both acute and chronic hepatitis with focal necrosis and portal fibrosis *Lycopodium serratum* has been considerably used based on duration of intake. It has sleep-inducing properties (Woolf et al. 1994, Picciotto et al. 1998). In U.S. ephedrine in Ma Hung (Ephedra sp.) used to lose weight. A person with acute hepatitis used Ma-Hung for only 3 weeks, he developed anti-nuclear antibodies and muscle anti-bodies (Nadir et al. 1996).

Many plant species have been examined for a broad-spectrum activity to cure liver disorders (Asadi-Samani et al. 2015). *Panax ginseng* belongs to family Araliaceae. Roots of ginseng inhibit toxin hepatic damage by decreasing vital genes expression, which is essential for normal liver functions (Hafez et al. 2017). *Cynara scolymus* (artichoke) of the Asteraceae family, a species, is traditionally used for the treatment of digestive disorders, moderate hyperlipidemia and liver and biliary diseases. *C. scolymus* leaf extract has been used for its hepatoprotective effects (Gebhardt 1997). By studying literature it has been confirmed that *C. scolymus* was important in maintaining normal liver function parameters, maintaining liver redox status, as manifested by a significant increase in the activities of antioxidant enzymes and a
reduction in glutathione accompanied by inhibition of lipid peroxidation (LPO) and protein oxidation, decreased nitric oxide and tumor necrosis factor alpha, and stabilized membrane in untested paracetamol-intoxicated rats (Ali et al. 2012). *Hedyotis diffusa* and some of its active constituents have a wide variety of reported pharmacological activities, including anticancer, chemo preventive, hepatoprotective, antiviral, antibacterial, anti-diabetic, antioxidant, and gastroprotective properties (Qi et al. 2015). *Nigella sativa* belongs to family Rannunculaceae is used traditionally for the different disorders such as asthma, cough, bronchitis, headache, rheumatism, fever, influenza, and eczema. Antioxidant activity and resolution of hepato-renal toxicity have been reported for *N. sativa* seeds (Ali-Ghamadi 2001). Juice of *Ananas comosus* (L.) Merr (Bromeliaceae) commonly known as pineapple, has liver protective action (Mohamad et al. 2020) also showed that some medicinal plants i.e. the leaf and flower part of the *Pandanus fascicularis* Lam, the root of the *Berberis aristata* DC and the whole plant of *Oxalis corniculata* L is used for the treatment of hepatitis. Farzaei et al. (2020) showed that the *Glycyrrhiza glabra* (Licorice) used for the treatment of hepatitis, besides from the treatment this plant also famous for the treatment of cough and sore throat. Many other medicinal plant species are traditionally used to treat hepatitis. Plants derived natural products such as flavonoids, terpenoids, protein, lignans and alkaloids to inhibit the replication cycle of DNA and RNA viruses (Prakash et al. 2006). *Argyrolobiurn roseum* (Fabaceae) produces vitex (flavonoid) and D-pinitol (monosaccharide) and these two compounds are reported to control hepatitis C (Gupta et al. 2005, Ram et al. 2007). Medicinal plants such as *Adiantum capillus-veneris*, *Argyrolobiurn roseum*, *Equisetum debile*, *Carissa opaca*, *Phyllanthus emblica*, *Segeretia brandrethiana*, *Viola serpens*, *Plantago ovate*, *Woodfordia fruticosa*, *Saccharum officinarum* and *Prunus domestica* have more recently been reported for the treatment of hepatitis. The medicinal plant *Adiantum capillus-veneris* (Adiantaceae) comprising chemical constituents, which are used for the treatment of hepatitis. It is important to confirm that which plant parts are used in liver diseases because in most of the phytochemical investigations, the secondary metabolites are different in plants parts. Different types of plants used by the local communities of Kalat and Huzdar region of Baluchistan, Pakistan traditionally to cure various types of hepatitis (Table 1). In addition, it has also been reported that, mostly plants used as a treatment of Hepatitis in the Soan Valley Salt Range Pakistan (Tareen et al. 2010, Bibi et al. 2014). The main natural products report from these plants are flavonoids, terpenoids, tannins, volatile oil, gallic acid (Khanum et al. 2013). The main secondary metabolites reported from *Berberis lycium* (Berberidaceae) have been shown active in curing hepatitis, as has *Equisetum debile* (Equisetaceae), *Cucumis sativus* (Cucurbitaceae), *Cuscuta reflexa* (Convolvulaceae) showed anti hepatitis activity.
Boerhavia diffusa, parameters against carbon tetrachloride induced lysosomal latency by normalizing serum biochemical activity (Moradi et al. 2015). The root extracts of P. niruri (Euphorbiaceae) are used to treat liver diseases; the extracts of this plant are reported to contain phyllanthine, flavonoids such as quercetin and isoquercetin. Prunus domestica (Rosaceae) fruit contains D-galactose, D-mannose, L-arabinose, D-xylene, glucoronic acid, flavonoid, and prudomestin. Punica granatum L. (Punicaceae) contain citric acid, sorbitol, mannitol, pelletierine, isoqueretin, glucose, sucrose, mallowt, oxalic acid in their fruits and seeds (Ikram 1978) and both plants show anti-hepatitis activity. Moreover, Silymarin found in the whole plant extracts of Silybum marianum (milk thistle) have been recognized as “Liver tonic” for centuries. Milk thistle has been reported to have protective effects on liver and to greatly improve its function (Hackett et al. 2013). Silybum marianum leaves are reported to contain flavoligrans, silybin, isosilybin and silymarin and these compounds have application to cure jaundice. The main compounds reported from Silybum marianum are the flavolagnans silybin, silydianin, and silychristine collectively called as silymarin. Silybin is the most important compound with range of biological activities. Moreover, Silymarin found in the whole plant but its more concentrated in fruits (6% in ripe fruit) and seeds. In addition, extracts of milk thistle have been recognized as liver tonic (Dhiman et al. 2005). Another plant, Ziziphus mauritiana (Rhamnaceae) contains twenty-one compounds, including ten triterpenoids, two sterols, six flavonoid and three cerebroside, these were isolated from the fruit of Ziziphus mauritiana for the disorder of liver diseases. Melia azedarach is found to be useful to treat hepatitis. Many of these plants show antioxidant activity, possibly explaining their hepatoprotective activity (Moradi et al. 2016). The crude powder of Mimosa pudica prevents liver cell necrosis and lysosomal latency by normalizing serum biochemical parameters against carbon tetrachloride induced hepatotoxicity (Qadir et al. 2017). The roots of Boerhavia diffusa, commonly known as 'Punarnava', are used by a large number of tribes in India for the treatment of various hepatic disorders. The hepatoprotective activity of different parts of Boerhavia diffusa L. (Nyctaginaceae) such as root and aerial parts was evaluated against Ibuprofen persuade hepatotoxicity in Wistar albino rats (Maity et al. 2015).

Conclusions

Our study showed that many medicinal plants have been used since ancient time to cure hepatitis worldwide. Our literature review will help the scientific community to identify anti-hepatitis plants in order to isolate novel anti-hepatitis compounds.

Declarations

List of abbreviations: HAV:Hepatitis A Virus, HBV:Hepatitis B Virus, HCV:Hepatitis C Virus, WHO:World Health Organization, LPO:lipid peroxidation, DNA:Deoxy-ribo Nucleic Acid, RNA:Ribo-Nucleic Acid, HIV:Human Immune Virus

Ethics statement: This study is pure literature review, and no ethics approval was required.

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Literature cited

Abbas W, Hussain W, Hussain W, Badshah L, Hussain K, Pieroni A. 2020. Traditional wild vegetables gathered by four religious groups in Kurram District, Khyber Pakhtunkhwa, North-West Pakistan. Genetic Resources and Crop Evolution 1-16. 10.1007/s10722-020-00926-3.

Abbas Z, Khan SM, Abbasi AM, Pieroni A, Ullah Z, Iqbal M, Ahmad Z. 2016. Ethnobotany of the Balti community, Tormik valley, Karakorum range, Baltistan, Pakistan. Journal of Ethnobiology and Ethnomedicine 12(1):38.

Abbasi AM, Khan MA, Ahmad M, Zafar M, Jahan S, Sultana S. 2010. Ethnopharmacological application of medicinal plants to cure skin diseases and in folk cosmetics among the tribal communities of North-West Frontier Province. Pakistan. Journal of Ethnopharmacology 128(2):322-335.
Abassi AM, Khan MA, Ahmad M, Zafar M, Khan H, Muhammad N, Sultana S. 2009. Medicinal plants used for the treatment of jaundice and hepatitis based on socio-economic documentation. African Journal of Biotechnology 8(8):1643-1650.

Abdel-Lateef E, Mahmoud F, Hammam O, El-Ahwany E, El-Wakil E, Kandil S, Hassenein H. 2016. Bioactive chemical constituents of Curcuma longa L. rhizomes extract inhibit the growth of human hepatoma cell line (HepG2). Acta Pharmacuetica 66(3):387-398.

Addo EM, Chai HB, Hymete A, Yeshak MY, Siebodnick C, Kingston DG, Rakotondraibe LH. 2015. Antiproliferative constituents of the roots of Ethiopian Podocarpus falcatus and structure revision of 2α-hydroxynagilactone F and nagilactone I. Journal of Natural Products 78(4):827-835.

Adebowale KO, Adedire CO. 2006. Chemical composition and insecticidal properties of the underutilized Jatropha curcas seed oil. African Journal of Biotechnology 5(10):901.

Adnan M, Jan S, Mussarat S, Tariq A, Begum S, Afroz A, Shinwari ZK. 2014. A review on ethnotobany, phytochemistry and pharmacology of plant genus Caralluma R. B r. Journal of Pharmacy and Pharmacology 66(10):1351-1368.

Agelet A, Valles J. 2003. Studies on pharmaceutical ethnotobany in the region of Pallars (Pyrenees, Catalonia, Iberian Peninsula). Part II. New or very rare uses of previously known medicinal plants. Journal of Ethnopharmacology 84(2-3):211-227.

Ahamed T, Mondal K, Khan M I, Munni TN, Alam T, Islam R. 2018. Ethnomedical survey of plants used by the folk medicinal practitioner (FMP) in the Jamalpur sadar Upazilla, Jamalpur district, Bangladesh. Asian Journal of Medical and Biological Research 4(4):422-426.

Ahmad A, Ahmad B, Ali A, Ahmad Y. 2009. Seroprevalence of HBsAg and anti-HCV in general healthy population of Swat district with frequency of different HCV Genotypes. Pakistan Journal of Medical Sciences 25(5):744-748.

Ahmad K, Pieroni A (2016) Folk knowledge of wild food plants among the tribal communities of Thakhte-Sulaiman Hills, North-West Pakistan. Journal of Ethnobiology and Ethnomedicine 12:7. https://doi.org/10.1186/s13002-016-0090-2.

Ahmad K, Weckerle CS, Nazir A (2019) Ethnobotanical investigation of wild vegetables used among local communities in northwest Pakistan. Acta Societatis Botanicorum Poloniae 88(1):3616. https://doi.org/10.5586/absp.3616.
Ali ZY, Atia HA, Ibrahim NH. 2012. Possible hepatoprotective potential of Cynara scolymus, Cupressus sempervirens and Eugenia jambolana against paracetamol-induced liver injury:in-vitro and in-vivo evidence. Natural Sciences 10(1):75-86.

Alishawsh MA, Abdulla MA, Ismail S, Amin ZA. 2011. Hepatoprotective effects of Orthosiphon stamineus extract on thioacetamidine-induced liver cirrhosis in rats. Evidence-based complementary and alternative medicine.

Amrani NM, El-Kashoury ESA, Abou El-Kassem LT, Abd El-Hakeem RE. 2013. Evaluation of the phenolic content and antioxidant potential of Althaea rosea cultivated in Egypt. Journal of The Arab Society for Medical Research 8(2):691-694.

Andrade JM, Faustino C, Garcia C, Ladeiras D, Reis CP, Rijo P 2018. Rosmarinus officinalis L.: an update review of its phytochemistry and biological activity. Future science OA 4(4):FSO283.

Appendino G, Belliardo F, Nano GM, Stefenelli S. 1982. Sesquiterpene lactones from Artemisia genipi Weber: isolation and determination in plant material and in liqueurs. Journal of Agricultural and Food Chemistry 30(3):518-521.

Asadi-Samani M, Kafash-Farkhad N, Azimi N, Fasihi A, Alinia-Ahandani E, Raffiean-Kopaei M. 2015. Medicinal plants with hepatoprotective activity in Iranian folk medicine. Asian Pacific Journal of Tropical Biomedicine 5(2):146-157.

Ashfaq UA, Idrees S. 2014. Medicinal plants against hepatitis C virus. World Journal of Gastroenterology:WJG 20(11):2941.

Bader GN, Mir PA, Naqash A, Ali T, Wadoo R, Ali S. 2017. Phytochemical screening and evaluation of Hepatoprotective potential of Swertia petiolata against thioacetamide induced hepatotoxicity in rats. International Journal Current Research 9(06):52737-47.

Badhani A, Rawat S, Bhatt ID, Rawal RS. 2015. Variation in Chemical Constituents and Antioxidant Activity in Yellow Himalayan (Rubus ellipticus Smith) and Hill Raspberry (Rubus niveus Thunb). Journal of food biochemistry 39(6):663-672.

Bai N, He KAN, Roller M, Zheng B, Chen X, Shao Z, Zheng Q. 2008. Active compounds from Lagerstroemia speciosa, insulin-like glucose uptake-stimulatory/inhibitory and adipocyte differentiation-inhibitory activities in 3T3-L1 cells. Journal of Agricultural and Food Chemistry 56(24):11668-11674.

Balick MJ, Elisabetsky E, Laird SA. (Eds.). 1996. Medicinal resources of the tropical forest:biodiversity and its importance to human health. Columbia University Press.

Bandaranayake WM. 2006. Quality control, screening, toxicity, and regulation of herbal drugs. Modern Phytomedicine:25-57.

Barros L, Pereira E, Calheira RC, Dueñas M, Carvalho AM, Santos-Buelga C, Ferreira IC. 2013. Bioactivity and chemical characterization in hydrophilic and lipophilic compounds of Chenopodium ambrosioides L. Journal of Functional Foods 5(4):1732-1740.

Batiha GES, Alkazmi LM, Wasef LG, Beshbishy AM, Nadwa EH, Rashwan EK. 2020. Syzygium aromaticum L. (Myrtaceae): Traditional uses, bioactive chemical constituents, pharmacological and toxicological activities. Biomolecules 10(2):202.

Bhatia H, Sharma YP, Manhas R, Kumar K. 2014. Ethnomedicinal plants used by the villagers of district Udhampur, J&K, India. Journal of Ethnopharmacology 151:1005-1018.

Bharagual DD, Kumar N, Garg VK, Sharma PK. 2010. Review on plants havin g hepatoprotective activity. Journal of Pharmacy Research 3(9):2077-2082.

Bibi S, Sultana J, Sultana H, Malik, RN. 2014a. Ethnobotanical uses of medicinal plants in the highlands of Soan Valley, Salt Range, Pakistan. Journal of Ethnopharmacology 155(1):352-361.

Bibi T, Ahmad M, Tareen RB, Tareen NM, Jabeen R, Rehman SU, Sultana S, Zafar M, Yaseen G. 2014b Ethnobotany of medicinal plants in district Mastung of Balochistan province-Pakistan. Journal of Ethnopharmacology 157:79-89. doi:10.1016/j.jep.2014.08.042

Boh B, Berovic M, Zhang J, Zhi-Bin L. 2007. Ganoderma lucidum and its pharmaceutically active compounds. Biotechnology Annual Review 13:265-301.

Calixto JB, Santos AR, Filho VC, Yunes RA. 1998. A review of the plants of the genus Phyllanthus: their chemistry, pharmacology, and therapeutic potential. Medicinal Research Reviews 18(4):225-258.

Ceuterick M, Vandebroek I, Pieroni A. 2011. Resiliency of Andean urban ethnotobanies:a comparison of medicinal plant use among Bolivian and Peruvian migrants in the United Kingdom and in their countries of origin. Journal of Ethnopharmacology 136(1):27-54.

Ceuterick M, Vandebroek I, Torry B, Pieroni A. 2008. Cross-cultural adaptation in urban ethnotobany: the Colombian folk pharmacopoeia in London. Journal of Ethnopharmacology 120(3):342-359.
Chen L, Chen R, Wei K. 1992. Constituents of tannins from Euphorbia prostrata Ait. Zhongguo Zhong yao za zhi= Zhongguo zhongyao zazhi= China Journal of Chinese Materia Medica 17(4):225-6.

Chen SL, Morgan TR. 2006. The natural history of hepatitis C virus (HCV) infection. International Journal of Medical Sciences 3(2):47-52.

Chen TSN, Chen PS. Liver in traditional Chinese medicine. Journal of Gastroenterology and Hepatology 1998:13:437–42

Choo QL, Kuo G, Weiner AJ, Overby LR, Bradley DW, Houghton M. 1989. Isolation of a cDNA clone derived from a blood-borne non-A, non-B viral hepatitis genome. Science 244(4902):359-362.

Corrêa GM, Alcântara AFDC. 2012. Chemical constituents and biological activities of species of Justicia: a review. Revista Brasileira de Farmacognosia, 22(1):220-238.

Cusher A. 2002. Acute and chronic viral hepatitis. In: Cusher A, Steel JC, Moosa AR, editors. Essential surgical practice. 5th ed. London:Oxford University Press 2:334-5.

Da Cheng H, Xiao Jie G, Pei GX. 2015. Phytochemical and biological research of Papaver pharmaceutical resources. Medicinal Plants: Chemistry Biology and Omics 217-251.

De Melo MLS, Narain N, Bora PS. 2000. Characterisation of some nutritional constituents of melon (Cucumis melo) hybrid AF-522 seeds. Food Chemistry 68(4):411-414.

Dhiman RK, Chawla YK. 2005. Herbal medicines for liver diseases. Digestive Diseases and Sciences 50(10):1807-1812.

EASL International consensus conference on hepatitis B. 13-14 September, 2002 Geneva , Switzerland. Journal of Hepatology 2003;38:533-40

Egea T, Signorini MA, Bruschi P, Rivera D, Obón C, Alcaraz F, Palazón JA. 2015. Spirits and liqueurs in European traditional medicine: Their history and ethnobotany in Tuscany and Bologna (Italy). Journal of Ethnopharmacology 175:241-255.

Ellena R, Quave CL, Pieroni A. 2012. Comparative medical ethnobotany of the Senegalese community living in Turin (Northwestern Italy) and in Adeane (Southern Senegal). Evidence-Based Complementary and Alternative Medicine, 2012.

Ercisli S, Orhan E. 2007. Chemical composition of white (Morus alba), red (Morus rubra) and black (Morus nigra) mulberry fruits. Food Chemistry 103(4):1380-1384.

Escudero NL, De Arellano ML, Fernández S, Albraccin G, Mucciarelli S. 2003. Taraxacum officinale as a food source. Plant Foods for Human Nutrition 58(3):1-10.

Farooq A, Anjmad MS, Ahmad K, Altaf M, Umar M, Abbasi MA. 2019. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 15 (1):45. doi:10.1186/s13002-019-0323-2

Farzai MH, Bayrami Z, Farzai F, Aneva I, Das SK, Patra JK, Abdollahi M. 2020. Poisoning by Medical Plants. Archives of Iranian Medicine 23(2):117.

Fawad K. 2016 response to anti -viral therapy in district Mardan, Khyber Pakhtunkhawa, Pakistan. Asian Pacific Journal of Cancer Prevention 1037-40.

Feng T, Su J, Ding ZH, Zheng YT, Li Y, Leng Y, Liu JK. 2011. Chemical constituents and their bioactivities of “Tongling White Ginger” (Zingiber officinale). Journal of agricultural and food chemistry 59(21):11690-11695.

Forouzanfar F, Bazzaz BSF, Hosseinzadeh H. 2014. Black cumin (Nigella sativa) and its constituent (thymoquinone): a review on antimicrobial effects. Iranian journal of basic medical sciences 17(12):929.

Foster S. 1991. Milk thistle Silybum marianum (No. Folleto 14309).

Gandomi H, Abbaszadeh S, JebelliJavan A, Sharifzadeh A. 2014. Chemical Constituents, Antimicrobial and Antioxidative Effects of Trachyspermum ammi Essential Oil. Journal of Food Processing and Preservation 38(4):1690-1695.

Gebhardt R. 1997. Antioxidative and protective properties of extracts from leaves of the artichoke (Cynara scolymus L.) against hydroperoxide-induced oxidative stress in cultured rat hepatocytes. Toxicology and Applied Pharmacology 144(2):279-286.

Gewali MB, Awale S. 2008. Aspects of traditional medicine in Nepal. Japan: Institute of Natural Medicine. University of Toyama.

Giday M, Asfaw Z, Woldu Z, Teklehaymanot T. 2009. Medicinal plant knowledge of the Bench ethnic group of Ethiopia: an ethnobotanical investigation. Journal of Ethnobiology and Ethnomedicine 5(1):34.

Gokavi SS, Malleshi NG, Guo M. 2004. Chemical composition of garden cress (Lepidium sativum) seeds and its fractions and use of bran as a functional ingredient. Plant Foods for Human Nutrition 59(3):105-111.
Govind P, Pandey SP. 2011. Phytochemical and toxicity study of Emblica officinalis (Amla). International Research Journal of Pharmacy 2(3):270-272.

Gunes S, Savran A, Paksoy MY, Kosar M, Cakicioglu U. 2017. Ethnopharmacological survey of medicinal plants in Karaisali and its surrounding (Adana-Turkey). Journal of Herbal Medicine 8:68-75. doi:10.1016/j.jhermed.2017.04.002.

Guo S, Duan JA, Zhao JL, Qian DW, Zhang WJ. 2014. Chemical constituents from seeds of Ziziphus mauritiana. Zhong yao cai= Zhongyaocai= Journal of Chinese Medicinal Materials 37(3):432-435.

Gupta OP, Ahmed Z, Bhagat A, Gupta KK, Handa SS. 2005. U.S. Patent No. 6,869,625. Washington, DC:U.S. Patent and Trademark Office.

Gupta PC, Sharma N, Rao CV. 2012. A review on ethnobotany, phytochemistry and pharmacology of Fumaria indica (Fumitory). Asian Pacific Journal of Tropical Biomedicine 2(8):665-669.

Gupta VK, Sharma SK. 2006. Antioxidants neutralise the effect of free radicals through different ways and mayAppears in Collections:NPR Vol.5(4),1346.

Gurudeeban S, Satyavani K, Ramanathan T. 2010. Bitter apple (Emblica officinalis):An overview of chemical composition and biomedical potentials. Asian Journal of Plant Sciences 9(7):394.

Habib-ul-Rehman, Yasin KA, Choudhary MA, Khaliq N, Atta-Ur-Rahman, Choudhary MI, Malik S. 2007. Studies on the chemical constituents of Phyllanthus emblica. Natural Product Research 21(9):775-781.

Hackett ES, Twedt DC, Gustafson DL. 2013. Milk thistle and its derivative compounds:a review of opportunities for treatment of liver disease. Journal of Veterinary Internal Medicine 27(1):10-16.

Hadijakhroodi A, Vatandoost H, Khanavi M, Sadeghpour Roodsari HR, Vosoughi M, Kazemi M, Abai MR. 2006. Fatty acid composition and toxicity of Melia azedarach L. fruits against malaria vector Anopheles stephensi. Iranian Journal of Pharmaceutical Sciences 2(2):97-102.

Hadžifejzović N, Kukić-Marković J, Petrović S, Soković M, Glamočlija J, Stojković D, Nahrstedt A. 2013. Bioactivity of the extracts and compounds of Ruscus aculeatus L. and Ruscus hypoglossum L. Industrial crops and products 49:407-411.

Hafriz MM, Hamed SS, El-Khadragy MF, Hassan ZK, Al Rejaie SS, Sayed-Ahmed MM., Al-Shabanah OA. 2017. Effect of ginseng extract on the TGF-β1 signaling pathway in CCl 4-induced liver fibrosis in rats. BMC Complementary and Alternative Medicine 17(1):1-11.

Hakim ST, Kazmi SU, Bagasra O. 2008. Seroprevalence of hepatitis B and C genotypes among young apparently healthy females of Karachi-Pakistan. Libyan Journal of Medicine 3(2):66-70.

Hao DC, Gu X, Xiao P. 2017. Anemone medicinal plants:ethnopharmacology, phytochemistry and biology. Acta Pharmaceutica Sinica B 7(2):146-158.

Haq F, Ahmad H, Alam M. 2011. Traditional uses of medicinal plants of Nandiar Khwarr catchment (district Battagram), Pakistan. Journal of Medicinal Plants Research 5(1):39-48.

Haq I, Hussain M. 1993. Medicinal plants of Mansehra. Hamdard Medicus 36(3):63-100.

He K, Cao TW, Wang HL, Geng CA, Zhang XM, Chen JJ. 2015. Chemical constituents of Swertia patens. Zhongguo Zhong yao za zhi= Zhongguo zhongyao zazhi= China journal of Chinese Materia Medica 40(20):4012-4017.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico:Healers' consensus and cultural importance. Social Science & Medicine 47(11):1859-1871. doi:10.1016/S0277-9536(98)00181-6.

Hsouna AB, Halima NB, Smaoui S, Hamdi N. 2017. Citrus limon essential oil:chemical composition, antioxidant and antimicrobial activities with its preservative effect against Listeria monocytogenes inoculated in minced beef meat. Lipids in Health and Disease 16(1):146.

Hussain I, Shah M, Khan MS, Saqlian M. 2013. Prevalence of hepatitis C in selected patients in Parachinar, Kurrum Agency, Pakistan. International Journal of Biosciences 3(3):142-54.

Hussain J, Munir M, Hassan Z, Bano N, Arshad S, Ahmad VU. 2010. Tanacetamide D:a new ceramic from Tanacetum artemisioides. Helvetica Chimica Acta 93(2):350-353.

Hussain W, Badshah L, Ullah M. 2018. Quantitative study of medicinal plants used by the communities residing in Koh-e-Safaid Range, northern Pakistani-Afghan borders. Journal of Ethnobiology and Ethnomedicine 14(1):30 . doi.org/10.1186/s13002-018-0229-4

Hussain W, Hussain J, Ali R, Khan I, Shinwari ZK, Nascimento IA. 2012. Tradable and conservation status of medicinal plants of Kurram Valley. Parachinar, Pakistan. Journal of Applied Pharmaceutical Science 2(10):66.

Idm’hand E, Msanda F, Cherif K. 2020. Ethnobotanical study and biodiversity of medicinal plants used in the Tarfaya Province, Morocco. Acta
Ecologica Sinica 40 (2) 134-144. doi:10.1016/j.ecss.2020.01.002.

Ikrar M, Hussain SF. 1978. Compendium of medicinal plants. P.C.S.I.R Laboratories, Peshawer 23-14

Ikrar M, Nowshad F. 1977. Constituents of Quercus infectoria. Planta medica 31(03):286-287.

Iqbal I, Afzal M, Aftab MN, Manzoor F, Kaleem A, Kaleem A. 2016. Hepatotoxicity of Cassia fistula extracts in experimental chicks and assessment of clinical parameters. Kuwait Journal of Science 43(3).

Ishtiaq S, Ahmad M, Hanif U, Akbar S, Kamran SH. 2014. Phytochemical and in vitro antioxidant evaluation of different fractions of Amaranthus graecizans subsp. silvestris (Vill.) Brenan. Asian Pacific Journal of Tropical Medicine 7:S342-S347.

Jaccard P. 1902. Lois de distribution florale dans la zone alpine. Bulletin of the the Vaudois Society of Natural Sciences 38:69–130

Jaime MFV, Redko F, Muschietti LV, Campos RH, Martino VS, Cavallaro LV. 2013. In vitro antiviral activity of plant extracts from Asteraceae medicinal plants. Virology 10(1):245.

Jan HA, Wali S, Ahmad L, Jan S, Ahmad N, Ullah N. 2017. Ethnomedicinal survey of medicinal plants of Chinglai valley, Buner district, Pakistan. European Journal of Internal Medicine 13:64–74.

Kadir MF, Sayeed MSB, Mia M. 2012. Ethnopharmacological survey of medicinal plants used by indigenous and tribal people in Rangamati, Bangladesh. Journal of Ethnopharmacology 144(3):627-637. doi:10.1016/j.jep.2012.10.003.

Kassaye KD, Amberbir A, Getachew B, Mussema Y. 2006. A historical overview of traditional medicine practices and policy in Ethiopia. Ethiopian Journal of Health Development 20(2):127-134.

Kato N. 2000. Genome of human hepatitis C virus (HCV), gene organization, sequence diversity, and variation. Microbial and Comparative Genomics 5:129-51.

Kayani S, Ahmad M, Sultana S, Shinwari ZK, Zafar M, Yaseen G, Bibi T. 2015. Ethnobotany of medicinal plants among the communities of Alpine and Sub-alpine regions of Pakistan. Journal of Ethnopharmacology 164:186-202. https://doi.org/10.1016/j.jep.2015.02.004

Kebela D, Achamyyleh H. 2018. Assessment of medicinal plants and their conservation status in case of Daligaw Kebela, Gozamen Werda, East Gojam Zone. J Biodivers Biopros Dev 5:170-175.

Khan AA, Ahmad H, Ghafoor US, Begum K, Khan Al. 2010. Frequency distribution of hepatitis in three districts of Hazara Division. Asian Journal 45:16-19.

Khan I, Najeebullah S, Ali M, Shinwari ZK. 2016. Phytopharmaceutical and ethnomedicinal uses of the Genus Berberis (Berberidaceae): A review. Tropical Journal of Pharmaceutical Research 15(9):2047-2057.

Khan S, Mirza KJ, Abdin MZ. 2010. Development of RAPD markers for authentication of medicinal plant Cuscuta reflexa. Eurasian Journal of Biosciences 1(4):1-7.

Khan ST, Riaz N, Afza N, Nelofar A, Malik A, Ahmed E, Hussain S. 2006. Studies on the chemical constituents of Prosopis cineraria. Journal of the Chemical Society of Pakistan 28(6):619-622.

Khanum R, Jahangir M, Abbasi MA, Mazhar F, Kausar S, Riaz T, Ajaib M. 2013. Phytochemical Screening and Antioxidant Evaluations of Different Fractions of Argyrolobium roseum. Asian Journal of Chemistry 25(13):14219-31.

Kidane L, Gebremedhin G, Beyene T. 2018. Ethnobotanical study of medicinal plants in Ganta Afeshum District, Eastern Zone of Tigray, Northern Ethiopia. Journal of Ethnobiology and Ethnomedicine 14:64. doi:10.1186/s13002-018-0266-z.

Kitazato K, Wang Y, Kobayashi N. 2007. Viral infectious disease and natural products with antiviral activity. Drug Discoveries & Therapeutics 1(1):14-22.

Konowalchuk J, Speirs JI. 1976. Virus inactivation by grapes and wines. Applied and Environmental Microbiology 32(6):757-763.

Konowalchuk J, Speirs JI. 1978. Antiviral effect of commercial juices and beverages. Applied and Environmental Microbiology 36(6):798-801.

Konowalchuk J, Speirs JI. 1978. Antiviral effect of apple beverages. Applied and Environmental Microbiology 35(6):1219-1220.

Kpodar MS, Lawson-Evi P, Bakoma B, Eklu-Gadegbeku P, Agbonon A, Aklikokou A, Gbeassor M. 2015. Ethnopharmacological survey of plants used in the treatment of diabetes mellitus in south of Togo (Maritime Region). Journal of Herbal Medicine 5(3):147-152. doi: 10.1016/j.hermed.2015.06.002.

Kumar CH, Ramesh A, Kumar JS, Ishaq BM. 2011. A review on hepatoprotective activity of medicinal plants. International journal of Pharmaceutical sciences and research 2(3):501.

Kumar KA, Sharvanee S, Patel J, Choudhary RK. 2010. Chemical composition and antimicrobial
activity of the essential oil of Desmostachya bipinnata L. International Journal of Phytomedicine 2(4).

Kumar N, Choyal R. 2012. Traditional use of some plants of Hamirpur district of Himachal Pradesh for the treatment of jaundice, hepatitis and other liver disorders. International Journal of Theoretical & Applied Sciences 4:201-205.

Kumar N, Kumar R, Kishore K. 2013. Onosma L.: A review of phytochemistry and ethnopharmacology. Pharmacognosy Reviews 7(14):140.

Kuo PC, Yang ML, Wu PL, Shih HN, Thang TD, Dung NX, Wu TS. 2008. Chemical constituents from Abutilon indicum. Journal of Asian natural products research 10(7):689-693.

Li D, Zuo H, Gao H, Wu L. 2004. Study on the chemical constituents of Sophora flavescens Ait. Journal of Shenyang Pharmaceutical University 21(5):346-348.

Liang HX, Dai HQ, Fu HA, Dong XP, Adebayo AH, Zhang LX, Cheng YX. 2010. Bioactive compounds from Rumex plants. Phytochemistry Letters 3(4):181-184.

Lin CC, Kan WS. 1990. Medicinal plants used for the treatment of hepatitis in Taiwan. The American journal of Chinese medicine 18(01):35-43.

Liu G, Liu X, Zhang Y, Zhang F, Wei T, Yang M, Zhao Z. 2015. Hepatoprotective effects of polysaccharides extracted from Zizyphus jujuba cv. Huanghetanzao. International Journal of Biological Macromolecules 76:169-175.

Liu J, Lin H, McIntosh H. 2001. Genus Phyllanthus for chronic hepatitis B virus infection: a systematic review. J Viral Hep 8:368-466.

Liu Q, Zhu M, Geng X, Wang H, Ng TB. 2017. Characterization of polysaccharides with antioxidant and hepatoprotective activities from the edible mushroom Oudemansiella radicata. Molecules 22(2):234.

Lok AS, Mc Mohan BJ. 2009. Chronic hepatitis B. Hepatology 50(03):661-662.

Mahmood A, Malik RN, Shinwari ZK. 2013. Indigenous knowledge of medicinal plants from Gujranwala district, Pakistan. Journal of Ethnopharmacology 148:714-723. doi:10.1016/j.jep.2013.05.035.

Maity T, Maity S, Pahari N, Kar DR, Ganguli S. 2015. A review on hepatic diseases and development of herbal drugs for the treatment of liver complications. World Journal of Pharmaceutical Research 4:677-691.

Malede M, Tefera M, Mehari B. 2020. Trace Metals in the Leaves of Selected Plants Used to Treat Hepatitis in Dembia, Ethiopia. Journal of Herbs, Spices & Medicinal Plants 26(1):101-112.

Malla B, Gauchan DP, Chhetri RB. 2015. An ethnobotanical study of medicinal plants used by ethnic people in Parbat district of western Nepal. Journal of Ethnopharmacology 165:103-117.

Mangro SM, Dahot MU, Leghari SM. 1995. Chemical constituents of Equisetum debile Roxb. Pakistan Journal of Plants Sciences 1(1):41-48.

Marrelli M, Amodeo V, Statti G, Conforti F. 2019. Biological properties and bioactive components of Allium cepa L. Focus on potential benefits in the treatment of obesity and related comorbidities. Molecules 24(1):119.

Maxia A, Lancioni MC, Balia AN, Alborghetti R, Pieroni A, Loi MC. 2008. Medical ethno botany of the Tabarkins, a Northern Italian (Ligurian) minority in south-western Sardinia. Genetic Resources and Crop Evolution 55(6):911-924.

Mazutti M, Mossi AJ, Cansian RL, Corazza ML, Dariva C, Oliveira JV. 2008. Chemical profile and antimicrobial activity of Boldo (Peumus boldus Molina) extracts obtained by compressed carbon dioxide extraction. Brazilian Journal of Chemical Engineering 25(2):427-434.

Medeiros PMD, Soldati GT, Alencar NL, Vande broek I, Pieron A, Hanazaki N, de Albuquerque U. 2012. The use of medicinal plants by migrant people: adaptation, maintenance, and replacement. Evidence-Based Complementary and Alternative Medicine, 2012.

Mkaddem M, Bouajila J, Ennajjar M, Lebrihi A, Mathieu F, Romdhane M. 2009. Chemical composition and antimicrobial activities of Mentha longifolia L. and M. viridis essential oils. Journal of Food Science 74(7):M358-M363.

Monika DM, Bisht PS, Chaturvedi P. 2020. Medicinal Uses of Traditionally Used Plants in Bhatwari Block, District Uttarkashi, Uttarakhand, India. Journal of Scientific Research 64(1).

Moradi MT, Asadi-Samani M, Bahmani M, Shahrani M. (2016). Medicinal plants used for liver disorders based on the Ethnobotanical documents of Iran: A Review. International Journal of PharmTech Research 9(5):407-415.

Moussaieff A, Shein NAA, Tsenter J, Grigoriadis S, Simeonidou C, Alexandrovich AG, Munoz E. 2008. Incensole acetate: a novel neuroprotective agent
isolated from Boswellia carterii. Journal of Cerebral Blood Flow & Metabolism 28(7):1341-1352.

Moyer LA, Mast EE, Alter MJ. 1999. Hepatitis C, routine serologic testing and diagnosis. American Family Physician 59:79-88.

Muley BP, Khadabadi SS, Banarase NB. 2009. Phytochemical constituents and pharmacological activities of Calendula officinalis L. (Asteraceae): a review. Tropical Journal of Pharmaceutical Research 8(5).

Mustafa B, Hajdari A, Krasniqi F, Hoa Xia E, Ademi H, Quave CL, Pieroni A. 2012. Medical ethnobotany of the Albanian Alps in Kosovo. Journal of Ethnobiology and Ethnomedicine 8(1):6.

Nadir A, Agraval S, King PD, Marshall JB. 1996. Acute hepatitis associated with the use of a herbal product, Ma Huang. American Journal of Gastroenterology 91:1436-8.

Nahrstedt A, Butterweck V. 1997. Biologically active and other chemical constituents of the herb of Hypericum perforatum L. Pharmacopsychiatry 30(S 2):129-134.

Nasri N, Tilii N, Elfalleh W, Cherif E, Ferchichi A, Khaled A, Triki S. 2011. Chemical compounds from Phoenician juniper berries (Juniperus phoenicea). Natural Product Research 25(18):1733-1742.

Negi JS, Singh P, Joshi GP, Rawat MS, Bisht VK. 2010. Chemical constituents of Asparagus. Pharmacognosy Reviews 4(8):215.

Negi JS, Singh P, Bisht B. 2011. Chemical constituents and biological importance of Swertia: a review. Current Research in Chemistry 3(1):1-15.

Okunade, AL. 2002. Ageratum conyzoides L. (Asteraceae). Fitoterapia 73(1):1-16.

Omo RA, Gathirwa J, Akala H, Malebo H M, Machocho AK, Hassanali A, Ndiele IO. 2014. Bisbenzylisoquinoline and hasubanane alkaloids from Stephania abyssinica Dillon & A. Rich. (Menispermaceae). Phytochemistry 103:123-128.

Ong HG, Kim YD. 2014. Quantitative ethnobotanical study of the medicinal plants used by the Ati Negrito indigenous group in Guimaras Island, Philippines. Journal of Ethnopharmacology 242:157-228. doi:10.1016/j.jep.2014.09.015.

Ouelbani R, Bensari S, Mouas TN, Khelfi D. 2016. Ethnobotanical investigations on plants used in folk medicine in the regions of Constantine and Mila (North-East of Algeria). J Ethnopharmacol 194:196-218. doi:10.1016/j.jep.2016.08.01

Ovanović O, Radulović, Stojanović G, Palić R, Zlatković, Gudzić B. 2009. Chemical composition of the essential oil of Centaurium erythraea Rafn (Gentianaceae) from Serbia. Journal of Essential Oil Research 21(4):317-322.

Paltinean R, Toiu A, Wauters JN, Frederic M, Tilts M, Angenot L, Crisan G. 2016. Phytochemical analysis of Fumaria officinalis L. (Fumariaceae). Farmacia 64(3):409-413.

Pant G, Nautiyal AK, Rawat MS, Sutherland JK, Morris GA. 1992. Identification and ab initio carbon-13 NMR assignment of a proanthocyanidin from Prunus jacquemontii. Magnetic resonance in chemistry 30(13):S142-S147.

Paterska M, Bandurska H, Wysłouch J. 2017. Chemical composition of horse-chestnut (Aesculus) leaves and their susceptibility to chestnut leaf miner Cameraria ohridella Deschka & Dimić. Acta Physiologiae Plantarum 39:105. https://doi.org/10.1007/s11738-017-2404-y

Pattiram PD, Lasekan O, Tan CP, Zaidul ISM. 2011. Identification of the aroma-active constituents of the essential oils of Water Dropwort (Oenanthe javanica) and 'Kacip Fatimah' (Labisia pumila). International Food Research Journal 18(3).

Pereira AP, Ferreira IC, Marcelino F, Valentão P, Andrade PB, Seabra R, Pereira JA. 2007. Phenolic compounds and antimicrobial activity of olive (Olea europaea L. Cv. Cobrançosa) leaves. Molecules 12(5):1153-1162.

Picciotto A, Campo N, Brizzolara R, Giusto R, Guido G, Sinelli N. 1998. Chronic hepatitis induced by Jin Bu Huan. Journal of Hepatology 28:165-7.

Pieroni A, Gray C. 2008. Herbal and food folk medicines of the Russlanddeutschen living in the Albanian Alps in Kosovo. Journal of Ethnobiology and Ethnomedicine 8(1):6.

Pieroni A, Muenz H, Akbulut M, Başer KHC, Durmuşkahya C. 2005. Traditional phytotherapy and trans-cultural pharmacy among Turkish migrants living in Cologne, Germany. Journal of Ethnopharmacology 102(1):69-88.

Ouelbani R, Privitera S. 2014. Ethnobotany and its links to medical sciences and public health: quo vadis? Journal of Phytotherapy 35(02):58-62.

Pieroni A, Quave CL, Giusti ME, Papp N. 2012. “We are Italian”: the hybrid ethnobotany of a Venetian
diaspora in Eastern Romania. Human Ecology 40(3):435-451.

Pieroni A, Quave CL, Santoro RF. 2004. Folk pharmaceutical knowledge in the territory of the Dolomiti Lucane, inland southern Italy. Journal of Ethnopharmacology 95(2-3):373-384.

Pieroni A. 2008. Local plant resources in the ethnobotany of Theth, a village in the Northern Albanian Alps. Genetic Resources and Crop Evolution 55(8):1197-1214.

PMRC. Prevalence of hepatitis B and C in Pakistan, Islamabad. Pakistan Medical and Research Council 2008.

Prajapati ND, Purohit SS, Sharma AK, Kumar T. 2006. A Hand book of Medicinal Plants. 3rd Edition.

Qadir MI, Ahmad Z. 2017. Advances in hepatoprotective medicinal plants research. Bangladesh Journal of Pharmacology 12(3):229-242.

Qi F, Zhao L, Zhou A, Zhang B, Li A, Wang Z, Han J. 2015. The advantages of using traditional Chinese medicine as an adjunctive therapy in the whole course of cancer treatment instead of only terminal stage of cancer. Bioscience Trends 9(1):16-34.

Ragasa CY, Guardamano JD, Tan MCS, Shen CC. 2016. Chemical Constituents of Brassica rapa Chinensis L. and Brassica rapa var. parachinensis (Baily) Hanelt. International Journal of Current Pharmaceutical Review and Research 7(5):316-318

Ram G, Bhan MK, Ahuja A, Meena SR, Kaul MK, Gupta KK, Jolly RL, Khajuria RK. 2007. Variability and selection on different Argyrolobium rosemum accessions for morphological traits and yield. Genetic Resources and Crop Evolution 54(03):649-654.

Rao MR, Palada MC, Becker BN. 2004. Medicinal and aromatic plants in agro forestry systems. New vistas in agroforestry Springer Dordrecht 31:107-122.

Rashid N, Gbedomon RC, Ahmad M, Salako VK, Zafar M, Malik K. 2018. Traditional knowledge on herbal drinks among indigenous communities in Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 14(1):16 doi:10.1186/s13002-018-0217-821

Riaz N, Nawaz SA, Mukhtar N, Malik A, Afza N, Ali S, Choudhary MI. 2007. Isolation and enzyme-inhibition studies of the chemical constituents from Ajuga bracteosa. Chemistry & bBiodiversity 4(1):72-83.

Rigat M, Bonet MA, Garcia S, Garnatje T, Valles J. 2007. Studies on pharmaceutical ethnobotany in the high river Ter valley (Pyrenees, Catalonia, Iberian Peninsula). Journal of Ethnopharmacology 113(2):267-277.

Saleem M, Farooq A, Ahmad S, Shafiq N, Riaz N, Jabbar A, Malik A. 2010. Chemical constituents of Citrus sinensis var. shukri from Pakistan. Journal of Asian natural products research 12(8):702-706. doi:10.1080/10286020.2010.489041.

Samani ZN, Kopaei MR. 2018. Effective Medicinal Plants in treating Hepatitis B. International Journal of Pharmaceutical Sciences and Research:9(9).

Sandhu DS, Heinrich M. 2005. The Use Of Health Foods, spices and other botanicals in the Sikh community in London. Phytotherapy Research:An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives 19(7):633-642.

Seeger C, Mason WS, Lai MM. 2020. Molecular biology of hepatitis viruses. The Liver:Biography and Pathobiology 793-820.

Shabbir A, Shahzad M, Arfat Y, Ali L, Aziz RS, Murtaza G, Waqar SA. 2012. Berberis lycium Royle:A review of its traditional uses, phytochemistry and pharmacology Pakistan. African Journal of Pharmacy and Pharmacology 6(31):2346-2353.

Shah SA, Shah NA, Ullah S, Alam MM, Badshah H, Ullah S, Mumtaz AS. 2016. Documenting the indigenous knowledge on medicinal flora from communities residing near Swat River (Suvastu) and in high mountainous areas in Swat-Pakistan. Journal of Ethnopharmacology 182:67-79.

Shang MY, Cai SQ, Lin WH, Wang MC, Park JH. 2002. Studies on chemical constituents from the seed of Trigonella foenum-graecum. Zhongguo Zhong yao za zhi= Zhongguo zhongyao zazhi= China Journal of Chinese Materia Medica 27(4):277-279.

Sharma S, Kumar S. 2013. Phyllanthus reticulatus Poir an important medicinal plant:a review of its phytochemistry, traditional uses and pharmacological properties. International Journal of Pharmaceutical Sciences and Research 4(7):2528-2534.

Sharma US, Kumar A. 2011. In vitro antioxidant activity of Rubus ellipticus fruits. Journal of Advanced Pharmaceutical Technology & Research 2(1):47.

Shivhare MK, Singour PK, Chaurasiya PK, Pawar RS. 2012. Trianthema portulacastrum L. (bishkapra). Pharmacognosy reviews 6(12):132.
Singh O, Khanam Z, Misra N, Srivastava MK. 2011. Chamomile (Matricaria chamomilla L.): an overview. Pharmacognosy Reviews 5(9):82.

Singh P, Khandelwal P, Sharma KK, Sharma MC. 2010. Cetyl triacontanoate and other constituents from Acacia jacquemontii and Kigelia pinnata. Journal of the Indian Chemical Society 87(11):1403.

Srikanth M, Swetha T, Veeresh B. 2012. Phytochemistry and pharmacology of Oxalis corniculata Linn.: A review. International Journal of Pharmaceutical Sciences and Research 3(11):4077.

Srivastav S, Singh P, Mishra G, Jha KK, Khosa RL. 2011. Achyranthes aspera-An important medicinal plant: A review. Journal of Natural Product and Plant Resources 1(1):1-14.

Stickel F, Schuppan, D. 2007. Herbal medicine in the treatment of liver diseases. Digestive and Liver Disease 39(4):293-304.

Su BN, Pawlus AD, Jung HA, Keller WJ, McLaughlin JL, Kinghorn AD. 2005. Chemical Constituents of the Fruits of Morinda citrifolia (Noni) and Their Antioxidant Activity. Journal of Natural Products 68(4):592-595.

Tadele A, Taddese M, Jeevanandham S. 2015. Determination of Some Toxic Heavy Metal Accumulation in Medicinal Plants Commonly Used in Gondar Area District, Northwestern Ethiopia. International Journal of Pharmacy and Analytical Research 4:399–405.

Tareen RB, Bibi T, Khan MA, Ahmad M, Zafar M, Hina S. 2010. Indigenous knowledge of folk healers to treat malignancies and other human ailments in Dalle District, Sidama Zone, Ethiopia. J. Ethnobiol. Ethnomed 14(1):15.

Tyler VE, Brady R, Roberts JE. 1981. Pharmacognosy, 8th edition. K.M. Varghese Company, Bombay, p. 250.

Uddin G, Rauf A, Rehman TU, Qaisar M. 2011. Phytochemical screening of Pistacia chinensis var. integerrima. Middle East Journal of Scientific Research 7(5):707-711.

Ullah K, GM, Shah J, Alam M, Hussain. 2020. Ethnobotany of the Medicinal Plants Used by Indigenous Communities in the Mountain of Shishikoh Valley, Hindukush Chitral, KP, Pakistan. Ukrainian Journal of Ecology., 10 (2), 92-105, doi:10.15421/2020_70

Ullah M, Zaynab M, Fatima M, Abbas S, Sharif Y, Farooq TH, Ullah I. 2018. Plants as Antidiabetic Agents: Traditional Knowledge to Pharmacological Validation. PSM Biological Research 3(3):111-119.

Ullah R, Hussain Z, Iqbal Z, Hussain J, Khan FU, Khan N, Hussain I. 2010. Traditional uses of medicinal plants in Darra Adam Khel NWFP Pakistan. Journal of Medicinal Plants Research 4(17):1815-1821.

Umair M, Altaf M, Abbasi AM. 2017. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. PLOS ONE 12(6):e0177912. doi:10.1371/journal.pone.0177912.

Umar M, Khair HB, Anwar F, Zahid M. 2002. Themanagement of acute viral bleeding by octreotide. Journal of Rawalpindi Medical College 4:14-16.

Van Damme P, Kokoska L. 2015. In Vitro Antistaphylococcal Effects of Embelia schimperi Extracts and Their Component Embelin with Oxacillin and Tetracycline.

Venateswaran PS, Millman I, Blumberg BS. 1987. Effects of an extract from Phyllanthus niruri on hepatitis B virus and woodchuck hepatitis viruses: in vitro and in vivo studies. Proceedings of the National Academy of Science USA 84:274–278.

Vitalini S, Iriti M, Puricelli C, Ciuchi D, Segale A, Fico G. 2013. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy)—An alpine ethnobotanical study. Journal of Ethnopharmacology 145(2):517-529. doi:10.1016/j.jep.2012.11.024.

Wagner H, Seligmann O, Seitz M, Abraham D, Sonnenbichler J. 1976. Silydianin und Silychristin, zwei isomere Silymarine aus Silybum marianum L. Gaerth. (Mariendistel)/Silydianin and Silychristin,
two Isomeric Silymarins from *Silybum marianum* L. Gaertn. (milk thistle). Zeitschrift fuer Naturforschung B 31(6):876-884.

Wang L, Wang HQ, Chen RY. 2007. Studies on chemical constituents from bark of *Morus nigra*. Zhongguo Zhong Yao Za Zhi 32 (23):2497-2499.

Wangchuk P, Keller PA, Pyne SG, Taweechotipatr M, Tonsomboon A, Rattanajak R, Kamchonwongpaisan S. 2011. Evaluation of an ethnopharmacologically selected Bhutanese medicinal plants for their major classes of phytochemicals and biological activities. Journal of Ethnopharmacol 137:730-742.

Wangteeraprasert R, Lipipun V, Gunaratnam M, Neidle S, Gibbons S, Likhitwitaywuid K. 2012. Bioactive compounds from *Carissa spinarum*. Phytotherapy Research 26(10):1496-1499.

Wiedenfeld H, Zych M, Buchwald W, Furmanow M. 2007. New compounds from *Rhodiola kirilowii*. Scientia Pharmaceutica 75(1):29-34.

Yeşil Y, İnal İ. 2019. Traditional knowledge of wild edible plants in Hasankey (Batman Province, Turkey). Acta Societatis Botanicorum Poloniae 88(3):3633. doi:10.5586/asbp.3633.