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Use of medicinal Plants for (Covid-19) Management in Hangu District of Khyber Pakhtunkhwa, Pakistan

Tahira Batool[1], Tahira Bibi[1]*, Safia Gul[1] and Ismail Mazhar[2]

[1]*Sardar Bahadur Khan Women's University Quetta
[2]CMH Lahore Medical College and Institute of Dentistry

***Corresponding Author:** Tahira Bibi
*Sardar Bahadur Khan Women's University Quetta

Abstract
Since ancient times contagious diseases has been affecting human health in terms of viral, bacterial and other, microbial infections. But to combat and fight against such infections human beings always keep themselves prepare most likely by using herbal remedies at their homes. Viral infection (COVID-19) caused by corona viruses, affected a huge population of human beings around the globe and also affected the socio-economic life of the people throughout the world. It affects the respiratory system of human beings mostly, symptoms related to (COVID-19) includes fever, cough, respiratory tract infection, flu and in severe cases pneumonia. This study was conducted in Hangu district of Khyber Pakhtunkhwa with the aim to document the ethnobotanical knowledge of the local residents for the treatment of (COVID 19). The study documented 100 plant species belonging to 52 families that were used by inhabitants of the area for (COVID-19) treatment. Family Asteraceae remained dominant family with 13 species followed by Lamiaceae with 10 species, Fabaceae with 6 species and rosaceae with 5 species. Leaves were the mostly plant part used (31%) for the preparation of herbal remedies. Medicinal plants were mostly used in the form of powder (41%). The quantitative analysis of the documented plants revealed the highest FC values for *Citrus medica* (35), and least was recorded for *Fumaria indica* (6). Highest RFC value was reported for *Cassia angustifolia* (0.20) and lowest for *Emblica officinalis* (0.03). highest UR was reported for *Canabis sativa, Ephedra intermedia, Adiantum capillus* and *nigella sativa* (6) each, whereas 26 species were reported with (1) UR. Highest UV was documented for *Adiantum capillus* (0.35) and lowest for *Calotropis procera* (0.02). Highest FIV was reported for *Cassia angustifolia* (20.55) and least for *Fumaria indica* (3.33). Medicinal plants with 100% FL was *Piper nigram* (used for cough and chest congestion*), Curcuma longa* (used for respiratory tract infections and cough). The reported plants of the study should be tested clinically for their potential to fight against (COVID-19) and also be tested for their antiviral potential to use in synthetic drugs used for (COVID-19) treatment.

Introduction

The residents of many rural areas are mostly dependent on herbal remedies for treating various ailments, due to scarcity of commercial medicines local people possesses good knowledge of medicinal plants and their utilization as they mostly rely on them (Abbas et al. 2020; Qureshi. 2004). According to World Health Organization (WHO) report 3/4th of the world population are dependent on traditional use of medicinal plants (Sandhya et al. 2006). The effectiveness of the ethnobotanical plants has attracted business world towards its self as well (Tahir et al. 2020). In India and Pakistan, the knowledge of plants and their customary use as remedies is recognized as Ayurveda and Unani (Marwat & Rehman 2011). Medicinal plants are considered to be having chemical diversity in the form of flavonoids, alkaloids, terpenoids, steroids etc, which can serve to save human lives, when used to treat a disease. The action of plant chemicals may be in terms of antibacterial, antifungal or antiviral (Ben shabat et al. 2020; Rios & Recio. 2005).

Similarly, a disease broke out in Wuhan, city of China in December 2019, which caused a massive destruction in the form of human deaths. This disease was named as coronavirus (COVID-19) on 12th Feburary, 2020, also mentioned as SARS-CoV-2. This viral disease is assumed to be 5th lethal infection after influenza pandemic since 1918 (Liu & Shih 2020; Chan et al. 2020). On March 11th (COVID-19) was declared as pandemic by WHO due to its expeitidious outspread (Mackenzie & Smith. 2020). The estimated deaths caused by this viral infection are over 200,000 and 177 countries has been affected by this virus so far (Lai et al. 2020). The (COVID-19) proved to be one of the significant threat of 21st centuary to the world, there is not only an increase in mortality rate but also caused immense economic losses, unemployment and other social-economic crisis (Mckee & Stuckler 2020).

The novel corona virus was first identified by taking a throat swab of a patient on 7th of January 2020, followed by declaring health emergency by WHO on January 30th with no specific treatment available (WHO. 2020). (SARS-CoV-2) i.e severe acute respiratory syndrome belongs to class of coronaviruses, which is considered to be of the lethal viruses as it attacks the respiratory system, the molecular mechanism of this virus is yet under study so that their nature could be fully understood and a vaccine against this virus could be discovered (Xu et al. 2020; Tian et al. 2020). Coronavirus, is classified into order Nidovirales and family Coronaviridae, which further is divided into 4 genera namely, Alpha, Beta, Gamma and Deltacoronavirus. The alpha and betacoronavirus is assumed to be responsible for causing diseases in mammals and the rest of the two in birds (Gu & Wang 2020; Li et al. 2020; Zhang et al. 2020). According to Researchers the virus is transmitted from animals to human beings and it is originated from a seafood market in Wuhan China (Noor et al. 2020).

For this deadly virus where no authentic synthetic drug is available, investigators are concentrating on the use of herbal therapies and phytochemical agents (Jayawardena et al. 2020). As we know that from time immemorial people have been practicing traditional remedies for different ailments such that Greeks who used to cure infections by using different herbs namely, *Moschus moschiferus* L. (mushk), *Aloe vera* L. (sibr), *Paeonia emodi* Royle. (ood), *Crocus sativus* L. (zaafran), *Liquidambar acalyina* (amber) as these herbs contain antiviral, anti-inflammatory and antioxidant properties (Nikhat & Fazil 2020). Herbal compounds such as flavonoids (quercetin) found in vegetables and fruits represses replication of viruses and thus prevents its transmision as well because it has a property of binding towards the target viruses such as SARS-CoV-2 (Haung et al. 202; Mani et al. 2020; Mirzaie et al. 2020; Pandey et al. 2021).

Berberin, a Chinese medicine is effective against influenza related viral infections because it contains an alkaloid (isoquinoline) derived from medicinal plants (Haslberger. 2020). Chinese are struggling to combine synthetic and herbal medicines to treat this fatal disease and thus reduce the death rate and thus the studies has revealed that the combinations of these medicines has positive effects in reducing the harmful effects (Liu et al. 2020). There is a huge number of medicinal plants found worldwide with antiviral, antioxidant, anti-inflammatory properties which can be recommended to treat (COVID-19), some of these plants include *Nigella sativa* commonly known as black seeds (kalonji) which contain nigellimine, which prevents replication of virus like chloroquine and stimulates the entry of zinc ions into lungs to combat viral infection (Rahman. 2020; Islam et al. 2021).

Beside *Nigella sativa*, other plants such as *Salvia officinale* or sena have also been studied for various compounds such as flavonoids which helps in boosting up immune system, other soucres may also include turmeric, garlic, pomegranate, ginger and black pepper (Haslberger. 2020). Recently, the use of aromatic plants to treat various respiratory infections has been demonstrated. The chemical compounds of 5 aromatic plants such as *Origanum syriacum*, *Eucalyptus globulus, Rosmarinus officinalis, Mentha piperita*, and *Eucalyptus citriodora,* are used in the form of spray for curing respiratory diseases like cough, sore throat, and hoarseness (Ben et al. 2011).

In addition to above mentioned aromatic plants some species from the family Apiaceae such as *Lomatium dissectum*, *Osmorhiza occidentalis* and *Ligusticum* respectively, has also been reported to have antiviral properties against respiratory infections, moreover they also help in immune induction due to these characteristics these herbs have potential to reduce the severity of (COVID-19) (Yarnell. 2018). Similarly, white flowers of *Sambucus cerulea,*are used to cold and cough, the flowers are gathered and dried and taken in the form of tea to cure flu, and clearing nasal congestion. Another Chinese herb called *Astragalus membranaceus,* helps in increasing white blood cells as these cells are related to immune system so taking this herb as a capsule or in the form of tincture helps to boost the immunity. The seeds, flowers. Leaves and roots of the *Echinaceae angustifolia* and *E.purpurea,* can be used for their antimicrobial and antiviral properties against influenza (Krohn et al. 2020).

The recent reports and publications are loaded with the authentication of dietary therapy and medicinal plants to possess antiviral, antimicrobial, immunomodulatory potential against COVID-19. According to the latest literatures the ethnobotanical and dietary therapy could be incorporated in 4 ways i.e a: taking herbs as a supplement for inducing immunity and reducing or preventing viral attack, b:as a disinfectsants to clean and sanitize surfaces, c: to use masks coated with antiviral agents extracted from plants, d: using essential oils as aerosole sprays to prevent air transmission of this COVID-19 virus. As we know that wearing masks are best way to control transmission of viral agents into air and their transfer from human to human but after removing masks the virus gets back into the air so wearing a mask coated with antiviral agents reduces this risk (Greenhalgh et al. 2020; Leung et al. 2020).

India and Egypt has been practicing Aromatherapy since thousands of years to cure various ailments (Cooke & Ernst 2000). Several literatures and studies have assured the antiviral and antimicrobial potential of essential oils (Swamy et al. 2016). Whereas, research on the use of essential oils is only restricted to its liquid form where it is taken orally for any treatment however their vapourized form is quite more effective in case of airborne viruses and bacteria. The aromatic plants with antiviral and antimicrobial properties reported are *Pelargonium graveolens, Cinnamomum zeylanicum, Eucalyptus globulus, Citrus bergamia,* they inactivate the viral protenis and thus inhibit their action. The spread of (COVID-19) could be prevented by using essential oils vapours to sterilze air without any health hazard to human beings (Vimalanthan & Hudson, 2014).

Due to the speedy outspread of (COVID-19) people around the globe are anxious about this disease However, we can keep or self and family calm and safe by experiencing the guide lines provided by WHO, yet keeping a distance of 6 feet, washing hands, avoiding gatherings is not a complete solution for eradication of this disease. Herbal remedies and traditional knowledge of indigenous people is playing a key role in combating corona virus.

Therefore, in Hangu, a district of Khyber Pakhtunkhwa, due to increased number of (COVID-19) cases day by day and due to a fragile medical facility people of the area were engaged in following traditional remedies for the treatment of corona virus. This study was carried out to depict the variety of medicinal plants used in Hangu district during (COVID-19) pandemic.

Materials and methods

Study site

The present study was conducted in five different areas (Hangu city, Darsamand, Naryab, Thal, and Samana) of district Hangu, Khyber Pakhtunkhwa Pakistan. The total calculated area of District Hangu is 1,097km^2 . District Hangu lies 858m above the sea level and is situated between 33.53 North latitude, 71.06 East longitude. The total Population of District Hangu is about 512,794 according to the data from 2017 census. The local language spoken in the area is 98.8% Pashto (Murad et al. 2013; Govt of Pakistan. 2000).

District Hangu is a beautiful valley surrounded by green mountains, and a number of water springs and canals are found in the area. The climate of the area is moderate to rainy and the temperature rises from January till June. July and August are the hottest months of the year and temperature then gradually drops from October till December. Some of the major vegetation of the area are reported as *Melia azedarach, Accacia nilotica, Accacia modesta, Olea ferruginea* (Khan et al. 2014; Murad et al. 2013).

Data Collection

The traditional knowledge of the selected areas was collected from June 2021 till November 2021. A total of 9 visits were done to the study areas for data collection. The study involved 180 participants (75 men and 105 women) by purposive selection method in which people were asked to point out people with traditional medicinal knowledge but some randomly selected participants were also there from educational institutes. The participants were aged between 20-80 years, some educated but most illiterate. Semi structured interviews, standard questionnaire and group discussions were done in order to collect maximum data from participants. The study area was a rural area with strict customs and traditions therefore women participants were interviewed at their homes and men participants were interviewed by male representatives on my behalf. Each group of the respondents were briefed about the aims and objectives of this study to ensure their privacy and protection of knowledge. Interviews and group discussions were done in local language (Pashto) of the region. Questionnaire was prepared keeping in mind the vernicular names of the plants, part used for the treatment, demographic features, method of preparation and use, availability of plant and disease treated.

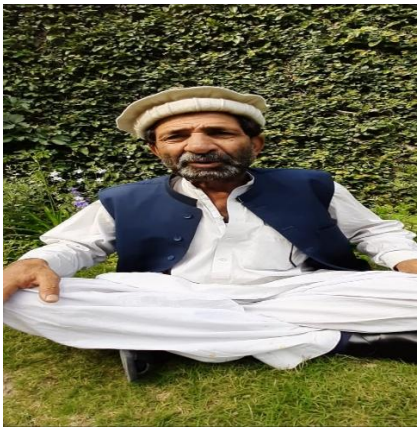

Fig 1 A local participant giving information on plants

Fig 2 A group of people being interviewed for plants for COVID treatment

Plants collection and identification

The plants reported during survey by participants were gathered from local vegetation of the area and from "pansars" and "hakeems" of the District Hangu. The specimens were mounted on herbarium sheet for preservation and identification from flora of Pakistan (Ali. 2008; Nasir & Ali 1971) and were also identified from taxonomists in University of Peshawar.

Data Analysis

Various statistical indices were used to analyze the collected data such as use value (UV), fidelity level (FL), relative frequency of citation (RFC), use report (UR), and family importance value (FIV).

Use Value (UV)

The relative significance of the plant species used was determined by use value using the following formula (Phillips et al. 1994).

$UV=\Sigma U/n$

Where U represents the number of plants cited by each respondent and n is the total number of respondents.

Frequency of citation (FC)

Frequency citation for the plant species was calculated using formula

FC= (no of times a particular plant species was cited/ total number of all the species cited) (Tardio & Santayana 2008).

Fidelity level (FL)

Fidelity level was used to determine the most cited species to treat a disease using a formula (Friedman et al. 1986).

$Fl\ (\%) = Np/N \times 100$

Where Np is the total number of respondents who cited the particular species and N is the total number of participants citing plant species for any disease.

Relative frequency of citation (RFC)

Medicinal plant species with highest therapeutic values were demonstrated using relative frequency of citation (RFC). It determines the value of each species and is calculated by frequency of citation (FC) to total no of respondants N (Yaseen et al. 2015; Vitalini et al. 2013).

$RFC = FC / N$ where $(0 < RFC < 1)$

Family index value (FIV)

The relative significance of each family was determined by family importance value which was calculated by %age of respondents referring family to the total number of participants (Vitalini et al. 2013).

FIV =FC/ N ×100

Significance of the study

The aim of the study was to document the different sources and status of medicinal plants used for the prevention of COVID-19 and to document the species diversity of the area and more preferably to file up the ethnobotanical knowledge of the inhabitants regarding different remedies which they prepare locally for the treatment of viral diseases and for the treatment of COVID-19 related symptoms.

Results and discussion

Demography of the area

The study conducted in District Hangu, of Khyber Pakhtunkhwa with the aim to document the medicinal plants used by the local people during (COVID-19) pandemic for the treatment of corona virus. A total of 180 participants were interviewed (53%) women and (47%) men. The informants were placed into different age categories i.e between (20-40), (40-60) and (60-80) however mostly (40%) were from (40-60) age group. The informants of the study belonged to different occupations and educational backgrounds,

The female informants were (15%) housewives, primary (7%) and (11%) high school teachers, few (3%) lady doctors, and mostly (16%) students. Whereas, the male participants were (10%) shopkeepers, (9%) hakeem and pansars, (5%) farmers, (6%) labours, (8%) primary and secondary school teachers. (1%) Law students, (3%) doctors and (5%) students.

Demographic table:

Table 1 Demographic data of the District Hangu

Gender	**Total**	**percentage**
Male	84	47%
Female	96	53%
Age groups	20-40=40	22%
	40-60=72	40%
	60-80=68	37%
Education attainment		
Illiterate	28	15%
Primary	33	18%
Middle	39	21%
Secondary	44	24%
University	36	22%
Occupation		
Female		
Housewives	28	15%
Primary school teachers	13	7%
High school teachers	20	11%
Lady health workers and doctors	5	3%
Students	30	16%
Male		
Shopkeepers	18	10%
Hakeem/pansar	17	9%
Farmers	9	5%
Labours	11	6%
Primary teachers	5	3%
High school teachers	6	3%
Law students	3	1%
Doctors	5	3%
Students	9	5%

Medicinal plants documented

The study documented a total of 100 plant species belonging to 52 families along their local names, family names, plant part used, disease treated and mode of preparation of the particular plant for the treatment of symptoms related to (COVID-19). The study preferred to document those plants that were used to treat the symptoms like fever, cold, cough, asthma and flue. The frequency citation (FC), use value (UV), use report (UR), relative frequency of citation (RFC), family importance value (FIV) and fidelity level (FL) of all the documented species are also listed in Table. Among the documented plants most were member of family Asteraceae (13 spp), followed by family Lamiaceae (10spp), Fabaceae (6spp), Rosaceae (5spp), Amarathaceae, Apiaceae, Amaryllidaceae and Rutaceae (3spp) each, Solanaceae, Malvaceae, Euphorbaceae, Zingiberaceae, Anacardiaceae**,** Asparagaceae, Myrataceae, Moraceae, Meliaceae, Papveraceae with (2spp) each, while rest of the 34 families were recorded with single plant species.

Table 2 Medicinal Plants name with their local names, family name, life form, part used, Mode of preparation and quantitative analysis

S.no	Taxonomic name	Family name	Local name	Life form	Part used	Disease treated	Mode of preparation	FC	RFC	UR	FIV	UV
1	*Aacia nilotica* L.	Fabaceae	Kiker	Tree	Flowers, Fruit	Fever, Cough, Throat Infection, flue	Powder	25	0.13	4	13.88	0.16
2	*Abelmoschus esculentus* L.	Malvaceae	Bindi	Herb	Leaves, Fruit	Cough, Fever	Decoction	21	0.11	2	11.66	0.09
3	*Acacia modesta* WalL.	Mimosaceae	Palosa	Tree	Bark, Gum	Cough, Chest Problem, backache, gynea problems	Powder	34	0.18	4	18.88	0.11
4	*Achyranthes aspera* L.	Amaranthaceae	Ghishkey	Herb	Leaves, Roots	Asthma, diarrhea, Cold, Cough, Bronchitis, Pneamonia	Decoction	12	0.06	6	6.66	0.5
5	*Acorus calamus* L.	Aceraceae	Skhwaja	Herb	Whole Plant	Fever, Cold Cough	Decoction and powder	11	0.06	3	6.11	0.27
6	*Adiantum capillus* L.	Pteridaceae	Sumbal	Herb	Whole Plant	Cough, Fever, Toothache, eye diseases, hepatitis, immunity regulator	Decoction	17	0.09	6	9.44	0.35
7	*Ajuga bracteosa* Wall Ex Benth	Lamiaceae	Boti	Herb	Shoot	Chest, Throat Pain, Nassal Infection	Extract	22	0.12	3	12.22	0.13
8	*Ajuga parviflora* Benth.	Lamiaceae	Bhutey	Herb	Whole Plant	Fever, Throat	Decoction and leaf powder	29	0.16	2	16.11	0.06
9	*Allium cepa.* L.	Amaryllidaceae	Piyaz	Herb	Bulb	Increasing Immunity, antiviral	Paste with honey	32	0.17	2	17.77	0.06
10	*Allium griffithianum* Boiss.	Amaryllidaceae	Da Ghara Piyaz	Herb	Leaves, Bulb	Cough	Decoction	17	0.09	1	9.44	0.05
11	*Allium sativum* L.	Amaryllidaceae	Ooga	Herb	Bulb	Antibacterial, Antiviral	Paste added to soups	26	0.14	2	14.44	0.07
12	*Artemisia absinthium* L	Asteraceae	Dhada Tarkha	Herb	Leaves	Abdominal Pain, Fever, Typhoid	Decoction and powder	34	0.18	3	18.88	0.08
13	*Artemisia vulgaris* L.	Asteraceae	Tarkha	Herb	Leaves	Fever	Decoction	31	0.17	1	17.22	0.03
14	*Asparagus officinalis* L.	Asparagaceae	Tandorey	Herb	Root, Shoot	Fever	Juice	27	0.15	1	15	0.03
15	*Asparagus racemosus* (Willd.) Oberm.	Asparagaceae	Shagrardak	Shrub	Stem, Leaves	Diarrhea, Inflammation, Cough	powder	19	0.10	4	10.55	0.21
16	*Aster trinervius* Roxburgh	Asteraceae	Tarkha	Herb	Root	Cough, Cold, Fever	Extract	18	0.1	3	10	0.16
17	*Azadirachta indica* A.Juss.	Meliaceae	Neem/Shandai	Tree	Leaves	For Malaria Fever, antibacterial	Decoction	17	0.09	2	9.44	0.11

18	*Berberis lyceum* L.	Berberidaceae	Kwarey	Shrubs	Root, Bark	Throat infection, Asthma	Root decoction and root powder	22	0.12	2	12.22	0.09
19	*Bergenia ciliate* (Haw.) Sternb	Saxifragaceae	Kamar Panra	Herb	Root	Fever, Cough, Cold, Pulmonay Infection	powder	23	0.12	4	12.77	0.17
20	*Bryophyllum pinnatum* (Lam.) Pers.	Crassulaceae	Kamar Gul	Herb	Leave	Cough, Astimah, Anti-septic	Decoction	19	0.10	3	10.55	0.15
21	*Calotropis procera* (Aiton) W.T.Aiton	Apocynaceae	Spalmaey	Shrub	Latex milk	Respiratory problem, Cough, Toothache, Ear pain	Powder	20	0.11	4	11.11	0.02
22	*Cannabis sativa* L.	Cannabaceae	Bhang	Herb	Leaves	Fever, Cough, Colic Pain, Digestion problem, immunity, diarrhea	Extract	30	0.16	6	16.66	0.2
23	*Carthamus oxyacantha* L.	Asteraceae	Ghazanka	Herb	Stem, Flower, Seeds	Fever	Powder	11	0.06	1	6.11	0.09
24	*Cassia angustifolia* MilL.	Fabaceae	Sana makhi	Shrub	Leaves	Constipation but widely Used for Covid-19	Powder	37	0.20	2	20.55	0.05
25	*Cassia fistula L.*	Fabaceae	Amaltas	Tree	Fruit	Chest infection, weight lose	Decoction	14	0.07	2	7.77	0.14
26	*Cedrela serrate* L.	Meliaceae	Shnai	Tree	Leaves	Fever, nerve tonic	Powder	18	0.1	2	10	0.11
27	*Cedrus deodara* Roxb.	Pinaceae	Ranzhra	Tree	Stem, Bark	Asthma, skin infection, blood purification	Stem decoction and bark powder	14	0.07	3	7.77	0.21
28	*Chenopodiastrum murale* L.	Amaranthaceae	Kharawa	Herb	Whole Plant	Colic Pain, Cough	Powder or decoction	30	0.16	2	16.66	0.06
29	*Chenopodium ambrosioides* L.	Amaranthaceae	Skha Botey	Shrub	Shoot	Common fever, Malaria Fever	Juice of shoot	18	0.1	2	10	0.11
30	*Cicer arietinum* L.	Fabaceae	Cholay	Herb	Fruit	Flue, Cough	Decoction	12	0.06	2	6.66%	0.16
31	*Cichorium intybus* L.	Asteraceae	Kasni botay	Herb	Leaves, Flower	Asthma, Cough, Flue	Decoction	18	0.1	3	10	0.16
32	*Cinchona officinalis* L.	Rubiaceae	Quenine	Shrub	Stem, Bark	For Malaria Fever	Powder	28	0.15	1	15.55	0.03
33	*Cinnamomum zeylanicum* L.	Lauraceae	Darchini	Tree	Bark	Cough, Cold, Flu, Immunity	Powder	33	0.18	4	18.33	0.12
34	*Citrus medica* L	Rutaceae	Narang	Shrub	Fruit, Leaves	Pain, Digestion, Stomach Problem, Dry cough	Decoction of leaves and fruit	35	0.19	4	19.44	0.11

							taken directly					
35	*Cleome brachycarpa* Vahl ex DC.	Capparaceae	Zachawa	Shrub	Leaves	Fever	Paste	11	0.06	1	6.11	0.09
36	*Crocus sativus* L.	Iridaceae	Zaafran	Herb	Stemens, Flower	Cold, Cough	Boiled in tea	29	0.16	2	16.11	0.06
37	*Curcuma longa* L.	Zingiberaceae	Kurkaman	Herb	Stem	Respiratory tract Infection, Cough, antiviral	Powder	22	0.12	3	12.22	0.13
38	*Datura innoxia* MilL	Solanaceae	Batora	Shrub	Seeds, Leaves	Asthma, Eyes Diseases, Antiseptic, cough	Powder	17	0.09	4	9.44	0.23
39	*Diospyros lotus* L.	Ebenaceae	Tor Amlok	Tree	Fruit, Leaf, Stem	Cough, Sore throat	Fruit taken directly, leaf powder and stem decoction	23	0.12	2	12.77	0.08
40	*Duchesnea indica* (Jacks)	Rosaceae	Zmakeen tooth	Herb	Fruit	Sour Throat, Cough	Fruit juice	16	0.08	2	8.88	0.12
41	*Emblica officinalis* Gaertn.	Phyllanthaceae	Amla	Tree	Fruit	Antibody formation	Raw fruit or juice	7	0.03	1	3.88	0.14
42	*Ephedra intermedia* Schrenk & C.A.Mey.	Ephedraceae	Mewa	Shrub	Stem	Nasal congestion, bronchitis, fever, Cough, Flu, Asthma	Decoction	24	0.13	6	13.33	0.25
43	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Lachi	Tree	Seeds	Cough, Throat Infection, cold, flue, chest problems	Powder	26	0.14	5	14.44	0.19
44	*Euphorbia helioscopia* L.	Euphorbiaceae	Mandarro	Herb	Whole Plant	Cough, Chest infection, antibacterial	Powder	29	0.16	3	16.11	0.10
45	*Ficus carica* L.	Moraceae	Inzar	Tree	Fruit, Leaves	Immunity, Cough, Anti-bacterial	Decoction of leaves and fruit taken directly	31	0.17	3	17.22	0.09
46	*Foeniculum vulgare* Mill	Apiaceae	Soonf	Herb	Seeds	Cough, Cold, Fever, Urinary Problem	Seeds taken orally or boiled in tea	33	0.18	4	18.33	0.12
47	*Fragaria nubicola*. LindL.	Rosaceae	Strawberry	Herb	Fruit	Cough	Fruit taken direcly	19	0.10	1	10.55	0.05
48	*Fumaria indica* Hausskn.	Papaveraceae	Pugsley	Herb	Shoot	Fever	Decoction	6	0.03	1	3.33	0.16
49	*Glycine max* L.	Fabaceae	Soybean	herb	seeds	Fever	Decoction	12	0.06	1	6.66	0.08
50	*Glycyrrhiza glabra* L.	Fabaceae	Mulathi	Herb	Fruit	Cough, Respiratory, Sour throat	Powder	19	0.10	3	10,55	0.15

51	*Helianthus tuberosus* L.	Asteraceae	Topanium boux	Herb	Tubers	Cough, Fever, Asthma	Powder and decoction	24	0.13	3	13.33	0.12
52	*Heracleum candicans* WalL.	Apiaceae	Skhwara	Herb	Whole Plant	Cough, Throat, Infection	Decoction mixed with honey	27	0.15	2	15	0.07
53	*Ipomoea carnea* Jacq.	Convolvulaceae	Perwatha	Shrub	Leaves, Stem	Asthma	Milky extract	09	0.05	1	5	0.11
54	*Justicia adhatoda* L.	Acanthaceae	Baza	Shrub	Leaf, Stem	Asthma, Bronchititis, Cough	Decoction	32	0.17	3	17.77	0.09
55	*Lactuca serriola* L.	Asteraceae	Termirra	Herb	Whole Plant	Asthma, Cough	Taken directly as salad	22	0.12	2	12.22	0.09
56	*Launaea nudicaulis* L.	Asteraceae	Shodapal	Herb	Leaves	Fever	Poultice	21	0.11	1	11.66	0.04
57	*Magnolia champaca* L.	Magnoliaceae	Champa	Tree	Flower	Fever	Decoction	9	0.05	1	5	0.11
58	*Malva neglecta* Wallr.	Malvaceae	Pandirak	Herb	Seed, Leaves	Cough, bladder ulcer	Seed powder and cooked leaves	24	0.13	2	13.33	0.06
59	*Mangifera indica* L.	Anacardiaceae	Aam	Tree	Bark, Seed, Leaf, Fruit	Sore Throat	Decoction and seed powder	10	0.05	1	5.55	0.1
60	*Mentha longifolia* L.	Lamiaceae	Velaney	Herb	Leaves	Fever, Diarrhea	Leaf powder	21	0.11	2	11.66	0.09
61	*Mentha spicata* L.	Lamiaceae	Podina	Herb	Whole Plant	Diarrhea, cough, Flu.	Decoction and powder	31	0.17	3	17.22	0.09
62	*Micromeria biflora* Benth	Lamiaceae	Nari Shamakay	Herb	Leaves, Stem	Cold, Cough, gum strenthening	Decoction and powder	14	0.07	3	7.77	0.21
63	*Morus nigra* L.	Moraceae	Tor Toot	Tree	Fruit	Cough	Fruit juice	28	0.15	1	15.55	0.03
64	*Nepeta cataria* L.	Lamiaceae	Chamjan boti	Herb	Leaves	Cold, Cough	Leaf infusion and decoction	12	0.06	2	6.66	0.16
65	*Nigella sativa* L.	Ranunculaceae	Kalwanji	Herb	Seeds	Cough, Flu, Asthma, Fever, immunity, bronchitis	powder	19	0.10	6	10.55	0.31
66	*Ocimum basilicum* L.	Lamiaceae	Kashmalu	Herb	Leaves, Seeds	Throat Infection	Powder	9	0.05	1	5	0.11
67	*Olea ferruginea* L.	Oleaceae	Khawaan	Tree	Leaves, Stem	Throat Pain, Antidiabetic	Decoction	32	0.17	2	17.77	0.06
68	*Origanum majorana* L.	Lamiaceae	Sperkay	Shrub	Leaves	Cold, Cough, Asthma	Powder	11	0.06	3	6.11	0.27
69	*Otostegia limbata* Benth.	Lamiaceae	Spin Azghey	Shrub	Leaves	Throat Infection	Decction	13	0.07	1	7.22	0.07

70	*Papaver dubium* L.	Papaveraceae	Kashqash	Herb	Seeds	Cough, Chest Problem	Decoction with milk	34	0.18	2	18.88	0.05
71	*Peganum harmala* L.	Nitrariaceae	Spelani	Shrub	Fruit, Seeds	Seed Powder used against Fever	Powder mixed with honey	13	0.07	1	7.22	0.07
72	*Pimpinella diversifolia* DC.	Apiaceae	Tarpakai	Herb	Leaves	Fever	Decoction	23	0.12	1	12.77	0.04
73	*Piper nigrum.* L.	Piperaceae	Tor Mirch	Herb	Fruit	Cough, Chest congestion	Powder	27	0.15	3	15	0.11
74	*Plantago lanceolate* L.	Plantaginaceae	Ispaghol	Herbs	Leaves	Cough and bronchitis	Leaves infusion	19	0.10	2	10.55	0.10
75	*Portulaca oleraceae*	Portulaceae	warkhari	Herb	leaves	Asthma, bronchitis, diabetes,	Powder of dried leaves	26	0.14	3	14.44	0.11
76	*Prunus domestica.* L.	Rosaceae	Allocha	Shrub	Fruit	Viral Infection immunity	Eated as fruit	21	0.11	2	11.66	0.09
77	*Psidium gujava*	Myrataceae	Amrood	Tree	Fruit, shoot, leaves	Fever, Heart Problem, immunity booster	Decoction, fruit directly	13	0.07	3	7,22	0.23
78	*Punica granatum* L.	Lythraceae	Anar	Tree	Fruit, Seeds, Bark	Flu, Asthma immunity inducer, constipation	Fruit juice, decoction of bark	26	0.14	4	14.44	0.15
79	*Pyrus pashia* Linnaeus	Rosaceae	Tangy	Tree	Fruit	Cough and weakness	Decoction	26	0.14	2	14.44	0.07
80	*Ricinus communis* L.	Euphorbiaceae	Randa	Shrub	Leaves, Fruit	Asthma	Powder	29	0.16	1	16.11	0.03
81	*Rubus fruticosus* Agg.	Rosaceae	Karwarah	Shrub	Fruit, Leaves	Cough, Diarrhea	Fruit taken, directly, powder of leaves	24	0.13	2	13.33	0.08
82	*Rumex dentatus* L.	Polygonaceae	Sarkari Palak	Herb	Leaves	Cold, Cough,	Decoction	16	0.08	2	8.88	0.12
83	*Saccharum spontaneous* L.	Poaceae	Shaat	herb	Whole Plant	Cough, Chest Infection	Juice of plant with milk	8	0.04	2	4.44	0.25
84	*Sisymbrium irio* L.	Brassicaceae	Zangali Sharsham	Herb	Leaves, Seeds	To increase immunity	Cooked as food	21	0.11	1	11.66	0.04
85	*Skimmia laureola* Franch.	Rutaceae	Nazar Panrah	Shrub	Leaves	Fever	Powder	13	0.07	1	7.22	0.07
86	*Solanum nigrum* L.	Solanaceae	Makoh	Herb	Roots, Leaves, Barries, Flower	Cough, bronchitis	Decoction	24	0.13	2	13.33	0.08

87	*Solanum virginianum* L.	Solanaceae	Markhundey	Herb	Leaf, Fruit, Root, Seeds	Fever	Fruit decoction, seed powder	31	0.17	1	17.22	0.03
88	*Sonchus arvensis* L.	Asteraceae	Dodak	Herb	Whole Plant	Cough, Asthma	Powder and decoction	17	0.09	2	9.44	0.18
89	*Sonchus asper* L.	Asteraceae	Tariza	Herb	Stem, Root	Asthma	Decoction and powder	17	0.09	1	9.44	0.05
90	*Spondias mombin* L	Anacardiaceae	Dhak Bair	Tree	Leaves	Respiratory tract infection	Extract or decoction	13	0.7	1	7.22	0.07
91	*Syzygium aromaticum* L.	Myrtaceae	Lawang	Tree	Fruit	Toothace, antiviral agent, Cold	Powder or chewing	24	0.13	3	13.33	0.12
92	*Taraxacum officinale* L.	Asteraceae	Zyar guley	Herb	Leaves, Flower	Cough, Yellowness of Skin	Decoction	12	0.06	2	6.66	0.16
93	*Taxus wallichiana* Zucc.	Taxaceae	Banray	Tree	Leaves, Fruit	Pneumonia, Asthma, Cough, bronchitis	powder	16	0.08	4	8.88	0.25
94	*Teucrium stocksianum* Boiss	Lamiaceae	Kwandi bootey	Herb	Whole Plant	Throat Pain, Sore Throat	Decoction mixed with honey	13	0.07	2	7.22	0.15
95	*Trianthema portulacastrum* L.	Aizoaceae	Lamai	Shrub	Leaf, Stem, Root	Asthma, bronchitis	Stem and leaf powder, root decoction	14	0.07	2	7.77	0.14
96	*Verbascum Thapsus* L.	Scrophulariaceae	Jarghai Tambaco	Herb	Roots, Seeds, Leaves	Diarrhea, Cough, Earache	Powder	27	0.15	3	15	0.11
97	*Viola odorata* L.	Violaceae	banafasha	Herb	Leaves, Flower	Flue, Cough, Cold	Decoction	17	0.09	3	9.44	0.17
98	*Xanthium strumarium* L.	Asteraceae	Jishkey	Herb	Leaves	Fever, Cold, Infection	Powder	11	0.6	3	6.11	0.27
99	*Zanthoxylum armatum* DC.	Rutaceae	Dambara	Shrub	Seeds	Respiratory disorders	Seed powder	13	0.07	1	7.22	0.07
100	*Zingiber officinale* Roscoe	Zingiberaceae	Adrak	Herb	Rhizome	Cough, Immunity	Powder	23	0.12	2	12.77	0.08

Plants parts mostly used and mode of preparation of the herbal remedies

The herbal remedies were prepared using some specific part of the medicinal plants. The results of the study reveals that leaves (31% with 44 species) are the most widely used part in the area for preparing herbal remedies either in the form of decoction, herbal tea, or as powder, followed by fruit of the plants (15% with 22 species), seeds (12% with 17 species), stem (7% with 11), roots and whole plant (11% (3% with 4 species), bulb (2% with 3 species), whereas berries, latex milk, gum, tuber, stamen, rhizome (1% with 1 species) each. While the mode of preparation of herbal remedies varies from Powder (41%), Decoction (38%), Juice and direct as fruit (6%), plant extract (3%), Infusion and paste (2%) to chewing and poultice (1%).

Table 3 Most used species of the studied area

Family name	Number of species
Asteraceae	13
Lamiaceae	10
Fabaceae	6
Rosaceae	5
Amaranthaceae	3
Apiacaeae	3
Amaryllidaceae	3
Rutaceae	3

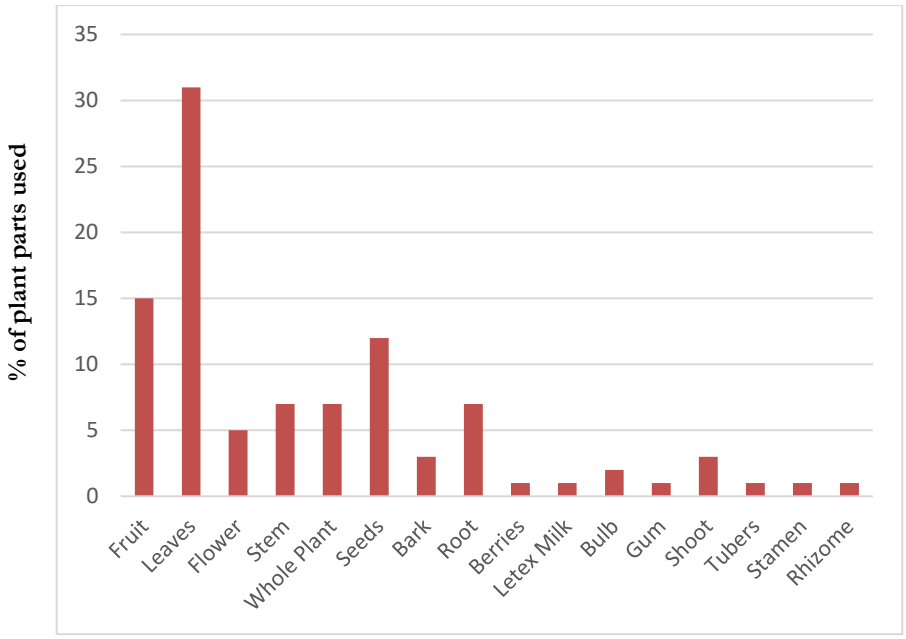

Fig 3 Percentage of plants parts used

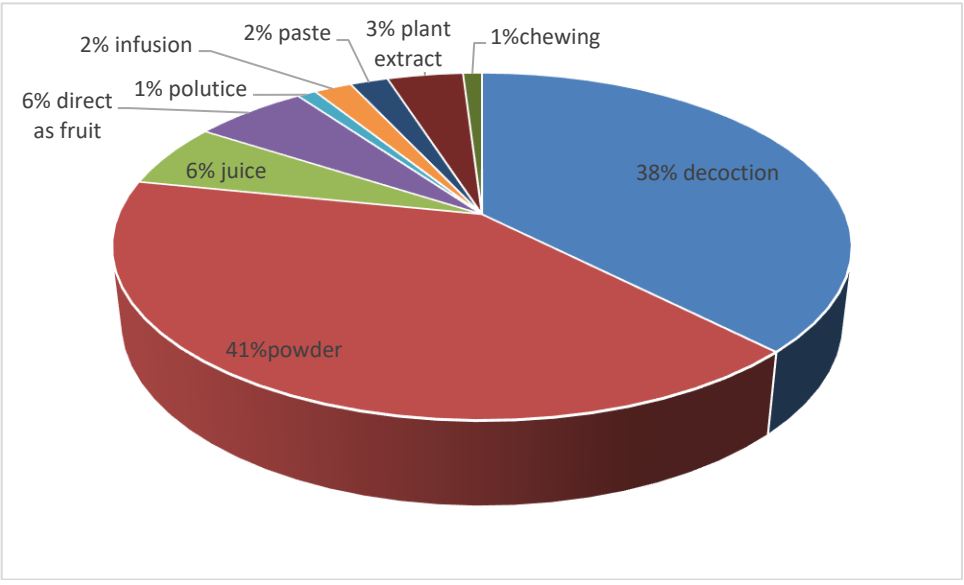

Fig 4 Percentage of mode of preparation

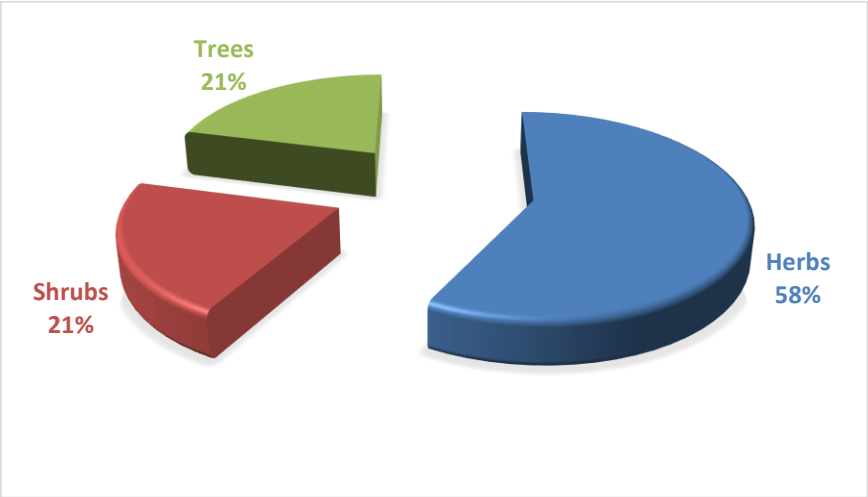

Fig 5 Percentage of plants life form

Quantitative Analysis

Analysis of frequency citation (FC), use report (UR)

In the present study highest frequency citation (FC) was reported for *Citrus medica* (35), *Acacia modesta, Papaver dubium* and *Allium griffithianum* (34), followed by *Cinnamomum zeyanicum* (33) and lowest (FC) was reported for *Fumaria indica* (6). Similarly, highest use report (UR) was reported for *Canabis sativa, Ephedra intermedia, Adiantum capillus, Nigella sativa* and *Achyranthes aspera* (6 UR each) and 26 species were reported with only (1 UR).

Use value (UV), relative frequency of citation (RFC) and family index value (FIV)

Highest use value (UV) was recorded for *Adiantum capillus* (0.35) followed by *Nigella sativa* (0.31) and *Acorus calamus* (0.27). whereas lowest (UV) recorded for *Calotropis procera* (0.02). Highest family index value (FIV) was reported for *Cassia angustifolia* (20.55) followed by *Citrus medica* (19.44) and *Artemisia absinthium, Accacia modesta*, and *Papaver dubium* (18.88) each whereas, least FIV was reported for *Fumaria indica* (3.33). Highest relative frequency of citation (RFC) was reported for *Cassia angustifolia* (0.20) followed by *Citrus medica* (0.19) and *Foeniculum vulgare* (0.18) whereas, lowest (RFC) was reported for *Fumaria indica* and *Emblica officinalis* (0.03 each).

Fidelity level (FL)

Fidelity level indicates ethnobotanical plants that have maximum potential to cure diseases, in this study the FL varied between 60 to 100 %. The Plant species with 100% fidelity level was *Piper nigram* used to treat diseases like cough, chest congestion. The other plant species with 100% fidelity level was *Curcuma longa* used to treat respiratory traack infection, and cough mostly. Whereas, lowest fidelity level was calculated for *Chenopodium murale* i.e 60% that was used to treat colic pain and cough.

Table 4 Fidelity level of the Medicinal plants of the studied area:

S.no	Plant name	No. Of informants repeated the taxa	No. Of ailments treated	No. of use most frequently determined by informant	FL
1	*Citrus medica L*	35	4	31	88.57
2	*Cannabis Sativa*	30	6	28	93.33
3	*Euphorbia Heliscopia L*	29	3	25	86.20
4	*Piper Nigram L*	27	3	27	100
5	*Calotropis Porcera*	20	4	19	95
6	*Curcuma Lorga*	22	3	22	100
7	*Cinnamonum Zeylanicum*	33	4	29	87.87
8	*Glycyrrhiza Galbra*	19	3	15	78.94
9	*Borgenia Ciliata*	23	4	20	86.95
10	*Zphedra intermedia*	24	6	18	75
11	*Mentha Spicata*	31	3	25	80.64
12	*Acacia Modusta Wall*	34	4	32	94.11
13	*Eucalyptus Camaldulensis*	26	5	20	76.92
14	*Adiantum Cappilus*	17	6	14	82.35
15	*Ficus Carical*	31	3	26	83.87
16	*Nigella Sativa L*	19	6	14	73.68

17	*Punica granatum*	26	4	23	88.46
18	*Justica Adnatoda*	32	3	23	71.87
19	*Syzygium aromaticum*	24	3	21	91.30
20	*Foeniculum Vulgare Mill*	33	4	29	87.87
21	*Papaver dubium*	34	2	27	79.41
22	*Artemisia absinthium L*	34	3	22	64.70
23	*Chenopodium Murale*	30	2	18	60
24	*Cassia Angustifolia*	37	2	35	94.59
25	*Olea Ferruginea Royre*	32	2	26	81.25
26	*Verbasum Thapsus L*	27	3	23	85.18
27	*Helianthus tuberosus*	24	3	16	66.66
28	*Portulaca Oleracea*	30	4	26	86.66

Discussion

The results of this study revealed that the local inhabitants of the area possess a valuable knowledge about the utilization of medicinal plants for various diseases. As this study focused on the treatment of symptoms related to the novel corona virus, yet the informants belonging to different educational backgrounds and different fields of services shared a valuable knowledge about a number of plants used during (COVID-19) pandemic. This indicates that the medical facilities of the area are fragile so the people are supposed to treat their common illness themselves, but here we can also admit the reality of the situation prevailing during corona virus where everyone was supposed to treat and take precautions themselves.

Source of medicinal plants used during pandemic

As we know that each and every medicinal plant is not available in every area, different areas around the world and even in Pakistan different regions have different flora. The study also Investigate the respondents about the sources of different medicinal plants that were utilized. The respondents obtained medicinal plants, from different sources such as kitchen garden, spice stores, different hakeem and pamsars and also from local flora of the studied area.

5.2 Consumption of medicinal plants for their Antiviral potential

As we know that the utilization of medicinal plants is common from ancient times for curing various virus related illness such as herpes, influenza, fever and cold. Active chemical compounds in the form of aspirin, digoxin, physostigmine, reserpine, and morphine present in these plants helps fight against biological agents causing disease (Phillipson, 2001). *Allium sativum* commonly called garlic contains Sulphur related chemical compounds such as vinyldithin and ajoene responsible for antiviral and anti-inflammatory activities during influenza virus and common cold (Mehrbod et al. 2009; Zhang et al. 2019).

Zingiber officinalis commonly called ginger contains certain volatile oils which serves as antiviral, antimicrobial agents against various bacteria, fungus and viruses. Ginger root contains an antioxidant that helps in immune-boosting (Pradhan et al. 2013).

Piper nigrum know as black pepper is also considered to be a source of 600 phytochemicals including alkaloids, terpenes, and lignans. It has anti-bacterial, antiviral, anti-inflammatory, and anti-pyretic propertites due to which it was used as curative agent during pandemic (Ahmad et al. 2012).

Syzygium aromaticum widely known as clove is a good source of many vitamins including A,C,K and E. Beside this it also contain proteins and carbohydrates, but the thing of our interest is that it has antiviral propertires, a phytochemical named Eugeniin is considered to be an effective antiviral agent against herpes virus as it stops the production of DNA polymerase enzyme (Lee & Shibamoto 2001). *Azadirachta indica* commonly called as neem is widely used to treat and prevent diseases caused due to viruses, bacteria and parasites, the phytochemicals present in neem are terpenes and limonoids (Bhowmik et al. 2010). *Curcuma domestica* know as turmeric commonly used in every kitchen is a rich source of proteins, dietary fibers, carbohydrates and cleansing of respiratory track effected due to infections, its anti-inflammatory activity helps to give relief in flu and cold (Wachtel et al. 2011).

Plants based chemicals effective against COVID-19

Antiviral Flavonoids against COVID-19

Flavonoids are naturally occurring secondary metabolites present in plants. They have natural tendency to fight against many viruses, for example flavonoids present in ethnobotanical plants such as roots of *Scutellaria baicalensis* produces a flavonoid called scutellarein which inhibits the ATPase activity of SARS-Co-V-2 (Yu et al. 2012). Whereas, biacalein and baicalin are other flavone glycosides of the same species with potential to fight COVID-19 (Song et al. 2020). Similarly, medicinal plants like *Azadirachta indica, Hibiscus sabdariffa* and *Ocimum sanctum* contains flavonoids which can be used in the formation of compounds against corona viruses (Lu et al. 2020). Similarly, other flavonoids like quercetin, luteolin, and epigenin extracted from *Torreya nucifera* has inhibition activity against SARS-CoV3CLpro (Ryu et al. 2010).

Antiviral Terpenoids

Terpenoids are also plants based chemicals which proved to be effective against corona viruses. This group of secondary metabolites constitutes a broad spectrum of action in terms of effects and structures. Monoterpenes are simple whereas complex molecules are also identified from various plant species. The antiviral properties of saikosaponins were studied on

fetal lung of a human being which showed that these triterpenoids were active in early stages of viral infection and penetration (Cheng et al. 2006). The root extract of *Glycyrrhyza galbra* contains a triterpenoid saponin which has a potential to fight against viruses (Pompei et al. 1979). *Canabis sativa* contains a phytocannabinoid i.e canabidiol which is responsible for modulating the angiotensin- conversting enzyme expression in (COVID-19) effected tissues (Campos et al. 2012).

Antiviral Alkaloids

Alkaloids are considered to be a major group of secondary metabolites, effective against viruses or their antiviral properties. The alkaloids isolated from the roots of *Stephania tetrandra* like fangchinoline, tetrandrine and cepharanthine retards the action of human corona virus protein necleocapsid and spike (Liu et al. 2016; Kim et al. 2019). The alkaloid lycorine extracted from *Lycoris radiate* shows greater inhibition of corona viruses as compared to the other alkaloids isolated from plants (Jahan & Ahmet 2020).

General discussion about the relevance of present work with previous literatures on the utilization of medicinal plants

The incorporation of ethnobotanical plants as a drug or food supplement to cure or dignose coronavirus is not fully addressed to the world. China, the origin of this novel coronavirus is stricking hard to integrate the TCM i.e traditional Chinese medicine into modern synthetic drugs since the outbreak of SARS 2003. However, in 2019 the TCM has been incorporated to treat respiratory related discomforts during the coronavirus pandemic (Silveria et al. 2020; Leung. 2007).

Medicinal plants like *Curcuma longa, Zingiber officinale, Foeniculum vulgare, Glycyrrhiza galbra* and *Ocimum basilicum, Piper nigrum,* has been used in Ayurvedic medicines in India to treat (Covid-19) patients as first line defense in early stages of infection which has relevance to our work in terms of usage of these particular plants for specific disease symptoms (Rastogi et al. 2020). Maldonado et al. (2017) also reported the use of *Cinchona sp.* for the treatment of fever as it contains an alkaloid quinine, which is also used in antimalarial drugs. In our study *Cinchona officinalis* was reported to treat malarial fever and also fever in coronavirus which is supported by a recent work that proposes the antiviral mechanism of quinine, the previous literature investigated the effect of quinine sulphate on dengue viruses. As there is structural similarity between dengue virus and SARS-CoV-2 virus so it may also be effective against coronavirus (Malakar et al. 2018). The use of leaf infusion of *Plantago lanceolate* was reported by (Aziz et al. 2016; Sher et al. 2016; Kayani et al. 2014) for the treatment of fever, cough and bronchitis which are in parallel with our study. Further, more they also reported this plant as demulcent, expectorant and emollient.

The bulb of *Zingiber officinale,* and *Allium sativum,* leaves of *Psidium guajava*, the stem, bark and leaves of *Mangifera indica,* stem and bark of *Cinnamomum zeylanicum* are reported for immune boosting by (Gabadamosi et al. 2012) which again provides a back to our present study. Similarly, he also reported the leaf decoction of *Bryophyllum pinnatum* as cough remedy and the use of *Calotropis procera* for respiratory tract infection, *Cassia fistula* and *Syzgium aromatic* as antiviral agents in viral disease management that also correlates to our work.

The immunomodulatory and antiviral function of 20 different medicinal plants against (COVID-19) were reported in a review by (Yang et al. 2020). According to his review the immune responses of a human body plays a very vital role in defence mechanism to protect body from any viral, microbial or bacterial attack initially. The reported medicinal plants which are related to our study in this review are *Punica granatum, Allium sativum, Piper nigrum, Nigella sativa, Glycine max, Citrus aurantium, Prunus domestica* and *Ficus carica* that are responsible for immune induction against viral diseases. The oral intake of ethnolic leaf extract of *Ficus carica* has cell-mediated immune responses (Patil & Bhangale 2011).

Some relevance of our reported medicinal plants fighting against (COVID-19) in either immune induction, antiviral agents etc are also supported by Ayurvedic papers specifically reviewed by (Mittal & Chand 2020). This review describes the characteristics of *Emlica officinalis* also reported in our study that it is a source of vitamin C and the Ellagic acid present in this plant is an excellent antioxidant. It also serves as immunomodulator by formation of antibodies and cell mediated immune responses. Furthermore, they also have reviewed about *Asparagus race*mosus as an anti-inflammation agent, immunomodulatory, its root extract has antioxidants and also the extract has been used for cough and bronchitis which supports our study.

Some other medicinal plants not mentioned in our study but they prove significantly to be used for the treatment of various (COVID-19) related symptoms are *Withania somnifera* which is used for cough treatment and have even better results than codine (Nosalova et al. 2013; Kuang et al. 2018). Similarly, some other medicinal plants like *Sambucus nigra, Allium sativum,* and *Echinacea purpurea* are effectively used for upper respiratory viral infection. The mentioned plants are not directly used for the COVID-19 treatment but their antiviral action on various (COVID-19) symptoms in many researches make them suitable to be used against (COVID-19) treatment (Nantz et al. 2012; Krawitz et al. 2011; Sperber et al. 2004).

Other than the common (COVID-19) symptoms fever, cold, cough, flu, pneumonia, respiratory tract infection) some literatures have narrated some unique symptoms that are digestive system related symptoms and cardiac involvement as COVID-19 symptoms, Digestive system related symptoms include nausea, diarrhea, abdominal pain, and loss of appetite (Luo et al. 2020). Phytotherapy recommended for these symptoms refers to utilization of *Achillea millefolium,* as it contain active compounds like phenolic acids, alkaloids and flavonoids that are helpful against diarrhea (Applequist & Moerman 2011; Chandler et al. 1982). Whereas, *Curcuma longa* and *Zingiber officinalis,* are reported as anti-nausea and digestion aiding agents and *Allium sativum* and *Armoracia rusticana* as appetite stimulants (Dulbecco & Savarino 2013; Palatty et al. 2013; Charles. 2012).

The cardiac involment during (COVID-19) infection tends to be more injurious and deadly as compared to other factors such as age, diabetes etc. The myocardial malfunction is also recorded as a result of (COVID-19). Patients are observed to have subjected to thrombosis due to elevated levels of D-dimers from lab analysis therefore, heart patients need more care during infection (Akhmerov & Marban (2020). Medicinal plants used for such symptoms are *Terminalia arjuna* as a heart tonic (Kumar

et al. 1987). *Cystus scoparius* is also used due to the presence of quinolizdine alkaloids as it regulates artrial and ventricular fibrillation (Yarnell & Abascal (2003).

Conclusion and recommendation

From the study conducted in District Hangu, of Khyber Pkahtun Khawa regarding the phytotherapeutic treatment of COVID-19, it is concluded that the research area is rich in medicinal plants. The residents of the area posseses a valuable knowledge regarding the use of various medicinal plants either found locally or rarely exotic species which they buy from Haakims and Pansars. It also indicated the fragile medical system of the area where people are supposed for herbal treatment. During COVID-19 pandemic people used various plant species to cure symptoms related to the coronaviruses and also they got positive results from those remedies. This study suggests further investigation and lab assessment of the mentioned plant species for the treatment of COVID-19 and also the utilization of these species into synthetic drugs commercially developing for COVID-19 treatment.

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