Ethnobotanical study of Mandi Ahmad Abad, District Okara, Pakistan

Mubashrah Munir, Sehrish Sadia, Adnan Khan, Bakht Zareen Rahim, Brian Gagosh Nayyar, Khawaja Shafique Ahmad, Arshad Mahmood Khan, Ishrat Fatima, Rahmatullah Qureshi

1 Department of Biological Sciences, University of Veterinary and Animal Sciences, Lahore, Pakistan, 2 Department of Botany, University of Balochistan, Quetta, Pakistan, 3 Department of Botany, University of Sialkot, Sialkot, Pakistan, 4 Department of Botany, University of Poonch, Rawalakot, Azad Jammu and Kashmir, Pakistan, 5 Govt. Hashmat Ali Islamia Associate College Rawalpindi, Punjab, Pakistan, 6 Department of Botany, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Punjab, Pakistan

☯ These authors contributed equally to this work.
* sehrish.sadia@uvas.edu.pk (SS); shafiquebot@gmail.com (KSA)

Abstract

This study hypothesized that native people have unique traditional knowledge of plant resources in the rural areas and basic objective was the documentation of this valuable inheritance. Ethnobotanical data was collected from a remote rural area of Mandi Ahmad Abad, Union council number NA-144 Tehsil Depalpur District Okara, Pakistan. A total of 94 informants were randomly interviewed to collect data about local names of plant species, mode of administration, recipes and ailments, and ethnobotanical uses through semi-structured questionnaire, interviews and group discussion methods. The collected data was statistically analyzed by calculating use value (UV), frequency of citation (FC), relative frequency of citation (RFC), factor of informant consensus (FIC), family importance value, and relative importance (RI). This study is also compared with ethnobotanical literature by using Jaccard’s index (JI) for similarity analysis. A total of 126 species belonging to 52 families were documented. The Poaceae (13 spp.), Leguminosae (12 spp.), Solanaceae (10 spp.) and Cucurbitaceae (10 spp.) were dominant families. Highest used value (UV = 0.22) was obtained for *Azadirachta indica*. The minimum used value (UV) was showed by *Alhagi maurorum*, *Eclipta prostrata*, *Hibiscus rosa-sinensis*, *Solanum virginianum* and *Trianthema potulacastrum* (UV = 0.01). Hepatitis, stomach ulcer, bowel disorders, urinary problems, psoriasis, cancer, and leucoderma were the most treated ailments with ICF value of 1, followed by leucorrhea (ICF: 0.89), and vomiting (ICF: 0.86). The highest Jaccard’s similarity index value (JI = 0.329) showed that plant species reported in our study was more similar with Arid regions of Northern Punjab, Pakistan. This novel ethnobotanical report concluded that traditional knowledge about use of medicinal plants is decreasing due to allopathic medicines. Immediate steps should be taken for conservation and documentation of traditional knowledge of plants especially those having medicinal properties.
Introduction

Ethnobotany is a branch of science that studies the use of plants by local peoples and how plants are used for food, timber, fuel, ornaments, and medicines. One of the purposes of ethnobotanical is to report, record, and conserve the indigenous knowledge of plants [1]. Modern ethnobotany is involving in knowledge of botany, taxonomy, biochemistry, geology, and medicine etc. [2]. Since ancient times, people have been using plants local to their villages for medicinal and other purposes [3, 4]. Traditionally, ethnobotanical knowledge has been passed down orally from generation to generation [5]. Conventional ethno-veterinary knowledge is generally still passed on orally. To prevent the extinction of this knowledge it is important to document it and preserve it for future generations [6].

Traditional knowledge about plants in China can be traced back to about five thousand years. According to a report from the World Health Organization, almost eighty percent of the current population in developing countries still depends on the usage of traditional plant knowledge [7, 8]. The folk knowledge of indigenous plants plays an important role in the discoveries of many vital modern-day drugs. Almost 25% of drugs in modern medicines are obtained from plants [9]. The usage of plant based pharmaceuticals, such as opium, aspirin, digitalis, and quinine, have a long history in herbal remedies [8]. Some plants are used to cure one specific disease, whereas other plants are used in different circumstances. In the field of pharmacology, wild flora is very important and used in the production of new medicines as well as it provides immunity against many illnesses [9, 10].

Plants are not only used for medicinal purpose but also reflect the economic status for some indigenous peoples. The use of medicinal plants is growing rapidly and is estimated to reach the value of 5 trillion dollars (US) by 2050 [11]. The world’s population is expected to increase up to 10 billion by 2050 [12]. While the plant biodiversity is threatened by a variety of factors, including the increasing human population, climate change and anthropogenic factors are the major reasons of the loss of biodiversity [13]. According to the United Nation, more than one million species are at risk of extinction globally [14]. The woody flora is important to maintain the terrestrial ecosystem, conservation of water, prevent soil erosion, avoid floods and droughts, clean air, and water resources [15]. Local knowledge plays an important role in resource management, understanding and conserving ancient practices, and play a vital role in saving the resources [14, 16]. Quantitative studies are very helpful to plan strategies for the conservation of natural plant resources [17, 18].

In Pakistan traditional medicine could have played an important role in providing health care to population [13, 19]. Only 12% medicinal plants are used for treatment of different diseases. The medicinal herbs are utilized for the cure of both animal and human diseases. Due to industrialization, over population and extensive collection, particular medicinal plant are near to extinction [20]. Peoples that are living in or near the forests are more dependent on forests than others and have more knowledge about the utilization of plants for various purposes [21]. The local communities living in Pakistan mostly use herbal remedies for treatment of different diseases [5]. The common diseases such as fever, cold, cough and diarrhea could be treated by locally available herbal teas and herbal powders and they have no side effects. Even today various locally produced drugs are still being used as remedies for different ailments [22]. Almost 40000–50000 local hakims are utilizing 200 medicinal plants in local recipes for the treatment of many ailments [20] and ethnobotanical knowledge on 600 plant species has been documented [23].

The folk and local healthcare knowledge has been passed orally from one generation to another instead of in the form of written document due to this reason the traditional knowledge is decreasing gradually [24]. There is a need to save this important conventional
knowledge [23]. Therefore, the purpose of this study was to collect ethnobotanical data about local plants from the peoples of Mandi Ahmad Abad which may help and find new leads to collect raw material for drug discovery. We also aimed to compare local ethnobotanical data between our area of study and other areas of Pakistan as well as neighboring countries via the technique of Jaccard’s Similarity Index.

**Materials and methods**

**Study area**

The city Mandi Ahmad Abad, District Okara Pakistan was selected for collection of ethnobotanical data. This city shares boundary with India therefore its geographical importance for defense is high.

It was previously called Mandi Hira Singh and renamed in 1993 by the Government of the Punjab in respect for the services of Mirza Ahmad Baig famous local politician. It is a union council, an administrative subdivision of Depalpur Tehsil. It is situated between 30.65˚ N north latitude, 74.031˚ E longitude. It has a subtropical climate with annual average precipitation 200 mm and 24.5˚C. The hottest months are May and June with maximum and minimum temperature 44˚C and 2˚C, respectively.

**Ethnobotanical survey**

The most of available literature of ethnobotanical data was studied. To collect maximum information about local uses of plants, many ethnobotanical surveys were carried out from October, 2019 to April, 2020 in the area of Mandi Ahmad Abad. The ethnobotanical data was collected by providing semi-structured questionnaires and oral interviews. Interviews were taken from both males and females in fields, streets, homes and shops. Review Committee for Biomedical Research, University of Veterinary and Animal Sciences, Lahore, Pakistan approved the conduction of this study. Oral consent was obtained from participants before starting study. The interview from female was a difficult task because they were not allowed to talk with unknown persons. Only 34 females with the help of local inhabitants on special request were interviewed. Total 94 informants ranging from 15–75 years including males, females, farmers, hakims, shepherds, herdsmen, school boys and others have sound local knowledge about different uses of plants. Out of 94 informants, 60 were males and 34 were females. Different age groups of informants were made e.g. 15–25, 25–35, 35–45, 45–55, 55–65, and 65–75. The questionnaire was prepared in such a way to collect maximum data about different plants, including (a) name of informants, gender, age, job and qualification (b) information about plants e.g. local name of plant, parts used, method of preparation of recipe, mode of administration and ethnobotanical uses. Information about local uses of plants like food, fodder, fuel, timber, medicine, furniture and other uses was also collected [25]. The location of plants was recorded by taking quadrants by using GPS essentials application. A total 94 informants were interviewed and information regarding to their gender, marital status, age group, literacy level and socio-economics is given in the (Table 1).

**Collection and identification**

Plants used by indigenous people and herbalists were collected from the study area. Samples of grasses, herbs, shrubs and trees were taken, dried, mounted on herbarium sheets and properly identified by using Flora of Pakistan [26]. Ethnobotanical data from local people was collected by providing semi-structured questionnaire, group meetings and interviews.
Data analysis

The medicinal plants collected and identified from study area were organized in a table according to botanical names in alphabetical order, common names, family, parts used, route of application and ethnobotanical uses. The accuracy and perfection of collected ethnobotanical data were checked and use value (UV), frequency of citation (FC), relative frequency citation index (RFCi), informant consensus factor (ICF) and Jaccard index (JI) by determined using different statistical tools.

**Frequency citation (FC).** The information provided by informants for a specific plant with respect to local medicinal value was considered as frequency citation.

**Relative frequency citation index (RFCi).** The value is calculated by dividing frequency of citation (FC) with total number of informants participating in a survey [27].

**Use value (UV).** The relative importance of plants collected from study area was calculated by given formula;

\[ UV_i = \sum \frac{U_i}{N_i} \]

Here, \( U_i \) = Number of use report for specific plant by each informant

\( N_i \) = Number of total informants interviewed for specific plant.

**Informant consensus factor.** The informant consensus factor (FIC) based on the reported remedies was calculated for the various remedies using the formula [28];

\[ FIC = \frac{Nur - Nt}{Nur - 1} \]

Here,

\( Nur \) is the number of used citation in each category

\( Nt \) is the number of species used for particular ailment

**Family importance value.** The family Importance value (sum of all the use values of species in a family), and/or average family importance value (use values of all spp. in a family/number of species in the same family) was also determined.
Relative importance. It was calculated according to Bennett and Prance (2000);
\[ \text{RI} = (BS + PH) \times 50 \]

Where, BS is the normalized number of the body systems for which the species used and PH is the normalized number of the pharmacological properties or particular minor uses of the same species.

Jaccard index (JI). The JI was calculated by comparison of previously published studies from other areas by analyzing the percentage of quoted species and their medicinal uses by using the following formula [29];
\[ JI = \frac{C}{(A + B - C)} \times 100 \]

“A” is the number of species of the area A, “B” is the number of species of the area B, “C” is the number of species common to both areas A and B.

In the present study, we calculated similarity index between our ethnobotanical survey and other studies which were carried out in different regions of Pakistan and neighboring countries.

Results and discussion
The results of the present work are summarized below:

Demographic information
The ethnobotanical data showed that the younger generation had less knowledge about the use of local plants compared to people aged 35 years and over, who had the most knowledge (Table 1). During the survey, most of the information was gathered from the male group (63.83%) compared to the female group (36.17%). The majority of knowledge was collected from the age group 55–65 years old (32.98%) and the minimum information was collected from the 20–25 year age group (5.32%). The ethnobotanical knowledge also varied according to the educational level of the community. The people who did matriculation (24.47%) had considerably more knowledge about indigenous plant usage than the graduate group (14.89%). The illiterate community of the study area had the least information about the plants (8.51%). The farmers of Mandi Ahmad Abad provided more ethnobotanical data for the plants (46.81%) followed by housewives (18.09%), shepherds (13.83%), shopkeepers (7.45%), local healers (6.38%), teachers (3.19%), homeopathic doctors (2.13%), and nurses (2.13%). Most of the population relied upon allopathic medicines and the modern health care system but the illiterate and less educated indigenous peoples predominantly used local medicinal plants to cure various ailments. As the modern health care system is growing and literacy levels are increasing, the indigenous knowledge is decreasing because the younger generation does not pay attention to this knowledge. The other studies reported that medicinal plant use is generally transmitted through the generations, but the older generation has been unable to impart traditional knowledge to the young, leading to a loss of information about biodiversity [30]. A study conducted in Bangladesh revealed the knowledge of medicinal plants was highest in the age group of 30–40 and lowest for the group aged 60 years and older [31].

Diversity of local plants
The results showed that the study area is rich in useful plants (Table 2). It is an agricultural area and diversified with medicinal flora that is used by indigenous people to cure diseases and
| #  | Botanical Name & Voucher No. | Local Name | Family      | Parts used | Mode of administration | Recipes & Ethnobotanical use | FC     | RFC  | UV   | RI   |
|----|---------------------------|------------|-------------|------------|------------------------|------------------------------|--------|------|------|------|
| 1  | Abelmoschus esculentus (L.) Moench (ADN-701) | Bhindi | Malvaceae   | Fruit      | Oral                   | Fresh fruit is cooked as vegetable, and raw eating cure joint pain. | 7.45   | 0.58 | 0.1  | 36.67|
| 2  | Acacia nilotica (L.) Delile (ADN-702) | Keekar | Leguminosae | Flower, Bean, Stem | Oral                  | About 10gm of flowers are soaked in 250 ml of water for 12 hours, filtered and drink to cure Leucorrhoea. The dried bean powder (2 table spoons daily) is used for few days to relief backache. The boiled and dried beans are also used in pickles. The wood is utilized to make furniture, and as fuel wood. | 11.7   | 0.92 | 0.17 | 55.00|
| 3  | Achyranthus aspera L. (ADN-703) | Puthkand/ Char chita | Amaranthaceae | Whole plant | Oral                   | The powder is used for treatment of cough and kidney problems | 2.13   | 0.17 | 0.03 | 36.67|
| 4  | Albizia procera (Roxb.) Benth (ADN-704) | Shirin | Leguminosae | Bean, Seed, Leaves | Oral                  | The dried beans and seeds powder (1/2 tea spoon) with water 3 times in a day to cure piles. Fresh Leaves are used for fodder. | 5.32   | 0.42 | 0.07 | 36.67|
| 5  | Alhagi maurorum Medik. (ADN-716) | Jawaiyan | Leguminosae | Whole plant | Oral                   | The powder is used in medicines to cure diseases of reproductive system. | 1.06   | 0.08 | 0.01 | 18.33|
| 6  | Allium cepa L. (ADN-705) | Piyaz | Amaryllidaceae | Bulb | Oral                   | The fresh bulb is used for blood purification, to enhance maleness, as salad and cooking purpose. | 9.57   | 0.75 | 0.18 | 55.00|
| 7  | Allium sativum L. (ADN-706) | Lehsan | Amaryllidaceae | Bulb | Oral                   | The fresh bulbs are used to control blood pressure, do blood purification, and in cooking, chutney and pickles. | 8.51   | 0.67 | 0.16 | 45.00|
| 8  | Aloe vera (L.) Burm.f. (ADN-707) | Kawar gandal | Xanthorrhoeaceae | Whole plant | Oral, Topical | The mucilaginous pulp is orally used as anti-constipatory, backache and proper functioning of liver. Pulp is directly applied on skin for whitening of skin and other skin disorders. | 9.57   | 0.75 | 0.14 | 73.33|
| 9  | Amaranthus viridis L. (ADN-708) | Chulai | Amaranthaceae | Shoot | Oral                   | The shoot is cooked as vegetable to cure constipation, and kidney stones. Fresh aerial parts are used as fodder for livestock. | 7.45   | 0.58 | 0.14 | 63.33|
| 10 | Anagallis arvensis L. (ADN-709) | Billi booti | Primulaceae | Aerial part | Oral                   | Fresh aerial parts are used as fodder for livestock. | 3.19   | 0.25 | 0.03 | 18.33|
| 11 | Andropogan sorghum L. (ADN-710) | Jawar | Poaceae | Aerial part | Oral                   | Fresh aerial parts are used as fodder for livestock. | 5.32   | 0.42 | 0.05 | 18.33|
| 12 | Arundo donax L. (ADN-711) | Naryan | Poaceae | Root, Whole plant | Topical | Poultice of roots applied on forehead for headache. Dried plants used in making roofs of huts. | 4.26   | 0.33 | 0.07 | 26.67|
| 13 | Avena sativa L. (ADN-712) | Jai | Poaceae | Seed | Oral                   | The powder dried seeds mixed with water for stomach disorders. | 6.38   | 0.5  | 0.06 | 18.33|
| 14 | Azadirachta indica A. Juss. (ADN-713) | Neem | Meliaceae | Fruit, Seed, Aerial parts | Oral                   | The infusion or syrup from fruit and seeds used for diabetes, blood purifier, for pustules and pimples. Brush of branches is used for tooth cleaning. | 12.77  | 1    | 0.22 | 73.33|
| 15 | Bauhinia variegata L. (ADN-714) | Kachnaar | Leguminosae | Flower | Oral                   | The powder dried flowers (1 tea spoon) or water extract for normal blood pressure and stomach disorders. Fresh flowers are cooked as a vegetable. | 6.38   | 0.5  | 0.1  | 55.00|

(Continued)
Table 2. (Continued)

| #  | Botanical Name & Voucher No. | Local Name | Family | Parts used | Mode of administration | Recipes & Ethnobotanical use | FC  | RFC | UV  | RI  |
|----|------------------------------|------------|--------|------------|------------------------|--------------------------------|-----|-----|-----|-----|
| 16 | Bennincasa cerifera (Thunb) ADN-715 | Petha | Cucurbitaceae | Fruit | Oral | Fruit is cooked as a vegetable. | 4.26 | 0.33 | 0.04 | 18.33 |
| 17 | Bombax ceiba L. (ADN-717) | Sumbal | Malvaceae | Root, Latex, Stem | Oral | The infusion of roots in water for proper functions of male reproductive systems. The latex orally taken with water for menstrual problems. Wood is used for sheets formation. | 5.32 | 0.42 | 0.1 | 45.00 |
| 18 | Bombosa arundinosa (Retz.) ADN-718 | Bans | Poaceae | Stem | Oral | Water extract is used for asthma. Dried plants are used for making huts, building materials and fuel | 7.45 | 0.58 | 0.11 | 36.67 |
| 19 | Bougainvillea berberidifolia Heimerl. (ADN-719) | Bougainvillea | Nyctaginaceae | Leaves | Oral | Extract of leaves use daily to control worms of abdomen. | 2.13 | 0.17 | 0.02 | 18.33 |
| 20 | Brassica oleracea L. var. capitata (ADN-722) | Band gobhi | Brassicaceae | Aerial part | Oral | Cooked as vegetable and also used as salad and fodder. | 5.32 | 0.42 | 0.11 | 35.00 |
| 21 | Brassica oleracea Lam. var. botrytis (ADN-723) | Phool gobhi | Brassicaceae | Aerial part | Oral | Cooked as vegetable, and used as fodder for animals. | 7.45 | 0.58 | 0.13 | 26.67 |
| 22 | Brassica rapa subsp. rapa L. (ADN-721) | Shaljam | Brassicaceae | Root, Leaves | Oral | Roots are cooked as vegetables, generate blood and improve digestion. Leaves are also used as fodder. | 7.45 | 0.58 | 0.14 | 63.33 |
| 23 | Brassica rapa var. campestris L. (ADN-720) | saag | Brassicaceae | Seeds, Aerial parts | Oral | Seeds are used for oil extraction. After oil extraction, the residue called "khall" is formed used for livestock for increasing milk production. Fresh leaves cooked as a vegetable and fresh leaves directly used as a fodder. | 8.51 | 0.67 | 0.22 | 53.33 |
| 24 | Bryophyllum pinnatum (Lam.) Oken (ADN-724) | Pathar chat | Crassulaceae | Leaves | Oral | Water extract or dried powder of leaves to cure kidney stones. | 4.26 | 0.33 | 0.04 | 18.33 |
| 25 | Calotropis procera (Aiton) Dryand. (ADN-725) | Akk | Apocynaceae | Leaves, Flower, Latex | Topical | Leaves are mixed with oil and heat to get infusion for joints pain. Flowers or latex directly used to cure wounds, psoriasis and snake bite. | 6.38 | 0.5 | 0.12 | 55.00 |
| 26 | Cannabis sativa L. (ADN-726) | Bhung | Cynnabaceae | Seeds, Leaves | Oral | Seeds are orally taken with water as a Anti-cancerous and used in infertility of females. Dried leaves used in narcotics. | 8.51 | 0.67 | 0.12 | 45.00 |
| 27 | Capsicum annum L. (ADN-727) | Shimla mirch | Solanaceae | Fruit | Oral | Fruit is used as a vegetable. | 2.13 | 0.17 | 0.02 | 18.33 |
| 28 | Capsicum frutescens L. (ADN-728) | Sabz mirch | Solanaceae | Fruit, Seeds | Oral | Seeds used in fever, fruit are used in chutney, pickle and cooking purpose. | 9.57 | 0.75 | 0.15 | 26.67 |
| 29 | Cassia fistula L. (ADN-729) | Amaltas | Leguminosae | Seeds | Oral | The powder of seeds used in stomach disorders. | 3.19 | 0.25 | 0.03 | 18.33 |
| 30 | Chenopodium album L. (ADN-730) | Bathu | Amaranthaceae | Leaves | Oral | Leaves cooked separately or mixed with brassica for normal blood pressure, Anti-constipatory and vegetable for humans. | 8.51 | 0.67 | 0.14 | 55.00 |

(Continued)
| #  | Botanical Name & Voucher No. | Local Name | Family         | Parts used          | Mode of administration | Recipes & Ethnobotanical use                                                                 | FC   | RFC  | UV  | RI   |
|----|-----------------------------|------------|----------------|---------------------|------------------------|-----------------------------------------------------------------------------------------------|------|------|-----|------|
| 31 | Chenopodium murale L. (ADN-731) | krund      | Amaranthaceae  | Aerial Part         | Oral                   | The decoction of leaves is orally used for pustules, pimples and wounds. Aerial parts are used as fodder. | 5.32 | 0.42 | 0.07 | 36.67 |
| 32 | Cicer arietinum L. (ADN-732)  | channy     | Leguminosae    | Seeds, leaves       | Oral                   | The powder of seeds used for diabetes, for weak eye sight and proper functioning of stomach. The leaves of young plants used as vegetable for humans and fodder for animals. | 11.7 | 0.92 | 0.16 | 55.00 |
| 33 | Cichorium intybus L. (ADN-733) | Kaasni     | Compositae     | Whole plant         | Oral                   | Syrup preparation to cure hepatitis, jaundice and proper functioning of liver. Decocion or water extract by grinding the parts of plant used for blood purification. | 5.32 | 0.42 | 0.15 | 63.33 |
| 34 | Citrullus colocynthis (L.) Schrad (ADN-734) | Kortumba  | Cucurbitaceae  | Fruit, Leaves       | Oral                   | Powder used as anti-constipatoty, to cure Asthma, for stomach disorders and rheumatism. Leaves are used as fodder. | 4.26 | 0.33 | 0.11 | 81.67 |
| 35 | Citrullus lanatus (Thunb.) Matsum. & Nakai (ADN-735) | Tarbooz   | Cucurbitaceae  | Fruit               | Oral                   | Fruit is used as a food, for proper liver functioning and to increase blood production.        | 6.38 | 0.5  | 0.09 | 36.67 |
| 36 | Citrus limon (L.) Osbeck (ADN-737) | Leemo     | Rutaceae       | Fruit               | Oral, Topical          | Fruit juice is used to make drink "askanjb een" and used as anti-vomiting, to cure stomach disorders and pickle formation. The extract of fruit is directly applied on skin for cleaning. | 7.45 | 0.58 | 0.12 | 63.33 |
| 37 | Convolvulus arvensis L. (ADN-738) | Valoor    | Convolvulaceae | Whole plant         | Oral                   | Grind and separate its extract and use (1 Tea spoon daily) for worms of stomach. Whole plant is used for treatment of dysentery in goats and sheep. | 4.26 | 0.33 | 0.05 | 26.67 |
| 38 | Cordia myxa L. 9ADN-739)       | Lasoorha   | Boraginaceae   | Fruit               | Oral                   | Fruit is directly edible and used for treatment of ulcer of stomach, joints pain and body's weakness. Fried fruit in pickle formation. | 6.38 | 0.5  | 0.11 | 63.33 |
| 39 | Cordia sinensis Lam. (ADN-740) | Goondi     | Boraginaceae   | Fruit               | Oral                   | Fruit is edible, and cure stomach inflammation, cough, throat and joints pain. Leaves are used as fodder. | 5.32 | 0.42 | 0.1  | 63.33 |
| 40 | Coriandrum sativum L. (ADN-741) | Dhania     | Apiaceae       | Leaves              | Oral                   | The powder of seeds used in condiments. Leaves are used in chutney and other cooked dishes      | 5.32 | 0.42 | 0.05 | 18.33 |
| 41 | Cucumis melo L. (ADN-742)      | Kharbooza  | Cucurbitaceae  | Seeds, Pericarp     | Oral                   | The powder of dried seeds and pericarp mix with honey to make tablets to cure kidney stones. Fruit is used in fever and as a food. | 4.26 | 0.33 | 0.05 | 36.67 |
| 42 | Cucumis melo var. agrestis Naudin (ADN-743) | Chibbar   | Cucurbitaceae  | Whole plant         | Oral                   | Fruit is edible. Powder of fruit is used in stomach disorders and skin problems. The leaves are used as a fodder. | 8.51 | 0.67 | 0.12 | 63.33 |
| 43 | Cucumis sativus L. (ADN-744)   | Kheera     | Cucurbitaceae  | Fruit               | Oral                   | Fruit is used for proper functioning of stomach and digestion of food.                         | 4.26 | 0.33 | 0.05 | 36.67 |
| 44 | Cucurbita pepo L. (ADN-745)    | Kaddo      | Cucurbitaceae  | Fruit               | Oral                   | Fruit is used as a vegetable and efficient working of stomach.                                | 5.32 | 0.42 | 0.07 | 36.67 |

(Continued)
| #  | Botanical Name & Voucher No. | Local Name | Family | Parts used | Mode of administration | Recipes & Ethnobotanical use | FC  | RFC | UV  | RI  |
|----|-------------------------------|------------|--------|------------|-----------------------|----------------------------|-----|-----|-----|-----|
| 45 | Curcuma longa L. (ADN-746)    | Haldi      | Zingiberaceae | Rhizome    | Oral                  | The powder of rhizome is used for joints pain and in condiments. | 5.32 | 0.42 | 0.09 | 36.67 |
| 46 | Cuscuta reflexa Roxb. (ADN-747) | Amar bail  | Convolvulaceae | Whole plant | Oral                  | Infusion in oil and tonic formation for efficient growth of hairs, anti-lice and anti-dandruff. Cooked juice for flu and influenza. | 8.51 | 0.67 | 0.1  | 26.67 |
| 47 | Cynodon dactylon (L.) Pers. (ADN-748) | Khabal ghaas | Poaceae | Whole plant | Topical               | Poultice/paste are applied on wounds and skin infections. | 2.13 | 0.17 | 0.02 | 18.33 |
| 48 | Dalbergia sissoo DC. (ADN-749)  | Sheesham   | Leguminosae | Leaves, Bark, Beans, Stem | Oral                  | Infusion in water for proper functioning of male reproductive system. Wood is used in furniture and fuel. | 6.38 | 0.5  | 0.1  | 36.67 |
| 49 | Datura innoxia Mill. (ADN-750) | Dhatoora   | Solanaceae | Seeds     | Oral, Topical         | Directly used or taken in powder form to cure scabies, pimples and other skin problems. | 5.32 | 0.42 | 0.06 | 35.00 |
| 50 | Daucus carota L. (ADN-751)     | Gajar      | Apiaceae | Root      | Oral                  | Root is used or cooked as a vegetable, generates blood and used in making salad. | 7.45 | 0.58 | 0.13 | 45.00 |
| 51 | Desmostachya bipinnata (L.) Stapf (ADN-752) | Dub ghasa | Poaceae | Whole plant | Oral                  | Decoction is used for the treatment of fever and headache. | 2.13 | 0.17 | 0.03 | 26.67 |
| 52 | Eclipta prostrata (L.) L. (ADN-753) | Bhangra  | Compositae | Whole plant | Oral                  | Powder dried parts of plants is used for tooth cleaning. | 1.06 | 0.08 | 0.01 | 18.33 |
| 53 | Eucalyptus camaldulensis Dehnh. (ADN-754) | Sufaida  | Myrtaceae | Whole plant, Stem | Oral                  | Fresh parts or powder is used to cure flu and influenza. Wood is used for fuel, timber and furniture. | 12.77 | 1   | 0.16 | 26.67 |
| 54 | Euphorbia granulata Forsk. (ADN-816) | Hazar dani | Euphorbiaceae | Whole plant | Oral                  | Powder is used for treatment of dysentery. | 1.06 | 0.08 | 0.01 | 18.33 |
| 55 | Ficus benghalensis L. (ADN-755)  | Bohr       | Moraceae | Whole plant, Aerial roots, Latex | Oral                  | The powder of aerial roots used for proper function of liver and blood production. Syrup from whole parts of plant is used to cure asthma. Latex is mixed with its bark used in the treatment of gonorrhea and for proper function of male reproductive system. | 9.57 | 0.75 | 0.13 | 81.67 |
| 56 | Ficus religiosa L. (ADN-756)    | Peepal     | Moraceae | Bark, Fruit, Latex | Oral                  | The powdered of dried bark is used for tooth cleaning. The cooked juice of bark is used as anti-vomiting. The powder of bark mixed with latex used for treatment of gonorrhea. The powder of bark, fruit and latex is used to relief from body pain. | 7.45 | 0.58 | 0.13 | 71.67 |
| 57 | Foeniculum vulgare Mill. (ADN-757) | Sounf      | Apiaceae | Seeds      | Oral                  | The powder of seeds mixed with sugar (2 tea spoon) for weakness of eyesight and stomach disorders. | 6.38 | 0.5  | 0.09 | 36.67 |
| 58 | Fragaria ananassa (Duchesne ex Weston) Duchesne ex Rozier (ADN-758) | Strawberry | Rosaceae | Fruit      | Oral                  | Fruit is edible and generates blood and full with iron. | 3.19 | 0.25 | 0.03 | 18.33 |
| 59 | Fumaria indica (Hausskn.) Pugsley (ADN-759) | Pit papra | Papaveraceae | Whole plant | Oral                  | Syrup preparation by boiling and adding sugar for allergy and scabies. | 2.13 | 0.17 | 0.02 | 18.33 |
Table 2. (Continued)

|   | Botanical Name & Voucher No. | Local Name | Family | Parts used | Mode of administration | Recipes & Ethnobotanical use | FC  | RFC | UV  | RI  |
|---|-----------------------------|------------|-------|------------|------------------------|-------------------------------|-----|-----|-----|-----|
| 60 | Gossypium arboreum L. (ADN-760) | Kapas | Malvaceae | Leaves, Seeds, Flowers, Stem | Oral | Water extract of leaves is used in medicines for regular menstrual cycle. Seeds are used for oil extraction, cotton and banoola is also obtained used as a fodder for animals. Dried stem is used as a fuel. | 8.51 | 0.67 | 0.14 | 53.33 |
| 61 | Hibiscus rosa-sinensis L. (ADN-761) | Shoe flower | Malvaceae | Flowers | Oral | Syrup formation from fresh or dried flowers used to cure heart diseases. | 1.06 | 0.08 | 0.01 | 18.33 |
| 62 | Hordeum vulgare L. (ADN-762) | Jou | Poaceae | Seeds | Oral | The powder of seeds is used for making breads and proper activity of stomach. Fresh aerial parts of plant are used as a fodder. | 6.38 | 0.5 | 0.1 | 36.67 |
| 63 | Ipomoea cairica (L.) ADN-763 | Ishq peecha | Convolvulaceae | Seeds | Oral | Seeds orally taken with water used in medicines for normal working of male reproductive system | 3.19 | 0.25 | 0.03 | 18.33 |
| 64 | Jasminum sambac (L.) Aiton (ADN-764) | Chambaili | Oleaceae | Whole plant | Nil | Grown in lawns and parks having ornamental value. | 5.32 | 0.42 | 0.07 | 26.67 |
| 65 | Lawsonia inermis L. (ADN-765) | Mehndi | Lythraceae | Leaves | Topical | Paste of dried leaves or powder used in feet burning, to color hands, feet and hairs. | 6.38 | 0.5 | 0.06 | 26.67 |
| 66 | Lepidium didymum L. (ADN-766) | Afsanteen | Brassicaceae | Leaves | Oral | Decoct from fresh leaves for scabies, blood purifier and liver problems. Flowers orally taken with water for the treatment of diabetes. | 8.51 | 0.67 | 0.17 | 81.67 |
| 67 | Luffa cylindrica (L.) M.Roem. (ADN-767) | Toori | Cucurbitaceae | Fruit | Oral | Cooked fruit used as a vegetable. | 4.26 | 0.33 | 0.04 | 18.33 |
| 68 | Lycopersicon esculentum Mill. (ADN-768) | Tamatar | Solanaceae | Fruit | Oral | Fruit is used for blood production, used in salad and cooking purpose | 5.32 | 0.42 | 0.1 | 45.00 |
| 69 | Malva parviflora L. (ADN-769) | Chiri choga | Malvaceae | Leaves | Oral | Leaves decoction is used to cure stomach disorders. | 4.26 | 0.33 | 0.04 | 18.33 |
| 70 | Mangifera indica L. (ADN-770) | Aam | Anacardiaceae | Fruit, Seeds | Oral | The powder of seeds (1–2 tea spoons) helpful in the treatment of leucorrhea. Fruit is edible and increase production of blood, pickle, chutney and marmalade. | 8.51 | 0.67 | 0.12 | 45.00 |
| 71 | Melia azedarach L. (ADN-771) | bakaen | Meliaceae | Fruit, Stem | Oral | Grind fruits and mixed with animal’s fodder for efficient digestion and more milk production In livestock. Fruit is edible and function as a blood purifier. Wood is used for fuel and furniture. | 6.38 | 0.5 | 0.1 | 73.33 |
| 72 | Melilotus indica (L.) All. (ADN-772) | Sainjhi | Fabaceae | Whole plant, Seeds | Oral | Dried powder of seeds used for proper bowel functions. Aerial parts are used as a fodder | 4.26 | 0.33 | 0.07 | 45.00 |
| 73 | Mentha arvensis L. (ADN-773) | Podina | Lamiaceae | Whole plant | Oral | Powder, paste or extract for stomach acidity and chest burning. | 6.38 | 0.5 | 0.09 | 26.67 |
| 74 | Mentha longifolia (L.) L. (ADN-774) | Jangli podina | Lamiaceae | Whole plant | Oral | Grind by using pestle & mortar, and squeeze the juice, taken orally to cure piles, stomach disorders and blood purification. | 7.45 | 0.58 | 0.1 | 45.00 |
| 75 | Momordica charantia L. (ADN-775) | Kareela | Cucurbitaceae | Fruit, Pericarp | Oral | Fruit with its covering place in water whole night and drink water in morning for diabetes, allergy and pustules. | 8.51 | 0.67 | 0.12 | 45.00 |

(Continued)
| #  | Botanical Name & Voucher No. | Local Name | Family       | Parts used | Mode of administration | Recipes & Ethnobotanical use                                                                 | FC  | RFC | UV  | RI  |
|----|-----------------------------|------------|--------------|------------|------------------------|---------------------------------------------------------------------------------------------|-----|-----|-----|-----|
| 76 | Moringa oleifera Lam. (ADN-776) | Suhanjna   | Moringaceae  | Beans, Leaves | Oral                  | The powder of leaves (2 tea spoon daily) used to cure diabetes, backbone pain, eye sight weakness. Beans are cooked, and used as food and in pickle formation. Leaves are used as a fodder for increasing milk and meat production for livestock. | 6.38 | 0.5 | 0.15| 81.67|
| 77 | Morus alba L. (ADN-777)        | Sufaid shahtoot | Moraceae     | Fruit, Stem   | Oral                  | Fresh or dried fruit is edible and used to cure inflammation of throat and problems associated with respiratory tract. Wood is used for fuel, timber and furniture. | 10.64 | 0.83 | 0.16| 45.00|
| 78 | Morus nigra L. (ADN-778)       | Kala shahtoot | Moraceae     | Fruit, Leaves  | Oral                  | Fresh, dried or syrup of fruit is used for treatment of cough, respiratory tract infection and worms of abdomen. Leaves are used as a fodder for livestock. | 9.57 | 0.75 | 0.14| 55.00|
| 79 | Musa paradisiaca L. (ADN-779)  | Kela       | Musaceae     | Fruit, Stem   | Oral                  | Fresh fruit is edible used to cure diarrhea and increasing body weight. Water extract from stem is used in the treatment of leucorrhea. | 6.38 | 0.5 | 0.11| 55.00|
| 80 | Nicotiana tabacum L. (ADN-780) | Tobacco    | Solanaceae   | Leaves       | Oral                  | Dried and crushed leaves are used in cigarette. Water extract from leaves is used as an antiseptic. | 4.26 | 0.33 | 0.06| 26.67|
| 81 | Ocimum basilicum L. (ADN-821)  | Tulsi      | Lamiaceae    | Seeds, Leaves | Oral                  | Water soaked seeds drink with water used for urinary tract infection and reduce swelling. Cooked juice of leaves used to cure cough, flu and other respiratory infections. | 5.32 | 0.42 | 0.1 | 63.33|
| 82 | Oryza sativa L. (ADN-781)      | Chawal     | Poaceae      | Seeds, Stem   | Oral                  | Cooked seeds and powder of seeds used as a food for humans. Dried stem used as fuel. | 3.19 | 0.25 | 0.04| 18.33|
| 83 | Oxalis corniculata L. (ADN-782) | Torshuk    | Oxalidaceae  | Leaves       | Oral                  | Leaves are grounded to paste, followed by juice extraction and taken to treat stomach and liver dis-functioning. | 5.32 | 0.42 | 0.07| 36.67|
| 84 | Peganum harmala L. (ADN-783)   | Hermal     | Nitrariaceae | Seeds        | Oral                  | The powder of seed (1 tea spoon) is used for diabetic patients and joints pain. | 3.19 | 0.25 | 0.05| 36.67|
| 85 | Pennisetum glaucum (L.) R.Br. (ADN-784) | Bajrah | Poaceae      | Seeds, Stem   | Oral                  | The powder of seeds used to cure joints pain. Stem is used as a fodder. | 4.26 | 0.33 | 0.06| 36.67|
| 86 | Pentatropis nivalis (J. F.Gmel.) D.V.Field & J.R.I.Wood (ADN-785) | Fareed | Apocynaceae  | Leaves       | Oral                  | Leaves paste mixed with honey is taken to regulate and correct menstrual cycle. | 2.13 | 0.17 | 0.02| 18.33|
| 87 | Phalaris minor Retz. (ADN-786) | Dumbi sitti | Poaceae      | Aerial part   | Oral                  | Aerial parts are used as a fodder for animals. | 4.26 | 0.33 | 0.04| 18.33|
| 88 | Phoenix dactylifera L. (ADN-787) | Khajoor | Arecaceae    | Fruit        | Oral                  | Fruit is edible and improves digestion, provide strength to body. | 7.45 | 0.58 | 0.1 | 36.67|
| 89 | Phylla nodiflora L. (ADN-788)  | Gandh booti | Verbenaceae  | Leaves       | Oral                  | Leaves are used as a fodder for livestock. | 3.19 | 0.25 | 0.03| 18.33|
| 90 | Pisum sativum L. (ADN-789)     | Matar      | Leguminosae  | Beans, Aerial parts | Oral                  | Seeds are used as vegetable. Aerial parts are used as fodder. | 7.45 | 0.58 | 0.1 | 26.67|
| 91 | Polygonum aviculare L. (ADN-791) | Hind ki raani | Polygonaceae | Whole plant  | Oral                  | Infusion from dried plant orally taken to cure leucoderma or vitiligo. | 2.13 | 0.17 | 0.02| 18.33|

(Continued)
| #  | Botanical Name & Voucher No. | Local Name | Family         | Parts used       | Mode of administration | Recipes & Ethnobotanical use                                                                 | FC  | RFC | UV | RI  |
|----|----------------------------|------------|----------------|------------------|------------------------|---------------------------------------------------------------------------------------------|-----|-----|----|-----|
| 92 | Pongamia pinnata (L.) Pierre (ADN-790) | Sukh chain | Leguminosae    | Aerial parts, Leaves | Oral                   | The branches are used for cleaning tooth. Leaves are used as a fodder.                     | 5.32 | 0.42 | 0.06 | 36.67 |
| 93 | Populus nigra L. (ADN-792) | Paplar      | Salicaceae     | Bark, Fruit       | Oral                   | The powder from bark and fruit used for treatment of arthritis and backache.               | 6.38 | 0.5  | 0.07 | 26.67 |
| 94 | Portulaca oleracea L. (ADN-793) | Qulfah      | Portulacaceae  | Whole plant       | Oral                   | Powder or boiled whole plant in water and orally taken to cure constipation, jaundice and skin problems. | 4.26 | 0.33 | 0.06 | 55.00 |
| 95 | Praecitrullus fistulosus (Stocks) Pangalo (ADN-736) | Tenda       | Cucurbitaceae  | Fruit             | Oral                   | Fruit is used as a vegetable.                                                              | 4.26 | 0.33 | 0.04 | 18.33 |
| 96 | Prosopis juliflora (Sw.) DC. (ADN-794) | Pahari keekar | Leguminosae    | Beans, Stem       | Oral                   | Fresh or dried beans used as a fodder for goats. Wood is used as fuel.                    | 2.13 | 0.17 | 0.04 | 26.67 |
| 97 | Prunus persica (L.) Batsch (ADN-795) | Desi aaro   | Rosaceae       | Fruit, Leaves     | Oral                   | Fresh or dried fruit is edible for diabetes, proper functioning of stomach and worms of abdomen, Leaves are used as a fodder. | 6.38 | 0.5  | 0.11 | 63.33 |
| 98 | Psidium guajava L. (ADN-796) | Amrood      | Myrtaceae      | Leaves, Fruit     | Oral                   | The decoction or cooked juice of leaves for diabetes, proper functioning of stomach And toothache. Fruit is edible and anti-constipatory. | 8.51 | 0.67 | 0.14 | 53.33 |
| 99 | Punica granatum L. (ADN-797) | Anaar       | Lythraceae     | Fruit             | Oral                   | Fruit is edible generates blood and used for normal activity of stomach.                 | 6.38 | 0.5  | 0.09 | 36.67 |
| 100 | Raphanus raphanistrum subsp. sativus (L.) Domin (ADN-798) | Mooli      | Brassicaceae   | Root, Leaves      | Oral                   | Root is used or cooked as a vegetable, proper functioning of stomach and used in salad. Leaves are used as a fodder. | 7.45 | 0.58 | 0.14 | 53.33 |
| 101 | Ricinus communis L. (ADN-799) | Arind       | Euphorbiaceae  | Seeds, Fruit      | Oral, Topical          | Oil extract from seeds used in medicines of rheumatism and arthritis and prevention of pregnancy. | 5.32 | 0.42 | 0.09 | 55.00 |
| 102 | Rosa alba L. (ADN-800) | Chitta gulab | Rosaceae       | Whole plant, Flower | Topical               | Water extract of flowers used to cure eyes infection. Whole plant have ornamental value.   | 4.26 | 0.33 | 0.06 | 36.67 |
| 103 | Rosa indica L. (ADN-801) | Lal gulab   | Rosaceae       | Flower            | Oral, Topical          | Flower petals mixed with sugar are used in making “Gulkand” for stomach disorders in humans and increasing milk production in livestock. Water extract of flowers is used for eyes infection, softness of skin. Whole plant has ornamental value. | 11.7 | 0.92 | 0.18 | 91.67 |
| 104 | Rumex dentatus L. (ADN-802) | Jangli palak | Polygonaceae   | Seeds, Leaves     | Oral                   | The powder of seeds and leaves or directly used for normal working of genital organs. Leaves are used as a fodder for animals. | 4.26 | 0.33 | 0.05 | 36.67 |
| 105 | Saccharum officinarum L. (ADN-803) | Ganna       | Poaceae        | Stem              | Oral                   | The stem juice is concentrated by boiling to local sweet called “Gurr”, Sugarcane juice is advised in case of liver and stomach disorders. Aerial parts are used as fodder. | 8.51 | 0.67 | 0.17 | 71.67 |

(Continued)
| #  | Botanical Name & Voucher No.       | Local Name       | Family         | Parts used        | Mode of administration | Recipes & Ethnobotanical use                                                                 | FC  | RFC | UV | RI  |
|----|-----------------------------------|------------------|----------------|-------------------|------------------------|---------------------------------------------------------------------------------------------|-----|-----|----|-----|
| 106| *Salvadora oleoides* Decne. (ADN-804) | Ban              | Salvadoraceae  | Root              | Oral                   | Fresh or dried roots are used as “miswak” or tooth-brush for tooth cleaning.                | 4.26 | 0.33 | 0.04 | 18.33 |
| 107| *Sesamum indicum* L. (ADN-805)      | Til              | Pedaliaceae    | Seeds             | Oral                   | Seeds are used for oil extraction and cure increased urination.                              | 8.51 | 0.67 | 0.1  | 36.67 |
| 108| *Solanum americanum* Mill. (ADN-806) | peelak/ mako     | Solanaceae     | Whole plant, Fruit| Oral                   | Decoction from whole plant is used as a blood purifier to cure allergy and inflammation. Fruit is edible and used as anti-inflammatory. | 7.45 | 0.58 | 0.12 | 73.33 |
| 109| *Solanum melongena* L. (ADN-807)       | Baingan          | Solanaceae     | Fruit             | Oral                   | Cooked fruit is used for treatment of kidney stones and as a vegetable.                      | 3.19 | 0.25 | 0.05 | 36.67 |
| 110| *Solanum tuberosum* L. (ADN-808)       | Aloo             | Solanaceae     | Tuber, Stem       | Oral                   | Tuber is edible and used as food. Stem is used as a fodder.                                  | 4.26 | 0.33 | 0.06 | 26.67 |
| 111| *Solanum virginianum* L. (ADN-809)     | Bhatkari         | Solanaceae     | Whole plant       | Topical                | Whole plant boiled in water and wash infected area with this boiled water used as an Anti-inflammatory. | 1.06 | 0.08 | 0.01 | 18.33 |
| 112| *Sonchus asper* (L.) Hill (ADN-810)    | Bhattal/ Sonchal | Compositae     | Leaves, Whole plant| Oral, Topical          | Powder from whole dried plant applied on burns and wounds. Fresh leaves are used for fodder. | 4.26 | 0.33 | 0.06 | 36.67 |
| 113| *Syzygium cumini* (L.) Skeels (ADN-811) | jaman            | Myrtaceae      | Whole plant, Seeds, Leaves | Oral                   | Decoction from whole plant is used to cure diarrhea, stomach disorders, proper liver functioning. The powder of seeds is used to cure diabetes and blood purification. Leaves are used as a fodder. | 9.57 | 0.75 | 0.18 | 100.00 |
| 114| *Thuja occidentalis* L. (ADN-812)      | Saro/ Mazoo      | Cupressaceae   | Seeds             | Oral                   | The powder of seeds is used for strengthening of teeth and gums, egg production in females and poultry. | 3.19 | 0.25 | 0.03 | 36.67 |
| 115| *Tinospora sinensis* (Lour.) Merr. (ADN-813) | Gloo             | Menispermaceae | Whole plant       | Oral                   | The powder of whole plant parts is used for treatment of typhoid and liver inflammation.     | 3.19 | 0.25 | 0.05 | 45.00 |
| 116| *Tithonia diversifolia* (Hemsl.) A.Gray (ADN-814) | Jangli gainda    | Compositae     | Seeds, Leaves     | Oral                   | Seeds are orally taken with water for treatment of piles. Leaves used as fodder.             | 5.32 | 0.42 | 0.07 | 36.67 |
| 117| *Trianthema potulacastrum* L. (ADN-815) | It sit           | Aizoaceae      | Whole plant, Aerial parts | Oral                   | The juice is used to treat kidney stones.                                                   | 5.32 | 0.42 | 0.01 | 36.67 |
| 118| *Tribulus terrestris* L. (ADN-817)     | Bhakhra          | Zygophyllaceae | Seeds, Aerial parts | Oral                   | The powder of seeds is used for kidney stones and backache. Aerial parts are used as fodder. | 6.38 | 0.5  | 0.09 | 55.00 |
| 119| *Trigonella foenum-graecum* L. (ADN-818) | Methi            | Leguminosae    | Whole plant       | Oral                   | Powder from dried parts of plant is used for joints pain and blood purifier. Stem is cooked and use as vegetable. | 7.45 | 0.58 | 0.12 | 55.00 |
| 120| *Triticum aestivum* L. (ADN-819)       | Gandum           | Poaceae        | Fruit, Stem       | Oral                   | The immature fruit is used to enhance milk production. “Tori” wheat straw is mixed with other fodder as animal feed. | 5.32 | 0.42 | 0.07 | 26.67 |
| 121| *Typha elephantina* Roxb. (ADN-820)    | Bora             | Typhaceae      | Stem              | Nil                   | Dried stem is used in forming mats.                                                         | 4.26 | 0.33 | 0.04 | 18.33 |
| 122| *Vigna radiata* (L.) R. Wilczek (ADN-822) | Moongi           | Leguminosae    | Beans, Stem       | Oral                   | Cooked beans used as vegetable for humans and to cure joints pain.                          | 4.26 | 0.33 | 0.05 | 36.67 |

(Continued)
is also used for many other purposes. A total of 126 local plants belonging to 52 families were reported where Poaceae (13 spp.) was the predominant family followed by Leguminosae (12 spp.) and Solanaceae, Cucurbitaceae (10 spp. each) (Fig 1).

**Herbal therapies and preparation**

More than 50 uses of plants were reported and many plant species were used against diseases including liver problems, skin disorders, heart problems, stomach disorders, respiratory tract...
infections and diabetes etc. A total of 25, 12 and 10 plant species were found effective against stomach disorders, joint pain and blood purification, respectively. Different parts of the local plants were used to prepare many local remedies. Among the different plant parts used, fruit were the favored part with (18.82%) usage in local remedies followed by leaves (18.28%) whole plant (16.13%), seeds (15.05%), stem (10.75%), aerial parts (6.99%), roots (3.23%), latex (2.69%), bark (1.61%), bulb (1.08), tubers and rhizome (0.54%) (Fig 2). Different recipes were prepared from indigenous plant species i.e. infusion, decoction, powder, freshly cooked, cooked juice, poultice, porridge, water soaked seeds and infusion in oil etc. in the study area [32]. In these recipes, fresh herbs were used the most (22.5%) followed by powder (17.5%) and freshly cooked (11.3%) by local inhabitants. Flowers of *Acacia nilotica* were used for the treatment of leucorrhea, the bulb of *Allium sativum* is used to control blood pressure, Latex from *Bombax ceiba* is used to cure menstrual problems, seeds of *Cassia fistula* are used for stomach disorders, powder from *Citrullus colocynthis* is used for constipation and to cure asthma, the fruit of *Cordia myxa* is used to cure ulcers of the stomach and joint pain and fruit yielding plants provide a rich source of food but also provide numerous vitamins. Previous studies also reported the use of these plants against cure of different diseases [33–36].

Mode of administration

Most of the herbal medicines are used orally by indigenous people but a few of the medicines are applied in the form of a paste or a poultice applied directly to the body (Table 2). The oral mode of ingestion is considered the best method for the treatment of different ailments but in skin disorders like skin allergies, wounds, pustules and pimples, herbal medicines are applied directly to the skin. Many plants of the same family or from different families were reported to be just as effective against a single disease [28].
Relative importance of medicines

To evaluate the relative importance of indigenous plants, the use value was calculated for each plant. The result of this study tells us that Azadirachta indica shows a maximum use value (UV = 0.22) with a minimum use value (UV) indicated by Alhagi maurorum, Eclipta prostrata, Hibiscus rosa-sinensis, Solanum virginianum and Trianthema potulacastrum (UV = 0.01). It is clear from the formula sheet that the plant with the higher UV value is used in many more recipes for different purposes and the plants with the lower UV value are used in a more limited amount for the treatment of ailments across many other recipes.

Informants consensus factor

The result of this study shows that hepatitis, ulcer of the stomach, bowel disorders, urinary problems, psoriasis, cancer, leucoderma, increased urination, antiseptic and burning feet were most prevalent in the study area with an ICF value (1.00). Followed by leucorrhea, which was second, with an ICF value (0.89) and vomiting was in third place, with an ICF value (0.86). Many other common diseases e.g., acidity of the stomach (ICF = 0.83), blood pressure (ICF = 0.82) and piles (ICF = 0.71) were observed with the calculation of the ICF value.

Jaccard’s similarity index

Jaccard’s similarity index shows the degree of similarity related species cited between our study and other studies carried out in different areas of the world. The highest Jaccard’s similarity index value (JI = 0.329) shows that plant species reported in our study are more similar with [37] followed by [8] with Jaccard’s index value (JI = 0.283), and followed by [25] with Jaccard’s index value (JI = 0.245). The maximum Jaccard’s index value for uses comparison is (JI = 0.28) for study of [37], followed by (JI = 0.24) for [38] and Jaccard’s index value (JI = 0.24) for [25] was on third number. The highest Jaccard’s similarity index value shows the highest similarity between two studies of different areas.

Conclusion

The current study reveals that the study area is diversified cereal, wild and many other medicinal plants. This is the first ethnobotanical survey of this study area. During this study very important information is collected with many medicinal plants. Reported medicinal plants are used to cure more than 50 ailments including heart diseases, respiratory tract infection, stomach disorders, hepatitis, joints pain and diabetes by indigenous people. Unfortunately, traditional knowledge about medicinal plants is decreasing day by day as young generation relies on allopathic medicines. Many people of this study area did not even know about ethnobotanical or medicinal uses of a single plant. The excessive use of medicinal plants, over grazing, deforestation and anthropogenic activities threatened the species. Most of the people are unaware from conservation strategies and this leads to the extinction of many species. On the basis of results of current survey, urgent attention is required for the conservation and documentation of traditional knowledge about plants and conservation of medicinal plants.

Supporting information

S1 File. Questionnaire for ethnobotanical survey of plants used by the people of Mandi Ahmad Abad, Okara.
(PDF)
S2 File. Excel data sheet for various ethnobotanical analyses.  
(XLSX)

Acknowledgments
We acknowledge two native English speakers, Kathy Harms and Jeff Peacock, for editing and proofreading of this manuscript.

Author Contributions
Conceptualization: Mubashrah Munir.
Formal analysis: Sehrish Sadia, Arshad Mahmood Khan.
Investigation: Khawaja Shafique Ahmad.
Methodology: Sehrish Sadia.
Project administration: Bakht Zareen Rahim.
Resources: Khawaja Shafique Ahmad.
Software: Sehrish Sadia, Arshad Mahmood Khan.
Supervision: Mubashrah Munir, Rahmatullah Qureshi.
Validation: Arshad Mahmood Khan.
Visualization: Bakht Zareen Rahim.
Writing – original draft: Adnan Khan.
Writing – review & editing: Sehrish Sadia, Brian Gagosh Nayyar, Ishrat Fatima.

References
1. Din BU, Hadi F, ul Haq Z, Ahmed M, Abbas M, Salam A, et al. Ethno Botanical Perspective of Medicinal Plants in Mulkhow Valley District Upper Chitral, Pakistan. Academic Journal of Plant Sciences. 2020; 13(1):15–22.
2. Safeer S, Qureshi R, ul Hassan U, Khalil S, Anwar F. Ethnobotanical study on useful indigenous plants in Mahasheer National Park, AJK. Journal of Coastal Life Medicine. 2017; 5(3):109–15.
3. Zereen A, Sardar AA. Ethnobotanical studies of wild herbs of central Punjab, Pakistan. Bangladesh Journal of Plant Taxonomy. 2013; 20(1):67–76.
4. Qaseem M, Qureshi R, Amjad M, Ahmed W, Masood A, Shaheen H. Ethno-botanical evaluation of indigenous flora from the communities of rajh mehali and goi union councils of district Kotli, Azad Jammu Kashmir Pakistan. Appl Ecol Environ Res. 2019; 17(2):2799–829.
5. Ahmad M, Sultana S, Fazi-i-Hadi S, Ben Haddia T, Rashid S, Zafar M, et al. An Ethnobotanical study of Medicinal Plants in high mountainous region of Chail valley (District Swat-Pakistan). Journal of ethnobiology and ethnomedicine. 2014; 10(1):36.
6. Aziz MA, Khan AH, Adnan M, Ullah H. Traditional uses of medicinal plants used by Indigenous communities for veterinary practices at Bajaur Agency, Pakistan. Journal of ethnomedicine and ethnomedicine. 2018; 14(1):11. https://doi.org/10.1186/s13002-018-0212-0 PMID: 29378636
7. Irfan M, Nabeela IK, Kamil M, Ullah S, Khan S, Shah M, et al. Ethnobotanical Survey of the Flora of Tehsil Balakot, District Manshera, Khyber Pakhtunkhwa, Pakistan. Journal of Applied Environmental and Biological Sciences. 2018; 8(8):1–13.
8. Rana D, Bhatt A, Lal B, Parkash O, Kumar A, Uniyal SK. Use of medicinal plants for treating different ailments by the indigenous people of Churah subdivision of district Chamba, Himachal Pradesh, India. Environment, Development and Sustainability. 2020:1–80.
9. Tufail M, Hussain K, Nawaz K, Bhatti KH, Yasin G, Ali SS. Ethnobotanical Survey of Important Wild Medicinal Plants of Tehsil Gojra, District Toba Tek Singh, Punjab, Pakistan. Ethnobotany Research and Applications. 2020; 20:1–14.
10. Anwer Z, Shabbir S, Iram T, Tariq S, Murad H. Ethnobotanical study of wild flora of Haroonabad, District Bahawalnagar, Punjab, Pakistan. European Journal of Biology. 2020; 5(1):41–62.

11. Zeb A, Khan Y, Yaseen T, Shah S. Ethno Botanical Study of Wild Medicinal Plants of Peerano Valley, District Malakand, Khyber Pakhtoonkhwa, Pakistan. Asian Plant Research Journal. 2020:34–44.

12. Ullan T, Diazgranados M, Pironon S, Padulosi S, Liu U, Davies L, et al. Unlocking plant resources to support food security and promote sustainable agriculture. Plants, People, Planet. 2020; 2(5):421–45.

13. Agrawal T. Ethnobotanical Investigation of the Silisarh Lake Area of the Alwar District of Rajasthan. Br J Res. 2017; 4(3):18.

14. Dapar MLG, Alejandro GJD, Meve U, Liede-Schumann S. Quantitative ethnopharmacological documentation and molecular confirmation of medicinal plants used by the Manobo tribe of Agusan del Sur, Philippines. Journal of ethnobiology and ethnomedicine. 2020; 16(1):1–60. https://doi.org/10.1186/s13002-019-0351-y PMID: 31924218

15. Arshad F, Waheed M, Iqbal M, Fatima K, Fatima K. Ethnobotanical assessment of woody flora of district Kasur (Punjab), Pakistan. Ethnobotany Research and Applications. 2020; 20;1–13.

16. Dapar Mlg, Meve U, Liede-Schumann S, Alejandro Gjd. Ethnomedicinal appraisal and conservation status of medicinal plants among the Manobo tribe of Bayugan City, Philippines. Biodiversitas Journal of Biological Diversity. 2020; 21(8).

17. Ullah S, Badshah L, Ali A, Muhammad N. Quantitative assessment and status of ethnomedicinal plants of Sheen Ghar Valley, Dir Lower, Khyber Pakhtunkhwa, Pakistan. Plant Science Today. 2020; 7(1):17–22.

18. Tugume P, Kakudidi EK, Buyinza M, Namata J, Kamatenesi M, Mucunguzi P, et al. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve, Uganda. Journal of ethnobiology and ethnomedicine. 2016; 12(1):5. https://doi.org/10.1186/s13002-015-0077-4 PMID: 26762159

19. Umair M, Altaf M, Bussmann RW, Abbasi AM. Ethnomedicinal uses of the local flora in Chenab riverine area, Punjab province Pakistan. Journal of ethnobiology and ethnomedicine. 2019; 15(1):7. https://doi.org/10.1186/s13002-019-0285-4 PMID: 30709360

20. Shinwari S, Qureshi R, Baydoun E. Ethnobotanical study of Kohat pass (Pakistan). Pak J Bot. 2011; 43:135–9.

21. Ali S, Shabbir A, Muhammad S. Ethnobotanical uses of some native and alien plants of The Jhok Reserve Forest, Punjab, Pakistan. Pakistan Journal of Weed Science Research. 2018; 24(2).

22. Sabeen M, Ahmad SS. Exploring the folk medicinal flora of Abbottabad city, Pakistan. Ethnobotanical Leaflets. 2009; 2009(7):1.

23. Murad W, Azizullah A, Adnan M, Tariq A, Khan KU, Waheed S, et al. Ethnobotanical assessment of plant resources of Banda Daud Shah, district Karak, Pakistan. Journal of ethnobiology and ethnomedicine. 2013; 9(1):77. https://doi.org/10.1186/1746-4269-9-77 PMID: 24287174

24. Malik S, Ahmad S, Sadiq A, Alam K, Wariss HM, Ahmad I, et al. A comparative ethno-botanical study of Cholistan (an arid area) and Pothwar (a semi-arid area) of Pakistan for traditional medicines. Journal of ethnobotany and ethnomedicine. 2015; 11(1):31.

25. Zubair M, Khan S, Hussain SB, Haq AU, Jamil A. Ethnobotanical Study Of Pakistan’s Southern Punjab Tehsil Of Dumpyapur. International Journal of Multidisciplinary Research and Studies. 2019; 2(09):40–52.

26. Farooq A, Amjad MS, Ahmad K, Altaf M, Umair M, Abbasi AM. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of ethnobiology and ethnomedicine. 2019; 15(1):45. https://doi.org/10.1186/s13002-019-0323-2 PMID: 31470868

27. Abbas Z, Khan SM, Abbasi AM, Pieroni A, Ullah Z, Iqbal M, et al. Ethnobotany of the Balti community, Tormik valley, Karakorum range, Baltistan, Pakistan. Journal of ethnobiology and ethnomedicine. 2016; 12(1):38. https://doi.org/10.1186/s13002-016-0114-y PMID: 27612599

28. Ishtiaq M, Mahmood A, Maqbool M. Indigenous knowledge of medicinal plants from Sudhanoti district (AJK), Pakistan. Journal of ethnopharmacology. 2015; 168:201–7. https://doi.org/10.1016/j.jep.2015.01.054 PMID: 25666425

29. Eddouks M, Ajebl M, Hebi M. Ethnopharmacological survey of medicinal plants used in Darraa-Tafilalet region (Province of Errachidia), Morocco. Journal of ethnopharmacology. 2017; 198:516–30. https://doi.org/10.1016/j.jep.2016.12.017 PMID: 28003130

30. Suwardi AB, Navia ZI, Harmawan T, Mukhtar E. Ethnobotany and conservation of indigenous edible fruit plants in South Aceh, Indonesia. Biodiversitas Journal of Biological Diversity. 2020; 21(5).

31. Rakib-Uz-Zaman S, Iqbal A, Mowna SA, Khanom MG, Al Amin MM, Khan K. Ethnobotanical study and phytochemical profiling of Heptapleurum hypoleu cum leaf extract and evaluation of its antimicrobial
activities against diarrhea-causing bacteria. Journal of Genetic Engineering and Biotechnology. 2020; 18(1):1–13. https://doi.org/10.1186/s43141-019-0015-2 PMID: 31903514

32. Saqib Z, Mahmood A, Malik RN, Mahmood A, Syed JH, Ahmad T. Indigenous knowledge of medicinal plants in Kotli Sattian, Rawalpindi district, Pakistan. Journal of ethnopharmacology. 2014; 151(2):820–8. https://doi.org/10.1016/j.jep.2013.11.034 PMID: 24286963

33. Roozbeh N, Darvish L. *Acacia nilotica*: New Plant for Help in Pelvic Organ Prolapse. J Menopausal Med. 2016; 22(3):129–130. https://doi.org/10.6118/jmm.2016.22.3.129 PMID: 28119891

34. Kuete V. Allium sativum. Medicinal Spices and Vegetables from Africa. 2017; 363–377.

35. Zare H. The Effect of *Citrullus Clocynthis* Extract on Cutaneous Leishmaniasis Lesion in Human. Biomed Pharmacol. J 2010; 3(1)

36. Ranjbar M, Varzi HN, Sabbagh A, Balooki A, Sazmand A. Study on Analgesic and Anti-inflammatory Properties of *Cordia myxa* Fruit Hydro-alcoholic Extract. Pakistan Journal of Biological Sciences. 2013; 16: 2066–2069. https://doi.org/10.3923/pjbs.2013.2066.2069 PMID: 24517032

37. Ashfaq S, Ahmad M, Zafar M, Sultana S, Bahadur S, Abbas N. Medicinal plant biodiversity used among the rural communities of arid regions of northern Punjab, Pakistan. 2019.

38. Altaf R, Bhatti K, Mirza S, Ajaib M, Ishtiaq M. Ethnomedicinal study of Tehsil Wazirabad Gujranwala Punjab Pakistan. Pakistan Journal of Science. 2019; 71(4):280.