Ethno-veterinary practices of Poaceae taxa in Punjab, Pakistan

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Abstract

Background: Plant species of Poaceae family are not only used as fodder and forage but also contribute substantially in the treatment of various health disorders, particularly in livestock. Consequently, present study was aimed to document the therapeutic uses Poaceae taxa by the inhabitants of the Punjab Province to treat various veterinary health disorders.

Methods: Semi structured interviews, group discussion and field walks were conducted to collected data. Furthermore, quantitative indices including cultural significance index (CSI), relative frequency of citations (RFC), fidelity level (FL), and relative popularity level (RPL) and Jaccard Index (JI) were adopted for data analysis.

Results: Traditional uses of 149 plants belonging to 60 genera, 16 tribes of 5 sub families of Poaceae were recorded. Whole plant and leaves were the most consistent grazing parts with 40.94 and 29.53% contribution and decoction (35 reports) was the most preferred mode of administration. Majority of the plant species were employed to treat infectious diseases (25.93 %). and digestive disorders (14.10 %). *Triticum aestivum* depicted highest CSI, RFC and RPL levels at 8.00, 0.96, 1.00, respectively, followed by *Oryza sativa* and *Poa annua*. Likewise, *T. aestivum* and Saccharum spontaneum had 100 % FL and ROP. Jaccard index ranged from 12.25 to 0.37. Twelve plant species namely *Chrysopogon zizanioides* (anti-inflammatory), *Pennisetum lansatum* (improve bull fertility), *Cymbopogon citratus* (glandular secretion), *Sorghum saccharatum* and *Themeda triandra* (malaria), *Aristida funiculate* (anticancer), *Koeleria argentina* (skin allergies), *Tetrapogon villosus* (antibacterial), *Cynodon radiates* (eyes infection), *Sporobolus nervosa* (Jaundice), *Enneapogon persicus* (antifungal), and *Panicum repens* (dysfunctional cattle organs) were reported for the first time with novelethnoveterinary uses.

Conclusion: Inhabitants of the study area had strong association with surrounding plant biodiversity and possess significant knowledge on therapeutic uses of grasses and other members of Poaceae to treat various health disorders in animals. Plant species with maximum cultural and medicinal values could be a potential source of novel drugs to cure health disorders in animals and human as well.

Background
Botanical taxa belonging to family Poaceae are the most substantial component of agriculture crops and livestock feed as well as the main sources of economy and revenue for the people of the rural areas around the globe [1]. Majority of the livestock depend on forage grasses and natural pastures. Native plant species of Poaceae are cost-effective source of nutrients for livestock and contribute significantly to conserve the soil integrity, water supply and air quality [2]. The major constraints for improved productivity of livestock is the low quantity and quality of available forages during the dry season that cannot meet the nutrient requirements of grazing ruminants [3]. Rural populace uses grasses as a source of feed for domesticated animals and as medicines to treat health disorders in cattle and human [4].

Many scientific attempts have been made to record ethnoveterinary data on medicinal plants in different part of the world like in Kenya [5], Italy [6], Canada [7], South Africa [8], Pakistan [9], Brazil [10], Argentina [11], India [12], Nigeria [13], Spain [14] and Uganda [15] but grasses on the other hand are among least explored in the Poaceae family. In the past, grasses rich in nutrition were preferred over those that have therapeutically important products [4]. Grasses are of particular importance in traditional health care system due to the presence of biological active compound like alkaloids, flavonoid and saponin [16]. Presence of alkaloids make them highly resistant against foreign microbes and flavonoid have been reported with anti-inflammatory, anticancer and antiviral activities and help animals to overcome the oxidative cell damage [17]. Cynodon dactylon, Saccharum spontaneum and Imperata cylindrica are reported effective in inflammatory and fungal diseases in animals [18]. Chloris barbata grass is used as disinfectant [19], while Heteropogon contortus has antimicrobial, anti-carcinogenic, anti-inflammatory properties and increases milk production in livestock [20].

The local inhabitants of rural areas of Punjab widely use grasses for ethnoveterinary purposes. For example, Cynodon dactylon, Eleusine indica, Bromus japonicus, Phragmites australis, Eragrostis minor and Desmostachya bipinnata are reported to treat various stomach problems whereas Sorghum bicolor, Brachiaria ramosa, Arundo donax, Chrysopogon zizanioides and Panicum antidotale are used to treat microbial infection in cattles [4]. Grasses provide livestock with food rich in nutrition.
especially in the dry winter season when other feed sources are not available [21]. Indigenous people with long histories of livestock rearing may have developed precious information about potential forage resources and they prefer to use grasses as fodder because they are highly plateable than other form of fodders [22]. Their platability also depends on animal choice and may be linked with their seasonal availability and morphological and chemical nature of plant [23]. Animals generally prefer fresh foliage over dried because leaves of grasses are rich source of protein and cellulose and have low lignin than forbs and shrubs [24]. Grasses beside the nutritional and healthcare services also reduce the grazing pressure on other platable species and improve the productivity in livestock [25]. Though, different workers have reported the traditional uses of plant species from different areas of Punjab [26–34], but little is known about the therapeutic potential of grasses and other members of family Poaceae [4], particularly for the treatment of various diseases in livestocks. Consequently, present study was intended with the aim to document the ethnomedicinal uses of plantspecies of Poaceae family from Punjab province of Pakistan, traditionally used to treat various health disorders in livestock and to explore the cultural significance of species and their popularity among different tribes on the basis of their usage in animal healthcare.

Materials And Methods

Study area

Punjab is the second largest province of Pakistan after Balochistan. It encompasses of 205,344 km² area, located between latitudes 27.42° and 34.02° N and longitudes 69.81° and 75.23° E at the north western edge of the geological Indian plate in South Asia [35]. Punjab is comprised of 36 districts which are grouped into 5 agro-ecological zones [36] i.e. southern irrigated zone, arid desert zone, river zone, northern irrigated zone, thal sandy deserts zone and baranizone are representative districts (Fig. 1). Northern irrigated zone and south desert zone are the two largest zone, with huge difference in cultural groups and ethnobotanical practices [4]. Majority of the area in Punjab consists of fertile alluvial plain heavily irrigated with 5 rivers namely Jehlum, Ravi, Chenab and Sutlej. Sparse deserts can be found in southern Punjab and Sulaiman Range. The variation in temperature and rainfall occurs all over the year. Soil is sandy, clay and loamy [37]. Most of the area experience foggy
weather during winter and hot weather in summer. The average annual temperature ranges from –2 °C to 45 °C. June is the hottest and January is the coldest month of the year. Average annual rainfall of last five years is 479.8 mm. Northern parts of the province receive reasonable amount of rainfall throughout the year as compared to the southern part. Almost half of the rainfall occurs during the month of July and August averaging about 255 mm.

Punjab is home to over half of the total population of Pakistan. The ethnic composition of the area is quite diverse comprising of different tribes and communities. Rana, Gujjar, Butt, Rayain are the major ethnic groups. Most of the people speak Punjab language followed by Saraiki and Pashto. Urdu and English languages are used in government offices. Compared to the other provinces, it has highest literacy rate. Punjab contributes major share in the economy of Pakistan in terms of GDP. The economy of the people in province is based on agriculture and wheat is the widely cultivated crop with significant production of rice, cotton, corn, sugarcane, pulses and jute. The major occupation of the rural communities is farming and they depend on agricultural means and livestock management to support livelihood. The inhabitants of the Punjab province have diverse traditional knowledge and practices because of linguistic and cultural variations. In agricultural lands like Punjab, grasses are preferred over other medicinal herbs and shrubs [4] because they are common, highly palatable and easy to process in order to cure livestock ailments [38].

Data collection

Data on ethnomedicinal application of Poaceae members to treat ethnoveterinary diseases were collected based on group discussion, semi-structured interviews and open and closed ended questionnaires during field visit in 2016-17, following the methods reported previously [39-41]. Prior to collect information, proper moral agreement was obtained from the head of local government and local informants. In total, 271 participants including both men and women, village leaders, shepherds, cattle holders who worked in local farms and some senior household animal owners were interviewed. Demographic information about the participants was gathered by adopting a method of [42]. Questionnaires were first developed in English, afterwards translated in local languistics i.e. Punjabi and Saraiki. Before conducting interviews, prior informed consents were also obtained from all the
participants after briefing the objectives of the current study and no further ethical approval was required as there is lacking of explicit rules or regulations pertain to the practices of ethnomedicinal uses of plants or animals in Pakistan. However, Participants were allowed to discontinue the interviews at any time.

Collected plant specimen were identified with the help of different flora of Pakistan, whereas botanical and family names were further verified from literature [43], www.efloras.org/index.aspx and Kew grass data base (https://www.kew.org/data/grasses-db/index.htm). For voucher specimen satnadrd herbarium techniques as explained before [44, 45] were strictly followed. All plants were labelled and deposited in the herbarium at the Department of Botany, University of Gujarat, Punjab, Pakistan and the voucher specimens were preserved for record.

**Cultural Significance Index (CSI)**

The relationship between use reports of a given species and agreement among the informant knowledge was attributed through cultural significance index (CSI). It was calculated following a method of [46] using formula:

$$\text{CSI} = \Sigma (i \times e \times c) \times CF$$

Where \(i\) is the management of species having considerable impact on community (a species cultivated, managed or operated by any mean is awarded score of 2 and the value 1 is awarded if species is yet free from any kind of manipulation), \(e\) is the use preference of informant for one plant species over another species for a specific purpose (value 2 is for preferred species and value 1 is for non-preferred species), \(c\) is use frequency of a plant species (value 2 is attributed to a high potential plant species being considerably used by informants and value 1 is awarded to a rarely cited species), correction factor (CF) is level of informant consensus which comes from species citation divided by the number of citations of the most mentioned species.

**Relative frequency of citation (RFC)**

RFC is to set up the priority order among the listed species and its value is depended on the numbers of participants who have mentioned a particular species as a medicinal plant or good fodder indicating
its significance. The RFC was estimated with the help of following equation following [47].

\[
RFC = \frac{FC}{N} \quad (0 < RFC < 1)
\]

Where, FC is number of participants who stated a particular plant species as an excellent medicinal plant and N is the total number of participants included in the study.

Use Value (UV)
Use value (UV) was calculated by applying standard procedure reported previously [48].

\[
UV = \frac{U}{n}
\]

Where U is total number of use reports mentioned by informants for a given plant and n is the total number of informants interviewed for a given plant species. UV close to 1 indicates many use reports for a given plant and its importance among informants.

Fidelity level (FL)
FL comes from the percentage of informant knowledge who report the uses of a plant species for an ailment and was determined using formula as reported previously by

\[
FL \% = \times \frac{Ip}{Iu} \times 100
\]

Where, Ip is the number of participants who reported the use of a grass for specific purpose; and Iu is the sum of participants who claimed the use of a grass for any purpose. High level of FL reflects the high use of plant species in specific disease in the study area.

Relative popularity level (RPL)
Plant healing potential can’t be differentiated when they show same fidelity level. In order to differentiate the healing potential of species with same FL values, relative popularity level is calculated, which is the ratio between ailments cured by a specific plant and total number of informants who reporting that disease. Base of RPL, plant species are divided into popular and non-popular groups. Popular speciesare those reported by more than half number of informants or above
and rest of the species are declared as non-popular. For popular plant species RPL was arbitrarily selected equal to 1 that represents the complete popularity of a species for the cure of ailments and 0 value represents that no ailment was treated by this species [36]

**Rank order priority (ROP)**
Plant species having different FL and RPL values were attributed with correction factor (ROP) to rank properly the reported species. The ROP was calculated by multiplying FL and RPL values as elucidated earlier

\[
ROP = FL \times RPL
\]

**Jaccard Index (JI)**
The data presented in our study was compared with already published data in the adjacent areas of Himalayan territory using Jaccard index by appraising percentage of reported species and their medicinal uses

\[
JI = \frac{cx100}{a + b - c}
\]

Where, \(a\) represent the number of plants in an area A, \(b\) is number of plants in area B and \(c\) is number of plants common to area A and B.

**Results And Discussion**
**Demographic features**
Data were collected from 271 informants (Table 1) of ages between 20 to 80 years old including female and male nomads (5.90 and 23.62%), female and male farm cattle holders (7.75 and 18.08%), and female and male domestic cattle holders (24.72 and 19.93%). About, 18.08% informants were illiterate while others were educated up to master and PhD levels. The level of indigenous knowledge on medicinal uses of the plant species of family Poaceae was more prevent in illiterate (around 80%) and less educated people and rest of informations were shared by the educated informants but well educated informants were less conversant on the ethnomedicinal uses of plant species, particularly of Poacease taxa. High level of exposure to modernization and dependence of allopathic medicines could be the reason behind this, which have already been reported [49, 50]. Though, previous studies
were focused on a single community having one ethnic group and same culture [51], but in the last few decades ethnobiologists are more interested in cross cultural variation of traditional knowledge of different communities and ethnic groups [52]. Because of this, we also collected data on ethno-veterinary uses of poaceae taxa from different ethnic groups i.e. Punjabi, Gujjar, Butt, Khawaja, Arayeen, and Rana. These groups have diverse culture and speak different languages (Fig. 2) such as Urdu, Punjabi, Saraiki, Pothare, Balochi, Pashto, Mewatti, Kashmiri, Hindki, and English (25.46, 17.34, 16.24, 8.86, 7.75, 6.64, 5.54, 4.80, 4.06 and 3.32%, respectively).

Table 1
Demographic informants of informants

| Variable          | Demographic catagories | Numbers | Percentage |
|-------------------|------------------------|---------|------------|
| Gender            | Male                   | 104     | 38.37      |
|                   | Female                 | 167     | 61.62      |
| Age               | < 20 years             | 31      | 11.43      |
|                   | 21-40 years            | 73      | 26.93      |
|                   | 41-60 years            | 119     | 43.91      |
|                   | 61-80 years            | 48      | 17.71      |
| Occupation        | Nomads                 | 80      | 29.52      |
|                   | Farm cattle holders    | 70      | 25.83      |
|                   | Domestic cattle holders| 121     | 44.64      |
| Education levels  | Illiterate             | 49      | 18.08      |
|                   | Primary                | 77      | 28.41      |
|                   | Middle                 | 53      | 19.56      |
|                   | Intermediate           | 37      | 13.65      |
|                   | Graduate               | 28      | 10.33      |
|                   | Master                 | 16      | 5.900      |
|                   | M.Phil                 | 9       | 3.320      |
|                   | Ph.D                   | 2       | 0.740      |

Taxonomic description of plant species

In total, 149 plant species of family Poaceae, belonging to 18 tribes were documented, which are used to treat various veterinary health disorders classified in to 12 major disease categories. Of these, 56% were of perennial nature and rest of the 46% were annual herbs (Table 2).

Table 2
Ethno-veterinary uses of poaceae taxa in the Punjab province, Pakistan.

| Tribe             | S. # | Binomial name                  | Local name | Life trend | Part Used | Preparation | Ethno veterinary uses | FC (n) | RFC | UV  | CSI |
|-------------------|------|--------------------------------|------------|------------|-----------|-------------|-----------------------|--------|-----|-----|-----|
| Andropogoneae     | 1    | Apluda mutica L. UOG-110       | Tachuli    | Perennial  | Aerial    | Extract     | Stomachache           | 47     | 0.17| 0.56| 0.18|
|                   | 2    | Bothriochloa bladhii (Retz.) S.T. Blake UOG-111 | Palvan    | Perennial  | Aerial    | Decoction   | Indigestion          | 220    | 0.81| 0.21| 1.68|
|                   | 3    | Chauza                        | Perennial  | Leaves    | Paste     | Digestive   | 0.36                  | 0.47   | 0.37|     |     |
| No. | Species | Part Used | Uses | Preparation | Dosage |
|-----|---------|-----------|------|-------------|--------|
| 3.  | Chrysopogon aucheri (Boiss.) Stapf UOG-117 | Leaves paste | Digestive disorders, improve fertility in bull | 70 | 0.26 0.47 0.27 |
| 4.  | Chrysopogon serrulatus Trin. UOG-118 | Leaves fodder | Antifungal & tonic | 86 | 0.32 0.31 0.33 |
| 5.  | Chrysopogon zizanioides (L.) Roberty UOG-122 | Leaves fodder | Antibacterial, anti-inflammatory | 111 | 0.41 0.12 0.84 |
| 6.  | Cymbopogon citratus DC. ex Nees UOG-131 | Leaves, seed herbal tea | Headaches, tonic body, nervous system, stimulants glandular secretions | 175 | 0.65 0.89 2.68 |
| 7.  | Cymbopogon commutatus (stend) Stapf. UOG-133 | Whole extract | Indigestion, gastroenteritis | 88 | 0.32 0.74 0.34 |
| 8.  | Cymbopogon jwarancusa (Jones.) Schult UOG-134 | Whole decoction | Typhoid fever, reproductive disorders | 168 | 0.62 0.66 2.57 |
| 9.  | Cymbopogon martini (Roxb.) J.F. Watson UOG-140 | Whole oil | Cough, fever, phlegmatic pains | 53 | 0.20 0.81 0.81 |
| 10. | Dichanthium annulatum (Forssk.) Stapf UOG-141 | Whole paste | Indigestion | 251 | 0.93 0.17 1.92 |
| 11. | Dicanthus foveolatum (Del.) Roberty UOG-145 | Whole smoke | Smoke of plant is supposed useful to treat measles, bone healing | 98 | 0.36 0.19 1.5 |
| No. | Plant Name                                      | Plant Type | Part Used | Preparation | Medicinal Use                                                                 |
|-----|-----------------------------------------------|------------|-----------|-------------|--------------------------------------------------------------------------------|
| 12. | Eulaliopsis binata (Retz) C.E.Hubbard UOG-147 | Perennial  | Stem      | Decoction   | Respiratory infections, fever, infectious, phlegmatic pains                    |
| 13. | Heteropogon contortus (L.) P Beauv. ex. Roem & Schult UOG-151 | Perennial  | Leaves    | Extract, Paste | Leucorrhoea, digestive disorders, anemia, typhoid                           |
| 14. | Imperata cylindrica (L.) Raeuschel UOG-155    | Perennial  | Leaves    | Paste       | Astringent, febrifuge, antibacterial                                           |
| 15. | Saccharum arundinaceum Retz. UOG-158          | Perennial  | Leaves    | Juice       | Diuretic, refrigerant, diaphoretic, urinary complaints, blood pressure        |
| 16. | Saccharum bengalense Retz. UOG-161            | Perennial  | Leaves    | Juice       | Oral infections, dyspepsia, fever, constipation, hepatitis                     |
| 17. | Saccharum spontaneum L UOG-165                | Perennial  | Leaves    | Juice       | Relief in inflammation, urinary problems, treatment of abdominal pain, improve ment of appetite |
| 18. | Saccharum ravennae L. UOG-167                 | Perennial  | Aerial    | Decoction   | Typhoid, improvement of appetite, phlegmatic pains                            |
| 19. | Saccharum officinarum Gana                       | Perennial  | Aerial    | Juice       | Improvement of appetite                                                       |
| 20. | Sorghum bicolor (L.) Moench | Lowar, milo | Perennial | Aerial | Fodder, Extract | Digestive problems | 223 | 0.82 | 0.91 | 3.56 |
| 21. | Sorghum saccharatum (L.) Moench | Milo | Annual | Aerial | Extract | Diuretic, demulcent, serious abdominal pain, piles, malaria | 178 | 0.66 | 0.64 | 0.68 |
| 22. | Sorghum halepense (L.) Pers. | Baru, Lunji | Perennial | Root, Whole | Fodder, Extract | Infectious diseases | 219 | 0.81 | 0.60 | 3.35 |
| 23. | Themedanthera (Nees) Hack | Ghaa | Perennial | Leaves | Fodder, juice | Body cooling, depression, nervous exhaustion, shingles, herpes, refrigerant | 89 | 0.33 | 0.25 | 0.34 |
| 24. | Themeda triandra Forsk. | Ghaa | Perennial | Leaves | Fodder | Anti-allergic, piles, malaria | 134 | 0.49 | 0.15 | 0.51 |
| 25. | Vetiveria zizanioides (L.) Nash | Makai | Annual | Aerial | Paste, Extract | Detoxifier, nerve tonic, antiseptic | 221 | 0.82 | 0.74 | 6.77 |
| 26. | Aristida adscensionis L. UOG-188 | LumbGah | Annual | Aerial | Paste | Skin disorders | 143 | 0.53 | 0.34 | 1.15 |
| 27. | Aristida cyanantha Nees ex Steud. UOG-191 | LumbGah | Annual | Aerial | Powder | Diuretic, antiseptic, anti-inflammatory, demulcent | 99 | 0.37 | 0.36 | 0.37 |
|   | Aristida funiculata Trin. & RuPr. UOG-212 | Lumb | Annual | Leaves | Extract | Hypertension, hysteria, premature ejaculation, cure cancer, antifungal | 55 | 0.20 | 0.29 | 0.21 |
|---|------------------------------------------|------|--------|--------|---------|--------------------------------------------------|----|-----|-----|-----|
| 30. | Aristida hystriculata (Edgew) UOG-216 | Lumb | Annual | Aerial | Extract | Diuretic, antiseptic, blood pressure, fever, to treat dysfunctional organs of cattle, clear menstrual discharge | 156 | 0.58 | 0.20 | 0.59 |
| 31. | Aristida mutabilis Trin. & RuPr. UOG-219 | Lumb | Annual | Leaves | Decoction, Extract | Stomach problem, antiseptic, anti-inflammatory, piles | 51 | 0.19 | 0.14 | 0.25 |
| 32. | Stipagrostis plumosa (L.) Munro. ex T. Anders UOG-233 | Lumb, Chitagh | Annual | Whole | Fodder | Anticancer, sexual disorder | 161 | 0.59 | 0.10 | 1.23 |
| 33. | Arundo donax L. UOG-236 | Naranbans, Nal, Narki | Perennial | Leaves & stem | Decoction | Blood pressure, fever, dysfunctional organs of cattle | 225 | 0.83 | 0.48 | 3.44 |
| 34. | Phragmites australis (Cav.) Trin. ex Steud. UOG-238 | Dila, Babyoon | Perennial | Leaves, Root | Fodder, Powder | Digestive disorder, vomiting, bronchitis, cholera, diarrhea, cough, urinary tract infections | 48 | 0.18 | 0.39 | 0.36 |
| 35. | Phragmites karka (Retz.) Trin. ex Steud. UOG-240 | Narr | Perennial | Leaves | Fodder, Extract | Cardiac problem, antiemetic, detoxifier | 159 | 0.59 | 0.35 | 1.22 |
| No. | Species                        | Part                | Description                | Uses                                                                 |
|-----|-------------------------------|---------------------|----------------------------|----------------------------------------------------------------------|
| 36  | Avena fatua L. UOG-243        | Annual Whole Fodder | Stomach problem, cooling, styptic depression, nervous exhaustion, piles, herpes | 149 0.55 0.54 1.14 |
| 37  | Agrostis gigantea Roth. UOG-245 | Leaves Fodder       | Anti-allergic, shingles, herpes | 87 0.32 0.27 0.33 |
| 38  | Agrostis viridis Gouan UOG-247 | Leaves Decoction    | Detoxifier, diaphoretic, diuretic, Hysteria | 107 0.39 0.71 0.41 |
| 39  | Avena sativa L. UOG-260       | Aerial Fodder       | Detoxifier, piles, refrigerant, demulcent | 239 0.92 0.86 7.33 |
| 40  | Avena sterilis (Dur.) Gill & Magne UOG-262 | Aerial Fodder   | Diarrhea, dyspepsia, gastrointestinal disease, depression, herpes, hysteria | 39 0.14 0.28 0.15 |
| 41  | Koeleria argentina Griseb. UOG-264 | Leaves Decoction  | Treat sores and skin problems, anti-inflammatory | 79 0.29 0.63 0.30 |
| 42  | Phalaris minor Retz. UOG-266  | Leaves Decoction    | Animal cough, depression, diaphoretic | 176 0.65 0.22 1.34 |
| 43  | Polypogon monspeliensis (L.) Desf. UOG-268 | Aerial Fodder | Cardiac disorders | 97 0.36 0.49 0.37 |
| 44  | Trisetum clarkei (Hook. f.) R. R. Stewart UOG-271 | Leaves Extract | Relieve inflammation, urinary problems, laxative | 55 0.20 0.33 0.21 |
| 45  | Polypogon fugax Nees ex Steud | Stem Juice, decoction | Improvement of appetite | 45 0.17 0.37 0.17 |
| Bromeae | 46. | Bromus catharticus Vahl UOG-277 | Rescue grass | Annual | Leaves | Fodder | Improvement of appetite, diuretic, anti-inflammatory | 70 | 0.26 | 0.18 | 0.26 |
| Bambuseae | 47. | Bambusa aglaeusecens (Willd.) Sieb. UOG-279 | Bans | Perennial | Aerial | Paste, Extract | Help to cure wounds, anemia, constipation, anti-allergic | 183 | 0.68 | 0.56 | 0.70 |
| Bromeae | 48. | Bromus japonicas Thunb. UOG-281 | Joukai, Silai grasses | Perennial | Aerial | Fodder | Treat constipation, anti-toxin, relieve inflammation | 82 | 0.30 | 0.37 | 0.31 |
| | 49. | Bromus pectinatus Thunb. UOG-286 | Chess grasses | Annual | Aerial | Fodder | Infusions used to normalize, increase heart palpitations | 67 | 0.25 | 0.17 | 0.25 |
| | 50. | Bromus sericeus Drobov UOG-289 | Brome Grass | Perennial | Leaves | Fodder | To treat dysfunctional organs of cattle, diarrhea, anti-allergic | 113 | 0.42 | 0.24 | 0.43 |
| Chlorideae | 51. | Tetrapogon cenchroiformis (A. Rich.) Clayton UOG-292 | Annual | Leaves | Fodder | Diarrhea, dyspepsia, antiseptic & tonic, piles, anti-allergic | 77 | 0.28 | 0.19 | 0.29 |
| | 52. | Tetrapogon tenellus (Roxb.) Chiov. UOG-294 | Dumbi seeti | Annual | Leaves, Root | Fodder | Antibacterial, antifungal, diarrhea, dyspepsia, shingles | 144 | 0.53 | 0.15 | 0.55 |
| | 53. | Tetrapogon villosus Desf. Fl. Atlant. UOG | Sager | Perennial | Aerial | Powder, fodder | Treatment of abdominal pain, anti | 43 | 0.16 | 0.21 | 0.16 |
| Family          | Species            | Collections | Type     | Trait                  | Uses                              | Strength 1 | Strength 2 | Strength 3 |
|-----------------|--------------------|-------------|----------|------------------------|----------------------------------|------------|------------|------------|
| Cynodoonteae    | Chloris gayana Kunth | UOG-297     | Perennial | Leaves Decoction        | Treat constipation, diarrhea, allergic, heart palpitations | 129        | 0.48       | 0.10       | 0.49       |
|                 | Chloris barbata Sw. | UOG-305     | Perennial | Aerial Decoction        | Diarrhea, dyspepsia, anti-inflamm atory, styptic | 228        | 0.84       | 0.16       | 0.87       |
|                 | Chloris dolicosta chya Lag. | UOG-307 | Perennial | Aerial Extract          | Diabetic, diuretic, laxative, cough | 137        | 0.51       | 0.02       | 0.52       |
|                 | Chloris virgata Sw. | UOG-308     | Perennial | Leaves Paster, decoction | Diabetic fracture, menstrual discharge, dysfunctional organs | 211        | 0.78       | 0.26       | 1.62       |
|                 | Cynodon dactylon (L.) Pers. | UOG-309 | Perennial | Leaves Paste, juice     | Eye pain, skin injuries or cutting, anti-inflamm atory, anemia, dysentery, heal bone fracture | 249        | 0.92       | 0.60       | 7.34       |
|                 | Cynodon radiates Roth. | UOG-312 | Perennial | Whole Decoction         | Eyeache, relieve the eye pain, anti-inflamm atory, haemostatic | 105        | 0.39       | 0.38       | 0.40       |
| Danthonieae     | Schismus arabicus Nees | UOG-315 | Perennial | Whole Fodder, juice     | Diuretic, laxative, cough, anti-toxin, demulcent | 216        | 0.80       | 0.24       | 0.83       |
| Eragos tideae   | Acrachne racemosa (Heyne ex Roth) Ohwi | UOG-318 | Annual   | Whole Fodder, paste     | Skins injuries or cutting, controls dysentery, treat wounds, kidney problems, bronchi | 132        | 0.41       | 0.31       | 1.02       |
| No. | Plant Name | Part Used | Formulation | Medicinal Uses |
|-----|------------|-----------|-------------|----------------|
| 62. | Aeluropus lagopoides (L.) Trin. ex. Thw UOG-320 | Kalar ghaa | Whole Fodder, juice | Bronchial disorders, Haemostatic, Anti-bacterial, Anti-inflammatory, Phlegmatic pains, Relieve inflammation |
| 63. | Dactylcitenium aristatum Link, Hort. Berol. UOG-332 | Madhan a ghaa | Annual Leaves Decoction | Laxative, cough, Haemostatic, Anti-allergic, Herpes |
| 64. | Dactylcitenium aegyptium (L.) Wild. UOG-338 | Koor, Madanah | Annual Whole Decoction | Abdominal pains, Malaria, Haemostatic, Anti-allergic, Demulcent, Detoxifier |
| 65. | Dactylcitenium scindicum Boiss. UOG-342 | Dela | Perennial Whole Paste, fodder | Dysentery, Jaundice, Digestive disorders, Anti-inflammatory |
| 66. | Desmostachya bipinnata L. Stapf UOG-344 | Kusa, Dab | Perennial Aerial Decoction | Digestive disorders, Diuretic, Anti-amenorrhea |
| 67. | Eragrostis tenella L. UOG-349 | Love grass | Annual Whole Fodder, juice | Treatment of abdominal pain, Kidney problems, Clear menstrual discharge |
| 68. | Eragrostis atrovirens (Desf.) Trin. ex Steud. UOG-81 | Thalia Grass | Perennial Whole Fodder, paste | Malaria, Jaundice, Anaemia, Dysentery, Toothache |
|   | Scientific Name | Common Name | Type | Part Used | Uses                                      | Code | Primary Effect | Secondary Effect | Tertiary Effect |
|---|----------------|-------------|------|-----------|------------------------------------------|------|----------------|------------------|-----------------|
| 69. | *Eragrostis barrelieri* Dav. | Makni Annual Whole Fodder | 355 | | Diuretic, constipation | | 0.47 | 0.24 | 0.48 |
| 70. | *Eragrostis ciliaris* (L.) R. Br. | Makni Annual Whole Fodder Extract | 368 | | Cure digestive disorders, astrigent, detoxifier | | 0.86 | 0.15 | 0.85 |
| 71. | *Eragrostis ciliaris* Lut. ex F.T. Hubbard | Stink grass Annual Whole Fodder Juice | 369 | | Digestive disorders, malaria, anti-allergic, herpes | | 0.55 | 0.14 | 0.56 |
| 72. | *Eragrostis japonica* (Thunb.) Trin. | Pan ghas Annual Leaves Paste, fodder | 370 | | Treat wounds, diuretic, anti-inflammatory | | 0.18 | 0.12 | 0.72 |
| 73. | *Eragrostis pectinacea* (Michx.) Nees ex Steud. | Tufted grass Annual Whole fodder | 371 | | Urinary problems, laxative, gastrointestinal disease | | 0.51 | 0.11 | 0.53 |
| 74. | *Eragrostis minor* Host. | Choti ghas Annual Whole fodder | 372 | | Digestive disorders, anti-inflammatory, demulcent | | 0.81 | 0.13 | 1.68 |
| 75. | *Eragrostis pilosa* (L.) P. Beauv. | Nika sanwak Annual Whole Paste, decoction | 373 | | Dysentery, toothache | | 0.19 | 0.22 | 0.21 |
| 76. | *Eragrostis papposa* (Roem & Schult.) Stued. | Ghaa Perennial Aerial Fodder | 374 | | Controls itching, diuretic, constipation, jaundice, styptic | | 0.57 | 0.19 | 0.56 |
| 77. | *Leptochloa panicola* (Retz.) Ohwi | Paja Annual Whole Fodder | 375 | | Blood pressure, diuretic, constipation, anti-inflammatory | | 0.14 | 0.21 | 0.31 |
| No. | Species                                      | Habitat | Part Used | Form | Use                  | UTW | PTW | WTW |
|-----|---------------------------------------------|---------|-----------|------|-----------------------|-----|-----|-----|
| 78  | Leptochloa chinensis (L.) Nees UOG-390      | Naru    | Annual    | Whole Fodder | Diuretic, digestive disorder, sore, anti-allergic, homeostatic | 67  | 0.25 | 0.32 | 0.25 |
| 79  | Eleusine indica (L.) Gaertn UOG-394         | Chezi, UntKata | Annual | Aerial Grain flour | Abdominal pain | 143 | 0.53 | 0.34 | 2.3  |
| 80  | Sporobolus arabicus Boiss. UOG-398          | Perenni al | Whole Fodder | Controls itching, treatment of abdominal pain, herpes, to treat dysfunctional organs | 46  | 0.17 | 0.35 | 0.17 |
| 81  | Sporobolus nervosa (Hocshst.) UOG-401      | Lambi ghaa | Perenni al | Aerial Fodder | Malaria, jaundice anemia, dysentery, toothache | 145 | 0.54 | 0.28 | 0.55 |
| 82  | Dactylotinus aristatum Link, Hort, Berol. UOG-403 | Crow foot grass | Perenni al | Whole Decoction | Diuretic, constipation | 231 | 0.85 | 0.29 | 0.88 |
| 83  | Dactylotinus scindicus Boiss UOG-406        | Chhaibh nrr | Perenni al | Whole Fodder | Cure digestive disorder, astringent, wounds treatment | 189 | 0.70 | 0.19 | 0.72 |
| 84  | Parapholis strigosa (Dum.) C. E. Hubbard UOG-408 | Tooti ghas | Perenni al | Whole fodder | Leucorrhoea, digestive disorders, malaria, anti-allergic, relieve inflammation | 43  | 0.16 | 0.13 | 0.16 |
| 85  | Oryza sativa L. UOG-409                     | Chawal   | Annual    | Aerial Paste, decoction | Diarrhea, wound healing | 255 | 0.94 | 0.76 | 7.81 |
| 86  | Enneapogon shimpranus Hochst UOG-409       | Jeo      | Perenni al | Whole Fodder, Paste | Disinfec tant, digestive disorder, anti- | 69  | 0.25 | 0.36 | 0.264 |
| No. | Genus and Species | Life Form | Part Used | Application | Edible | Nutrients |
|-----|-------------------|-----------|-----------|-------------|--------|-----------|
| 87. | Enneapogon persicus Boiss. | Annual | Seeds | Improve digestion, laxatives, anti-fungal, controls itching | 46 | 0.17 0.04 0.17 |
| 88. | Enneapogon desvauxii P. Beauv. | Whole | Fodder | Digestive disorders, malaria | 56 | 0.21 0.37 0.21 |
| 89. | Digitaria nodosa Parl. | Perennial | Whole | Fodder, juice | 201 | 0.74 0.52 0.77 |
| 90. | Brachiaria distachya (L.) Stapf. | Annual | Whole | Fodder, juice | 151 | 0.56 0.19 1.14 |
| 91. | Brachiaria deflexa (Schumach.) C.E.Hub bard ex Robyns | Annual | Whole | Fodder, powder | 169 | 0.62 0.27 0.65 |
| 92. | Brachiaria mutica (Forssk.) Stapf. | Annual | Leaves | Fodder, Extract | 142 | 0.52 0.33 2.26 |
| 93. | Brachiaria eruciforis Grisev. | Annual | Juice, paste | Leaves work as antiseptic, relieve inflammation | 159 | 0.59 0.26 0.61 |
| 94. | Brachiaria reptans (L.) Gardner & Hubbard | Annual | Juice | Leaves help to cure anemia, laxatives, diuretic | 184 | 0.68 0.11 0.70 |
| No. | Species Name | Common Name | Lifecycle | Part Used | Form | Condition | SD | PD | LD |
|-----|--------------|-------------|-----------|-----------|------|----------|----|----|----|
| 95. | Brachiaria ovalis Stapf | Ghaah | Perennial | Leaves | Juice | Anti-inflammatory | 148 | 0.55 | 0.09 | 0.56 |
| 96. | Cenchrus biflorus Roxb. | Bhurat | Annual | Aerial | Extract | Urinary problems | 163 | 0.60 | 0.16 | 1.25 |
| 97. | Cenchrus ciliaris L. | Dhaman | Perennial | Aerial | Juice, Extract | Urinary disorders | 238 | 0.69 | 0.46 | 1.82 |
| 98. | Cenchrus prieurii (Kunth.) A Marie | Dhaman | Annual | Leaves | Juice | Digestive disorders, anemia, toothache, sore, general weakness | 173 | 0.64 | 0.27 | 0.66 |
| 99. | Cenchrus pennisetiformis Steud. | Bara | Annual | Whole | Paste, powder | Kidney problems, digestive disorders, herpes | 186 | 0.69 | 0.24 | 1.42 |
| 100. | Cenchrus setigerus Vahl. | Kala dhaman, Talra | Perennial | Aerial | Extract, powder | Disinfectant, kidney pain, sore, wound, phlegmatic pains | 135 | 0.50 | 0.08 | 0.52 |
| 101. | Digitaria arvensis L. | Tera | Perennial | Leaves | Fodder | Kidney problems, digestive disorders, anti-allergic | 52 | 0.19 | 0.07 | 0.21 |
| 102. | Digitaria ciliaris (Retz.) Koeler | Shamokha, Tandla | Annual | Whole | Fodder | Diuretic, aphrodisiac, digestive disorders, anti-fungal | 147 | 0.54 | 0.42 | 0.56 |
| 103. | Digitaria longiflora (Retz.) Pers. | Deeta, Indian Crab Grass | Annual | Whole | Fodder | Diuretic, kidney pain, general weakness, stimulant, cure wounds, styptic | 88 | 0.32 | 0.16 | 0.68 |
| 104. | Digitaria stricta R. | Meru | Perennial | Leaves | Fodder | Treat Tumors, Diuretic | 221 | 0.82 | 0.25 | 0.85 |
| No. | Species                                      | Part(s)         | Use                                                                 | Reference |
|-----|---------------------------------------------|-----------------|---------------------------------------------------------------------|-----------|
| 105 | *Digitaria radicosa* (Presl) *Miq.* UOG-477 | Whole Fodder    | Leucorrhoea, digestive disorders, kidney pain, tonic                | 0.25      |
|     |                                             |                 |                                                                     | 0.10      |
|     |                                             |                 |                                                                     | 0.25      |
| 106 | *Digitaria sanguinalis* (L.) scop. UOG-485  | Whole Fodder    | Antiseptic, stimulant, treat tumors, kidney pain, sore              | 0.64      |
|     |                                             |                 |                                                                     | 0.58      |
|     |                                             |                 |                                                                     | 0.66      |
| 107 | *Digitaria setigera* Roth ex. Roem. & Schult. UOG-489 | Whole Fodder    | Laxative, diuretic, malaria, tonic, refrigerant, clear menstrual discharge | 0.86      |
|     |                                             |                 |                                                                     | 0.32      |
|     |                                             |                 |                                                                     | 0.88      |
| 108 | *Digitaria violascens* Link, Hort. UOG-490  | Leaves, Root    | Stimulant, treat tumors, diuretic, anti-bacterial, herpes          | 0.19      |
|     |                                             |                 |                                                                     | 0.12      |
|     |                                             |                 |                                                                     | 0.21      |
| 109 | *Echinochloa colona* (L.) Link UOG-493      | Whole Paste     | Digestive disorders, general weakness, constipation, phlegmatic pains | 0.67      |
|     |                                             |                 |                                                                     | 0.21      |
|     |                                             |                 |                                                                     | 1.38      |
| 110 | *Echinochloa crus-galli* (L.) P. Beauv. UOG-495 | Whole Juice     | Digestive disorders, demulcent                                     | 0.36      |
|     |                                             |                 |                                                                     | 0.28      |
|     |                                             |                 |                                                                     | 0.74      |
| 111 | *Ochthochloa mepressa* (Forssk.) Hili UOG-497 | Aerial Grains    | Kidney pain, anti-allergic, clear menstrual discharge             | 0.56      |
|     |                                             |                 |                                                                     | 0.33      |
|     |                                             |                 |                                                                     | 0.58      |
| 112 | *Panicum Gharam*                           | Whole Decoction  | Anti-                                                              | 0.70      |
|     |                                             |                 |                                                                     | 0.73      |
|     |                                             |                 |                                                                     | 0.73      |
| No. | Scientific Name | Botanical Name | Part Used | Preparation | Conditions/Use                                                                 | Ref. | Value 1 | Value 2 | Value 3 |
|-----|----------------|----------------|-----------|-------------|--------------------------------------------------------------------------------|------|--------|--------|--------|
| 113. | Panicum antidotale Retz. | UOG-499 | Morrota | Morrota | Decocton, Juice Anti-bacterial | 43 | 0.26 | 0.57 | 0.16 |
| 114. | Panicum atrosanguineum Hochst. ex A. Rich | UOG-500 | Ghamota | Perennial | Seed Decocton For fever, diarrheic, tonic, laxative, wounds treatment, gastrointestinal disease | 139 | 0.51 | 0.61 | 2.13 |
| 115. | Panicum maximum Jacq. | UOG-501 | Bansi Gha | Perennial | Whole Paste, Decocton Digestive disorders, diuretic, tonic, malaria, emollient | 81 | 0.30 | 0.68 | 0.31 |
| 116. | Panicum pspilopodi um Trin. | UOG-507 | Cheena Gha | Perennial | Whole Leaves Juice, Paste Diuretic, laxative, cure cancer, gastrointestinal diseases | 104 | 0.38 | 0.62 | 0.39 |
| 117. | Paspalidium distichum L. | UOG-511 | Knotgrass | Perennial | Whole Fodder, Juice Diuretic, laxative, anti-bacterial, to treat dysfunctional organs, general weakness | 93 | 0.34 | 0.44 | 0.35 |
| 118. | Paspalidium flavidum (Retz.) A. Camus | UOG-513 | Gandghas | Perennial | Leaves Powder Urinary problems, laxative, anti-allergic, demulcent | 86 | 0.32 | 0.47 | 0.33 |
| 119. | Paspalidium punctatum (Burm.) A. | UOG-524 | Nseila | Perennial | Whole Paste, Decocton Kidney problems, diuretic, oral infections, anti-bacteria l | 41 | 0.15 | 0.24 | 0.15 |
| 120. | Paspalum paspaloides (Michx.) Scribner | | Maro | Perennial | Leaves Juice Digestive disorders, antibiotic | 84 | 0.31 | 0.08 | 0.32 |
| No. | Species Name                      | Common Name            | Part Used       | Preparation    | Uses                                      | Strength  |
|-----|---------------------------------|------------------------|-----------------|----------------|-------------------------------------------|-----------|
| 121 | Panicum repens L. UOG-539       | Goli ghara Perennial   | Whole Juice     | Digestive disorders, wounds treatment, emollient. to treat dysfunctional organs | 213       |
|     |                                 |                        |                 |                |                                           | 0.39      |
|     |                                 |                        |                 |                |                                           | 0.15      |
|     |                                 |                        |                 |                |                                           | 1.64      |
| 122 | Pennisetum divisum (J. Gmel.) Henrard UOG-542 | Morrot Awansi grass Perennial Leaves Decoction | Urinary problem, anti-inflammatory, oral infections | 94        |
|     |                                 |                        |                 |                |                                           | 0.35      |
|     |                                 |                        |                 |                |                                           | 0.22      |
|     |                                 |                        |                 |                |                                           | 0.72      |
| 123 | Pennisetum glaucum (L.) R.Br. UOG-546 | Bhaajhi Perennial Whole Tea, Extract | Digestive disorders, jaundice, antibiotic, wounds treatment | 100       |
|     |                                 |                        |                 |                |                                           | 0.37      |
|     |                                 |                        |                 |                |                                           | 0.18      |
|     |                                 |                        |                 |                |                                           | 0.76      |
| 124 | Pennisetum americum (L.) Leeke UOG-555 | Bajra Perennial Leaves, Root Decoction, juice | Digestive disorders, jaundice, detoxifier | 38        |
|     |                                 |                        |                 |                |                                           | 0.14      |
|     |                                 |                        |                 |                |                                           | 0.09      |
|     |                                 |                        |                 |                |                                           | 0.15      |
| 125 | Pennisetum orientale Rich UOG-566 | Haathi ghaa Perennial Whole Decoction | Relieve inflammation | 211       |
|     |                                 |                        |                 |                |                                           | 0.78      |
|     |                                 |                        |                 |                |                                           | 0.55      |
|     |                                 |                        |                 |                |                                           | 0.81      |
| 126 | Sporobolus iocladus (Nees. ex. Trin.) Nees. UOG-567 | Swag Perennial Leaves, Root Fodder | Remove debris from wounded area, anti-allergic, general weakness | 90        |
|     |                                 |                        |                 |                |                                           | 0.33      |
|     |                                 |                        |                 |                |                                           | 0.75      |
|     |                                 |                        |                 |                |                                           | 0.34      |
| 127 | Paspalum dilatatum Poir. UOG-577 | Batto Perennial Leaves Juice | Laxative, gastrointestinal disease, oral infections | 36        |
|     |                                 |                        |                 |                |                                           | 0.13      |
|     |                                 |                        |                 |                |                                           | 0.33      |
|     |                                 |                        |                 |                |                                           | 0.14      |
| 128 | Setaria glauca (L.) P. Beauv UOG-578 | Ban Kangni Annual Whole Extract | Leucorrhoea, anemia, skin disorders, digestive disorder | 228       |
|     |                                 |                        |                 |                |                                           | 0.84      |
|     |                                 |                        |                 |                |                                           | 0.48      |
|     |                                 |                        |                 |                |                                           | 0.87      |
| No. | Species | Family | Habitat | Part Used | Uses | Reactions |
|-----|---------|--------|---------|----------|------|-----------|
| 129 | Setaria intermedi a Roem. & Schult. UOG-584 | Poaceae | Annual | Whole Powder, juice | Disorders: Diabet es, gastrointestinal disease, oral infect ions | 220 | 0.81 | 0.36 | 0.84 |
| 130 | Setaria italic (L.) P. Beauv. UOG-587 | Poaceae | Annual | Leaves Decoction, Extract | Urinary problem, antibacterial, relieve inflammation | 97 | 0.36 | 0.24 | 0.74 |
| 131 | Setaria pumila (Poir) Roem. & Schult. UOG-589 | Poaceae | Annual | Aerial Extract | Oral infect ions, general weakness | 189 | 0.70 | 0.20 | 1.44 |
| 132 | Setaria verticillata (L.) P. Beauv. UOG-590 | Poaceae | Annual | Leaves Grains Demulcent | Indigestion, febrifuge and tonic. | 167 | 0.62 | 0.23 | 1.28 |
| 133 | Setaria viridis (L.) P. Beauv. UOG-593 | Poaceae | Annual | Leaves, Stem Grains | Urinary problems, febrifuge and tonic. | 241 | 0.89 | 0.16 | 0.92 |
| 134 | Brachiaria prostrata Grisev. UOG-596 | Poaceae | Annual | Leaves Juice | Headaches, tonic body, nervous system | 231 | 0.85 | 0.33 | 0.88 |
| 135 | Brachiaria ramose (L.) Stapf UOG-600 | Poaceae | Annual | Leaves Juice | Infectious diseases, indigestion, anti-allergics | 201 | 0.74 | 0.07 | 0.77 |
| 136 | Pennisetum lansatum Klotzsch UOG-605 | Poaceae | Annual | Whole Fodder | Diuretic, improve fertility in bull, oral infections | 160 | 0.59 | 0.06 | 0.61 |
| 137 | Urochloa panicoides P. Beauv. UOG-611 | Poaceae | Annual | Leaves Smoke | Smoke of plant is suppose d useful to treat measles, febrifuge, sore | 143 | 0.53 | 0.11 | 0.55 |
| 138 | Urochloa setigera (Retz.) Stapf Jhun | Poaceae | Annual | Whole Decoction | Patient of typhoid fever | 233 | 0.86 | 0.09 | 0.89 |
| Species                      | Cultivar            | Type       | Part(s)               | Use                                                                 | Code | Result 1 | Result 2 | Result 3 |
|-----------------------------|---------------------|------------|-----------------------|----------------------------------------------------------------------|------|----------|----------|----------|
| UOG-615                     |                      |            |                       |                                                                      |      |          |          |          |
| Poeae                       | 139. Dactylis glomerata L. UOG-621 | Gadu Perennial Leaves Extract | Diuretic, sore, diabetes demulcent                                     | 101  | 0.37     | 0.09     | 0.38     |
|                            | 140. Lolium temulentum L. UOG-625 | Cockle Perennial Leaves Grains Nervous disorders, to treat dysfunctional organs | 35  | 0.13 | 0.68 | 0.13 |
|                            | 141. Lolium persicum Boiss. & Hohen. ex Boiss UOG-631 | Bera Annual Leaves Grains Respiratory infections, fever, diabetes, to treat dysfunctional organs, improve fertility in bull, general weakness | 119  | 0.44 | 0.39 | 0.45 |
|                            | 142. Poa annua L. UOG-633 | Blue Grass Annual Whole Fodder, decoction | Gastrointestinal disease | 251  | 0.93 | 0.86 | 7.69 |
|                            | 143. Poa infirma Kunth. UOG-637 | Wakh, Kandail Annual Whole Decoction, juice Digestive disorder, jaundice, diabetes, antifungal | 249  | 0.92 | 0.72 | 0.95 |
|                            | 144. Hordeum vulgare L. UOG-645 | Jao Annual Leaves, Seed Paste, powder Leucorrhoea, anemia, skin cleaner, diabetes, herpes | 107  | 0.39 | 0.83 | 0.82 |
|                            | 145. Triticum aestivum L. UOG-648 | Kanak, Gandum Annual Whole Paste Anti-cancerous, gastrointestinal disease | 261  | 0.96 | 0.93 | 8.00 |
|                            | 146. Leptothrium senegalese (Kunth) W. D Clayton UOG-650 | Madhan Annual Whole Juice, powder Cure cancer, laxative, anti-inflammatory, anti-allergic | 154  | 0.57 | 0.25 | 0.59 |
|                            | 147. Tragus berteronanus Schult. UOG. | Annual Leaves Decoction Digestive disorders, nervous disorder | 65  | 0.24 | 0.07 | 0.25 |
Plant part(s) used

As depicted in Fig. 3, about 41% recepies were based on whole plant, followed by leaves, aerial parts and stem (29.53, 20.13 and 5.370%, respectively). As majority of the Poaceae taxa are small annual herbs with shallow roots, therefore they are easy to pull out as a whole plant and utilized to treat various diseases [4]. Likewise, leaves are also easy to collect, rich in health beneficial secondary metabolites that contribute significantly in the treatment and prevention of health disorders [49, 53, 54]. Leaves have also been reported previously as one of the most consistently used plant part for grazing and medicinal purposes [26, 36, 54].

Method of preparation and administration

As mentioned in Fig. 4, decoction was the common method of herbal preparation with 35 reports, followed by juice (31 reports), paste (26 reports), extract (24 reports), powder (10 reports), grains (5 reports), smoke (2 reports) and herbal tea, oil and raw material (1 report each). Crude preparation of decoction by boiling the plant parts in water for the treatment of various ailment is a common practice among the ethnic communities of in Punjab. The powder is prepared by grinding the shade dried plant parts and paste is made from crushing the fresh or dried plant parts with water or oil [34]. Mode of administration falls into two main categories viz. oral and topical. Herbal preparations used to treat internal diseases i.e. gastrointestinal disorders, fever, pain etc. are usually administrated orally, while for joint pain, skin infections topical method is common. Most of the plants were given orally as fodder (59 reports) without processing them in crude preparation. Offering plant
as fodder to animals is the best way to treat a specific disease without having side effects. Interestingly, there is a significant trend of multi-plant formulation devised by semiprofessional herbalists and traditional practitioners. In that case, powder of more than one plants/plant part is orally administered with water known as “Phakki”. There are certain cases with such recipes where overdose and malpractice resulted in adverse drug reactions.

**Ethno-veterinary uses of Poaceae taxa**

In Pakistan, ethno-veterinary studies are an important source of indigenous information associated with animal healthcare system. The present study is a continuance of earlier explorations for the improvement of records on the ethno-veterinary medication in Pakistan. In Pakistan, many documentations of ethno-veterinary knowledge have been developed so far [9], [60], [77-99] but unfortunately grasses are totally neglected. Many researchers carried out ethno-veterinary investigations in other parts of the world, for example Africa, Orma land- Kenya [100], Nigeria [101], Zimbabwe [102], India [103], China [104], Netherlands [105], America [106], Canada [7] and Brazil [107]. Besides these studies, literature on Poaceae members used in ethno-veterinary practices is still missing in Pakistan. Therefore, this paper contains an important information of biological resources used in ethnomedicines (EM) and ethnoveterinary practices (EVPs) in Punjab, Pakistan.

Ethno-veterinary implies all traditional methods used to treat common diseases in livestock [55]. Nutritional value and pharmaceutical properties of Poacea taxa make them an ideal candidate among indigenous communities to cure and feed the domestic cattle [4]. Inhabitants of the study area use 149 plant species to treat various health disorders in cattle, which were grouped into 12 major disease categories (Tables 2). As shown in Fig. 5, maximum number of use reports of plants were documented for infectious diseases (25.93%), followed by digestive disorders (14.10%), internal causes (13.90%), skin diseases (11.41%), cardiac disorders (8.50%), kidney problems (7.88%), reproductive diseases (5.60%), nervous problems (4.35%), musculoskeletal diseases (4.14%), respiratory infections (1.65%), injuries (1.45%), and cancer (1.03%).

Eulaliopsis binata, Saccharum bengalense, Sorghum halepense, Phragmites australis, Paspalidium punctatum, Pennisetum divisum, Paspalum dilatatum, Setaria intermedia, Brachiaria ramose and
Pennisetum lansatum were mainly used to cure infectious diseases in livestock. Most of the skin disorders were cured by Aristida adscensionis, Koeleria argentia, Cynodon dactylon, Acrachne racemose, Panicum turgidum, Setaria glauca and Hordeum vulgare. In previous studies, Brachiaria ramose and Sorghum bicolor have been reported to treat microbial infections [56], and Sorghum halepense for infectious diseases in livestock [57].

Chrysopogon aucheri, Saccharum officinarum, Phragmites australis, Dactyloctenium scindicum, Desmostachya bipinnata, Eragrostis ciliaris, Eragrostis cilianensis, Eragrostis minor, Leptochloa chinensis, Parapholis strigosa, Cenchrus prieurii, Echinochloa colona, Echinochloa crus-galli, Paspalum pspaloides, Panicum repens, Pennisetum glaucum, Pennisetum typhoidum, Tragus berteronianus and Tragus racemosus were used to treat digestive diseases. These findings were compatible with other studies conducted in Pakistan such as Desmostachya bipinnata, Eleusine indica, Eragrostis minor have already been reported to treat digestive disorders [4]. Likewise, Arundo donax, Cynodon dactylon and Dichanthium annulatum have been reported to cure gastrointestinal problems in animals [58–60]. Eleusine indica is used to cure abdominal pain in Punjab, whereas in previous study this plant has been reported as anti-helminthic, febrifuge and to treat cancer [61].

Cardiovescualr diseases were treated with Phragmites karka and Polypogon monspeliensis. Acrachne racemosa, Eragrostis tenella, Brachiaria deflexa and Cenchrus pennisetiformis were used for kidney disorders, whereas Cymbopogon jwarancusa was used to cure reproductive diseases in livestock. Eulaliopsis binata and Lolium persicum were used to treat respiratory diseases. Cymbopagon citratus, Cymbopogon citratus, Avena fatua, Brachiaria prostrata, Lolium temulentum and Tragus berteronianus were used for nervous disorders. Cymbopogon citratus is used to cure nervous disorders and to stimulate glandular secretions but it has been reported as anti-bacterial, anti-fungal and anti-infamatory agent also [62]. Aristida funiculata, Stipagrostis plumose, Panicum psilopodium, Triticum aestivum, Leptothriumse negalense, Tragus racemosus and Tragus roxburghii were used in cancer.

We reported that Dactyloctenium aegyptium as detoxifier and antiallergic plant but according to [63] this plant has anti-inflammatory, anti-cancer, anti-microbial properties and is widely used to treat
small pox and ulcer in children. Leucorrhoea, anemia, skin cleaner, diabetes and herpes are treated with Hordium vulgare in different parts of Punjab. Its stem is grinding and mixed with water in order to gain the weight in Hawassa Zuria District, Sidama zone, Southern Ethiopia [64]. This plant is also used to treat fever in some parts of India while in Salt Range of Pakistan, flour made from this plant is used to cure jaundice [65, 66]. Desmostachya bipinnata is diuretic, anti-amenorrhea and is used to treat many digestive disorders. [67] documented that powder made from the roots of this plant is used to cure rheumatism in Soon Valley of Pakistan while root infusion of the same plant is used to treat urinary infections and whole plant is taken orally to treat dysentery [68].

Vetiveria zizanoides is antiseptic, demulcent and anti-inflammatory. It is rich in aroma which is used to treat stomach disorders and inflammation [69]. Paste made from the leaves of Cynodon dactylon effective against skin injuries while juice of the plant is used in healing bone fractures. According to [66], root decoction of Cynodon dactylon is given to cattle having respiratory problem. Decoction made from Sorghum bicolor is given to the children in case of typhoid and water extracted from the plant is used to bath the babies [70]. Themeda anathera is refrigerant and juice extracted from leaves is used to reduce depression. However, decoction made from the leaves is also used as blood purifier [71]. Desmostachya bipinnata is anti-amenorrhea and diuretic. Decoction made from the leaves is given to asthma patient to relieve from pain [72]. Decoction made from the whole plant of Cymbopogon jwarancusa is used in typhoid fever. Other documented ethnomedicinal uses are; abdominal pain, tumor and unconsciousness [73]. Eleusine indica is used in abdominal pain which is in line with the study of [7], who reported that grain flour made from the aerial parts of the same plant is used to treat digestive problems. Apluda mutica is used to get relieve from stomach pain while [74] reported that paste made from this plant is also used to cure fungal diseases in livestock. [38] describe that besides impairing digestion, Bothriochloa bladhii is also used as stored food and fodder for both livestock and wild ruminants. Extract made from aerial parts of Zea mays is detoxifier, nerve tonic and antiseptic. [56] reported that seedsof the same plant are mixed with oil to manage tick infection in livestock. Paste made from leaves of Imperata cylindrica is given to cattle in order to control microbial infections. [75] reported that this plant possess antioxidant, neuroprotective and anticer
properties. Juice extracted from leaves and roots of Saccharum spontaneum improves appetite and gives relieve in inflammation, urinary problems and abdominal pain. According to [60], stem of this plant is chewed to relieve stomach pain. Whole plant of Dichanthium annulatum is used in indigestion but [76] also reported that whole plant is also used in dysentery and menorrhagia.

Cultural significance index (CSI)

Cultural significance index was used to calculate the importance of individual plant used by indigenous people. In CSI, the recognition or reputation of species is linked to its functions to the people and are considered auxiliary element in the cultural recognition of a plant [108, 109]. It was observed that cultural importance of each species varies between local communities. This difference is influenced by level of knowledge, the particular cultural settings and the local conditions. In the present study, CSI values varied from 0.13 to 8.00 which was markedly affected by the preference, management and frequency of use by the local inhabitants (Table 2).

The highest CSI value was obtained by Triticum aestivum (8.00), which is extensively used in anticancerous and gastrointestinal disorders in livestocks. The other 6 species and their respective CSI are Oryza sativa (0.81), Poa annua (7.69), Cynodon dactylon (7.34), Avena sativa (7.33), Saccharum officinarum (7.14) and Zea mays (6.77). These species were highly cited and preferentially used by the informants to be used in therapeutic and other purposes but also cultivated and used different kind of management tools. The preference and frequency of use and quality of medicinal use are the factors that determine the cultural importance of plants. The high CSI values of plant species also reflect the fact that more a species is available to the users of a community for medicinal purpose, it become more important. For instance, Triticum aestivum is well known herb which is mentioned in Ayurveda herbal system. It has been used in a large number of dietary supplements and is extremely valuable for treating various ailments such as kidney malfunctioning, immune modulator, joint swelling and bacterial infection [110]. The documented species with high cultural significance are not only important for ethnic groups of Punjab but also for the other ethnic group of the world. Further, these species have accumulated a lot of traditional knowledge that has been transmitted direct experience over the time in next generations. Grasses represented with lowest CSI values were,
Lolium temulentum (0.13), Paspalum dilatatum (0.14), Pennisetum typhoidum (0.15), Paspalidium punctatum (0.15), Avena sterilis (0.15), Panicum atrosanguineum (0.16), Parapholis strigosa (0.16), Tetrapogon villosus (0.16), Enneapogon persicus (0.17), Sporobolus arabicus (0.17), Dactyloctenium aristatum (0.17), Polypogon fugax (0.17), and Apluda mutica (0.18). The results obtained in our study are in agreement with the studies conducted by other researchers [111], who observed that plants which are not easily availability to user community for the disease management are less significant and usually have lower CSI value. However [112] proposed a weak correlation between use and availability of plants and suggested that species with greater cultural significance have a tendency to become vulnerable or rare locally.

Relative frequency of citations (RFC)

Relative frequency of citations reveals the importance of each grass among indigenous communities of Province Punjabin ethno-veterinary medicines and primary health care of animals to make them healthy and productive. It is calculated from the citation frequency of informants claiming the use of a plant species divided by the total number of informant who participated in the survey to share their indigenous knowledge [5]. In our work, RFC ranges 0.96 to 0.14 (Table 2).

Maximum RFC values was obtained by Triticum aestivum (0.96). The other high citations species and their respective values are Oryza sativa (0.94), Poa annua (0.92), Dichanthium annulatum (0.92), Cynodon dactylon (0.91), Poa infirma (0.91) and Avena sativa (0.91), Setaria viridis (0.88), Saccharum officinarum (0.85), Saccharum bengalense (0.85), Urochloa setigera (0.85), Digitaria setigera (0.85) and Brachiaria prostrata (0.85), Chloris barbata (0.84), Setaria glauca (0.84), Sorghum bicolor (0.82), Zea mays (0.81), Setaria intermedia (0.81), Sorghum halepense (0.80), and Eragrostis minor (0.80). These species narrate the fact that these plants were known to local culture for a long period of time. It is noteworthy that majority of the people in different regions of the Punjab were not fully aware of the medicinal potential of the plants of Poaceae. The poor educational background is the major reason that directly affects the learning system in this concern. The study is in agreement with [113]. Relative frequency of citation highlighted the importance of individual species among local communities based on the number of uses [114]. It has been suggested [55] that plants with high RFC
values should be involved in biological, phytochemical and pharmacological studies for further investigation of drug development. Such kind of plants must be conserved on priority basis due to the threat of over exploitation and extensive use of these plants in community [19]. Values of RFC are very dynamic as it changes with area to area and depends on the folk knowledge of the native people. It is well known that species with low RFC values are not unavoidably insignificant [115]. Their low value may represent the low knowledge of the local people in particular the younger ones who are not aware of the uses of these species.

Plants with high RFC values depicted their dominancy in the study area and indigenous people had more familiarity with this group. These plants were preferred over others because of their availability and positive role in traditional health system. The results are in line with the “appearance hypothesis” [57], which explains that local people have greater knowledge of ethnomedicinal use on plants which are more common in an area. Futher, common plants would allow local people to gain more experience of their properties and consequently would have a greater probability of being introduced into the local culture [55].

Use Value (UV)

UV index was used to evaluate the importance of plant species among the indigenous communities [116]. UV value ranged from 0.02 to 0.93 (Table 2). The most commonly used medicinal plants in livestock diseases were, Triticum aestivum (0.93), Sorghum bicolor (0.91), Cymbopogon citratus (0.89), Avena sativa (0.86) Poa annua (0.86), Hordeum vulgare (0.83), and Cymbopogon martini (0.81) and Saccharum spontaneum (0.80). The high use value of the species show their importance in the traditional medicine system [117]. The high use value of medicinal plants can be attributed with the fact that they are the first choice of the traditional healers for the treatment of ailments and local inhabitants are well aware of these plants [57], [118]. Species with low use value were, Chloris dolicostachya (0.02), Enneapogon persicus (0.04), Panicum repens (0.05), Pennisetum lansatum (0.06) and Tragus racemosus (0.06). This might be due to their less availability but they are not necessarily less effective [57]. These plants can be employed in the development of human pharmaceuticals [119].
Correlation among used indices

The relationship among ethnobotanical indices i.e. CSI, RFC and UV is given in Fig. 6. A strong positive correlation was present between CSI and RFC ($r^2 = 0.60$), followed by CSI and UV ($r^2 = 0.52$) while between RFC and UV a relatively weak positive correlation was recorded ($r^2 = 0.25$). About 60% of the values of CSI and RFC and 52% of the CSI and UV values fall in the same region, representing high association among these indices whereas, only 25% values of RFC and UV showed weak correlation between these two indices.

Fidelity level

Fidelity level of 24 most important species ranged from 14.3 to 100% (Table 3). In general, the highest fidelity level of a species highlighted the existence of a particular disease in the study area and utilization of plant species by the local people in order to treat it [93, 94]. Triticum aestivum and Saccharum spontaneum showed 100% fidelity level for anticancer and urinary pain. Other species with high FL values were; Cymbopogon jwarancusa (Typhoid fever), Vetiveria zizanioides (Stomach pain), Saccharum officinarum (Digestive disorders), Tetrapogon tenellus (Antimicrobial), Desmostachya bipinnata (Digestive problems), Saccharum bengalense (Oral infections), Eragrostis minor (Anti-inflammatory), Oryza sativa (Wound healing), Dactyloctenium aegyptium (Jaundice), Phalaris minor (Cough) and Chloris virgate (Bone fracture) with 98, 94, 84, 80, 78, 76, 75, 74, 71, 71 and 70%, respectively. Use of plants by human beings for animal health care is an old practice. These species are not only used for feeding livestock instead these are an important and cheap source of medicine for cattle to treat multiple health issues [120]. The traditional ethno-veterinary system has played a significant role in animal production especially in the rural areas where livestock diseases are locally treated [121, 122].
Table 3
Highly utilized plant species with FL, RPL and ROP

| S. No. | Species name              | Iu  | NA | Major ailments          | Ip  | FL  | RPL | ROP |
|--------|---------------------------|-----|----|-------------------------|-----|-----|-----|-----|
| 1.     | Triticum aestivum         | 84  | 3  | Anticancer              | 84  | 100 | 1   | 100 |
| 2.     | Saccharum officinarum     | 90  | 3  | Digestive disorders     | 76  | 84  | 1   | 84  |
| 3.     | Sorghum halepense         | 80  | 4  | Infectious diseases     | 55  | 69  | 1   | 69  |
| 4.     | Cymbopogon jwarancusa     | 84  | 4  | Typhoid fever           | 82  | 98  | 1   | 98  |
| 5.     | Saccharum bengalense       | 71  | 7  | Oral disorders          | 54  | 76  | 1   | 76  |
| 6.     | Saccharum spontaneum       | 71  | 4  | Urinary pain            | 71  | 100 | 1   | 100 |
| 7.     | Oryza sativa              | 68  | 3  | Diarrhea                | 50  | 74  | 1   | 74  |
| 8.     | Vetiveria zizanioides      | 65  | 3  | Stomach pain            | 61  | 94  | 1   | 94  |
| 9.     | Arundo donax              | 62  | 5  | Blood pressure          | 37  | 60  | 0.98| 58  |
| 10.    | Bambusa glaucescens       | 57  | 4  | Allergies               | 30  | 53  | 0.92| 48  |
| 11.    | Phragmites karka          | 53  | 2  | Nervous problems        | 25  | 47  | 0.86| 41  |
| 12.    | Imperata cylindrica       | 51  | 6  | Piles                   | 25  | 49  | 0.86| 42  |
| 13.    | Cynodon dactylon          | 42  | 8  | Anemia                  | 24  | 57  | 0.79| 45  |
| 14.    | Setaria pumila            | 34  | 2  | Oral infection          | 21  | 62  | 0.74| 46  |
| 15.    | Bromus japonicus          | 29  | 2  | Constipation            | 17  | 59  | 0.74| 43  |
| 16.    | Sporobolus ioclados       | 29  | 5  | Liver disorder          | 14  | 48  | 0.66| 32  |
| 17.    | Octhochloa compressa      | 21  | 4  | Kidney pain             | 14  | 67  | 0.58| 39  |
| 18.    | Panicum antidotale        | 19  | 2  | Antibacterial           | 10  | 53  | 0.53| 28  |
| 19.    | Phalaris minor            | 14  | 1  | Cough                   | 10  | 71  | 0.5 | 36  |
| 20.    | Dactyloctenium aegyptium  | 14  | 4  | Jaundice                | 10  | 71  | 0.45| 32  |
| 21.    | Tetrapogon tenellus       | 10  | 4  | Antimicrobial           | 8   | 80  | 0.45| 36  |
| 22.    | Chloris virgata           | 10  | 2  | Bone fracture           | 7   | 70  | 0.41| 29  |
| 23.    | Desmostachya bipinnata    | 9   | 4  | Digestive problems      | 7   | 78  | 0.36| 28  |
| 24.    | Eragrostis minor          | 8   | 2  | Anti-inflammatory       | 6   | 75  | 0.29| 22  |

Legends: Iu: Sum of participants who claimed the use of a grass for any purpose NA: Number of ailments treated Ip: Number of participants who reported the use of a grass for specific purpose FL: Fidelity level RPL: Relative popularity level ROP: Rank order priority.

Relative popularity of species

One hundred and forty-nine species were mentioned by 271 informants, interviewed during this study for different kinds of diseases. Of these, 125 species were reported by fewer than 8 informants and
therefore were excluded for further discussion. The rest of the 24 species were reported by more than 7 informants are presented in Table 3. For species cited by 8 to 62 informants, the number of uses per species increased progressively (Fig. 7) with increase in the number of informants interviewed showing positive correlation ($r = 0.14$, coefficient of variation, 0.46). Conversely, species mentioned by more than 65 informants, the average number of uses per species did not increased with increasing number of informants. About sixteen plant species mentioned by 62 informants were grouped as unpopular whereas, eight species reported by 65 or more informants were classified as popular. Species with high popularity level (1.0 RPL) were; Triticum aestivum, Saccharum officinarum, Sorghum helepense; Cymbopogon jwarancusa, Saccharum bengalense, Saccharum spontaneum, Oryza sativa and Vetiveria zizanioides. The healing potential of each species may vary and is expressed by its FL value [36]. Rank order priority index can be used as correction factor to rank plants properly with different fidelity level [48]. Out of 24 species only 9 attained 50% or above ROP values. This can be attributed to the decreasing popularity of herbal medicines in the study area. Triticum aestivum and Saccharum spontaneum were reported with highest ROP value (100%), trailed by Cymbopogon jwarancusa (98%), Vetiveria zizanioides (94%), Saccharum officinarum (84%), Saccharum bengalense (76%), Oryza sativa (74%), Sorghum helepense (69%) and Arundo donax (58%). Rest of the species were presented by less than 50% of ROP values. The high popularity of these species can be attributed to their high nutritional values [4] and may be linked to the fact that local farmers are well aware of these species and they frequently used them for the treatment of various ailments in the livestock. This is an agreement with similar findings of previously reported studies conducted in same province (Punjab) [4, 36]. Our study is also consistent with the findings of on the status of healing potential of medicinal plants in Palestinian area [48] and medicinal plants among Bedouins communities in Negev desert [46].

**Jaccard Index (JI)**

Novelty index was done (Table 4) in order to compare the reported taxa with the other studies conducted in different parts of same province (Punjab), other province of Pakistan and in neighbouring countries like India, Bangladesh and Nepal. Ethobotanical information may have cultural differences
and different origin among rural populations as this knowledge greatly varied from region to region [52, 54]. Therefore, a comprehensive research with high understanding of ethno-botanical folk knowledge is mandatory for better judgement [123], and exploration of traditional knowledge in order to find novelty in work and possible drug discovery [98, 124]. Jaccard index in our study ranged from 12.2 to 0.37. Within Pakistan, highest Jaccard index (12.2) was found with previous report from Hafizabad Punjab, Pakistan [4], followed by the study conducted by [125], from district Layyah, Punjab, Pakistan (5.61), [57] from Swat KPK, Pakistan (3.70), [126] from Gujrat, Pakistan (3.63) and [4] from Central Punjab, Pakistan (3.63). Outside the Pakistan, maximum Jaccard index was found with the study conducted by [70] from Ogun State, Nigeria (1.99), [127] from Terai Forest, Western Nepal (1.97) and [128] from tropical regions of Nigeria (1.73). Within Pakistan, the lowest Jaccard index was recorded from [21] from Quetta-Balochistan Pakistan (0.36), [57] from Hungu, Pakistan (0.46) and [50] from Mohmand Agency, FATA, Pakistan (0.47). In the world, the lowest novelty index was recorded for [129] from Eastern Amazon, Brazil (0.49), [130] from Tamil Nadu India (0.50), [131] from Baitadi&Darchula, Nepal (0.50) and [54] from Bandarban, Bangladesh (0.60).

Table 4
Comparison between present and previous studies at neighboring, regional, and global level as performed by Jaccard Index (JI)

| S.N. | Study area | Journal name | Ref. | TRS | CPBA | PPAA | PPSA | PSU | PDU | % SU | % DU | JI |
|------|-------------|--------------|------|-----|------|------|------|-----|-----|------|------|----|
| 1    | A: Bandarban, Bangladesh | Front. Pharma col. | [127] | 159 | 1   | 9   | 147  | 0   | 1   | 0   | 0.06 | 0.64 |
| 2    | B: Lakki Marwat, KPK, Pakistan | J. Ethnopharmacol. | [132] | 62  | 3   | 59  | 146  | 1   | 2   | 0.16 | 0.32 | 1.48 |
| 3    | A: Nigeria | J. Ethnopharmacol. | [131] | 93  | 4   | 89  | 145  | 3   | 1   | 0.32 | 0.1  | 1.73 |
| 4    | B: Ratwal, District Attock, Pakistan | Pak. J. Bot. | [62] | 43  | 1   | 42  | 148  | 0   | 1   | 0   | 0.23 | 0.52 |
| 5    | B: District Peshawar, KPK, Pakistan | Pak. J. Bot. | [91] | 83  | 8   | 75  | 141  | 5   | 3   | 0.6  | 0.36 | 3.70 |
| 6    | B: | J. | [145] | 46  | 3   | 43  | 146  | 3   | 0   | 0.65 | 0   | 1.61 |
| No. | A: | B: | C: | D: | Evid Based Comp. Alt. Med. | 132 | 67 | 1 | 66 | 148 | 0 | 1 | 0 | 0.14 | 0.46 |
|-----|----|----|----|----|----------------------------|-----|----|---|----|-----|---|---|---|------|------|
| 7   | Karak, KPK, Pakistan | Hangu, KPK, Pakistan | Ethnopharmacol. | 70  | 101 | 3 | 98 | 146 | 1 | 2 | 0.09 | 0.19 | 1.24 |
| 8   | Talang, Punjab, Pakistan | Ethnopharmacol. | 129 | 63  | 4 | 59 | 145 | 1 | 3 | 0.15 | 0.19 | 1.99 |
| 9   | Ogun State, Nigeria | Amer. J. Plant Sci. | 134 | 54  | 1 | 53 | 148 | 1 | 0 | 0.18 | 0 | 0.50 |
| 10  | Tamil Nadu, India | Ethnopharmacol. | 133 | 56  | 1 | 55 | 148 | 0 | 1 | 0 | 0.17 | 0.49 |
| 11  | Eastern Amazon, Brazil | Ethnopharmacol. | 146 | 138 | 3 | 135 | 146 | 1 | 2 | 0.07 | 0.14 | 1.07 |
| 12  | Tehsil Kabal, KPK, Pakistan | J. Bot | 70  | 88  | 8 | 80 | 141 | 7 | 1 | 0.79 | 0.11 | 3.63 |
| 13  | Gujrat, Punjab, Pakistan | Ethnobotanics & Leaflets | 71  | 85  | 8 | 87 | 141 | 6 | 2 | 0.7 | 0.23 | 3.63 |
| 14  | Hafizabad, Punjab, Pakistan | Plosone | 147 | 78  | 2 | 76 | 147 | 1 | 1 | 0.12 | 0.12 | 0.90 |
| 15  | Western Himalaya, India | Ethnobiol Ethnomed. | 18  | 120 | 1 | 119 | 148 | 0 | 1 | 0 | 0.08 | 0.37 |
| 16  | Abbottabad, Pakistan | Ethnopharmacol. | 33  | 142 | 4 | 138 | 145 | 1 | 3 | 0.07 | 0.21 | 1.45 |
| 17  | Guimaras Island, Philippines | Ethnopharmacol. | 148 | 22  | 1 | 21 | 148 | 1 | 0 | 0.45 | 0 | 0.60 |
| 18  | Switzerland | Ethnobiol Ethnomed. | 60  | 64  | 1 | 63 | 148 | 1 | 0 | 0.15 | 0 | 0.47 |
| 19  | Mohmand Agency FATA, Pakistan | Ethnobiol Ethnomed. | 144 | 122 | 3 | 118 | 146 | 0 | 3 | 0 | 0.24 | 1.14 |
In the current study, percentage of similar uses ranged from 0.89 to 0.00 and dissimilar uses percentage ranged from 0.36 to 0.00 (Table 4). The highest level of similar plant uses (0.89) were matched with the study conducted by [125], from district Layyah, Punjab, Pakistan, followed by the [126] from Gujrat, Pakistan (0.79), [4] from Central Punjab, Pakistan (0.71), and [36] from Hafizabad, Punjab, Pakistan (0.70). All these studies were conducted from different parts of same province (Punjab). The highest percentage of dissimilarities of plant uses was matched (0.36) with [117] from Peshawar KPK, Pakistan, trailed by (0.32), [54] from Lakki Marwat, KPK, Pakistan.

The high degree of similar type of plant uses may indicate same cultural practices among communities and similar type of vegetation may reflect same type of floral diversity and climate in those areas [41]. It has been recorded that neighbouring indigenous communities share more common traditional practice of plants as medicines in order to cure various ailments and this is because of more social trade and sharing of ethnomedicinal knowledge among native groups [132, 133]. In contrast, a low similarity index indicates less sharing of medicinal knowledge and low social interaction that could have been happened in the past bringing more difference in ethnobotanical
practices [50]. Geological isolation of ethnic groups and plants resulted a significant change in vegetation structure and therapeutic uses of indigenous plants and this may be a reason for loss of ethnobotanical information [44]. A low degree of similarity index of our study with other studies conducted in same province or in other parts of Pakistan indicated that either a little attention has been paid towards grasses in these studies and zero (0) percent similarity index show that grasses were totally ignored. Therefore, this is the first comprehensive report on ethno-veterinary knowledge of indigenous grasses of whole province of Punjab.

Similarities and differences in ethnobotanical use of plant species were compared with studies conducted within and outside the Pakistan. The maximum diversity in ethnobotanical uses of plants was found with the study of [4] from Central Punjab, Pakistan (13 uses) and data is presented in Table 5. It was trailed by other studies conducted in surrounding areas; [118] from Toba Tek Singh, Punjab, Pakistan (13 uses), [134] from Peshawar, Pakistan (3 uses), and [135] from Uige, Northern Angola (3 uses) and [136] from Guimaras Island, Philippines (3 uses). In rest of the studies, diversity in therapeutic uses of medicinal plants was found 1 to 2 or 0. The maximum similarity in ethnobotanical uses was found in [4] from Central Punjab, Pakistan (38 uses), followed by [125] from Layyah, Punjab Pakistan (7 uses), [126] from Gujrat, Punjab, Pakistan (7 uses) and [36] from Hafizabad, Punjab, Pakistan (6 uses).
Table 5
Diversity in uses of medicinal plants used by the communities across the globe.

| Sr.# | Work done previously | Location | Common uses | Diverse uses |
|------|----------------------|----------|-------------|--------------|
| 1.   | [4]                  | Central Punjab, Pakistan | 38 | 13 |
| 2.   | [128]                | Layyah, Punjab, Pakistan | 7 | 2 |
| 3.   | [71]                 | Hafizabad, Punjab, Pakistan | 6 | 2 |
| 4.   | [34]                 | Gujrat, Punjab, Pakistan | 7 | 1 |
| 5.   | [91]                 | District Peshawar, KPK, Pakistan | 5 | 3 |
| 6.   | [143]                | Toba Tek Singh, Punjab, Pakistan | 0 | 4 |
| 7.   | [33]                 | Guimaras Island, Philippines | 1 | 3 |
| 8.   | [70]                 | Talagang, Punjab, Pakistan | 1 | 2 |
| 9.   | [144]                | Uige, Northern Angola | 0 | 3 |
| 10.  | [129]                | Ogun State, Nigeria | 1 | 2 |
| 11.  | [134]                | Tamil Nadu, India | 1 | 0 |
| 12.  | [146]                | Tehsil Kabal, KPK, Pakistan | 1 | 2 |
| 13.  | [145]                | Karak, KPK, Pakistan | 3 | 0 |
| 14.  | [131]                | Nigeria | 3 | 1 |
| 15.  | [132]                | Lakki Marwat KPK, Pakistan | 1 | 2 |
| 16.  | [127]                | Bandarban, Bangladesh | 0 | 1 |
| 17.  | [62]                 | Ratwal, District Attock, Pakistan | 0 | 1 |
| 18.  | [132]                | Hangu, KPK, Pakistan | 0 | 1 |
| 19.  | [133]                | Eastern Amazon, Brazil | 1 | 0 |
| 20.  | [147]                | Western Himalaya, India | 1 | 1 |
| 21.  | [18]                 | Abbottabad, Pakistan | 0 | 1 |
| 22.  | [148]                | Switzerland | 1 | 0 |
| 23.  | [60]                 | Mohmand Agency, FATA, Pakistan | 1 | 0 |
| 24.  | [135]                | Baitadi & Darchula, Nepal | 0 | 1 |
| 25.  | [130]                | Terai Forest, Western Nepal | 2 | 0 |

Novelty in ethno-veterinary uses

Therapeutic uses of plant species of family Poaceae were compared with previous reports from different parts of the Pakistan and with other studies conducted in the neighbouring areas including India, Bangladesh and Nepal to find out the novelty index. The data showed significant differences in the usage plant species and their parts used to treat helath disorders in animals. Out of 149 species, ethnomedicinal uses of 12 plant species such as Chrysopogon zizanioides (anti-inflammatory), Pennisetum lansatum (improve bull fertility), Cymbopogon citratus (glandular secretion), Sorghum saccharatum and Themeda triandra (malaria), Aristida funiculate (anticancer), Koeleria argentina (skin...
allergies), Tetrapogon villosus (antibacterial), Cynodon radiates (eyes infection), Sporobolus nervosa (Jaundice), Enneapogon persicus (antifungal), and Panicum repens (dysfunctional cattle organs) have rarely been reported so far from this region and rest of the world. It is noteworthy that majority of these plants have not been explored pharmacologically. Therefore, could be used for indepth phytochemical screening and bioactivity assays in order to validate their traditional uses. Moreover, less familiar Poa annua, Dichanthium annulatum, Poa infirma, Setaria viridis, Saccharum bengalense, Urochloa setigera, Digitaria setigera, Brachiaria prostrata, Chloris barbata, Setaria glauca, Setaria intermedia and Eragrostis minor with high citations should also be investigated in detail.

Conclusion
Present study is the first comprehensive report emphasis on the application of Poaceae taxa in ethno-veterinary health disorders. A total of 149 species were reported with therapeutic uses that represent new bioresources for pharmacological studies and drugs discovery. Our study revealed that ethnobotanical knowledge of Poaceae taxa is less prevailing in the rural areas of Punjab compared to other medicinal plants. Therefore, ethnomedicinal application of the members of this family should be reported from other parts of the country, which will be helpful in conserving precious medicinal plant knowledge and its application in novel drug discovery.

Declarations

**Ethics approval and consent to participate**

Before conducting interviews, prior informed consent was obtained from all participants. The study was carried out according to the set rules and recommendations of the Code of Ethics of the International Society of Ethnobiology. No further ethics approval was required.

**Consent for publication**

This manuscript does not contain any individual person’s data and further consent for publication is not required.

**Competing interest**

The authors declare that they have no competing interest.
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Authors' contribution

Khizar Hayat Bhatti and Muhammad Shoaib Amjad: Conceptualization, Methodology;
Muhammad Majeed: Data curation, Writing-Original Draft Preparation, Audil Rashid: Identification;
Arshad Mehmood Abbasi and Khawaja Shafique Ahmad: Supervision, Resources; Fahim Nawaz: Writing- Reviewing and Editing; Ansar Mehmood: Validation, Visualization; Majid Mahmood: Software, Formal Analysis

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Figures

Figure 1

Map of study area showing all districts of Punjab, Pakistan.
Figure 2

Linguistic wise classification of informants.
Proportion of plant part(s) used in different recipes.

Figure 3
Methods of herbal preparations.
Diseases categories

Figure 5

Percentage use reports of Poaceae taxa in different ailments
Figure 6

Correlation among various ethnobotanical indices.
Correlation between number of informants and ailments.

Figure 7