

Short Communication: Ethnobotanical survey of medicinal plants for wound-healing in Dir Upper District, Pakistan

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Abstract. Jawadullah, Akhtar N. 2023. Short Communication: Ethnobotanical survey of medicinal plants for wound-healing in Dir Upper District, Pakistan. *Asian J Ethnobiol* 6: 145-152. Medicinal plants have been used since ancient time by communities as an alternative to the synthetic medicine, which have adverse side effects and is not available to every individual. This study reports medicinal plants used for wound-healing by the local peoples in Dir Upper District, northern area of Pakistan. A semi-structured questionnaire was used to collect ethnobotanical data by interviewing 50 informants of different ages (25 to 90 years old). Plant samples were collected as herbarium to be identified in the laboratory. The result shows a total of 20 plant species, each belonging to different families, were used for wound-healing. The majority of growth forms of such plants were herbs (35%) and trees (35%), followed by shrubs (25%) and climbers (5%). The plant parts used for healing were leaves of the plant (45%), followed by plant bark (10%), whole plant (10%), plant roots (10%), fruit peel (5%), gum (5%), bulb (5%), rhizome (5%) and latex (5%). Furthermore, external applications were more common than oral consumption to promote wound-healing. *Berberis lycium* Royle, *Curcuma longa* L. and *Punica protopunica* Balf.fil. were the most cited species used to heal wounds. This study revealed that there is an array of plant biodiversity among Pakistanis for the purpose of wound-healing. This is a result of the socioeconomic status and limited access to modern health services and their preference for folk medicine. Further studies should be planned to create an online database for a collection of therapeutic medicinal plants and their traditional healing potentials.

Keywords: Dir Upper, medicinal plants, pharmacological characteristics, species, wound-healing

INTRODUCTION

Plants have various roles in human life. Throughout history, humans have been using about 40,000-100,000 plant species for various purposes, accounting for only 5% of the total global flora. Among them, 30,000 plant species have been used as source of food and 7000 species have been cultivated for other purposes. However, due to green revolution, most of these species are substituted with high yielding varieties (Guzo et al. 2023). People have also been using medicinal plants to treat various ailments. According to World Health Organization (WHO), about 80% of the world population depends on the medicinal plants to cure various types of diseases (Tahir et al. 2023). One type of ailments that are frequently cured with medicinal plants is wound.

Wound is defined as a break in the skin epithelium or cellular and anatomical breakage in the living tissue continuity (Alam et al. 2011). In terms of location, there are two types of wounds, i.e., external wounds and internal wounds. The external wound is related to the damage to skin or upper layer of the body that may be caused due to the puncture, penetrating or incised wounds. In internal wound, the skin remains intact while the underlying tissue is damaged to a varying degree (Handoo 2006). Based on the cause, wounds can be classified as: (i) acute wound, which

is caused by cuts or surgical incision; (ii) closed wound, in which blood leaks out from vessels but remains inside which form bruises; (iii) open wound, in which blood escapes from the vessels and clearly visible; (iv) incised wound, which is caused by a sharp object but no loss of tissue; (v) tear wound, in which loss of tissue occurs; (vi) puncture wound, which is caused by needle or nail and chances of infections are there; (vii) abrasive wound, which is caused due to sliding on rough surface and induces abrasion (Sharma et al. 2021). Cutaneous wound forms due to the damage of skin structure as a result of burns, surgery or injuries, which results in tissue damage (Xu et al. 2023).

Wounds are a serious problem for healthcare sector to be treated well and on time. Untreated wounds become worsen due to an unhealthy lifestyle. Wound infection is the major cause of wound complications and occurs due to a favorable environment for the microbes. Therefore, wound-healing should be done in order to maintain the epithelial barrier (Zulkefli et al. 2023). An estimated cost of 25 billion USD is being spent annually for chronic wound treatment. This cost increases day by day due to the expensive healthcare. Skin tissues help the body to protect itself from external harmful agents (Marques et al. 2023).

Due to the series of adverse effects of synthetic therapeutic agents, medicinal plants are being recommended because they have been used since ancient times (Budovsky

et al. 2015). Natural and bioactive compounds present in plants can act as antibacterial and anti-fungal properties, which fasten the wound-healing process. Various research shows that herbal extracts have antioxidant properties that promote wound-healing (Yazarlu et al. 2021). It is being assumed that ingredients from plants have few side-effects and non-toxic compared with synthetic therapeutic agents. Wound care using medicinal plants involves debridement and disinfection to provide a suitable environment for healing process (Oguntibeju 2019). Extracted natural compounds from plants help in various stages of wounds healing process. These plants have anti-inflammatory action and anti-fungal activities (Criollo-Mendoza et al. 2023).

Different studies have reported that for centuries African and Asian people traditionally have used medicinal plants. These people have an Indigenous Knowledge System (IKS) in their cultural practices, including the use of medicinal plants by traditional healers, which are believed to have healing properties (Cheikhyoussef et al. 2011). Nowadays, these plants have been scientifically investigated to have tremendous importance in the healing activity of wounds (Ayyanar and Ignacimuthu 2009). Currently, most researchers are attracted to natural compounds of medicinal plants due to promising results of these plants in patients and curing wounds (Monika et al. 2022). The major characteristic of these plants is they have blood-clotting properties (Bhardwaj and Gakhar 2005). Naturally derived substances are being used in the wound-healing process, because they have cell synthesis modulation, anti-inflammatory and antioxidant properties.

This study aimed to report medicinal plants used for wound-healing by the local peoples in Dir Upper District, northern area of Pakistan. In this study area, research has already been done regarding a general ethnobotanical study on medicinal plants but has yet to be done on the local plants

specifically used for wound-healing. During this research, several trips were made to collect data on the wild and cultivated medicinal plants locally used for wound-healing. We expected the results of this study might help the people not to lose this precious knowledge and the researchers to work on the identified medicinal species of plants further to procure the actual ingredients that are helpful in wound-healing process.

MATERIALS AND METHODS

Study area and period

This study was carried out in Dir Upper District, Khyber-Pakhtunkhwa (Kp), Pakistan (Figure 1). The district is spread over 3,699 square kilometers. It is situated at Latitude 35°06'51" N and Longitude 72°01'59" E. Geographically, it is bounded by Chitral District to the northern side, by Bajaur and Afghanistan to the western side, by Dir Lower District to the southern side and by Swat District to eastern side. The climate of Dir Upper is cold and damp and is visited by the monsoon in July and August. The mountains are usually covered with snow and receive heavy snowfall in December, January and February. The average rainfall in the district is 700 mm and the temperature varies from -6°C to 38°C. Farming, trade and overseas work are the main occupations of the people. Dir Upper is very diverse in flora, having almost all types of plants. Due to rapid climate change and many other hazards, the flora remains not the same as it was before but still has diversity in its way. Most of its population are Yusufzai, Swati, Sahibzadgan and Roghani (Muhammad et al. 2014; Khan et al. 2015). Data was collected in 2020 between April and August.

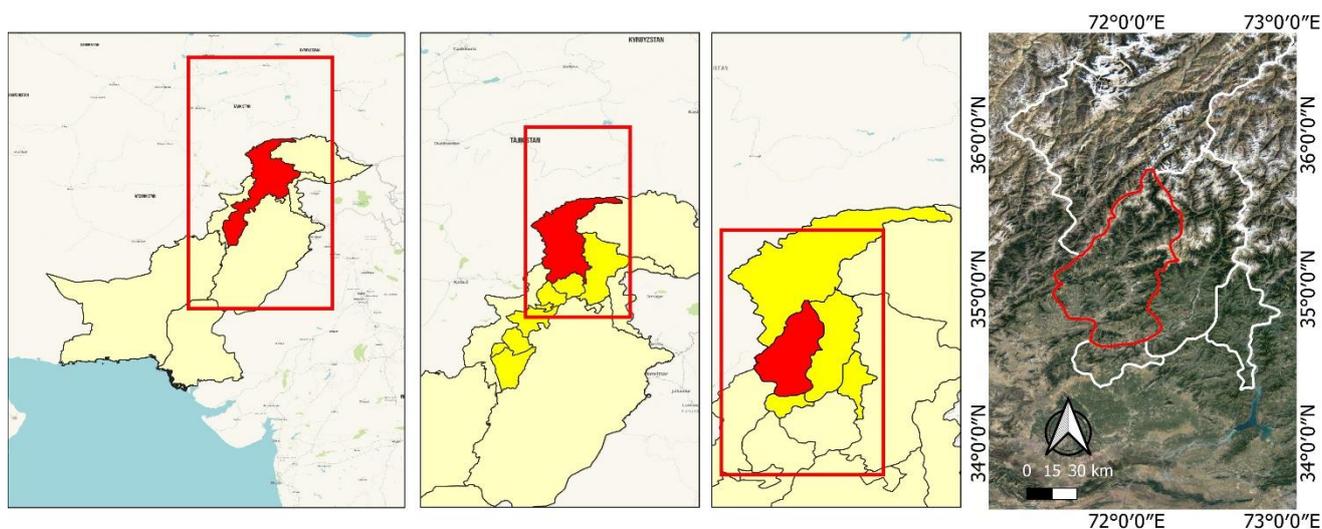


Figure 1. Map of study area in Dir Upper District, Pakistan

Ethnomedicinal data collection

Ethnomedicinal information was collected from local inhabitants and traditional healers in Dir Upper District using interview method. Respondents were randomly selected whoever wanted to share this precious knowledge. A total of 50 respondents of different ages (25 to 90 years old), sex and traditional knowledge were interviewed, with all respondents being free to state obtained from elders. No specific permits were required for this study data collection, as the researcher was also an inhabitant of the same area. However, most of the people were older, so prior to the data collection, they were briefed about the importance and their role in this data collection.

A semi-structured questionnaire was used to gather their knowledge related to a particular plant, including mode of administration (oral, apply on wound), type of wound in which that particular plant is used (abrasion, burn, cut and pimple), plant part used (leaf, stem, root, bark etc.), mode of preparation (powder form, extract or fresh plant part) and local name of the plant.

Plant samples collection

The natural habitat of the medicinal plants locally used for wound-healing was visited accompanied by the local inhabitants and identified their location where they have naturally grown. The information related to the plant was taken as a semi-structured questionnaire. For the plant collection, preparation, preservation, drying and ethnomedicinal uses, a standard method was observed. The plant's correct nomenclature was arranged alphabetically. The samples were dried in shade and mounted on a herbarium sheet. The pictures were taken from the plant while still in their natural habitat. Plants botanical names were confirmed by a botanist in the Faculty of Botany, Islamia College Peshawar. The dried samples were taken and deposited in the herbarium of Islamia College Peshawar. Some additional information was also collected, like altitude of the area where that plant was growing, latitude and longitude with the help of an App (accurate altimeter).

RESULTS AND DISCUSSION

Twenty plant species, each belonging to different families, were specifically used for wound-healing directly and some indirectly in the studied area (Figure 2, Table 1). Among the documented species, 16 were wild, while 4 were cultivated in the local area or other areas. Among the species, the most commonly used was *Berberis lycium*. Pharmacological studies showed that *B. lycium* has antimicrobial and wound-healing properties (Bukhari and Ali 2022). A study by Neto et al. (2020) in the Brazilian Cerrado showed that 29 plant species belonging to 18 families were traditionally used and have pharmacological features to heal wounds, with major used families were Bignoniaceae, Fabaceae, Asteraceae and Euphorbiaceae.

Plant parts used as a recipe to heal wounds were in this order, i.e., leaves (10), roots (2), bark (2), whole plant (2), rhizome (1), bulb (1), latex (1) and gum (1) (Figure 3). This

result aligns with the study on tribal people in southern India, which also found leaves as the most frequent part of the plant. Most herbal remedies are prepared and applied externally (Ayyanar and Ignacimuthu 2009). Mobale et al. (2023) reported that plants and their parts used for wounds healing activity were in this order: trees (38%) and shrubs (28%) were the most used life forms, while the leaves (48%) and bark (38%) were the most parts of the plant that were exploited.

There were three main preparation methods applied, namely powder, paste and decoction, but some other forms, like fresh leaves, pulp, latex and gum, were also in use (Table 1). The preparation concentration could have been more quantitatively measured as it depended on the wound condition. Most of the injuries cured by these plants were pimples, as they are very common wounds in local areas and too dangerous to be uncured. Because most peoples take it non-serious and does not have the facilities, local plants are very important in this regard, as they are easily accessible to everyone and free of cost.

An ethnopharmacological study conducted in Dogonland revealed 73 plant species used to heal wounds, with mostly the information obtained from traditional healers (Inngjerdingen et al. 2004). Another ethnobotanical survey was also conducted in Tamil Nadu, Kancheepuram, to reveal native plants used for wound-healing during (Muthu et al. 2006). In Bangladesh, the local healers of Santal tribe in Dinajpur District used 16 plant species belonging to 14 families to treat cuts, diabetes, fever, respiratory issues, skin problems and wounds (Azad et al. 2014). Ethnobotanical study in the Balkan Peninsula identified 128 plant species used for wound-healing through external application in the form of an infusion, tinctures, oils, decoction, syrups, balms, ointment and direct to the skin (Jarić et al. 2018). Through clinic surveys and interviews with rural dwellers and traditional healers, Grierson and Afolayan (1999) documented different plants used for wound-healing in Eastern Cape Province, South Africa. An ethnobotanical survey was carried out in Iran to record plant species used by the inhabitants of the area, especially in the rural areas, for wounds healing (Pirbalouti et al. 2010).

Medicinal plants used to heal wounds include the scales of *Allium cepa* warmed with oils of *Brassica campestris* and crushed, applied on the wound externally. The *A. cepa*, commonly known as onion, is proven to have antioxidant, anti-diabetic, anti-thrombotic, anti-hypertensive, hypoglycemic, and antihyperlipidemic activity (Alam et al. 2011). In current study, the most cited plant species were *B. lycium* and *Curcuma longa*, followed by *Punica protopunica* and *Aloe vera*. Leaf pulp of *A. vera* is applied on bleeding wounds, the dried bark of *B. lycium* is sprinkled on injured parts and a paste of *Dodonaea viscosa* leaves is applied externally on wounds as germicide (Abbasi et al. 2010). The *A. vera* has been used by Egyptians, Asians, Romans and Americans for over 5000 years. It has bioactive compounds like saponins, acetones, phytol etc., which act as antimicrobial agents and can act as first-line treatment for burns, ulcers, and wounds (Shedoeva et al. 2019).





Figure 2. Plant species used to heal wounds in Dir Upper District, Pakistan. A. *Aloe vera*, B. *Acacia modesta*, C. *Allium cepa*, D. *Azadirachta indica*, E. *Berberis lycium*, F. *Curcuma longa*, G. *Dodonaea viscosa*, H. *Daphne mucronata*, I. *Ficus carica*, J. *Juglans regia*, K. *Mirabilis jalapa*, L. *Olea ferruginea*, M. *Plantago lanceolata*, N. *Punica protopunica*, O. *Ricinus communis*, P. *Rheum emodi*, Q. *Solanum nigrum*, R. *Salvia moorcroftiana*, S. *Tamarix aphylla*, T. *Vitis vinifera*

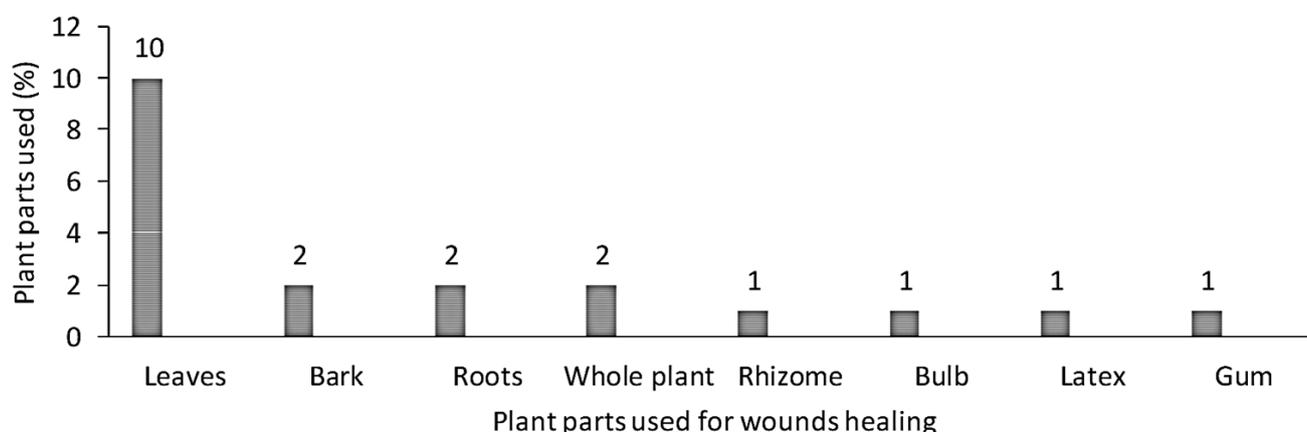


Figure 3. Plant parts used in wound-healing in Dir Upper District, Pakistan

Curcuma longa, commonly known as turmeric, has been reported to contain anti-fungal, anti-bacterial and anti-inflammatory activities. Rhizomes are the parts used. It also contains protein, fats, vitamins (A, B, C, etc.) all of which have a very important role in wound-healing and regeneration. The *D. viscosa* was reported to have anti-ulcer, anti-inflammatory, anti-fungal and anti-bacterial activities (Venkatesh et al. 2008). While *A. vera*, *C. longa* and pomegranate have already been reported to have wounds healing activity (Albahri et al. 2023), to our knowledge, present use of *Acacia modesta*, *D. viscosa*, *Daphne mucronata*, *Ficus carica*, *Juglans regia*, *Mirabilis jalapa*, *Olea ferruginea*, *Plantago lanceolata*, *P. protopunica*, *Ricinus communis*, *Solanum nigrum*, *Salvia moorcroftiana* and *Vitis vinifera* to cure wounds were rarely reported before from any other part of Pakistan.

For new antiseptic and insecticidal medicine this survey gathered information to screen out biological activities of identified valuable plants. The medicinal plants and polyphenolic compounds have therapeutic potential to cure wounds, and can develop new drugs (Mssillou et al. 2022). Future research can be directed to test their biological

activities against infectious organisms in order to set up a scientific ground for the searching of new active compounds.

This present study showed that for treatment of primary healthcare, the inhabitants depend on medicinal plants greatly. Due to lack of interest among young generation to carry on this traditional way of healthcare, this traditional knowledge is diminishing day by day as traditional healers remained very few in number. Traditional knowledge of various plant has been acquired from decades of trial and error by local communities of different localities. With respect to time, they have transferred this precious knowledge from generation to generation by oral tradition (Birhan et al. 2023). A study by Bhattarai (1997) in Nepal revealed wound-healing properties of 42 plant species from 40 genera and 23 families used for the treatment of wounds and injuries. This knowledge of remedies by using plants is based on their ancestral and personal knowledge still used and maintained in the rural localities. Ethnobotanical study by Kumar et al. (2007) documented indigenous knowledge of plants used for wound treatment and cuts by the tribal and folklore practices prevailing in India.

Table 1. Medicinal plant species used to heal wounds in Dir Upper District, Pakistan

Botanical name	Family	Local name	Wound heals	Plant part used	Preparation mode	Administration mode	Altitude (m)	Growth form	Plant status	Frequency	Frequency of plants cited	Habitat
<i>Aloe vera</i>	Asphodelaceae	Zuqam	Pimple and cut	Leaves	Fresh plant part	Apply on wound	1006	Herb	Cultivated	Rare	40 resp. (80%)	Arid areas
<i>Acacia modesta</i>	Fabaceae	Palosa	Erector spinae injury	Gum	Fresh or mix with oils and cooked	Oral	1006	Tree	Indigenous	Common	25 resp. (50%)	Woodland
<i>Allium cepa</i>	Amaryllidaceae	Piaz	Pimple	Bulb	Fresh plant part	Warm the bulb and add to wound	937	Annual	Cultivated	common	30 resp. (60%)	Arable
<i>Azadirachta indica</i>	Meliaceae	Neem	Internal wound	Leaves	Extract	Oral or apply externally	1402	Tree	Alien	Scattered	23 resp. (46%)	Woodland
<i>Berberis lycium</i>	Berberidaceae	Koare	Abrasion	Roots	Fodder form	Oral or apply on wounds	1433	Shrub	Indigenous	Rare	48 resp. (96%)	Woodland
<i>Curcuma longa</i>	Zingiberaceae	Kurkaman	Cut and abrasion	Rhizome	Paste (warmed with oils)	Bandage on wound	916	Herb	Alien	Rare	48 resp. (96%)	Arable
<i>Dodonaea viscosa</i>	Sapindaceae	Ghwaraske	Abrasion	Leaves	Fresh plant part	Apply wounds	998	Shrub	Indigenous	Common	20 resp. (40%)	Arid areas
<i>Daphne mucronata</i>	Thymelaeaceae	Neghone	Abrasion	Branch	Extract	Wash the lesion with the extract	1027	Shrub	Indigenous	Common	10 resp. (20%)	Woodland
<i>Ficus carica</i>	Moraceae	Inzar	Sliver wound	Branch	Latex	Intrusion in sliver wound	968	Tree	Indigenous	Rare	18 resp. (36%)	Arable
<i>Juglans regia</i>	Juglandaceae	Ghuz	Gingivitis	Root bark / leaves	Fresh plant part	Rubbing gums with fresh plant	966	Tree	Cultivated	Rare	22 resp. (44%)	Arable
<i>Mirabilis jalapa</i>	Nyctaginaceae	Mazegar goale	Pimple	Leaves	Fresh plant part	Add on to the pimple	1009	Herb	Cultivated	Scattered	12 resp. (24%)	Arable
<i>Olea ferruginea</i>	Oleaceae	Khona	Oral infection	Leaves	Fresh plant part	Mastication	968	Tree	Indigenous	Common	32 resp. (64%)	Woodland
<i>Plantago lanceolata</i>	Plantaginaceae	Ghwajaby	Pimple	Leaves or whole plant	Fresh plant	Add on to the wound	968	Perennial	Indigenous	Scattered	21 resp. (42%)	Wetland
<i>Punica protopunica</i>	Lythraceae	Nangore	Uti	Fruit peel	Fodder form	Oral	969	Tree	Indigenous	Common	45 resp. (90%)	Woodland
<i>Ricinus communis</i>	Euphorbiaceae	Harhanda	Pimple	Leaves	Fresh plant part	Add on to the pimple	1013	Shrub	Established Alien	Scattered	27 resp. (54%)	Ruderal
<i>Rheum emodi</i>	Polygonaceae	Chotyal	Internal wound	Root	Fodder form	Oral	1463	Perennial	Cultivated	Scattered	7 resp. (14%)	Arable
<i>Solanum nigrum</i>	Solanaceae	Karmachu	Pimple	Leaves	Fresh plant part	Add on to the Pimple	968	Annual	Indigenous	Common	41 resp. (82%)	Ruderal
<i>Salvia moorcroftiana</i>	Lamiaceae	Kharkhwag	Abrasion	Leaves	Fresh plant part	Add on to the wound	1263	Perennial	Indigenous	Scattered	30 resp. (60%)	Ruderal
<i>Tamarix aphylla</i>	Tamaricaceae	Ghaz	Burn (antibiotic)	Bark	Fodder mixed with oils	Paste on wound	1448	Tree	Alien	Rare	9 resp. (18%)	Woodland
<i>Vitis vinifera</i>	Vitaceae	Koar	Pimple	leaves	Fresh plant part	Add on to the wound	937	Perennial climber	Cultivated	Rare	25 resp. (50%)	Arable

Note: resp.: respondents

In conclusion, the Dir Upper District area is rich in plant diversity, and its local inhabitants benefit by using it to heal wounds. Due to socioeconomic and limited access to modern health facilities, local people in this area prefer to use medicinal plants, as it is cheap and has little or no known side effects. In this study, a total of 20 plant species were identified to have the ability to cure various types of wounds. Types of wounds that these plants could cure include pimples, cuts, abrasions and internal infections. The growth forms of medicinal plants were mostly herbs and trees, followed by shrubs and climbers. The parts used for healing were dominated by leaves, followed by bark, whole plant, roots, fruit peel, gum, bulb, rhizome and latex. The plants were easy to access and free of cost. External applications were more common than oral consumption to heal wounds. This study revealed that there is an array of plant biodiversity among Pakistanis for the purpose of wound-healing. The younger generation is reluctant to carry on this practice of using herbal plants, and because of this, in the near future, there is a high risk of losing this vibrant knowledge that the elders maintain. Therefore, we recommend setting up an online database to bring to eminence this incredible traditional knowledge of medicinal plants for therapeutic purposes and healing wounds.

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