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Exploring traditional anti-diabetic herbal practices in a Western Himalayan village Pancheri of Udhampur District, Jammu and Kashmir, India

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Abstract

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by either insufficient insulin production or reduced effectiveness of insulin action in the body. This condition leads to persistent hyperglycemia and, over time, may result in severe complications affecting the nervous, cardiovascular, retinal, and renal systems. The likelihood of diabetes increases with advancing age, tobacco use, sedentary behavior, poor dietary habits, excess body weight, prior gestational diabetes, and having relatives with the condition. These co-morbidities result in premature deaths Traditional plant remedies have been used throughout the world for the treatment and control of diabetes mellitus. These remedies are cost effective and have no side effects. The present study was conducted in a mountainous village Pancheri of Udhampur district, Jammu and Kashmir with an aim of enlisting the anti-diabetic plants used by the locals of the region. The study revealed 26 plants species belonging to 23 genera and 18 families used for treatment of diabetes by local inhabitants. Use Value (UV) of the plant species was also recorded. On the basis of use value, the prominent plants used for treatment of diabetes were *Syzygium cumini* (L.) Skeels (UV=0.81)., *Momordica charantia* L. (UV=0.78), *Ajuga integrifolia* Buch.-Ham. (UV=0.75) , *Catharanthus roseus* (L.) G. Don (UV= 0.73) and *Psidium guajava* L. (UV=0.69).

Keywords: Diabetes mellitus, hyperglycemia, Pancheri, Traditional plant remedies, Udhampur.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder arising from insulin deficiency or due to ineffectiveness of the insulin produced by the body. This results in high blood glucose level and with time, to neurological, cardiovascular, retinal and renal complications. It is a debilitating disease affecting the population of every country of the world (Morey, 1997; Rahmatullah et al., 2012; Bahmani et al., 2014; Gang et al., 2023). It can be Type I diabetes (T1D) which is characterized by insufficient insulin secretion in the pancreatic β-cells or type II diabetes (T2D) with progressive rate of insulin resistance in liver and peripheral tissues, reducing β-cells mass, and deficient insulin Secretion (Srinivasan & Ramarao, 2007; Kazemi et al., 2010; Kerner & Bruckel, 2014). The common symptoms of disease include excessive thirst, frequent urine, and overeating (Meigs, 2002; Bahmani et al., 2014). It causes serious metabolic complications such as ketoacidosis and hyperosmolar coma, and produces chronic, long-term harms including retinopathy, kidney failure, nerve damage, skin

issues—and increased cardiovascular risk (Gleckman and Morr, 1994; Behradmanesh et al., 2013). The likelihood of diabetes increases with advancing age, tobacco use, sedentary behavior, poor dietary habits, excess body weight, prior gestational diabetes, and having relatives with the condition. These co-morbidities result in premature deaths (Salsali & Nathan, 2006; Padhi et al., 2020; Kharroubi & Darwish, 2015; Broholm et al., 2019; Parasher et al., 2024). Over the past forty years, diabetes has surged globally, largely driven by population growth and aging, diets high in calories and fat, and increasingly sedentary lifestyles (Noubiap et al., 2019; Gang et al., 2023). According to the International Diabetes Federation (10th Edition, 2021), diabetes affected **10.5%** of people aged 20–79 in 2021 (about **537 million**); this is projected to rise to **643 million** by 2030 and to **783 million** (approximately **12.2%)** by 2045, with the economic burden climbing to **$1,054 billion** by 2045 (Sun et al., 2022; Parasher et al., 2024). Data on disease patterns show diabetes has grown substantially in India with **77 million** diagnosed cases earlier, projected to climb to **124.9 million** by 2045, and **39.4 million** individuals likely remain undiagnosed. Insulin injections and oral hypoglycemic drugs are the primary treatments for diabetes, yet they can cause various side effects and do not prevent long-term diabetic complications (Parasher et al., 2024) With improved knowledge of diabetes and its long-term harms, it is important to identify treatments that are both effective and have fewer side effects. Traditional medicinal plants are valuable sources for such alternative or adjunctive therapies (Nasri & Kopaei, 2013; Eddouk et al., 2014). The World Health Organization (WHO) has also substantiated the utilization of herbal remedies for the management of diabetes (Noor et al., 2008). A large number of medicinal plants have been reported to be effective in diabetes, yet plenty of research is still needed to be done. The present study is such an attempt from Pancheri tehsil of Udhampur district, Jammu and Kashmir to know the traditionally used medicinal plants for the management of diabetes. Tehsil Pancheri of Udhampur is a hilly terrain and many villages of the region are cut off from the frequent visits of the town. Therefore, they use the available medicinal plants for treating various ailments, and thus are the treasure trove of valuable ethnomedicinal knowledge. This knowledge-base is developed through age old experience and descends orally from one generation to another as a domestic practice (Bhatia et al. 2014).

Material and methods

Study area

District Udhampur of Jammu division of J & K state lies between 32°34′ & 39°30′ North latitude and 74°16′ & 75°38′ East longitude and has a total area of 2380 sq. km. Situated in the south-eastern part of J&K, the district presents an altitudinal variation from 600 to 2900 m above mean sea level and is divided into 4 tehsils viz Udhampur, Chenani, Ramnagar, Basantgarh, Latti, Moungri, Panchari, and Majalta. Panchari is a hilly tehsil in Udhampur district of Jammu and Kashmir lying between 33° 3′ 36″ N and 75° 8′ 24″ E. station is situated at an altitude of 5900 feet and located 40 kilometers from the district headquarters Udhampur and 90 t0 95 kilometers from Jammu city (Fig 1). Panchari village is well connected by road by NH 44. It consists of 22 villages with a total population of 36,258. Meer is the largest village by population (4,222). The smallest village is Uchh Niala. Explore detailed information about each village in this block (Village gram, 2025).

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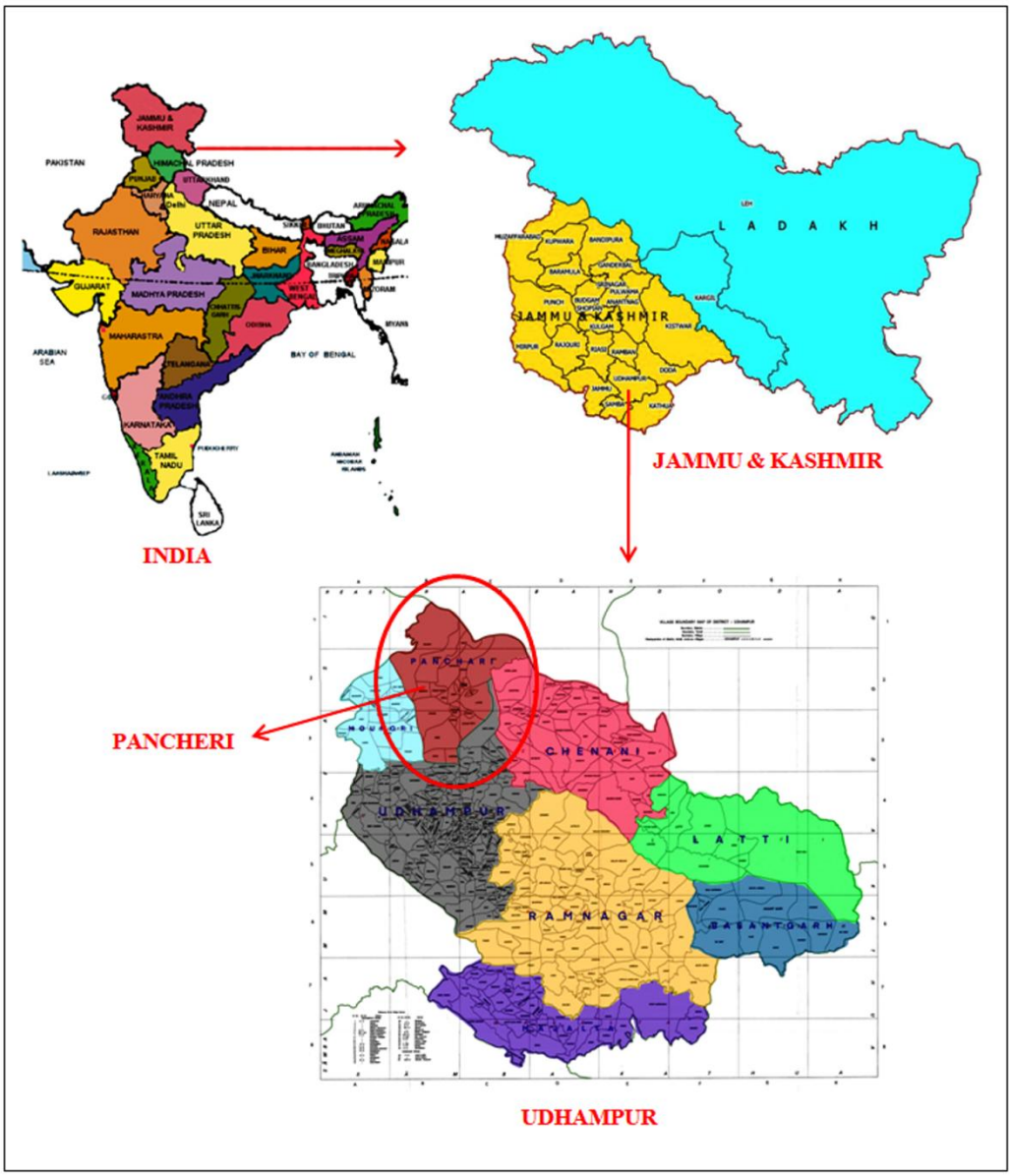

Fig. 1. Geographical map of study area (not upto scale).

Data Collection

A systematic ethnobotanical survey was carried out in Pancheri village of the Udhampur district during March 2023 to Nov. 2024 for collection of information on plant species being used by local in the study area for the treatment of Diabetes. Interaction with local people was done to identify the knowledgeable informants. Data on medicinal plants was collected through semi-structured interviews, questionnaires and focus group discussions (Fig. 2). The plants will be collected during their respective flowering seasons. A total of 69 informants between age group of 25-85 were interviewed. The plant specimens collected were raised in the form of herbarium sheets. Identification of plants was done with the help of relevant literature including both regional and local floras. Besides, help was also taken from expert taxonomist and Herbarium of University of Jammu, Jammu. Their identification further confirmed by consulting websites, www.efloras.org and www.flowersofindia.net. The

International Plant Names Index (http://www.ipni.org) and Plants of the World online (http://www.plantsoftheworldonline.org/) was followed for the correct botanical nomenclature of plant species.

Fig. 2. Ethobotanical data collection from local inhabitants of Pancheri village

Ethnobotanical indices

The data collected through interview of the informants was further analysed for their relative importance using use value (UV) as a quantitative index. The use–value which is a quantitative measure for the relative importance of species known locally was calculated by following formula as per (Phillips *et al.*, 1994),:

$$UV = \Sigma U/n$$

where, U is the number of use- reports cited by each informant for a given species and n refersto the total number of informants. Use values are high when there are many use–reports for a plant, implying that the plant is important and approach zero (0) when there are few reports related to itsuse.

Result and Discussions

The current paper communicates 26 plants species belonging to 23 genera and 18 families used for treatment of diabetes by local inhabitants of Pancheri village of Udhampur district. All these species belonged to angiosperms with 92.3 % age of dicots (24) and only 7.69 % of monocot species (Plate 1). The analysis indicates that trees, herbs, climbers, and shrubs contribute differently to traditional antidiabetic healthcare practices. Trees constituted the dominant life form with maximum number of species (12) contributing 46.1% followed by herbs (10 species) contributing 38.4% while Shrubs and climbers were represented by 2 species each contributing 7.6 % to total plants (Fig. 3). The most dominant family was Moraceae followed by Myrtaceae, fabaceae, Lamicaeae, Meliaceae and Cucurbitaceae (Fig. 4). Leaves were the most frequent plant part used followed by fruit, seed and whole plant (Fig 5.). Six different modes of preparation/administration i.e decoctions (44%), fruit/bulb

juice (20%), leaf extract (16%), dried powder (12%), infusion (4%) and others (4%) were recorded during the study. decoctions (44%) was the most common mode of preparation followed by jucie (20%) and leaf extract and (16%) (Fig. 6) The UV of the recorded medicinal plants varied from 0.1 to 0.8. On the basis of use value, the prominent plants used for treatment of diabetes were *Syzygium cumini* (L.) Skeels (UV=0.81), *Momordica charantia* L. (UV=0.78), *Ajuga integrifolia* Buch.-Ham. (UV=0.75) , *Catharanthus roseus* (L.) G. Don (UV= 0.73) and *Psidium guajava* L. (UV=0.69) as shown in table 1 (Fig. 6.)

Table 1. : Information on anti-diabetic plants and their uses

S. No.	Botanical name	Family	Common Name	Vernacular name (Dogri)	Life Form	Part used	Ethnomedicinal use	UR	UV
1	*Syzygium cumini* (L.) Skeels	Myrtaceae	Black plum tree	Talle	Tree	Seed	Dried seed powder is taken with water.	56	0.81
2	*Momordica charantia* L.	Cucurbitaceae	Bitter gourd	Karela	Climber	Fruit	Fruit juice is taken empty stomach.	54	0.78
3	*Ajuga integrifolia* Buch.-Ham.	Lamiaceae	Bugle weed	Neel Kanthi	Herb	Whole plant	Leaf extract in a glass of water is taken in the morning.	52	0.75
4	*Catharanthus roseus* (L.) G. Don	Apocynaceae	Madagascar periwinkle	Sadabahar	Herb	Leaves	Leaf extract is taken in the morning	51	0.73
5	*Psidium guajava* L.	Myrtaceae	Guava	Amrood	Tree	*Leaves*	Decoction of leaves is taken two or three times a day.	48	0.69
6	*Trigonella foenum-graecum* L.	Fabaceae	Fenugreek	Methi	Herb	Seed	Seeds kept overnight in curd and consumed on an empty stomach are effective in diabetes.	45	0.65
7	*Aloe vera* (L.) Burm. f.	Aloaceae	Barbados Aloe	Kuaargandal	Herb	Leaves	Infusion of whole plant is taken orally.	41	0.54
8	*Melia azedarach* L.	Meliaceae	Chinaberry tree	Daraink	Tree	Leaves	Decoction of leaves mixed with sugar is taken twice a day.	41	0.59
9	*Artemisia maritima* Linn.	Asteraceae	Sea wormwood		Herb	Leaves	Decoction of leaves mixed with jaggaery is taken empty stomach	41	0.59
10	*Punica granatum* L.	Lythraceae	Pomegranate	Darooni	Tree	*Fruit bark*	A spoonful of dried and powdered rind taken with water empty stomach	39	0.39
11	*Mangifera indica* L.	Anacardiaceae	Mango	Amb	Tree	*Leaves*	Aqueous extract of leaves is taken twice a day.	39	0.56
12	*Dalbergia sissoo* DC.	Fabaceae	Indian rosewood	Tali	Tree	Leaves	Aqueous extract of leaves is taken empty stomach in the morning.	33	0.47
13	*Ficus.*	Moraceae	Sacred fig	Bar, Peepal	Tree	Leaves	Decoction of leaves	32	0.46

	religiosa L.					/bark	and bark is taken orally twice a day		
14	*Boerhavia diffusa* L.	Nyctaginaceae	Pig weed	Ittsitt	Herb	Whole plant	Decoction of the whole plant is taken two or three times a day	29	0.42
15	*Ziziphus jujuba* Mill.	Rhamnaceae	Chinese Date	Bair	Shrub	Fruit/ seeds	Dried and powdered seeds taken orally with water check diabetes.	29	0.42
16	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Ivy Gourd	kantoori	Climber	Fruit	Fruit extract/juice is taken orally twice a day	26	0.37
17	*Azadirachta indica* A. Juss.	Meliaceae	Indian lilac	Nimm	Tree	leaves	Decoction of leaves is given against diabetes.	23	0.33
18	*Coriandrum sativum* L.	Apiaceae	Coriander	Dhania	Herb	*Seeds*	Seeds soaked overnight in water and decoction of the same taken empty stomach in the morning	22	0.31
19	*Ficus benghalensis* L.	Moraceae	Banyan tree	Borh	Tree	*Bark*	Decoction of leaves, stem and bark is given against diabetes.	20	0.28
20	*F. palmata* Forssk.	Moraceae	Wild fig	Phagwara	Tree	*Leaves*	Decoction of leaves is given against diabetes.	19	0.27
21	*Ocimum tenuiflorum* L.	Lamiaceae	Holy basil	Tulsi	Herb	Leaves	Decoction of leaves, stem and seeds is given against diabetes.	18	0.26
22	*Aegle marmelos* (L.) Correa	Rutaceae	Stone apple	Bill	Tree	Fruit	Ripened fruit juice mixed in water is taken as cold drink twice a day	18	0.26
23	*Allium cepa* L	Liliaceae	Onion	Ganda, pyaz	Herb	Bulb	A teaspoon full of onion juice is taken empty stomach.	16	0.23
24	*Justicia adhatoda* L.	Acanthaceae	Malabar nut	Brenkad	Shrub	Leaves	Leaves boiled in water and mixed with sugar are taken as hot drink in the morning.	15	0.01
25	*Allium sativum* L.	Liliaceae	Garlic	Thom	Herb	Bulb	Juice of bulb is taken twice a day	14	0.2
26	*Murraya koeingi i*(L.) Spreng.	Rutaceae	Curry Leaf Plant	Kari pata	Small Tree	Leaves	Aqueous extract of leaves is taken empty stomach in the morning.	13	0.18

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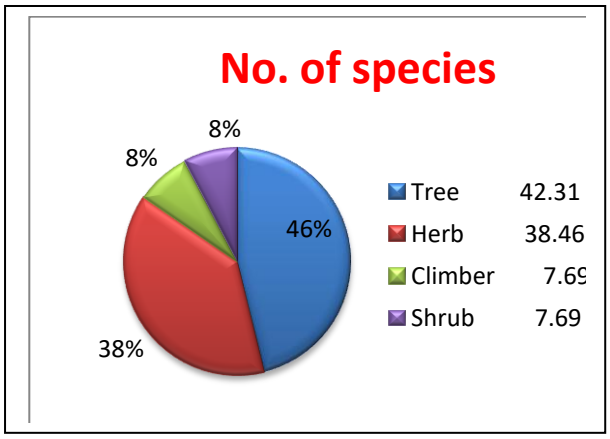

Fig. 3: Life forms of plants

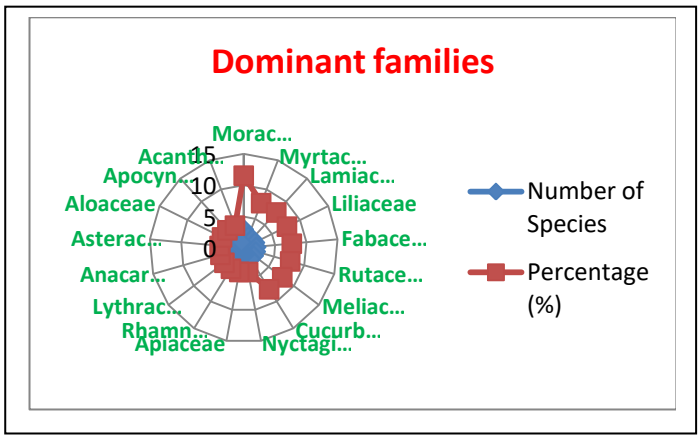

Fig. 4: Dominant families reported from the study area

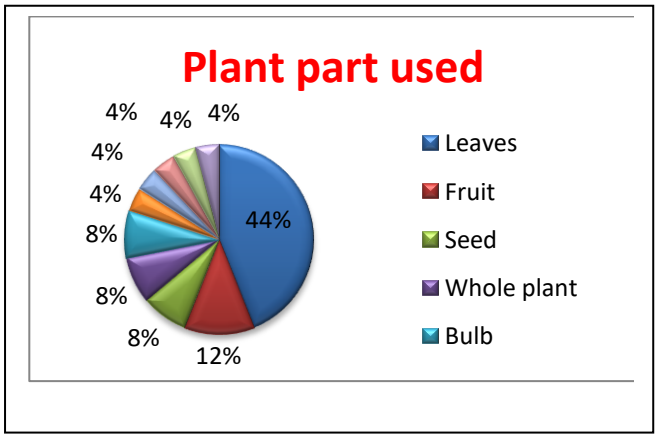

Fig. 5: Plant part used for ethno botanical preparations.

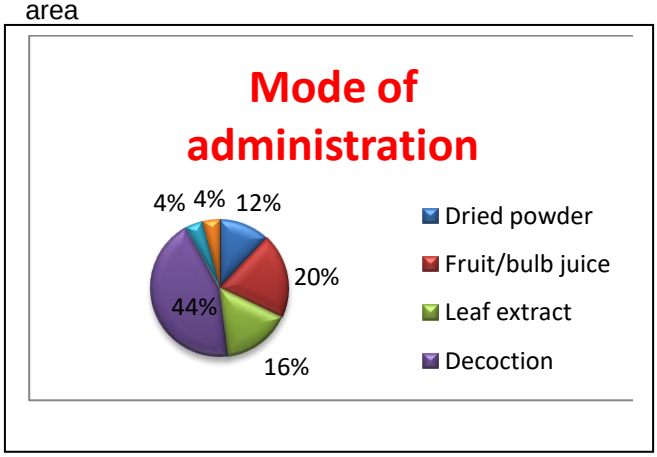

Fig. 6: Common modes of administration

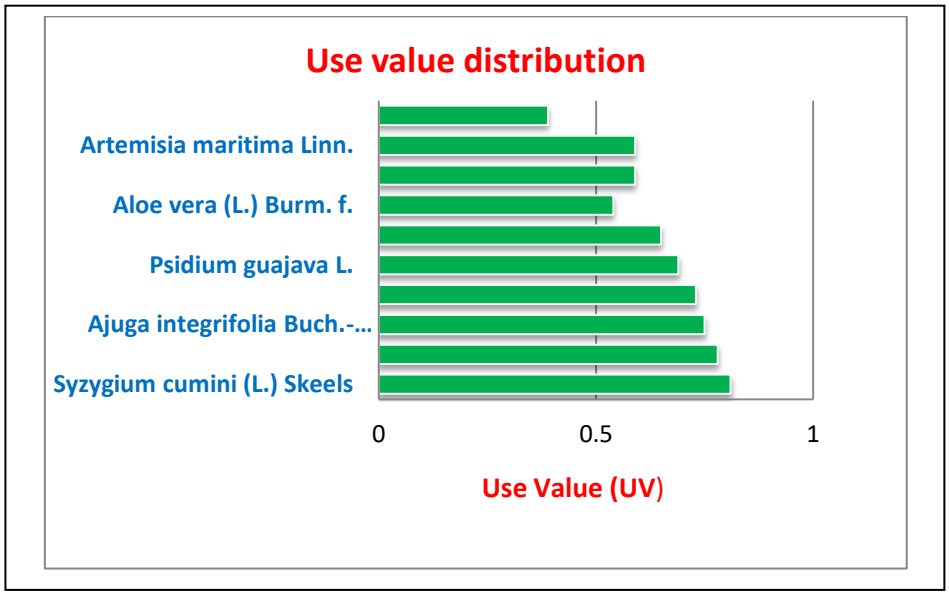

Fig. 7: Top 10 dominant plants with high use value (UV):

Trees and herbs constituted the predominant life forms among plant species used for antidiabetic treatments. Similar observations have been reported in several ethnobotanical surveys focusing on monoherbal formulations, where trees and herbs were identified as the most dominant plant categories (Passalacqua et al., 2007; Kadir et al., 2012). This predominance may be attributed to their widespread availability and easy accessibility in natural habitats. The prevalence of tree species also reflects ecological abundance and supports sustainable harvesting practices, as perennial plants provide a continuous and reliable source of medicinal materials. Leaves were the most commonly utilized plant part, a trend frequently documented in ethnomedicinal studies due to their ease of collection and high content of bioactive secondary metabolites such as flavonoids and alkaloids. Several studies have likewise reported leaves as the primary component in traditional medicinal preparations, owing to their richness in phytochemicals including tannins, glycosides, flavonoids, alkaloids, and saponins (Mrabti et al., 2021). Flavonoids are recognized as important bioactive compounds present in plants, vegetables, and fruits that play a significant role in the treatment and management of diabetes. Certain flavonoids, including quercetin, have been reported to stimulate insulin secretion and act as potent inhibitors of sorbitol accumulation in body tissues (Hii & Howell, 1985). These properties may explain the therapeutic effectiveness of many traditional herbal medicines used in diabetes management.

Furthermore, family-level analysis indicated that antidiabetic plant species were largely concentrated within a limited number of dominant plant families, suggesting possible phylogenetic trends associated with antidiabetic activity. Among the 18 recorded plant families, Moraceae, Myrtaceae, Fabaceae, Lamiaceae, Meliaceae, and Cucurbitaceae were dominant, likely due to the presence of bioactive compounds involved in glycemic regulation and antioxidant activity (Tag et al., 2012). The ethnobotanical survey revealed considerable diversity of antidiabetic plant species, reflecting extensive traditional medicinal knowledge. *Syzygium cumini* and *Momordica charantia* exhibited the highest Use Values (UV), indicating strong informant consensus and frequent therapeutic use, a pattern often associated with pharmacological efficacy in ethnopharmacological studies.

In India, kernels of *Syzygium cumini* are traditionally used as a decoction for diabetes and form an important component of several herbal formulations. Aqueous and alcoholic extracts, as well as lyophilized powder, have shown significant antihyperglycemic activity by reducing blood glucose levels (Sheela and Augusti, 1992; Shafi & Tabassum, 2013). Jamun pulp extract produced rapid hypoglycemic effects in streptozotocin-induced diabetic mice, whereas seed extracts showed delayed action. Oral administration also increased serum insulin levels in diabetic rats (Achrekar et al., 1991; Modak et al., 2007). Moreover, extracts from different plant parts have demonstrated hypoglycemic effects in various experimental models. Similarly, *Momordica charantia* is widely acknowledged for its significant antidiabetic properties. Polypeptide-P, isolated from its fruits, seeds, and plant tissues, has demonstrated pronounced hypoglycemic effects when administered subcutaneously to both langurs and humans (Khanna et al., 1981). Ethanolic extracts of *M. charantia* (200 mg/kg) have shown both antihyperglycemic and hypoglycemic activities in normal and streptozotocin-induced diabetic rats. These effects are thought to be mediated through inhibition of key hepatic enzymes, including glucose-6-phosphatase and fructose-1,6-bisphosphatase, along with enhanced activity of glucose-6-phosphate dehydrogenase in the liver (Shibib et al., 1991; Modak et al., 2007; Rahmatullah et al., 2012; Shafi, S., & Tabassum, N., 2013).

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Plate 1: Some common anti-diabetic plants reported from the study area.

Conclusion

The present ethnobotanical investigation highlights the rich traditional knowledge of antidiabetic medicinal plants practiced by the inhabitants of Pancheri village, Udhampur district. Overall, the study underscores the importance of indigenous knowledge systems as valuable sources for identifying potential antidiabetic agents. It can be concluded that the local people of the study area have very good knowledge on the use of medicinal plants. But such knowledge of medicinal plants is restricted to a few persons in a rural area. Therefore it

is necessary that suitable requirements are needed in order to protect the traditional knowledge in particular area with reference to medicinal plant utilization and it was found that traditional ethno-medicine still persists among locals. Documentation and conservation of these medicinal plants, along with further phytochemical and clinical investigations, are essential for sustainable utilization and for the development of novel plant-based therapeutics for diabetes management.

Declarations

Ethical approval and consent to participate: Since, the present study involves the data collection on antidiabetic plants used by inhabitants of Pancheri Tehsil of district udhampur through standard questionnaires, interviews and formal/informal discussions, no ethical approved required for the study. The participants were thoroughly explained the purpose of study and their consent was taken before collecting information on antidiabetic plants.

Consent for Publication: Not applicable, as no identifying information of participants is included.

Competing interests: The authors have no competing interests to disclose.

Authors' contributions: KK (Kewal Kumar) devised the study, framed its draft, collected the data, and wrote the manuscript. **SK** (Sanjeet Kour) helped to design, draft and edit the manuscript. **YP** (Yash Paul) participated in collection of ethnobotanical informations, compiling and interpretation of data, finalizing the draft and critical revision of the manuscript before approval for final submission.

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