RESEARCH ARTICLE

Enhancing Health Through Telemedicine and Ayurvedic Resources: A Sustainable Model

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Abstract

Increasing awareness of herbal and ayurvedic medicine has been found to pave the way for stable and non-ramification effects on the cure of human and environmental health in the present experiment at remote sites located at higher elevations of 3392 ft. to 5886 ft. above sea level representing the mid-hill zone of Himalayan range. Mid-hill zone typically represents regions in India, Nepal and Bhutan. Out of total 210 people interviewed at three locations viz Chalthi, Narendra Nagar and Pratap Nagar in Tehri Garhwal area of Uttarakhand state, India, 84.8 to 100% people responded, positively about glycyrrhizin (*Glycyrrhiza glabra*), stevioside (*Stevia rubaudiana*), trilobatin (*Symplocos paniculata*), stinging nettle (*Urtica dioica*), finger millet (*Eleusine coracana*) and cynarin along with 16.5% alcohol (*Cynara scolymus*) providing relief from lethal diseases like diabetes, high blood pressure, hepatitis, liver, digestive disorders and cancerous diseases. This approach corroborated with the ubiquitous telemedicine platform for herbal medicine (UTPHM) conceptual method applied in this experiment. Secondly, the general health appearance of Himalayan residents at experimental sites was found to be better than Mana (Chamoli) located at a high elevation of 10,500 ft above sea level (very cold and freezing environment) where all experimental plants, including nonsacchariferous super sweet plants (NSSS plant) failed to survive. This indicates that experimental plants appear to raise O_2 pressure in the environment and NSSS plants provide protection to human beings from the danger of UV rays for maintaining better health at experimental sites. Such integrated techniques have been found to enhance the accessibility, cost-effectiveness, personalized care and reshaping of an ecofriendly environment in harnessing the full potential of the telemedicine approach at remote places on Himalayan hills.

Keywords: Tele-herbal, ICT in herbal care, telemedicine application in herbal care, UTPHM Model.

Highlights

- The development of telemedicine creates a foundation for combining modern medical knowledge with traditional practices, particularly in regions with strong beliefs in traditional medicine, like the Himalayas.
- Telemedicine offers a new and exciting way to work with herbal plants.
- The conservation of existing and extinct herbal and ayurvedic resources and knowledge is aimed at achieving sustainable improvement in human and environmental health.
- Ubiquitous telemedicine for herbal medicine (UTHM) based survey used to identify the uses of medicinal plants like licorice, Lodha, stevia, stinging nettle, artichoke and ragi for treating common diseases

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Introduction

Telemedicine has the potential to transform healthcare accessibility in any corner of the world. In the last few decades, there has been a significant surge of interest and investment in developing herbal medicines as a new and complementary treatment approach aimed at improving patient welfare. (Porro *et al.*, 2024). Telemedicine and digital health tools hold the potential to improve access to high-quality healthcare, facilitate the communication of medical information and support pharmacovigilance processes in remote and underserved areas. (Kamsu-Foguem *et al.*, 2014). The development of mobile telemedicine has established a foundation for a healthcare approach that integrates modern medical knowledge with ancient medical practices, particularly in the remote, difficult and isolated Himalayan region of the Asian subcontinent. (Kapoor *et al.*, 2005, 2007). Access to digital and communication technology, digital devices, or portable media fosters a complementary approach to healthcare where conventional medicine is practiced in an environment with a strong belief in traditional medicine (Taylor-Swanson *et al.*, 2020; Strehle *et al.*, 2006 and Ogirima *et al.*, 2021).

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The application of telemedicine in herbal plants is an innovative approach that can revolutionize how we understand, utilize, and manage these botanical resources. Telemedicine can be applied in the context of herbal plants for remote consultations with herbalists (Taylor-Swanson *et al.*, 2020; Wild folk herb farm website, 2024), identification and diagnosis of diseases (Ogirima *et al.*, 2021) and related education and training. This can advance herbal plant monitoring and management (Ogirima *et al.*, 2021) concerning research and activities for promoting the sustainable use of herbal plants.

Within the framework of information and communication technology (ICT), the Indian home-based care (IHC), integrates conventional medicine with deeply rooted traditional healing beliefs. This is performed with the help of community volunteers with medicinal knowledge who serve as vital links between patients and qualified medical professionals stationed at nearby clinics and hospitals. This paper provides comprehensive views on potential applications of telemedicine combined with the conceptual method of UTPHM (ubiquitous telemedicine platform for herbal medicine) to bridge the gap between modern healthcare practices and traditional healing wisdom and, thereby, enhance healthcare to Indian communities at remote locations of the Himalayan region. Besides this, the conservation of existing and extinct herbal and ayurvedic resources and knowledge is aimed at, so as to achieve sustainable improvement in human and environmental health.

Review of Literature

As early as in 1970, Thomas Bird, an American scientist, coined the term "telemedicine," Latin "Medicus" (healing) and Greek "tele" (distance) mean healing at a distance (Strehle *et al.*, 2006). In 1999-2000, Saroj Kanta Mishra, an endocrine surgeon at the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow and K. Ganapathy, a neurosurgeon at Apollo Hospitals, Chennai, pioneered telemedicine in India. Their work marked the beginning of efforts to use technology for remote healthcare delivery, making specialized medical consultations more accessible to patients in distant and underserved areas. Their initiatives played a key role in establishing telemedicine as a vital part of India's healthcare system, leveraging information and communication technologies to bridge gaps in healthcare access. Telehealthcare for the Kailash Mansarovar pilgrims was implemented in 1999 (Kapoor *et al.*, 2005) and established telemedicine services across the Sub-Himalayan region of the Indian state of Uttaranchal in 2004 (Kapoor *et al.*, 2007).

Himalayan communities effectively utilize local herbs and spices known for their appetite-stimulating and healing properties (Tiwari *et al., 2020)*. One such herb is Finger millet (*Eleusine coracana*), commonly referred to as 'Maduva' or 'Ragi.' This grain is particularly beneficial for managing cold symptoms, coughs and blood pressure. (Kamsu-Foguem *et al.*, 2014; Basar *et al.*, 2015).

Dwivedi, 2022 presented a comprehensive review of the medicinal utilities of non-sacchariferous super sweet plants like artichoke, *Cynara scolymus,* licoris (*Glycyrrhiza glabra)*, lodhra (*Symplocos paniculata)* and stevia (*Stevia rubaudiana)*, which are growing well in valley of Himalayan region. Artichoke has a long history of use in folk medicine for its choleretic effects. More recently, its extract has gained attention for its potential antioxidant properties. These benefits are now being explored in the context of liver health in both traditional and modern medicine. (Ojha *et al.*, 2022; Speroni *et al.*, 2003). Artichoke is a taste modifier, making water and food taste sweet after consumption. Hence, the need to take additional sweet dishes is nullified. Besides this, artichoke offers a range of beneficial effects, including antidiabetic, anti-obesity, anti-hypercholesterolemic, anti-inflammatory, nephroprotective, hepatoprotective, gastrointestinal protective, reproductive and anticancer properties. (Dwivedi, 1999). Research involving artichokes in experimental animals has found no evidence of mortality or significant toxicity. Cynarin combined with 16.5% alcohol in *C. scolymus* has been reported to protect from ultraviolet rays, skin burns, etc., and reduce environmental warming (Dwivedi, 2022). It contains high levels of vitamin B complex, vitamin K, vitamin C, calcium, iron, zinc, potassium and phosphorus. (Porro *et al.*, 2024).

Licorice (*Glycyrrhiza glabra)* is a non sacchariferous supersweet plant and its calorie-free sweet principal glycyrrhizin is 150 times sweeter than sugar. It has been used traditionally in sweetening betel (leaves), tea and beverages for centuries (Dwivedi, 1999 and 2022). Current findings support a range of health benefits associated with artichoke, including its traditional use as an antioxidant. These benefits encompass antioxidant, anticancer, anti-inflammatory and antimicrobial effects as well as positive impacts on the immune system, skin diseases and conditions affecting the lungs, liver and heart. (Sharma *et al.*, 2021; Bahmani *et al.*, 2014). Researchers have evaluated the cytotoxicity of polyphenol molecules extracted from *Glycyrrhiza glabra* in the treatment of breast and prostate cancer (Ahmad *et al.*, 2023), head and neck cancer cell lines and non-malignant primary mucosal cells (Rafi *et al.*, 2002). Additionally, these polyphenols have been tested against various cancer cell lines, including immortal human keratinocytes (HaCaT), lung adenocarcinoma (A549), and liver carcinoma (HepG2) cell lines (Schmidt et al., 2013). Over the years, inflammation has been recognized as a crucial factor in the onset of several human diseases, such as arthritis, inflammatory bowel disease and atherosclerosis. (Rawat *et al.*, 2017). Recently, glycyrrhizin in *Glycyrrhiza glabra* has been reported to be effectively used for treating respiratory tract infections like influenza, virus infection, and coronavirus, including COVID-19 throat infection and cough (Dwivedi, 2022).

Symplocos paniculata is an NSSS plant and has trilobatin as a calorie-free sweetener, 400-1000 times sweeter than sucrose. Trilobatin in *Symplocos paniculata* is used for the treatment of diabetes and blood pressure patients and as an anticancer, anti-snake venom, anti-poison, antitumor, anti-inflammatory, inhibit lipid metabolism, obesity & multiple diseases like gynecological disorders, nephritis (Dwivedi 1999 and 2022). The genus *Symplocos* is widely recognized for its traditional applications in treating numerous ailments such as leprosy, gynecological disorders, ulcers, leucorrhea, menorrhagia, malaria, tumefaction, bacterial infections, diarrhea, dysentery, eye diseases, hemorrhagic gingivitis, nephritis, bowel complaints, enteritis, snake bites and detoxification. Additionally, these plants are particularly known for their anti-HIV, antitumor and phosphodiesterase inhibitory properties. (Xiaomin *et al.*, 2020).

Steviosides in *Stevia rubaudiana* is used as antioxidants for relief of diabetes, high blood pressure, and cardiovascular disease. This is zero-calorie super sweetener monosaccharide, which is 250-350 times sweeter than sugar and is used by diabetes patients and healthy people for sweetening tea and beverages (Dwivedi 1999 and 2022)

Stinging nettle (*Urtica dioica*) leaves have been studied for their pharmacological properties including antibacterial, antioxidant, and immunomodulatory activities. These effects are largely due to the phenolic compounds and flavonoids found in the leaves. Additionally, nettle roots are commonly used to treat benign prostatic hyperplasia, attributed to their rich lignan content. Beyond its use in pharmaceuticals, stinging nettle extracts are also applied in the cosmeceutical and food industries (Kusuma *et al.*, 2018). Nettle leaf extract derived from an herbal plant is used to treat conditions such as arthritis, certain allergies, and minor uterine hemorrhage (Grauso *et al.*, 2020). An isopropanol extract from nettle leaves was found to reduce primary T-cell responses, suggesting it may have an immunomodulatory effect in T-cell-mediated diseases like rheumatoid arthritis. (Broer and Behnke, 2002; Goswami *et al.*, 2022).

Material and Methods

Experiments were conducted at 03 remote locations viz Chalthi in Champawat (elevation: 4672 ft above sea level), Narendra Nagar (elevation: 3392 ft above sea level) and Pratap Nagar (elevation: 5886 ft above sea level) in Tehri Garhwal in state of Uttarakhand, India (Fig. 1) on Himalayan range where licorice (*G. glabra*), lodhra (*Symplocos paniculata*), stevia (*Stevia rebaudiana*), Stinging nettle (*Urtica dioica*), artichoke (*Cynara scolymus*) & ragi (*Eleusine coracana*) grow well and used for medicinal purposes. A screenshot of the geotagged images of experimental plants is presented in Fig. 2. Seventy persons at each location were interacted and discussed on indigenous knowledge of the medicinal plants. Most of the respondents were 20 to 65 years of age. A large number of 59 to 63% of respondents were educated, remaining 37 to 41% were illiterate and keen to provide information and transfer indigenous knowledge from one generation to another. The telemedicine physical interview was conducted with villagers with a video to know the valuable knowledge they possess about medicinal plants and their efficacy in treating a variety of common ailments. Twenty diseases investigated included abdominal pain, asthma, cough, eczema, cold, flu, influenza, osteoporosis, diarrhea, dysentery, bronchitis, digestive disorders, ear infections, cancerous diseases and eye diseases, as detailed in Table 1. The documentation involved the analysis of the medicinal plants, which have been derived from interviews and informal discussions with a total of 210 Himalayan residents and presented in Table 2. Detailed statistical analysis is presented in Table 3.

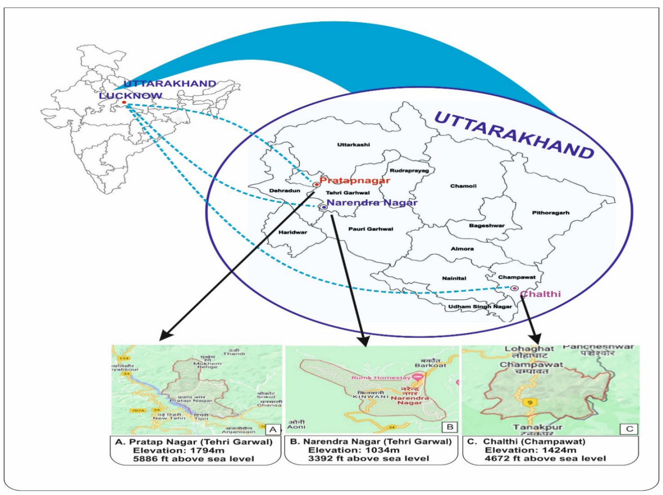

Fig. 1: Map of Uttarakhand showing location of (a) Pratap Nagar (Tehri Garhwal) (b) Narendra Nagar (Tehri Garhwal) and (c) Chalthi (Champawat) where 210 inhabitants connected using UTPHM

(a) (b)

Fig. 2: Screenshot of the images few surveyed experimental plants captured from the Himalayan region of Uttarakhand (a. Stinging nettle (*U. dioica*), b) artichoke (*C. scolymus*))

Table 1: List of common health Ailments discussed with the community living in the Himalayan region of Uttarakhand

1	*Gastric ulcers*	*11*	*Urinary tract infections (UTIs), gynecological disorders*
2	Respiratory track, throat and cough	12	Liver disorders
3	Eczema	13	Digestive disorders
4	Viral infections, influenza	14	Cardiovascular diseases
5	Hepatitis	15	Anemia
6	Diabetes	16	Skin burn
7	Metabolism and obesity	17	Leprosy
8	Blood pressure, hypertension	18	Anticancer & anti-inflammatory
9	Allergies	19	Anti-venomic and antitumor
10	Arthritis and osteoporosis	20	Antioxidant

Table 2: Awareness and response of 210 Himalayan inhabitants at remote places viz Chalthi, Narendra Nagar and Pratap Nagar on Himalayan Hills in respect of plants and their effect on curing and improving diseases

Plant Name	*Diseases cured/ improved*	*Awareness (in number) out of 210 inhabitants interviewed*	
		Yes (Average)	Don't Know (Average)
G. glabra (Licorice)	Gastric ulcers, coughs, viral infections, hepatitis, diabetes and cancerous diseases	195 (92.9%)	15 (7.1%)
S. rebaudiana (Stevia)	Diabetes, obesity, hypertension	178 (84.8%)	32 (15.2%)
Symplocos *paniculata* (Lodhra) Saphire Berry	Diabetes, obesity	201 (95.7%)	9 (4.3%)
U. dioica (Stinging Nettle)	Arthritis, muscle aches, eczema, allergies, urinary tract infections (utis)	210 (100%)	0 (0%)
C. scolymus (Artichoke)	Liver, diabetes and digestive disorders	198 (94.3%)	12 (5.71%)
Ragi (Eleusine coracana)	Anemia, osteoporosis, digestive issues	210 (100%)	0 (0%)

Table 3: t-test calculation on "Yes" and "Don't know" group awareness and response of 210 Himalayan inhabitants in respect of plants and their effect on curing and improving diseases

Group	*Mean ($\bar{x}$)*	*Variance (s2)*	*Standard Deviation (ss)*	*Degree of Freedom (df)*	*t-test statistic*	*Critical value (a=1%)*	*p-value*
"Yes"	198.67	348.27	18.65	10	19.66	2.571	<0.001
"Don't know"	11.33	208.27	14.42				

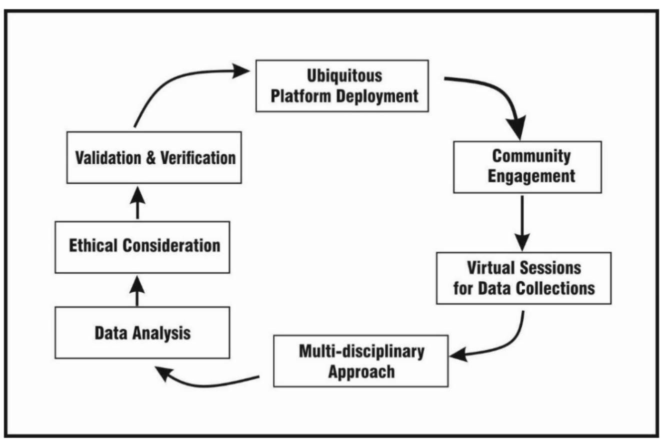

Fig. 3: Ubiquitous telemedicine platform specifically tailored for herbal medicine

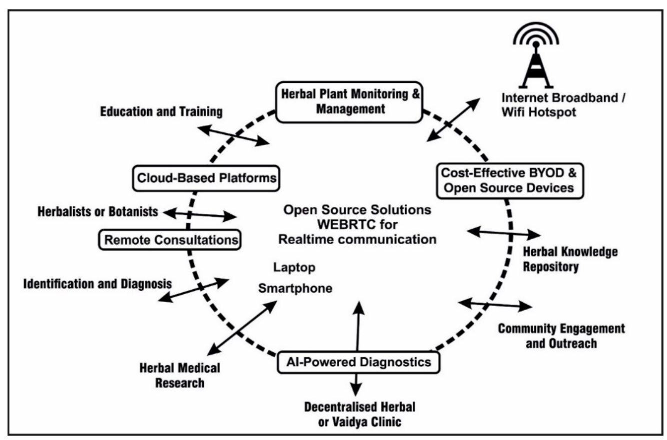

Fig. 4: The conceptual diagram for the operational, functional components and the flow of activities for an economically efficient UTPHM

In the current era, lot of information is available on the internet and using satellites, different types of images of any location and commodities are taken, which is not possible through physical mode. Vaidya clinic, herbal medical center, botanists, herbalists' different websites, and internet smartphones are also available in hill areas to provide some medical information. Considering these facilities and medicine as community ethical concerns, the following process described below and illustrated in Figs 3 and 4 was attempted to facilitate Ayurvedic medicine without much effort. This technique, named Ubiquitous Telemedicine Platform for Herbal Medicine (UTPHM) and its reliability of recommendation was validated by a telemedicine physical survey approach. A comprehensive summary of the results of both techniques and scientists supporting this result is presented in Table 4.

Ubiquitous platform specifically tailored for herbal medicine has the following seven steps and the same are also illustrated in Figs 3 and 4.

Platform deployment

The telemedicine platform is deployed across the Himalayan region, ensuring accessibility to remote communities and healthcare practitioners.

Table 4: Comprehensive summary of the information about plants with its general properties, chemical constituents, and their use for common disease treatment recorded through telemedicine surveyed UTPHM and references in agreement with obtained results.

Plant Name	*Chemical Compound*	*General Properties*	*Common Diseases Treatment*	*Plant Part Used*	*References in agreement with the present work*
G. glabra (Licorice) Mulethi	Glycyrrhizin calorie-free super sweetener, 150 times to sugar	Intense sweet taste used for chewing in throat cough, In Asian countries used as a sweetener with Beetle leaves, and calorie-free tea for all including diabetic patients.	Gastric ulcers, coughs, viral infections, hepatitis, prostate cancer, diabetes	Roots (Rhizomes)	Rafi *et al.,* 2002; Schmidt *et al.,* 2013; Kamsu-Foguem *et al.,* 2014; Basar *et al.,* 2015; Dwivedi, 2022; Ahmad *et al.,* 2023
S. rebaudiana (Stevia)	Stevioside super sweetener, 250-350 times to sugar	Intense sweetness, natural sweetener, calorie-free for all including diabetic patients.	Diabetes, obesity, hypertension	Leaves	Dwivedi, 2022; Porro *et al.,* 2024
Symplocos paniculata (Saphire Berry) Lodhra	Trilobatin is a calorie-free super sweetener, 400-1000 times to sugar	Natural sweetener, found in bark, potential applications in the food industry, calorie-free sweet tea for all including diabetic patients.	leprosy, ulcers, malaria, dysentery, eye diseases, gynecological disorders, snake bites, hemorrhagic gingivitis, bacterial diarrhea, bowel complaints, diabetes, obesity	Bark	Xiaomin *et al.,* 2020; Dwivedi, 2022; Porro *et al.,* 2024
U. dioica (Stinging Nettle) Bichhu Booti Bichhu Ghas	Various compounds like Formic acid, histamine, serotonin	On touching the plant it stings like a Scorpion, contains flavonoids, phenolic acids, sterols; anti-inflammatory, diuretic	Arthritis, muscle aches, eczema, Allergies, urinary tract infections (UTIs)	Leaves, Roots & Stem	Broer and Behnke, 2002; Bahmani *et al.,* 2014; Kusuma *et al.,* 2018; Grauso *et al.,* 2020; Sharma *et al.,* 2021; Goswami *et al.,* 2022
C. scolymus (Artichoke) Hathi Choke	Cynarin, a taste modifier, causes water and food to taste sweet.	Tasteless flower, sweet taste on consuming with water and food, no need of eating sweetener to all including diabetic patients, hepatoprotective, stimulates bile production, aids in digestion.	Liver disorders, digestive disorders, diabetes	Flower head	Speroni *et al.,* 2003; Ojha *et al.,* 2022; Dwivedi, 2022
Ragi (*E. coracana*) Manduwa	Iron, calcium, dietary fiber	Ragi bread tastes sweet. Raw seeds can be consumed after soaking in water or after germination, Bread of ragi is reddish brown in color and rich in nutrients as well as gluten-free nutrient	Anemia, osteoporosis, digestive issues	Grain (seeds), flour	Schmidt *et al.*, 2013; Kamsu-Foguem *et al.*, 2014; Basar *et al.*, 2015

Community engagement

Local communities engaged through collaborative partnerships, respecting cultural protocols and ethical considerations. Community leaders and elders facilitated the dissemination of traditional knowledge and participation in data collection efforts.

Data collection sessions

Virtual sessions are organized via the telemedicine platform, incorporating a variety of formats such as interviews, focus group discussions, and interactive workshops. These sessions provided a platform for knowledge sharing, documentation, and validation of traditional practices.

Multidisciplinary approach

Experts from diverse fields, including traditional healers, healthcare professionals, ethnobotanists, and cultural anthropologists, were involved in data collection, ensuring a comprehensive understanding of traditional knowledge within its cultural, ecological, and social context.

Data analysis

Collected data underwent rigorous analysis, employing qualitative research methodologies such as thematic analysis, content analysis, and grounded theory (Glaser and Strauss (1967); Corbin and Strauss (1990)). Patterns, themes, and insights are extracted to elucidate the richness and depth of traditional knowledge.

Ethical considerations

Ethical guidelines and principles such as informed consent, confidentiality and respect for cultural autonomy were strictly followed throughout the data collection process.

Validation and verification

Findings are validated and verified through community feedback sessions and peer review processes, ensuring accuracy, relevance and cultural authenticity.

Tele-sessions of a maximum 10 to 25 minutes in live interactive mode were connected to remote hilly villages over cloud-hosted video platforms like Whatsapp™, GoToMeeting™, and Zoom™. Flexibility in adopting ICT technology available in mobile makes persons accept live interaction for case studies and answered queries. Geotagged images in Fig. 2 were taken from the villages having details like location, longitudes, latitudes, etc., and shared using Whatsapp™ and electronic mail.

To understand and prove the effect of experimental plants on the environment, plants and human health at experimental sites, the general physical health of Himalayan residents located at Pratap Nagar in Tehri Garhwal district (5586 ft. above sea level) and Mana village in Chamoli district (10500 ft. above sea level) where plant of present experiment does not survive.

As early as in 1970, Thomas Bird, an American scientist coined the term "telemedicine" Latin "medicus" (healing) and Greek "tele" (distance) means healing at distance (Strehle *et al*., 2006). In 1999-2000, Dr. S. K. Mishra, an endocrine surgeon at the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow and Dr. K. Ganapathy, a neurosurgeon at Apollo Hospitals, Chennai, pioneered telemedicine in India. Their work was pivotal in establishing telemedicine as a crucial part of India's healthcare system, bridging significant access gaps. Telehealthcare for the Kailash Mansorovar pilgrims was implemented in 1999 (Kapoor *et al*., 2005) and established telemedicine services across the Sub-Himalayan region of the Indian state of Uttaranchal in 2004 (Kapoor *et al*., 2007).

Himalayan communities utilize local herbs and spices known for their appetite-stimulating and healing properties (Tiwari *et al*., 2020). Finger millet, or 'Maduva'/'Ragi' (Eleusine *coracana*), aids in managing cold symptoms, coughs and blood pressure (Kamsu-Foguem *et al*., 2014; Basar *et al*., 2015). Dwivedi (2022) reviewed non-sacchariferous sweet plants like artichoke (Cynara *scolymus*), licorice (Glycyrrhiza *glabra*), lodhra (Symplocos *paniculata*) and stevia (Stevia *rubaudiana*), which thrive in the Himalayan valleys. Artichoke with a history in folk medicine for liver health, is now recognized for antioxidant, anti-diabetic, anti-inflammatory, nephroprotective and anticancer properties.

Licorice (Glycyrrhiza glabra) a calorie-free super-sweet plant contains glycyrrhizin, a compound 150 times sweeter than sugar is traditionally used to sweeten betel leaves, tea and beverages (Dwivedi, 1999; 2022). Licorice offers numerous health benefits including antioxidant, anti-cancer, anti-inflammatory and antimicrobial effects benefiting the immune system, skin, lungs, liver, heart (Sharma *et al*., 2021; Bahmani *et al*., 2014) and is also effective against respiratory infections, including influenza and COVID-19-related throat infections and cough (Dwivedi, 2022). Studies show that its polyphenols have cytotoxic effects on cancer cell lines such as breast, prostate and lung (Ahmad *et al*., 2023).

Symplocos *paniculata*, a NSSS plant, contains trilobatin, a calorie-free sweetener 400-1000 times sweeter than sucrose. Trilobatin aids in managing diabetes, blood pressure, cancer, obesity and various ailments like gynecological disorders and nephritis (Dwivedi, 1999; 2022). Traditionally, Symplocos treats leprosy, ulcers, malaria, bacterial infections, diarrhea, eye diseases, snakebites, and more, with noted anti-HIV, anti-tumor and phosphodiesterase-inhibitory effects (Xiaomin *et al*., 2020).

Steviosides in Stevia *rubaudiana,* a zero-calorie sweetener 250-350 times sweeter than sugar used as antioxidants to help manage diabetes, high blood pressure and cardiovascular disease. (Dwivedi, 1999 and 2022).

Stinging nettle (Urtica *dioica*) leaves possess significant pharmacological properties, including antibacterial, antioxidant and immunomodulatory effects, primarily due to phenolic compounds and flavonoids. The roots are used to treat benign prostatic hyperplasia, attributed to their lignan content. Beyond pharmaceuticals, nettle extracts are utilized in the cosmeceutical and food industries (Kusuma *et al*., 2018). Nettle leaf extract is commonly used to treat conditions like arthritis, allergies and minor uterine hemorrhage (Grauso *et al*., 2020). An isopropanol extract from nettle leaves has shown potential immunomodulatory effects, particularly in T-cell-mediated diseases like rheumatoid arthritis (Broer and Behnke, 2002; Goswami *et al*., 2022).

Conclusion

The traditional method of telemedicine survey validated the reliability of results obtained through the UTPHM modular method. The data collection process facilitated a nuanced understanding of traditional medicinal knowledge in the Himalayan region. This collaborative approach might not only help in preserving and documenting Indigenous practices, knowledge, and near-to-extinct medicinal plants but also promote cultural resilience, community ethical concern, and empowerment about healthcare interventions.

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Author Contribution

Repu Dhaman Chand, Ranjana Rajnish, Hem Chandra and Ram Snehi Dwivedi designed and supervised the experiments and fieldwork. Repu Dhaman Chand & Ram Snehi Dwivedi analyzed the results and drafted the manuscript. Rana Pratap Singh elaborated on environmental impact.

Conflict of Interest

None

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