Original Article

A Study on Indigenous Plants as Source of Anticancer Agents: An Ethnomedicinal Approach

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ABSTRACT

Traditional medicine plays an important role in health care provision in the developing countries. In India, there is no documented information of ethnomedicinal knowledge regarding anticancer properties of indigenous plants. Yet, some traditional healers of eastern U.P. claim that they have been treating cancer like symptoms using herbal remedies. The aim of the present investigation was to document the indigenous medicinal plants traditionally used to treat cancer like symptoms in thirteen districts of Uttar Pradesh (U.P.), India. Traditional healers of six tribal communities inhabited in thirteen districts were interviewed using questionnaires and field visits were also carried out to collect claimed plants for identification purpose during the month of April 2019 to March 2020. In the present study, total 31 plant species belonging to 24 families were used by the tribal communities to treat seven types of cancers. Leaves were the most important part to be used in the treatment of cancers. The information suggests that tribal traditions may have much to contribute to the therapeutic armamentarium. Therefore, authors wish to propose the urgent need of conservation and management of the traditional knowledge of indigenous medicinal plants as potential anticancer agents of future.

Key words: Anticancer agents, Ethnomedicine, Ayurveda, Cancer therapy, Herbal remedies, Indigenous plants.

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INTRODUCTION

Since human civilization, resources particularly the bio-resources have been utilized by diverse human communities. Living close to nature they have acquired unique knowledge about the ambient biodiversity by instinct, trial or error and experimentation and used a variety of plants and animals to meet his essential requirements like food, medicine, fuel, fiber, etc.[1,2] Therapeutic use of animals and their products as traditional medicines has been common since time immemorial by the people all over the world and the people of India too.[3-5] The tribal medicine of India, particularly, the local health traditions and the written traditions such as Ayurveda, Siddha, Unani and Amchi utilizes a large number of medicinal plants and animals products in the preparation of curative, protective and preventive medicines.[6-9] Ethnobotany, a modern branch of plant science, is very old in concept but is new in its execution. Ethnobotany study highlights how the plants found in tribal areas and their communities could be conserved and utilized for the betterment of tribal races who exploit nature for their survival.[10,11] The focus of ethnobotany is on how plants are used or, managed and perceived in human societies and includes plant products used for food, medicine, divination, cosmetics, dyeing, textiles, shelter, tools, currency, clothing, rituals, social life and music etc.[12,13] Ethnobotany is a multidisciplinary science defined as the interaction between plants and people.[14] The relationship between plants with human cultures is not limited to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation and health care.[15,16]

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Due to the vast progress and researches in allopathic drugs there has been a great set-back for the traditional drugs all over the world and in India also.[17,18] If one looks into the olden days, one can find the frequent use of such traditional drugs by our ancestors to cure the various human ailments. World Health Organization has reported that about 80 percent of the world's populations rely primarily in folk medicine derived from plant and animal origin for immediate cure against illness.[19,20] By the end of the 20th century, the life of the traditional communities was disturbed and disrupted and that led to the decline and destabilization of these people, causing imminent danger of extinction of their culture and precious knowledge about most of the wild plants and animals which their forefathers had.[21,22] But some of the ethnomedicine practices are still prevalent among many ancient populations even though there is well developed modern medical system in the country. Need for systematic documentation of such ethnomedicinal practices has been emphasized by Lohani *et al.*[23] Thus an extensive and illustrative report on ethnomedicinal knowledge is essential since no good documentation has been compiled till date.

Cancer is one of the leading causes of morbidity and mortality globally among the non-communicable diseases.[7,8] It is the second most fatal diseases after cardiovascular diseases and in the present decade, every year millions of people die because of various types of cancers.[24-27] Cancer is a complex disease that is very heterogenic and variable at cellular level and also differs from one patient to the other in its behavior, development, and outcome.[8,28,29] It starts with the deformation of a natural cell caused by genetic mutations in DNA. This abnormal cell reproduces in an abnormal way by asexual reproduction *i.e.* it ignores signals related to regulation of cell's growth around it and obtains invasion characteristics and causes changes in surrounded tissues.[7,30,31] The successful cancer therapy till now has been under research, only surgery; radiation and chemotherapy therapy treatments are at times successful. Chemotherapy can be done before surgery to shrink the tumor or after surgery to kill the remaining cancer cells.[7,8] However, most of the chemotherapeutic drugs lack specificity and tend to rapidly damage normal dividing tissues, causing side effects such as immunosuppression, neurotoxicity, and hair loss.[32]

Alternative and less toxic medication is very much in need towards the disease. With due attention to rapid progress in the study of indigenous plants chemical, traditional medicine with knowledge of Ayurveda could present better drug leads towards the inhibitory treatment of cancer.[33] Many secondary plant metabolites like polyphenols, terpenes and alkaloids possess antimutagenic and anticancer properties with high activity and low toxicity for cancer therapy without showing any toxic effects on the body of treated individuals.[17,18,34] *Vinca rosea* alkaloids, Vinblastine and Vincristine, are one of the most potent anticancer drugs known. Taxol isolated from *Taxus brevifolia* has figured high in the therapeutic segment of cancer. *Cannabis sativa* was used in cancer therapy for its analgesic, antinausea and antiemetic properties.[35] These less expensive herbal drugs may be beneficial for the rural and poor people to treat effectively the various types of cancers.[20,22] Thus treatment of cancer by use of natural products and traditional medicine by applying the concepts of Ayurveda is attaining a great significance scope of cancer research. So, by keeping in view the importance of phytotherapies for cancer treatment, survey of tribal belts of Eastern Uttar Pradesh was conducted with the aims to unveil the valuable indigenous plants used as anticancer agents of this area, and unexplored in this regard. This work is also an attempt to record traditional folk knowledge regarding plants used as medicine against different types of cancer. The authors hope that this information will provide the baseline data for phytochemists, pharmacologists and will be helpful in biodiversity conservation and also provide a clue to investigate bio-active compound in these plants raw materials.

MATERIALS AND METHODS

An extensive survey was conducted during the month of April 2019 to March 2020 in Tribal belts of Eastern Uttar Pradesh covering number of villages of Gonda, Balrampur, Shravasti, Bahraich, Lakhimpur, Siddhartgnagar, Azamgarh, Jaunpur, Mirzapur, Sonbhadra, Gorakhpur, Basti and Deoria districts to collect the ethnomedicinal information. Information of aboriginals was collected from District Officers and Block Development Officers regarding their location, population and social structure.

The ethnomedicinal information and associated folk claims were collected either by personal contact and interview with the local inhabitants of various tribal communities (Tharu, Nat, Mushar, Gond, Oraon and Buksa) of the area and had traditional knowledge, the ethno-medicinal information about several plants was recorded. Interviews were arranged through the help of senior persons of the communities. In each and every district, the different tribes were interviewed from as many localities as possible to obtained accurate and elaborate information regarding the drugs derived

from various species of plants, mode of their application and therapeutic used in cancer disease. Field visits were also carried out to collect claimed plants for identification purpose. Whenever language difficulty arose, the services of interpreters were utilized.

The inhabitants includes traditional medical local healers, village headmen, elder person (>35 and 75+) that mostly relies on local markets and forest products, and people who were willing to share their traditional knowledge, acquired by virtue of ancestral knowledge or past experiences all of which permanently resides in these study areas. A detailed list of tree species, their vernacular names, their family, parts used, illness/diseases associated, composition and dosage were also recorded. During the survey, photographs and recorded specimens were collected to ensure correct and proper identification of species. Identifications of correct scientific names were determined with the help of existing standard literature.

RESULTS

The 50-65 years old male and females of various tribal communities (Tharu, Nat, Mushar, Gond, Oraon and Buksa) were interviewed and the information regarding indigenous medicinal plants used against different types of cancer. The different plants and their parts used by tribal people to make their medicinal products for treating the cancer patient are presented in the Table 1.

Table 1: List of medicinal plants traditionally used by tribal population of Eastern Uttar Pradesh in cancer therapy.

S.No.	Botanical name (Common name) Family	Parts used	Mode of application and administration	Types of Cancer treated	Citation
1.	*Asparagus officinalis* (Satawar) Asparagaceae	Bark, Roots	Bark and root are crushed and the sap is applied on the affected area.	Skin, Prostate cancer	[35]
		Leaves	Leaves cooked with little oil and without spice and consumed daily.		
2.	*Achyranthes aspera* (Lahchichra) Amaranthaceae	Leaves	Dried powder of leaves mixed in animal fat and applied on the affected area.	Skin cancer	[36]
3.	*Artemisia vulgaris* (Mugwort) Asteraceae	Leaves	Powder of dry leaves taken orally with hot water.	Breast cancer	[37]
4.	*Albizia lebeck* (Siris) Fabaceae	Leaves	Crushed leaves dipped in cold water for two days than take orally.	Breast, Liver, Skin cancer	[37]
5.	*Cannabis indica* (Bhanj) Cannabaceae	Whole Plants	Boiled with salt and taken orally like soup.	All cancers	[35]
6.	*Calotropis procera* (Madar) Asclepiadaceae	Roots	Fresh root are crushed and the sap is applied on the affected area.	Breast cancer	[36]
7.	*Crotalaria juncea* (Barseen) Fabaceae	Seeds	Powder of dry seeds mixed with honey and applied on affected area.	Skin cancer	[36]
8.	*Cyphostemma scrpens* (Jungli Kajorni) Vitaceae	Roots	Dry powders with honey are pasted.	Skin cancer	[36]
9.	*Centella asiatica* (Brahami) Apiaceae	Leaves	Leaves are crushed and take orally in the form of soup.	Throat cancer	[38]
10.	*Croton bonplandinum* (Ban Tulsi) Euphorbiaceae	Leaves, Stems	Sap of fresh leaves and stems are applied on the affected area.	Breast, Skin cancer	[38]
11.	*Carissa carandas* (Karunda) Apocynaceae	Leaves,	Leaves are crushed and take orally in the form of soup before meal and also applied on the affected area.	Skin cancer	[39]
12.	*Clematis simensis* (Traveller's Joy) Ranunculaceae	Leaves	Sap of fresh leaves applied on the affected area.	Breast, cancer	[40]
13.	*Duranta erecta* (Dhatura) Verbenaceae	Leaves, Fruits	Leaves and fruits boiled with salt and taken orally like soup.	All cancers	[35]
		Bark, Roots	Dry powder of bark and root taken orally.		

Continued...

Table 1: Cont'd.

S.No.	Botanical name (Common name) Family	Parts used	Mode of application and administration	Types of Cancer treated	Citation
14.	*Heteromorpha trifoliate* (Van Dhania) Apiaceae	Leaves, Bark, Roots,	Leaves, bark and root are crushed and the sap is applied on the affected area.	Skin cancer	[35]
			Dry powder of bark and root taken orally.	Blood cancer	
15.	*Hibiscus rosa-sinensis* (Gudhal) Malvaceae	Leaves, Flower	Fresh leaves and roots are crushed and take orally with water	Blood, prostate cancer	[35]
16.	*Justicia sativa* (Kitkit) Acanthaceae	Root	Fresh root are crushed and boiled and take orally before meal.	Lung cancer	[36]
17.	*Kigelia africans* (Balam Khira) Bignonlaceae	Fruit, Seeds	Dry powder of fruit and seed with honey taken orally, twice daily.	Blood cancer	[35]
		Bark, Root	Bark and root are crushed and the sap is applied on the affected area.	Skin cancer	
18.	*Lantana indica* (Panch Phulee) Verbenaceae	Leaves	Sap of fresh leaves drunk with water.	Breast, Skin cancer	[35]
19.	*Lippia nodiflora* (Lippa) Verbenaceae	Leaves	Fresh leaves are crushed and take orally with cold water.	Skin cancer	[37]
20.	*Moringa oleifrea* (Sahjan) Moringaceae	Leaves, Roots, Seeds	Boiled with salt and taken orally like soup.	All cancers	[41]
21.	*Oxalis articulate* (Tinputia) Oxalidaceae	Leaves, Roots	Leaves are crushed and applied on the affected area.	Breast cancer	[42]
22.	*Prunus persica* (Peach) Rosaceae	Seed, Stem, Bark	Seed, bark and stem are crushed and the paste is applied on the affected area.	Skin cancer	[43]
23.	*Pseudolachnostylis maprouneifolia* (Kudu Berry) Phyllanthaceae	Leaves	Leaves are crushed and the sap is applied on the affected area.	Skin, cancer	[44]
24.	*Rumex patientia* (Curley Dock / Yellow Dock) Polygonaceae	Roots	Powder of dry root is taken orally with water.	Skin, cancer	[39]
25.	*Solanum incanum* (Bhat Katia) Solanaceae	Fruits	Fresh fruits are taken orally.	Skin, Breast, Blood cancers	[35]
		Roots, Seeds	Dry powder of root and seed taken orally.		
26.	*Syzygium cumini* (Jamun) Myrtaceae	Leaves, Roots	Powder of dry leaves and roots take orally with water.	Skin, Liver cancer	[37]
27.	*Salvia parviflora* (Gutvan) Lamiaceae	Whole Plant	Powder of dry plant parts mixed with honey and applied on affected area.	Breast cancer	[45]
28.	*Sida acuminata* (Wire Weed) Malvaceae	Leaves, Roots	Fresh leaves and roots are crushed and take orally with water.	Breast cancer	[46]
29.	*Steganotaenia araliacea* (A small flowering tree) Apiaceae	Young Leaves	Fresh leaves are consumed orally.	All cancers	[47]
		Bark	Dry powder of bark taken.		
30.	*Vernonia amygdalina* (Bitter leaf /Iron weed) Asteraceae	Leaves	Sap of fresh leaves applied on the affected area.	Skin cancer	[48]
31.	*Ximenia* (Hog Plum) Ximrniaceae	Fruits, Roots, Seeds	Crushed the fruits, roots and seeds than boiled with salt and taken orally in the form of soup.	All cancers	[35]

DISCUSSION

Majority of the respondents gained their knowledge from family members. Most of the interviewed were uneducated or educated at primary level, so they usually used their intuition and relied on the chronicity, ulcerative wound and lumpy growth of external mass, as a means to diagnose cancer. However, there were instances where some of the healers claimed to have treated patient already diagnosed with cancer. Out of different types of cancer, seven specific cancer type (skin, breast, blood, throat, prostate, liver and lung) claimed to be treated by respondents. Table shows total 31 plant species belonging to 24 families that were used by the various tribal communities in this survey to treat different types of cancer.[10-12,14] Eighteen plant species were used to treat skin cancer, ten plant species

were used for cancer of breast, four were used to treat blood cancer, two were used to treat prostate cancer and single plant species was used to treat throat and lung cancers. Out of 31, plant species, 5 species were used to treat all types of cancer. The result of the survey indicated that most of the shrubs and herbs have anticancer properties. The study also showed that although leaves, bark, fruits, stems, root and seeds were used to treat the cancer but leaves was the most commonly used plant parts followed by root, bark, fruit, seed and stem [10-12/. Most of the reported remedies prepared from these plants parts, were either applied externally in the form of past or taken orally as soup or with drinking water.[18,22,33]

Ethnobotanical studies conducted in different countries of the world, could be attributed that many traditional healers have attitude to guard their indigenous ethnomedicinal knowledge as a community secret and they do not want to share with interviewer easily so getting information from these traditional healer was a very hard task. Nonetheless, some understood the importance of the study and volunteered their knowledge on the subject matter. The list of thirty cited plants obtained and their traditional uses can be compared with other studies. The bioactive constituents present in most of the plants parts include iridoids, naphthoquinones, flavonoids, terpenes and pheneylethanoglycosides.[35] The high polyphenol content in dried leaf extract of *Hibiscus sabdariffa* L. have been linked to its activity against blood and prostate cancer.[35] *Hibiscus* sp. and *Pseudolachnostylis* sp. have been reported for their use as cytotoxic agents where as *Solanum incanum* possesses anticancer, antinociceptive, antipyretic and antimicrobial activities.[35,44] The low cost and almost no side effects of the ethnobotanical preparations made them adaptable for use by the local communities particularly curing various types of cancer.

CONCLUSION

The present study showed that traditional healers in different districts of Eastern Uttar Pradesh use different medicinal plants to treat cancer like symptoms. The tribal communities of different area used different plants for the treatment of the same type of cancer. However, in some cases; similar plant was used by healers of different area as well as different tribal communities. Cancers of the skin, breast and blood were the most commonly treated cancers by local healers. Leaves were the most important part to be used in the treatment of cancers. Oral administration was the most common rout of administration by the practitioners. Hence, based on these finding, there is urgent need to evaluating the *in vitro* antiproliferative activities of cited indigenous plant species. Due to rapid disappearance of the traditional knowledge of indigenous medicinal plants there an urgent need for new anticancer agents.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest among themselves or with any other individual, organization etc. throughout entire duration of this study.

ABBREVIATIONS

DNA: Deoxyribo Nucleic Acid; **WHO:** World Health Organization.

SUMMARY

The current investigation showed that conventional healers in various locale of Eastern Uttar Pradesh utilize distinctive therapeutic plants to deal with malignant growth like indications. Leaves were the main part to be utilized in the therapy of malignancies. Oral application was the most widely recognized defeat of organization by the professionals. The data proposes that ancestral customs may have a lot to add to the helpful armamentarium. Hence, creators wish to propose the earnest need of protection and the executives of the customary information on native therapeutic plants as expected anticancer specialists of future.

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