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Medicinal plants used in the management of cancer and other diseases in Swat District, Pakistan

SHUJAT ALI[1,♥], MEHMOODA MUNAZIR[2]

[1]Independent Researcher. Swat, Khyber Pakhtunkhwa 19120, Pakistan. ♥email: alishujat119@gmail.com
[2]Department of Botany, Government College, Women University. Kutchehry Road, Sialkot 51040, Pakistan

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Abstract. *Ali S, Munazir M. 2024. Medicinal plants used in the management of cancer and other diseases in Swat District, Pakistan. Asian J Nat Prod Biochem 22: 8-18.* The provision of healthcare in impoverished nations is significantly influenced by traditional medicine. It has been revealed that many cancer patients use traditional medicine, either as a complementary therapy or as a primary treatment. Among noncontagious infections, cancer is one of the main causes of morbidity and mortality worldwide. This study aimed to determine the plants that people in the Swat regions, Pakistan used to treat cancer through traditional medicine. Interviewing consenting individuals about the ethno-medicinal plants they use to treat cancer was done using a structured questionnaire. Also, an assessment of the literature published on the mentioned plants was done. Questions about plants used to cure cancer, parts of plants used, the form of cancer cured, therapeutic applications of the plants, and the preparation and administration of the plant parts were posed to the practitioners and the locals. About 12 plants in all, comprising five herbs, three climbers, three trees, and one shrub, were used to treat cancer. About 50% of plants contain flavonoids, compounds with various anticancer properties. Fruits accounted for 41% of all the parts used in the documented species, with leaves coming in second at 25%, bark at 17%, roots at 17%, and the entire plant at 8%. However, the highest RFC was shown by *Vitis vinifera* L. (0.56), the lowest was shown by *Viola biflora* L. (0.03), while the highest FL was shown by *Hedera nepalensis* K.Koch (83), and the lowest was shown by *V. biflora* (30). According to the study, the gathered plants were used to treat a variety of malignancies: general tumors were treated by 75% of the plants, breast cancer was treated by 17%, and lung cancer was treated by 8%. The reported uses of the medicinal plants from prior ethno-pharmacological studies conducted in Swat regions align well with the traditional uses of the plants mentioned in this study. Therefore, if sufficiently investigated, the Swat district's indigenous herbs used to treat cancer may play key roles in searching for and creating anticancer medications.

Keywords: Bioactive compounds, cancer, local people, medicinal plants, Swat

INTRODUCTION

The term "traditional medicine" describes methods of maintaining and regaining health that predate the development of contemporary medicine (Domfeh 2007). According to WHO (2003), a third of people on the planet do not regularly have access to basic modern medicine. An estimated half of the population in some regions of Africa, Asia, and Latin America is thought to lack access to basic healthcare, primarily due to inadequate government funding. This explains the stark disparities in healthcare quality in underdeveloped nations. People in developing nations suffer greatly from the high drain of infectious syndromes (HIV, AIDS, Malaria, TB, Pneumonia and Diarrhea) also the rising menace of non-infectious ailments (NCDS) like diabetes, cancer, hypertension, and ischemic heart disease, among several others (Payyappallimana 2010). Human health is enhanced using ethnomedicinal plants, which support the primary healthcare needs of the local population (Kambizi and Afolayan 2001). Traditional medicine is used for primary healthcare by around (80%) of individuals in remote areas of emerging nations (Bodeker et al. 2005). Several cancer patients generally use customary remedies as key treatment and complementary medication (Cassileth and Deng 2004; Verhoef et al. 2005).

Many plant-based anticancer medicines are used in clinical practice, including taxol, vincristine, vinblastine, etoposide, irinotecan and topotecan. Worldwide research is still being done on ethnomedicine to treat cancer, and the National Cancer Institute USA is a major participant in medicinal plant investigation for cancer treatment. The NCI gathered around thirty-five thousand plant models from twenty different nations, and roughly 114,000 excerpts have been tested for anticancer bustle (Manju et al. 2017). According to projections, there will be 11.5 million cancer deaths by 2030, up from seven million in 2002 (Mathers and Loncar 2006). Deterioration of quality of life is linked to cancer, not only for the patients but also for spouse caregivers. The quality of life for spouse caregivers is significantly influenced by the diagnosis, period of hospitalization, intensity, and duration of care (Chen et al. 2004). Among several serious side effects, treatment for the condition with some medications has been linked to a decline in the worth of life, as well as in the stimulation of exhaustion and roughly marginal neuropathy.

Many commonly used anticancer medications can induce Chemotherapy-Induced Peripheral Neuropathy (CIPN), which compensates for equally large and small afferent sensory neurons (Mantyh 2006). Other medications have been shown to suppress bone marrow, which leaves patients more vulnerable to infections and other illnesses. Therefore, it is crucial to design medications that provide

the best possible treatment for an illness without lowering a patient's quality of life. In an attempt to reduce side effects, many patients often combine traditional medicine with their conventional therapy or, in some cases, forego it entirely. In many developing nations, a sizable section of the populace gets their healthcare from traditional healers and the usage of medicinal herbs; these health treatments are supposed to be inexpensive, easily accessible, and effectively treated (Konno 2004). Particularly in wealthy nations, many traditional remedies are now more widely accessible commercially. Strict manufacturing requirements are applied to producing these medications in certain nations (WHO 2002).

Traditional medicine knowledge has been primarily transmitted verbally between generations without extensive documentation. The absence of documentation may have resulted in the loss of some knowledge. Most communities' dependence on ethnomedicinal plants for basic healthcare has assisted in sustaining the body of knowledge on medicinal plants (Maroyi 2011). Preserving medicinal plants and protecting indigenous knowledge systems (IKS) in traditional medicine may be aided by documenting the IKS. Globally, especially for indigenous people, it depends on acknowledging IKS for cultural and economic emancipation. Therefore, developing successful adaptation solutions that may be affordable, inclusive, and sustainable might result from including native information in relevant strategies, like those about healthiness or the environment (Robinson and Herbert 2001).

Although traditional medicine is becoming more and more popular in the Swat district, little is known about the indigenous expertise in using medicinal plants to treat cancer. This specific ethnobotanical survey was conducted in an attempt to close the gap. Documentation helps conserve medicinal plants by ensuring that knowledge of traditional medicine is maintained. It also simplifies the process for further research projects that can concentrate on verifying the detected plants' activity in contrast to the claims.

MATERIALS AND METHODS

Study area

Swat District, Khyber Pakhtunkhwa State, Pakistan is known as "Paradise on Earth" for its outstanding natural appearance, spreading across its domain of 5,337 km^2. Swat is famous for its abundant greenish-beautiful scenery, including snow-covered mountains, broad water springs and streams, colorful meadows, clear environmental conditions, and pleasing and welcoming people (Ali 2023). Until 1969, Swat persisted as an independent and sovereign state known as "The Yusafzai State of Swat." The State of Swat voluntarily merged with Pakistan on 14 October 1969. This union occurred 22 years later, in 1947, when Pakistan gained independence from British rule. Swat is bordered by Chitral to the Northwest, Dir to the West, Malakand to the South, and Buner to the Southeast. Also, to the east is Shangla, to the Northeast is Kohistan, and to the North is Gilgit-Baltistan (Figure 1) (Ali et al. 2023). Swat is known for its impressive mountains at the foot of the Hindu-Kush range. The Swat River Valley, which endeavors through the district's southern boundaries, has an elevation of about 600 meters and emerges rapidly to the north. Various peaks have altitudes ranging from 4,500 meters to over 6,000 meters above sea level. Its climate is quite intermediate and changeable but often highly hot. It is an area where you can see all four seasons in one day, but it is a 20 to 30-minute drive one way, and the weather is often completely different. During the spring, high temperatures in March to May range from about 7°C to 13°C. Summers in Swat, such as June to August, are usually the warmest months, with average highs of around 15°C to 17°C. Swat's Autumn (or fall) temperatures can range from about 8 °C to 14 °C from September to November. December to February are usually the coldest months in Swat, with average high temperatures around 5°C.

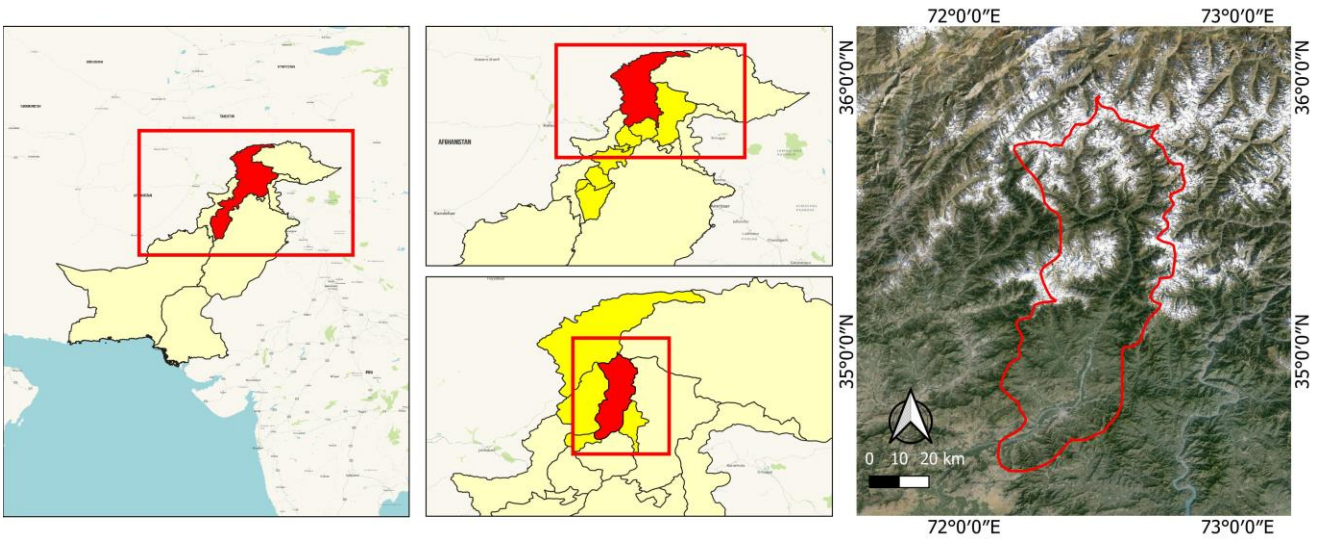

Figure 1. Study area in Swat District, Khyber Pakhtunkhwa State, Pakistan

Data collection

This study was conducted to gather information about plants used to fight or prevent cancer. The data were collected using questionnaire-type forms. The data were collected over almost one year (December 2021 to December 2022). We interviewed well-informed respondents based on their knowledge of ethno-medicinal plants, and all respondents' consent was obtained before the interviews. About 300, including 216 male and 84 female respondents, were chosen based on specific criteria, such as who prescribes treatment recipes, is involved in selling, is a plant collector, is an elderly member, or is a young, educated individual. We also included some professionals for interviews, such as physicians, pathologists, nurses, medical technologists, radiologic technicians, and other health- and hospital-related individuals. Generally, the professions were investigated to collect data about the signs and symptoms, clinical treatment, and benefits and side effects of clinical treatments like chemotherapy, radiotherapy, and other related treatments. We also used different literature databases, including PubMed, Scopus, Online Science Web, Google Scholar, and previously published literature.

Data analysis

The collected data were analyzed statistically via Microsoft Excel (2016) and cross-checked with old published literature. Additionally, the quantitative indices, including Fidelity Level (FL) and Relative Frequency of Citation (RFC), were used to assess the obtained data statistically.

Fidelity Level (FL)

Multiple plant species are certainly utilized in the treatment of a single ailment within a certain category. The formula established was carefully considered while determining the Fidelity Level (FL) index.

$$FL = Np/N \times 100$$

Where: N is the total number of informants who cited the species for any ailments, and Np is the number of informants who mentioned using the plant for a particular disease. A high FL score indicates that the study area's informants use the plant species more frequently to treat a certain illness category.

Relative Frequency of Citation (RFC)

RFC is the most utilized plant taxon by the native people. It was determined by using the formula:

$$RFC = FC/N$$

Where: ($0 < RFC < 1$), FC is the 'Number of informants citing a useful species' and N is the 'total number of informants' in the survey.

RESULTS AND DISCUSSION

Information

A total of 40 field trips were to collect data on medicinal plants. The entire period of the fieldwork was about one year, from December 2021 to December 2022. A total of 300 individuals were interviewed. Almost all the participants were natives of the area. The greatest number of people were aged between 60 to 80 years (50%), 40 to 60 years (33%), and less than 30 years (17%), as shown in Table 1. Approximately 200 people were illiterate, 30 were metric passers, 20 held bachelor's or master's degrees, and 50 were chosen from professional fields. Among these 50, 10 were selected from the laboratory (a pathologist or microbiologist), 20 were nurses by profession, 10 were medical technologists, and 10 were radiologic technicians, as shown in Table 1. Most of the individuals were Pashto speakers. Most informants were male (72%) rather than female (28%). This could be because the male interviewer made them feel at ease and allowed them to speak freely.

Using plants as a complementary and alternative medicine for cancer

Plants and their product-based treatments play a vital role in cancer prevention. Nowadays, scientists have been trying to make drugs or introduce possible ways to treat cancer, but it is unlikely they have not successfully introduced a proper form of medication for cancer except chemo and radiotherapy. Therefore, people across the world still depend on plant-based products for cancer treatments. As a result, the current study involves examining the plants to document their importance in cancer prevention. The current study documented about 12 plants that were used to treat various diseases. In addition to being effective against other diseases, these plants are also effective against cancer in the study area, as shown in Tables 2 and 3. Current research indicates that about 12 plants belong to 9 families. As shown in Table 3, the documented 12 plant species have been described to be used in treating human cancer, most of them being 42% herbs, 25% vines, 8% shrubs, and belonging to different plant families, including 25% trees, as shown in Figure 2. For the treatment of cancer, the highest RFC was shown by *Vitis vinifera* L. (0.56), and the lowest was shown by *Viola biflora* L. (0.03), while the highest FL was shown by *Hedera nepalensis* K.Koch (83), and the lowest was shown by *V. biflora* (30), as shown in Table 3.

The most common compounds were flavonoids, found in 50% of plants and have various anticancer effects because they regulate the activity of enzymes that scavenge Reactive Oxygen Species (ROS), contribute to cell cycle perturbations, and persuade and suppress apoptosis and autophagy cancer cell growth and invasion. Along with cancer, the documented 12 plant species custom to cure a range of other ailments, including laxatives, expectorants, heart problems, stomach problems, as a plaster, carbuncles, diuretic effects, aphrodisiac tonics, rheumatism, skin inflammation, fever, purgatives, respiratory diseases, dyspepsia, brain disorders, asthma, jaundice, piles, joint aches, diabetes, blood purification, and epilepsy.

Table 1. Demographic characteristics

Demographic characteristics	Number	Percentage
Age		
30 or below	50	17%
40 to 60 years	100	33%
60 to 80 years	150	50%
Sex		
Male	215	72%
Female	85	28%
Education status		
Educated	100	33%
Uneducated	200	67%
Professions		
Farmer and others	200	67%
Pathologist or microbiologist	10	3%
Nurses	20	7%
Medical technologists	10	3%
Radiologic technicians	10	3%
Govt school teachers	15	5%
Private school teachers	5	2%
No proper profession (jobless)	30	10%

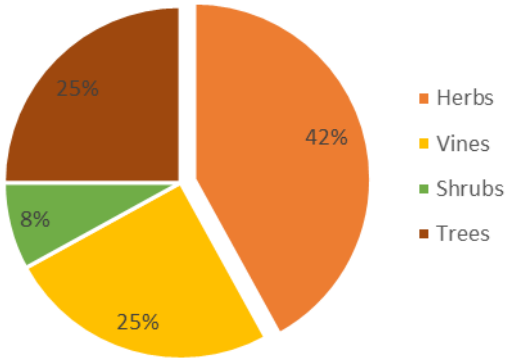

Figure 2. Plants forms

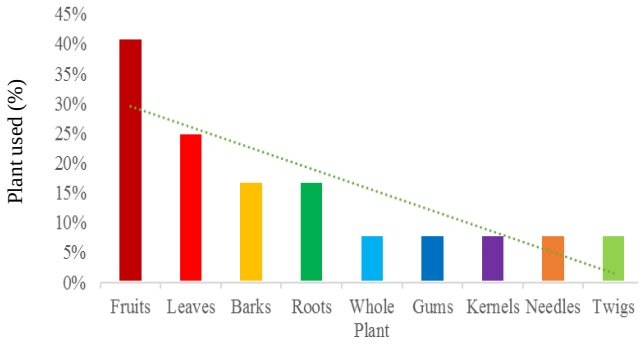

Figure 3. The plant parts used

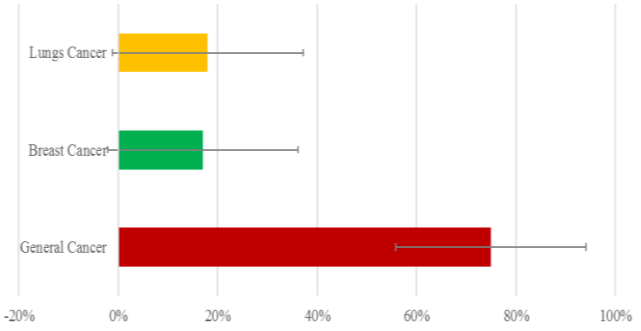

Figure 4. Cancer type treated with plants

Plant parts used against cancers

Locals used several parts of the plant, like leaves, roots, bark, seeds, fruits, and occasionally the whole plant, to create medicines for careful control. The fruits and leaves were the most commonly used parts. In 12 plant species, fruits (41%) were extracted, followed by leaves (25%), bark (17%), roots (17%), the whole plant (8%), gum (8%), kernel (8%), needle (8%), and twigs (8%) as shown in Figure 3 and Table 3. It was also noted that the reported plants were used to treat cancer and many other diseases. However, we noticed that a single plant can treat more than one disease. During the interviews with local people, these plants were also brought from an adjacent area when they were not available there.

Types of cancer treated with plants

During the field study, we documented that several forms of cancer have been cured with medicinal plants such as blood, lung, colon, rectum, prostate, skin, breast, uterus, thyroid, and lymphatic system. Chemotherapy, precision medicine, radiation therapy, surgery, stem cell transplantation, hormone therapy, immunotherapy, and targeted therapies have all been used to treat cancer. However, the present study revealed that they were used to treat various cancers, such as generalized cancer. As shown in Table 2, 75% of plants treated general cancers, 17% treated breast cancer, and 8% treated lung cancer, as shown in Figure 4. The study showed that all the collected plants were used to treat all types of cancer.

Secondary metabolites and their anticancer effects

Secondary metabolites serve crucial supporting roles in plant development and evolution, even though they are not necessary for it. These include promoting herbivore defense, preventing the growth of rival plants, thwarting the growth of bacterial and fungal diseases, and facilitating pollination. They include many antioxidant and anti-inflammatory substances (Adebayo et al. 2015). The chelation of redox-active metal ions, which results in lipid peroxidation and free radical outflow, is a component of antioxidant action. These items aid in the management of cancer as well. Plant secondary metabolites are categorized into alkaloids, terpenoids, polyphenols, and flavonoids based on their structural makeup (Singh et al. 2016). Vinblastine, vincristine, and camptothecin are examples of

known anticancer alkaloids; lycopene and gamma-tocopherol are examples of terpenoids. Resveratrol, curcumin, etoposide, and epigallocatechin gallate (EGCG) are examples of polyphenols. Camphorol, genistein, and apigenin are examples of flavonoids. These bioactive substances are necessary for the development, proliferation, microtubule formation, and cell death of cancers. They can act alone or in concert with other substances to produce anti-tumor effects through classical metabolic and signaling pathways (Kojima-Yuasa et al. 2015). Numerous botanical and herbal infusions have been studied for their antiproliferative qualities over time; many show ontogeny and effectiveness in slowing the spread of cancer.

Table 3 summarizes some of the plants that have been studied and their active ingredients with good cancer-preventing and limiting effects. A detailed study of the implicit chemical processes behind the actions of these compounds and the actions of several other new compounds can shed light on the biological underpinnings of their anticancer properties. As a result of this goal, it is important to recognize changes in cancer physiology that differ from normally proliferating cells to transfer the side effects of anticancer drugs to normal cells.

Compounds found in different parts of plants can help treat diverse forms of cancer, and all compounds collected from plants belong to different classes. For example, flavonoids are plant-derived polyphenol secondary metabolites. Sterols are assigned to lipids (fat in the broadest sense). There are 11 major classes of saponins (dammarane, tirucallane, lupine, hopane, oleanane, taraxasterane, ursan, cycloartane, lanostane, cucurbitan, and steroid). Squalene is an acyclic triterpene, while achilleol A, lanostane, dammarane, and euphane are monocyclic, pouoside A is a bicyclic triterpene, and oleane group, ursan group, lupine group, and hopane group are pentacyclic triterpenes. The two primary classes of carotenoids are carotenes and xanthophylls. Antioxidant qualities are present in both forms of carotenoids.

Table 2. Plants used for the treatment of cancers in Swat District, Pakistan

Plants	Extract from	Anticancer Potential
Carthamus oxyacantha M.Bieb.	Seeds and flowers	According to an anti-oxidation investigation, a 40µg extract from this plant indicated more than 40% inhibition of cancers (Souri et al. 2004).
Convolvulus arvensis L.	Whole plant	Its alcoholic infusions have essential anticancer effects against cell lines. Oral administration of proteins and polysaccharides suppressed tumor growth dose-dependent (Meng et al. 2002).
Hedera nepalensis K. Koch	Leaves and barks	It has two major compounds that are prudent for anticancer activities: hederagenin 3-O-L-arabinopyranoside and pulsatilla saponin A (Li et al. 2015).
Malus pumila L.	Fruits	Apple has bioactive substances that contribute to the prevention of cardiovascular disease, diabetes, inflammation, and cancer (Han et al. 2020).
Prunus armeniaca L.	Kernel and gums	The plant has bioactive compounds, which can activate different anticancer processes and signaling pathways, such as tumor suppressor proteins that reduce the proliferation of tumor cells (Kitic et al. 2022).
Rosa moschata J. Herm.	Fruits and flowers	It is also used as a food that may reduce the incidence of cancer and as a means of stopping or reversing cancer growth (Mathews 1994).
Solanum nigrum L.	Leaves and fruits	The plant's crude infusion has demonstrated anti-tumor effects in a variety of cancer types, including colorectal, endometrial, cervical, and breast malignancies in humans (Li et al. 2008; Liu et al. 2021).
Taxus wallichiana Zucc.	Barks, needles, twigs, and roots	The plant has recently attracted attention because of the discovery that taxol, a powerful anticancer medication, is mostly present in its leaves and bark. Numerous other biological functions are also present in it (Juyal et al. 2014).
Viburnum grandiflorum Wall. ex DC.	Fruits and barks	The plant extract activated apoptosis through a caspase-dependent route, thereby inhibiting the viability of lung cancer cells. As a result, its extract effectively inhibits the growth of lung cancer cells (Liu et al. 2021).
Viola biflora L.	Flowers	The plant has anticancer properties (Hamayun et al. 2007). The present study recommended this plant for further phytochemical studies.
Vitis vinifera L.	Fruits	Its extract showed cytotoxic against cancer cells. Infusion isolated from seeds and stems investigated anti-tumor action in human breast cancer cell lines (Kaur et al. 2009).
Withania somnifera (L.) Dunal	Leaves and roots	The plant has main constituents like withanolide A and withaferin A; withaferin A is mostly found in the plant leaves and produces fast apoptosis in cancer cells (Malik et al. 2007).

Table 3. Plants used for the treatment of different diseases in Swat District, Pakistan

Family	Plants	Local name	Habitat	Extract from	Medicinal uses	RFC	FL
Araliaceae	*Hedera nepalensis* K. Koch	*Zela Bota*	Climber	Leaves and bark	Used as cancer, also used as fodder and ornamental.	0.2	83
Asteraceae	*Carthamus oxyacantha* M.Bieb.	*Kareeza*	Herb	Seed and flower	Used as fuel and food. Seed oil is used to control cancer, urination, and stomach problems.	0.4	58
Caprifoliaceae	*Viburnum grandiflorum* Wall. ex DC.	-	Shrub	Fruit and Bark	Fruit is used to cure cancer and stomach problems.	0.23	71
Convuluaceae	*Convolvulus arvensis* L.	*Perwathai*	Herb	Whole plant	Used for cancer, diabetes, and blood purification.	0.31	42
Rosaceae	*Malus pumila* L	*Manra*	Tree	Fruits	It is an economical fruit, laxative, and expectorant, used in jams and jellies and for heart diseases. Its tough wood is used to make agricultural tools and fuel wood. Leaves are used as fodder.	0.5	40
Rosaceae	*Prunus armeniaca* L.	*Khobanay*	Tree	Kernel and gum	Used as fresh or dried fruits and seeds. In addition to being utilized as fuel wood and a honeybee species, it is a purgative for cancer. Foliage is made from leaves.	0.43	60
Rosaceae	*Rosa moschata* J. Herm.	*Qaroch*	Climber	Fruits and flowers	Used for cancer and curing stomach disorders	0.1	67
Solanaceae	*Solanum nigrum* L.	*Kachmacho*	Herb	Leaves and fruit	The leaves are used to treat skin inflammation, while the fruits are used to treat fever.	0.13	38
Solanaceae	*Withania somnifera* (L.) Dunal	*Kotilal*	Herb	Leaves and root	Used as a plaster, it is also used for cancer, ulcers, and carbuncles. Fruit has a diuretic effect. Root is an aphrodisiac tonic, diuretic, narcotic, and rheumatism treatment.	0.51	58
Taxaceae	*Taxus wallichiana* Zucc.	-	Tree	Bark, needles, twigs, and roots	Its leaves are used for cancer and respiratory diseases. It is also used in dyspepsia and brain disorders; the leaves and fruits are sedative and aseptic; it is utilized in constructing roofs; and due to its strength against dense snowfall, its wood is placed on graves.	0.33	40
Violaceae	*Viola biflora* L.	*Banfsha*	Herb	Flower	It is used as a diaphoretic, antipyretic, cancer preventive, and febrifuge, as well as for epilepsy and nervous diseases.	0.03	30
Vitaceae	*Vitis vinifera* L.	*Kowar*	Climber	Fruits	It is used to cure piles, joint aches, cancer, fever, asthma, jaundice, vomiting, and stomach issues. It is also used as a laxative, purgative, diuretic, and aphrodisiac.	0.56	59

Furthermore, taxol is a member of the plant alkaloids class of chemotherapeutic medicines. Because each amygdalin molecule contains a nitrile class that beta-glucosidase might release as a deadly cyanide anion, amygdalin is categorized as a cyanogenic glycoside. Mannose is a member of the hexose class of chemical compounds, where monosaccharides are molecules with six carbons as the sugar component. Luteolin is a flavone, a type of flavonoid, and kaempferol belongs to the flavonol group of organic compounds. Sesquiterpenes are a group of terpenes belonging to three isoprene units. Sesquiterpenes, like monoterpenes, can be cyclic or have several specific combinations of rings. Vibsin-type diterpenoids are thought to be common in natural products.

Why plant-based drugs are best for the treatment of cancer instead of other clinical drugs

During a field survey, some professionals and cancer patients said that about 85% of cancer patients faced various side effects when treated with chemotherapy and radiotherapy, such as impotence, fatigue, nausea, hair loss, and vomiting. Sore mouth and numbness are also common side effects, and less common are diarrhea, abdominal cramps, and memory loss, which are reported as erogenous zone side effects. A similar report was made by Aslam et al. (2014) from Pakistan. Current research, therefore, indicates that chemotherapy aims to be as efficient as possible with manageable side effects. The morbidity of chemotherapy drugs can pose significant difficulties in treating cancer with symptomatic or conventional drugs. Several therapies have been developed to cure cancer, many of which use plant-derived products, and those plants have great potential for new drugs and are endowed with anticancer chemo-protective properties. Remarkable improvement has been made in warning and guiding malignancy (cancer) development, but there is still considerable validity and room for enhancement. Some unexpected side effects may occur during chemotherapy. Natural remedies can reduce harmful side effects, such as using herbal products to cure malignancies (cancer), and recent investigations have found about a dozen botanical products. Nevertheless, a myriad of products prepared from the documented 12 plants have been found to have very promising anticancer properties but need to be evaluated for further applications in human cancer treatments. It is necessary to determine the efficacy of these botanical products.

Knowledge and awareness of cancer among residents of Swat

During the fieldwork for the present study, we asked the people about cancer, and their responses were very surprising; they did not know about cancer. Cancer is referred to as "*Sakha*" (bad) or "*Khatrnaka Bemari*" (dangerous diseases) by the locals. Thus, the current survey results show extremely low cancer awareness or consciousness among Swat residents. According to our general observations, about 95% of illiterate people did not know about cancer. As a result, this study found that few residents knew much about cancer, while most knew almost nothing about the risk factors and early symptoms of the disease. In this regard, several efforts must be made to increase people's awareness of cancer and its prevention and treatment.

Discussion

Medicinal plants, including in many countries, contain frequent alternative medicines for treating cancers worldwide (Tascilar et al. 2006). About 3,000 plants are reported as anticancer sources worldwide (Graham and Quinn 2000). Worldwide, the frequency of use of products derived from plants for cancer ranges from 10 to 40%, but now it is reaching 50% in Asian patients. Throughout the Middle East and Europe, herbal medicine has been used for a long time (Cassileth and Deng 2004; Molassiotis et al. 2006). A recent WHO (2004) report reveals that many developing countries believe traditional herbs are legitimate anticancer drugs. About 5-15% of these herbs are being studied to find bioactive anticancer compounds (Ahmad et al. 2016).

The study shows that the root of *V. biflora* is used for stomach disorders and jaundice, expectorants, epilepsy, nervous disorders, antispasmodics, diaphoretic purposes, colds, flu, and laxatives, as shown in Table 3; similar applications are found for *V. biflora* in the study area described by Hamayun (2007). The plant contains compounds like aurantiamide acetate, solalyratin B, esculetin, scopoletin, lupeol, 2S-hydroxypheophytin, vomifoliol, dibutyl phthalate, (-)-dihydrovomifoliol, grasshopper ketone, crassifol, and -sitosterol (Cong et al. 2016). The *Convolvulus arvensis* L. is used in medicine to cure purgatives and skin disorders. Similar uses for the plant were also suggested by Akhtar et al. (2013) and Sher et al. (2003); it is used as an anticancer agent on different cell lines. Saponins, steroids, flavonoids, alkaloids, proteins, and lipids are the major compounds found in this plant (Kaur and Kalia 2012). However, alcoholic infusions have essential anticancer effects against IMR-32 and Colo-205 cell lines (Kaur and Kalia 2012). Particularly, oral administration of proteins and polysaccharides suppressed cancer progression in a dose-dependent; around 70% of tumor development was suppressed at a broad, indefinite dose (200 mg) daily. Over 70% of tumor growth is suppressed by subcutaneous or intraperitoneal administration at 50 mg daily (Meng et al. 2002).

The *Carthamus oxyacantha* M.Bieb. controls urination and cures stomach problems and cancer, as shown in Table 3; similar uses for the plant are also documented by Khan et al. (2015). Its flowers and seeds contain glycosides, serotonin, flavonoids and sterols (Souri et al. 2004). Among the chemical components, it also contains oils such as oleic and linoleic derivatives; the pyrrolizidine alkaloids were also isolated and defined from the plant. Its fruit contains 20-25% protein. HPLC was used to isolate two glycosides, 2-O-methyl glucopyranosyl carthamo side and beta-D-fructo furanosyl carthamo side, as well as compounds 3', 4', 5, and 7-tetrahydroxy flavanone (Ahmad et al. 2010). Oxidative stress is linked to several degenerative illnesses, such as cancer. Therefore, the trend of looking for antioxidants from natural sources is growing

daily. In an antioxidant study, a 40 µg extract of *C. oxyacantha* showed over 40% inhibition (Souri et al. 2004). studied the antifungal activity of crude extracts (methanol, ethanol, and aqueous) of this *C. oxyacantha* against fungal strains (*Bipolaris sorkiniana* Shoemaker, *Fusarium oxysporum* Schltdl., *Rhizoctonia solani* J.G.Kühn, *Phytophthora drechsleri* Tucker) and found that the extracts were effective against these strains found to exhibit a broad spectrum of activity. A dichloromethane extract of *C. oxyacantha* at a 25 µg/ml concentration exhibited 27.5% neuroprotection and inhibited 44.5% of ROS (Abdolmaleki et al. 2011).

The *H. nepalensis* is used for diabetes, scabies, boils, cancer, heart disease, and diabetes, as shown in Table 3; a similar result was also found by Ahmad et al. (2014). It has inositol, carotenes, and cardiac glycosides (hederagain) (Kanwal et al. 2011). Cytotoxic can affect HeLa and HeLa cancer cell lines. N-hexane and ethyl acetate from the examined plants appear to offer good potential in cancer chemoprevention, according to the evaluation's results. The n-hexane fractions containing lupeol and ethyl acetate have a reduced IC50 (0.20 ± 1.9 µM) when assessed by NFκB. The three cancer cell lines' ontogeny was reduced by roughly 60% by the crude extract and its fractions, and their IC50 values for lupeol ranged from 2.32 to 10.2 µM. Plant leaves are a rich source of lupeol, as demonstrated by the HPLC-DAD-based measurement of lupeol in diverse plant tissues (0.196 mg/100 mg dry weight).

The *V. vinifera* is used to cure skin malignancy (cancer), heart ailment, and antimicrobial activity, as shown in Table 3; similar uses are also noted by Ahmad et al. (2014). The grape infusion did, however, demonstrate cytotoxicity against PC-3, A-549, and MCF-7 cancer cells. In human breast cancer cell lines (MCF-7 and MDA-MB-23), colon (HT29), kidney (786-0 and Caki-1), thyroid (K1), hepatocellular carcinoma, oral squamous cell carcinoma, and normal human fibroblasts, infusions derived from seeds and stems were employed to investigate anti-tumor activity in cell lines (Kaur et al. 2009). Resveratrol, a chemo-protective compound found in grape skins, stimulates autophagy and has anticancer properties. In gastric cancer cells that were activated with TNF-α and whose ICAM-1 mRNA levels were suppressed by methanol infusion, the result was cell death and the control of inflammation (Kaliora et al. 2008). However, increasing evidence from human medical institution trials has shown that consumption of grape juice promotes many health problems and may have anticancer effects. Therefore, there is a great deal of promise for using grape skin and seed infusions to prevent cancer, and further research in this promising area is needed (Zhou and Raffoul 2012).

Rosa moschata J. Herm. is widely used to cure stomach disorders, as shown in Table 3; a similar result was found by Ali et al. (2011). Moreover, it contains important fatty acids, which is uncommon for a fruit. It has also been researched as a diet that can stop or reverse the growth of cancer and lower the incidence of cancer (Matthews 1994). It is an extremely rich source of minerals and vitamins, particularly flavonoids, bioactive compounds, and vitamins A, C, and E.

Taxus wallichiana Zucc. is used as a hypnotic and antispasmodic. The leaves are used in bronchitis, whooping cough, and asthma. It is also used in indigestion and epilepsy; the leaves and fruits are sedatives and antiseptics, as shown in Table 3; a similar result was also found by Ilyas et al. (2013). Its bark and leaves have garnered attention recently since it was discovered that they are the primary source of taxol, a highly effective anticancer medication. Numerous other biological functions are also present in it (Juyal et al. 2014).

Prunus armeniaca L., locally known as *Khobani*, belongs to the Rosaceae family. It is a laxative, and the gum extracted from the stem is anticancer, as shown in Table 3; similar uses of the plants mentioned by Akhtar et al. (2013) from the area. The gum extracted from the stem of *P. armeniaca* was used to treat cancer (Iqbal and Hamayun 2004; Akhtar et al. 2013). Various parts of the apricot plant are used worldwide for their anticancer properties, either as a primary remedy in traditional medicine or as complementary or alternative medicine (Kitic et al. 2022). Bioactive compounds may mediate anticancer properties, activating various anticancer processes and signaling pathways, such as tumor suppressor proteins that reduce tumor cell proliferation (Kitic et al. 2022). It strongly and concentration-dependently reduced cell growth during the incubation period (P 0.05). In both types of cancer cells, the expression levels of the Bax and c-FLIP genes were consistently higher in the untreated group as compared to the control group ($P < 0.001$). According to Mahmoudi et al. (2019), it had a very significant time-dependent mode (P 0.001) of inhibiting the expression of the Bax and c-FLIP genes in cancer cells.

Solanum nigrum L. is an effective treatment for digestive disorders, chronic skin disease, hepatitis, inflammation, and liver problems, as shown in Table 3; similar uses for the plants mentioned by Akhtar et al. (2013), Ali et al. (2011), and Ilyas et al. (2013) from the study area. Plant infusions have shown anti-tumor effects on various cancers, including human melanoma, colorectal, endometrial, and cervical breast cancer (Wang et al. 2010; Liu et al. 2021). Aqueous plant infusions are essential components of a number of traditional Chinese medicine recipes that demonstrate anti-tumor effects in human HCC cells and are used to cure cancer in Hep3B and HepJ5 cells carefully. These recipes help the cells integrate AE-SN-enhanced cytotoxicity induced by doxorubicin and cisplatin by accumulating microtubule-associated protein-1-light chain-3 A/1B II (LC-3 A/B II), which in turn causes both cells to undergo autophagy and apoptotic cell death (Wang et al. 2010).

Withania somnifera (L.) Dunal is used in Swat to treat aphrodisiacs, as a poultice for swellings, ulcers, and carbuncles, as a diuretic, a narcotic, and to treat rheumatism, as shown in Table 3; similar uses for the plants also mentioned by Akhtar et al. (2013). It has sitoindosine, anferine, isopellertierine, withanolides, and withaferins. The plant's infusion has a number of biological effects (Winters 2006). Because of its anti-stress, anti-aging, anti-peroxidative, anti-inflammatory, antioxidant,

anti-tumor, cardio-tonic, and immunomodulatory qualities, it is utilized in a variety of preparations (Malik et al. 2007). Among the plant's primary components are withanolide A and withaferin A, the latter of which is mostly present in the leaves and causes cancer cells to undergo rapid apoptosis. This plant preparation's cell signaling pathways largely rely on the wide range of withferin (Malik et al. 2007). Preparation of *W. somnifera* induced cell cytotoxicity in a number of human cancer cell lines. Additionally, by upregulating the expression of IL-2 and IFN-gamma, its preparation alters the T cell population in tumor-bearing mice (Malik et al. 2007).

Viburnum grandiflorum Wall. ex DC. belongs to the Lotus family. It has been used to cure gastrointestinal complications in the study area, as shown in Table 3; similar uses for the plant were also mentioned by Akhtar et al. (2013) and Ali et al. (2011). Plants are pretreated with UVB-exposed cells, and inflammatory and apoptotic signaling cascades are profoundly regulated. Its VG can act against UVB-induced photodamage (Liu et al. 2021). Viability of H1650, HCC827, and H1299 cells by VGE happened in a way that was dependent on both concentration and time. At 48 and 72 hours, the VGE treatment markedly elevated the apoptotic rate of H1650 ($P < 0.05$) and H1299 ($P < 0.02$) cells. The number of cells in the sub-G1 phase was dramatically increased when 10 µM VGE was applied to H1650 and H1299 cells. In H1650 and HCC827 cells, VGE treatment resulted in the cleavage of procaspase-8/-9 and -3 after 72 hours. His VGE treatment decreased the expression of the Mcl-1 protein in HCC827 and H1650 cells. VGE treatment significantly decreased p-Akt levels in H1650 and HCC827 cells. On H1650 and HCC827 cells, however, the viability-inhibitory effects of VGE were neutralized by transfection with the caspase-9 dN plasmid. When VGE was applied to H1650 and HCC827 cells, cytosolic cytochrome C levels rose. (Han et al. 2020).

Malus pumila L., also called apple, belongs to the Rosaceae family. It is used as a purgative, a source of iron, an expectorant, in jams and jellies, and is good for the heart, as shown in Table 3; similar study uses of the plant also collected from the study area by Iqbal and Hamayun (2004). Fruit-derived biologically active substances are attracting attention as regulators for various diseases because they have fewer side effects than chemical drugs. Apples, one of the most popular fruits, are high in bioactive components and a rich source of nutritious elements. Pentacyclic triterpenes, phytosterols, polyphenols, and polysaccharides (pectins) are the main structural classes of apple components. Trace minerals and vitamins complete the apple fruit's nutritional profile. These physiologically active ingredients found in apples and their skins have benefits for human health, including the prevention of cancer, diabetes, inflammation, and cardiovascular disease. Numerous scientific studies have demonstrated that it might enhance health (Patocka et al. 2020).

In conclusion, people in the area used different plants to treat diseases, including cancer. However, this investigation showed that the same plant was used to cure different ailments in some cases, while in others, different plants were used to cure different ailments. Before, people were not well aware of the diseases, but currently, cancer is the most spread disease with a high ratio in the area. Now, the locals face this extremely uncured disease, of which the most common are breast, colon, blood, and lung cancers. As a result, the current study is being carried out to create a primary report on cancer in the area and to assess the outcome and significance of plants in this dangerous disease. Hence, this study reported that 12 plants are superior for cancer treatment. Studying these plants could serve as a template or conductor for malignancy medicine innovation and development. The increasing trend of malignancy (cancers) in Swat is alarming. This preliminary study will be important in cancer prevention, treatment, and future planning in Swat.

As other nations have done, the Pakistani government, through the Ministry of Health, is obligated to incorporate medicinal plants into the healthcare system so that folks can freely take advantage of the opportunities it presents and freely discuss with physicians the various herbal medicines without fear of retaliation. To facilitate long-term preservation and increase access, further research has to support documenting the existing plant practices.

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