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HERBAL TREATMENT FOR DIFFERENT TYPES OF CANCERS AND THEIR PHARMACOLOGY

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ABSTRACT

Natural products, including medicinal plants, are characterized by varied chemical structures and bioactive properties, which, although extensively studied, have yielded successful examples of natural anti-cancer agents. Natural products exhibit anticancer activities often derived from flavonoids, phenolic acids, alkaloids, terpenes, and other phytochemical molecules. For patients, herbal anti-cancer drugs have some clear advantages of clinical applications with targeted therapy; they achieve good selective toxicity and present significantly lower, fewer and manageable side effects. Despite the successes of natural products as anti-cancer drugs, there are still a number of challenges to face with respect to development, application, and usage of natural anti-cancer drugs including, but not limited to, acceptable standards for herbal extracts, delivery mechanisms, and developing therapeutic regulations on herbal therapies to be managed as adjunctive agents with other chemotherapeutic drugs. In the future, interdisciplinary academic studies and clinical health professionals should support research and provide clinical guidance to use herbal cancer therapy into the contemporary menus of cancer patient health care.

KEYWORDS: Natural products, cancer, herbal cancer therapy, anti-cancer drugs.

INTRODUCTION

Cancer is a considerable global health issue and relevant estimates are that there will be around 21 million cases by 2030. Even with advances in diagnostic methodologies, therapy, and the ability to prevent disease, cancer research is still relatively practical. This is due in part to its diverse cancers, body organs impacted, varying prognosis, and staging, making selection of therapy confusing. There are many interventions such as surgery, radiotherapy, chemotherapy, and immunotherapy that are effective.[1] Chemotherapeutic agents (alkylating agents, antimetabolites, antitumor antibiotics, topoisomerase inhibitors, tubulin-binding drugs) are effective agents used for the treatment of cancer. All chemotherapy

agents are selective to normal cells that divide rapidly, having the most adverse effects. Conversely, Small molecule targeted therapy (SMTT) uses chemical(s) that bind specifically to many of the molecular structures in cancer cells that are genetically altered in cancer, effecting tumor growth and survival.[2]. Herbal medicine has been researched as a source for anticancer drugs, largely based on the number of bioactive compounds contained in the plant. There is still no attributed standard with the use of herbs in modern cancer treatment medicine, including differences in quality and concentration of herbs with bioactive compounds, identification and standardization of herbal extracts, and the possibility of drug interaction.[3]

HERBAL TREATMENT FOR DIFFERENT CANCERS

Breast cancer and their pharmacology: Herbs such as turmeric, green tea, ashwagandha, ginger, garlic, flaxseed, milk thistle, ginseng, graviola, and black cumin seed may have some action in breast cancer. For example, curcumin is an anti-inflammatory and antioxidant agent, while EGCG in green tea is thought to prevent proliferation of cancer cells.[4] Ashwagandha is an anti-tumor, immunomodulatory, and stress-reducing agent. Ginger is anti-inflammatory and could attenuate some of the side effects of chemotherapy. Garlic is considered to have anticancer properties and immune enhancement abilities. Flaxseed is an antioxidant and regulates hormone balance. While milk thistle protects the liver against the toxic effects of chemotherapy.[5] Ginseng not only provides immune support but also may have anticancer effects. Graviola has been found to have anticancer effects but caution must be exercised due to toxicity. Black cumin seed is anti-inflammatory, antioxidant, and anti-proliferative. While these herbs are not a substitute for treatment of breast cancer, they may be considered as complementary modalities.[6] Turmeric, Green Tea, Ashwagandha, Ginger, Flaxseed, Milk Thistle, Ginsing, Graviola, and Black Cumin are all dietary supplements that could potentially be utilized in patients with breast cancer. Turmeric is a spice that contains curcumin, which inhibits the supplements the NF-κB, COX-2 and pro-inflammatory cytokines which promote cancer cell proliferation.[7] Turmeric causes apoptosis or programmed cell death. Green Tea contains EGGC which inhibits angiogenesis/tumour growth, is antioxidant, DNA protector and may induce tumour growth. Ashwagandha, induces apoptosis, decreases cellular oxidative stress, and stimulates cellular immunity.[8] Ginger contains gingerols and shogaols, that inhibit COX & LOX pathways. Ginger has also been shown to inhibit metastasis and cancer cell division. Flaxseed contains lignans, and omega-3 fatty acids that modulate oestrogen receptors, may be anti-inflammatory, and antioxidant. Milk thistle protects liver cells and reduces oxidative stress. Ginseng has also been shown to induce apoptosis, inhibit angiogenesis and modulate immunity.[9]

Lung cancer and their pharmacology: The studies demonstrated that lung cancer patients wanted complementary and alternative medicine (CAM) mostly used herbal remedies to manage their symptoms. More work needs to be done to analyze the benefits and uses of herbal remedies.[10]. As herbal remedies are found in traditional medical systems, patients may feel an individualized more natural and non-invasive approach to their symptom management. Of the patients, nearly 50% indicated would be willing to participate in herbal clinical trials, showing they want more research. Many active compounds in herbal remedies exist, including turmeric, green tea, ashwagandha, ginger, licorice, holy basil, ginseng, black cumin, artemisinin, cordycepin and baical skullcap and cat's claw.[11]. Many of these herbs can possibly provide benefits in lung cancer offering anti-inflammatory, antioxidant or immuno-modulatory properties. Since herbal remedies have been conferred significant advantages, further understanding to examine them further needs to occur surrounding the potential benefits of herbal remedies to lung cancer treatment.[12]. Studies found that several natural treatments (i.e. Licorice, Holy Basil, Ginseng, Black Cumin, Artemisia annua, Cordyceps sinensis,

Baical Skullcap, and Cat's Claw) all have various effects based on their mechanisms of action on cancer cells. [13] In the case of licorice, it mediates through blocking the action of the PI3K/Akt pathway to both protect the lung tissues and slow the development of cancer cells. Ginseng also works through blocking angiogenesis and proliferation by stimulating immune cells whereas holy basil reduces oxidative stress and inflammation in the lung. Black cumin has been found to have anti-inflammatory, anti-cancer, and antioxidant activity by inducing apoptosis while also blocking inflammatory cytokines. [14] Artemisia annua is very important as we know it as a powerful anti-tumor agent because it produces ROS, or free radicals, that damages DNA and induces death in cancer cells. Cordyceps sinensis is an immunostimulant and anti-tumor agent as it increases the immune cells to respond, and mediates caspase-mediated death. Baical Skullcap also promotes DNA repair, induces cell cycle arrest and anti-angiogenesis which promotes the inhibition of tumor dissemination.[15]

Prostate cancer and their pharmacology: An herbal product PC-SPES comprised of eight herbs has proven effective in the treatment of androgen-independent prostate cancer (AIPC). A Phase II trial showed that PC-SPES resulted in significant declines in prostate-specific antigen (PSA) and median time to progression compared to diethylstilbestrol (DES) and other synthetic estrogens, although the safety of PC-SPES was in question due to contamination by synthetic estrogens.[16] The herbal remedies include Saw Palmetto, Turmeric, Green Tea, Pomegranate, Stinging Nettle, Ginger, Flaxseed, Grape Seed Extract, Milk Thistle, Reishi Mushroom, Lycopene, and Black Cumin. These herbs have pharmacological actions that include inhibition on 5-alpha reductase, delayed prostate enlargement and tumor growth, induction of apoptosis in prostate cancer cells, and inhibition of androgen receptor signal transduction.[17] Saw Palmetto, Turmeric, Green Tea, Pomegranate, Stinging Nettle, Ginger, Flaxseed, Grape Seed Extract, Milk Thistle, Reishi Mushroom, Lycopene, and Black Cumin are all natural ways to help decrease the risk of prostate cancer.[18] Saw Palmetto decreases testosterone's conversion to its active form, decreasing prostate enlargement and slowing tumor advancement. Turmeric blocks NF-κB and STAT3 and induces apoptosis in prostate tumor cells, and decreases inflammation. Green Tea inhibits androgen receptors and VEGF, decreasing tumor growth and blood supply to the tumor. Pomegranate inhibits cancer cell proliferation and decreases PSA levels, decreasing the perturbation and propagation of prostate cancer.[19] Ginger inhibits COX and LOX pathways, which decreases inflammation in the prostate tumor cells and induced apoptosis in cancer cells. Flaxseed regulates estrogen/testosterone, as well as inhibits angiogenesis which slows angiogenesis. Grape Seed Extract induces oxidative stress in cancer cells, inducing apoptosis. Milk Thistle protects liver and inhibits growth of cancer cells. Reishi mushroom stimulates immune cells and induce apoptosis in cancer cells.[20]

Leukemia: Hibiscus cannabinus (Kenaf) is a plant with bioactive components that possess high antioxidative and anticancer activities. Inhibitory bioactive compounds are practical in the seeds' oil, against carcinogenic compounds and can induce apoptosis against ovarian cancer cells.[21] The root of the Taiwan plant ginseng is effective against inhibit DNA synthesis, angiogenesis, cell invasion, cell cycle arrest and induce apoptosis. Euphorbia formosana Hayata (EF) has been a treatment in traditional medicine for rheumatism, liver cirrhosis, herpes zoster, scabies, photo aging, and has been used for tumor suppression.[22] Garlic extract (GE) has a leading role in cancer preventative properties and has been found to induce cytotoxic activity on cancer cells especially leukemia. Moringa oleifera (The Miracle Tree) root has strong antileukemic potential and has also been tested for its antioxidant activity.[23] Roots of Vernonia amygdalina populations inhibit growth of some cancer cell lines that include acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL). Achillea fragrantissima (Af), in their constituents have antioxidant properties and were

found to possess anticancer properties against CML cell lines K562 and Jurkat cells. Typhonium flagelliform is a multi-purpose herb that has curative properties against various cancers.[24]

Hepatocellular carcinoma and their pharmacology: Xanthorrhizol (XNT), a sesquiterpenoid complex derived from Curcuma xanthorrhiza rhizome, has been shown to have anti-inflammatory effects in lipopolysaccharide-mediated mouse leukemic monocyte macrophage cells, as well as it suppresses the activity of inducible nitric oxide synthase (iNOS) and reduced cyclooxygenase-2 (COX-2) production, therefore inhibits pro-inflammatory cytokines interleukin-6 (IL-6), TNF-alpha (TNF-α), iNOS and COX-2 in activated microglial cells. XNT has anticancer activities and this is most likely due to its anti-inflammatory effect, as it suppresses the activity of NF-kB, COX-2 and release of Inos.[25] XNT has also suppressed tumor development and formation in numerous in vivo studies.

Also, Berberine, a small alkaloid molecule from Coptidis rhizome, to have anti-inflammatory and anticancer activity. Berberine can down-regulate numerous hepatics, pro-inflammatory genes including IL-6, serum amyloid A3, NF-kB and TNF-alpha that are important for the development of steatohepatitis. Berberine can have anti-cancer activity on human HCC cell lines through inducing apoptosis and inhibiting tumor cell proliferation.[26] Berberine induced cell death and also cell death through apoptosis in HepG2 cells associated with down-regulation of CD147 which is expressed higher in HCC cells.

Alpinia officinarum, also known as lesser galangal, belongs to the family Zingiberaceae and possesses a number of pharmacological effects as an antioxidant, anti-inflammatory, antimicrobial, antiemetic and cytotoxic. It has been demonstrated to have anti-cancer effects against several cancer cell lines, including breast, neuroblastoma, lung and liver.[27] Alpinia officinarum rhizome extract and its parts have demonstrated anti-cancer effects against many cancer cell lines, including breast, neuroblastoma, lung, and liver.

Lycii fructus (wolfberry) is an old traditional Chinese supplemental or drug, which also has value for both eyes and liver. The most important portion of wolfberry is the Lycium polysaccharide portion (LPP), with extensive biological actions, including immunoregulation, antioxidant effect, neuroprotective properties, glucose metabolism control and anti-tumor activity.[28]

Cervical cancer and their pharmacology: Scutellaria baicalensis, Curcuma longa, Ganoderma lucidum, Camptotheca acuminata, Antrodia cinnamomea, Terminalia catappa, Chelidonium majus, and Lycopodium clavatum are all anti-cancer herbs that work specifically in cervical cancer. Scutellaria baicalensis inhibits cell proliferation (with a higher degree compared to other herbs) by arresting the cell cycle and causing apoptosis via caspase activation and the mitochondrial pathway.[29]

Curcumin directly inhibits HPV E6/E7 oncoproteins, restoring p53 and Rb tumor suppressor activity in cervical cancer. Ganoderma lucidum increases immune response while advancing cell cycle arrest and inducing apoptosis (via the mitochondria). Camptotheca acuminata inhibits the function of Topoisomerase I (an enzyme that uncoils DNA) which prevents DNA replication leading to cell cycle arrest and apoptosis.[30]

Antrodia cinnamomea induces apoptosis via reactive oxygen species (ROS) generation and mitochondrial dysfunction while reducing angiogenesis and invasion in cervical cancer cells. Terminalia catappa induces DNA fragmentation,

ROS generation and caspase activation which leads to apoptosis, decreased angiogenesis, and inhibition of metastasis.[31]

Chelidonium majus inhibits microtubule polymerisation, preventing mitosis and inhibits G2/M cell cycle arrest and caspase-dependent apoptosis. Lycopodium clavatum induces oxidative stress and mitochondrial apoptosis, inhibiting proliferation of HeLa cells by regulating a number of cell cycle proteins. All of the anti-cancer herbs discussed have been shown to affect cancer progression through activating the mitochondria pathway.[32]

Ovarian cancer and their pharmacology: Artemisinin, a compound of Artemisia annua, creates reactive oxygen species (ROS) and triggers apoptosis through caspase-3 activation and significant disruption of mitochondrial membrane potential, leading to cell cycle arrest in either the G1 or G2/M phase and inhibits the proliferation of cervical cancer HeLa cells and tumor growth. Triptolide, an active component of Tripterygium wilfordii, inhibits transcription that is RNA polymerase II-mediated and results in gene suppression and apoptosis, through a mitochondrial pathway.[33] Triptolide also results in decreased inflammation and halt tumor progression, stops angiogenesis and cell migration, and potentially aids chemotherapy.

Panax ginseng, a type of Korean/Asian Ginseng, and has ginsenosides that cause apoptosis via mitochondrial and extrinsic pathways and inhibit pro-survival signaling, decreases angiogenesis and metastasis via downregulating VEGF and MMP-9, and inhibits HPV E6/E7 oncoproteins leading to restoration of p53 function.[34]

Scutellaria baicalensis, commonly known as Chinese skullcap, contains active compounds such as Baicalin and Baicalein, which halt cell cycle progression, induce mitochondrial dependent apoptosis, and both inhibit the growth of cervical cancer and metastasis in both in vitro and in vivo models.[35]

Ganoderma lucidum is also known as Reishi Mushroom and has important triterpenes, polysaccharides, and ganoderic acid that activate immune cells, induce release of cytokine from immune cells, induce apoptosis in cervical cancer cells, and inhibits the process of angiogenesis. These beneficial reactions are expected to enhance the host immune state and inhibit proliferation activity of cervical cancer cells.[36] In the case of triptolide, it is known to be highly toxic, so it would require intense monitoring.

Renal cell carcinoma and their pharmacology: Angelicin is a furocoumarin found in a variety of plants. Some of the notable species include Inutoki or Yamaninjin, wild angelica, Bituminaria basaltica, and common fig. Angelicin has shown to have antiviral, anti-inflammatory, and anticancer activity in both in vitro and in vivo studies. Angelicin has been shown to enhance TRAIL-induced cell death in human RCC Caki cells. Using a combination of angelicin and TRAIL involved in the accumulation of a sub-G1 cell population, cleavage of PARP, demonstrating apoptotic morphology.[37] Combination treatments with angelicin and TRAIL displayed increased caspase-3 activation and decreased c-FLIP expression, indicating that angelicin enhanced TRAIL-induced apoptosis in Caki cells.

Apigenin, a naturally occurring flavonoid found in parsley, celery, and chamomile, has demonstrated anti-tumor activity in vitro and in vivo, acting to modulate signals and pathways in a variety of cell signaling pathways. It has been reported that apigenin inhibited the proliferation of human RCC lines ACHN, 786-O, Caki-1, noting that apigenin inhibited proliferation in all three of the cell lines. Apigenin creates DNA damage in ACHN cells by showing enhancement in H2A histone family member X phosphorylated on serine 139 (γH2AX), a hallmark of double-stranded

DNA breaks.[38] In ACHN cells, the authors detected G2/M arrest in the cell cycle and an enhancement in phosphorylated-ataxia telangiectasia mutated (p-ATM), phosphorylated checkpoint kinase 2 (p-Chk2), phosphorylated Cdc25 on serine 216 (p-Cdc25c), and phosphorylated Cdc2 on tyrosine 15 (p-Cdc2).

Chrysin supplementation led to increased expression levels of glutathione S-transferase (GST) and quinone reductase (QR) and had reduced proliferating cell nuclear antigen (PCNA) positive cells in kidney tissue. Furthermore, chrysin supplementation reduced nuclear factor-κB (NF-κB) activation by reduced expression levels of cyclooxygenase-2 (COX-2), interleukin 6 (IL-6), tumor necrosis factor-α (TNF-α), and prostaglandin E2 (PGE2); reinforcing chrysin's protective effects in renal carcinogenesis.[39]

Daphnetin, a derivative of coumarin which was extracted from the plants Daphne Korean Nakai and Euphorbia semen, has been shown to have some combination of anti-inflammatory and anticancer activities at past studies [40]. Esculetin, a product of coumarin, has shown somewhat success to be a possible treatment of diseases of obesity, diabetes, cardiovascular disease, renal death and disease, and neurologic and neoplastic diseases.[41] Eupafolin is a flavone found in Japanese mugwort has demonstrated the inhibition of numerous human cancer cells.

Pancreatic adenocarcinoma and their pharmacology: The pharmacology of herbs used in Traditional Chinese Medicine (TCM) for pancreatic adenocarcinoma included Atractylodis Macrocephalae, Hedyotis Diffusa, Astragali Radix, Codonopsis Radix, and Scutellaria Barbata. Atractylodis Macrocephalae Rhizoma (Bai Zhu) tonifies the spleen and enhances immunity by promoting natural killer (NK) cell activity and affecting cytokine expression.[42]

Hedyotis Diffusa (Oldenlandia diffusa) is an anti-inflammatory and anti-tumor herb that induces apoptosis of pancreatic cancer cells through activation of caspase-3 and inhibits angiogenesis. It also inhibits the NF-κB and PI3K/Akt signalling pathways.[43]

The herb Astragali Radix (Huang Qi – Astragalus membranaceus) promotes macrophage, T-lymphocyte, and dendritic cell functions, enhances chemotherapy by increasing chemosensitivity, reduces inflammation, and cytokines associated with tumor promotion. It promotes an immune response and mitigates the side effects of chemotherapy.[44]

Codonopsis Radix (Dang Shen) stimulates hematopoiesis, improves energy metabolism in cancer patients, and inhibits tumor-induced immunosuppression.[45] Cordonopsis Radix helps in recovery and improves vitality during cancer treatment. Scutellaria Barbata (Ban Zhi Lian) clears heat and resolves toxicity, and possess anti-cancer properties. They inhibit cell proliferation and promote apoptosis in pancreatic cancer cells, suppresses VEGF expression and angiogenesis, and down regulate cyclin D1, up regualte p53, and activates caspase-3.[46]

The proposed advantages of combination therapy include inhibiting the growth of cancers and supporting immune function, minimizing toxicities and inflammation, produce a better outcome with chemotherapy, and maximize the quality of life in patients with pancreatic adenocarcinoma.[47]

Esophageal carcinoma and their pharmacology: Banxia, Shu Di Huang, Radix Bupleuri, Xuan Fu Hua, and Sha Shen are five herbal approaches that can be used for esophageal cancer. Banxia, Shu Di Huang, Radix Bupleuri, Xuan Fu Hua, and Sha Shen have important roles in healing esophageal cancer.[48]

Banxia, with its alkaloids, polysaccharides, and pinelline, has antitumor effects while simultaneously alleviating nausea and reducing phlegm.[49]

Shu Di Huang has demonstrated anti-inflammatory effects, suppressing IL-6 and TNF-α, while also alleviating chemotherapy-induced nausea.[50]

Radix Bupleuri has two active ingredients, saikosaponins A and D, which have established anticancer properties, promoted T-cell activity and boosted NK cell cytotoxicity.[51]

Xuan Fu Hua contains sesquiterpene lactones which induce apoptosis, inhibit the proliferation of cancer cells, alleviate phlegm and discomfort in the esophagus.[52]

Sha Shen has polysaccharides, saponins, and coumarins which exhibit anti-inflammatory effects while reducing oxidative damage to the mucosal lining and acting as a yin tonic.[53]

These herbal treatments all have Mechanisms of Actions targeting esophageal cancer prominently by providing anti-tumor treatment, reducing nausea, regulating phlegm, inflammation, aiding blood/yin recovery post-chemo, exhibiting anti-inflammatory effects, boosting innate immunity, further decreasing inflammation while promoting cancer cell death, exhibiting expectorant qualities, supporting esophagus functionality, and helping patients manage dry mouth effects from radiation therapy.[54]

Thyroid cancer and their pharmacology: While individual responses may vary, bugleweed is a folk remedy demonstrated to improve thyroid function and has some potential to improve hyperthyroidism.[55]

Clinical evidence confirms its use for treating thyroid cancer is entirely unsubstantiated. Another plant which, like the bugleweed has not been clinically validated for anticancer (or thyroid) indications, is agarwood.[56]

Saussurea costus has anticancer effects using mechanisms such as mitochondrial-mediated apoptosis, cell cycle arrest, and attenuation of NF-κB, TNF-α, VEGF, Ki-67, and MMP-9 pathways against breast, colon, esophageal, and liver cancer cell lines .[57] Costus root extract has been shown to protect thyroid levels and thyroid tissue in an animal model of drug-induced thyroid toxicity.

Bunium incrassatum has been shown to inhibit thyroperoxidase (TPO), inhibit hormone production, and stimulate TSH, is an ethnopharmacological plant that is used in Algeria to treat thyroid problems, including thyroid cysts. There is no evidence it has efficacy as an anticancer agent or that it is applied for treating thyroid cancer. In North Africa and the Middle East.[58]

Atriplex halimus is an herbal treatment for the treatment of thyroid problems and cysts. To our knowledge, there are no studies previously published demonstrating direct cytotoxic or anticancer effects of atriplex halimus for thyroid carcinoma.[59]

NOVEL HERBAL PRODUCTS AND CREATIVE THERAPIES

Studies in herbs have revealed many innovative bioactive compounds suggested as anticancer agents, including withaferin A, triptolide, and nanoparticle-based delivery systems. Withaferin A induced apoptosis and inhibited

angiogenesis in breast, prostate, kidney and stomach cancer cells.[60] Triptolide had an anticancer potential because it can affect multiple signaling pathways including NF-κB, MAPK, and PI3K/Akt.

There has been a surge in new acarious herbal formulations and delivery systems to improve efficacy and better target the agents. Nanoparticle-based delivery systems, including liposomes and polymeric nanoparticles, have been used to improve the bioavailability and delivery of herbal agents. For instance, Curcumin-loaded nanoparticles conferred greater cellular uptake and increased anticancer effects.[61] Curcumin-loaded magnetic nanoparticles achieved an anticancer effect on prostate cancer cells that was elevated above that of curcumin alone.

Non-herbal formulations comprising multiple bioactive agents have been developed to achieve complementary anticancer implications. Wang et al have reported on the anticancer implications of Huang-Lian-Jie-Du-Tang (HLJDT)[62], a traditional Chinese medicine that comprises four herbs: Coptis chinensis, Scutellaria baicalensis, Phellodendron amurense, and Gardenia jasminoides.

Novel treatments using herbal agents include nano-herbal formulations, Herbo-chemotherapy, phytochemical drug design, immunomodulatory therapy, and gene-targeted therapies, with a goal of producing effective, low-toxicity, and affordable treatment for cancer.[63] While there is potential, more research is needed to understand the mechanisms of action, safety and clinical effectiveness of the new herbal agents and treatments listed above.

CONCLUSION

Herbal medicine represents an important avenue in cancer treatment, although interdisciplinary studies and collaborations are required to realize its full therapeutic potential. The objective of evidence-based cancer care is to inform decision making on how best to utilize herbal therapies; not only for practical efficacy, but with full knowledge of the potential implications in doing so. Herbal therapies may play an ever-increasing role as therapeutic agents as they begin to receive the same valid scientific treatment and attention as standard treatment modalities. Herbal therapies may transition from the realm of supportive care, to being central to strategic targeted cancer treatment, although they must first be substantiated by scientific evidence. However, beyond a focus on efficacy, the use of herbal agents must make practical and reasonable use of, and be underpinned by, scientific understanding and knowledge to ensure their safe and effective use as adjuncts in cancer management. Although herbal agents have exploitable therapeutic potentials unique to their phytochemical profiles, they should not be used and integrated into cancer care solely based on anecdotal lore or folklore. If the effectiveness of herbal products is evidenced with established efficacy from the scientific literature, there is no other more appropriate evidence-based approach to integrating herbal products into cancer care.

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