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A review on the potential use of *Garcinia cowa*

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Abstract
Medicinal plants have been used in the treatment for several human ailments since time immemorial. They are important because of the bioactive compounds present in them. They have been reported to possess anti-microbial, anti-inflammatory, anti-oxidant, and anti-cancer properties. Among the various existing diseases, cancer is more prevalent in recent times. Medicinal plants have been used in the treatment of cancer. Medicinal plants also serve as the source for the development of new drugs in the clinical treatment of cancer. *Garcinia cowa* possess various medicinal properties and has been used in the treatment illness including fever and diabetes. The phytoconstituent of *Garcinia cowa* has been reported to have potential anticancer activity.

Keywords: Medicinal plants, cancer, *Garcinia cowa*, anticancer

Introduction
Medicinal plants contain phytoconstituents that are of therapeutic value. They have been used to treat ailments since thousands of years. Medicinal plants are rich in bioactive compounds and are a source of drug development and nutrition. Bioactive compounds in medicinal plants include alkaloids, flavonoids, glycosides, terpenes, tannins and phenolic compounds. The existence of these bioactive chemicals in medicinal plants contributes to their therapeutic potential. [1]. Some of the medicinal plant products commonly used in the Indian cooking are asafoetida, black pepper, fenugreek, ginger, garlic, mint, lemon, turmeric, and so onIt has been reported that traditional medicine is used by around 80% of the population worldwide [2]. Use of medicinal plants for the treatment of ailments was initially based on traditional knowledge of indigenous communities passed on from generation to generation.

Medicinal plants are inexpensive raw materials for the synthesis of new drugs and the likelihood of the human body accepting plant derived preparations are higher when compared to the substances produced in the laboratory. India is a rich source of medicinal plants. It is reported that the Nawarangpur district of Odisha is a medicinal plant hub in India. Over 1,10,000 studies on medicinal plants were published between 1960 and 2019 according to global trends on medicinal plants. Worldwide research on medicinal plants indicated that China and India have the highest publications with more than 10,000 publications [3].

About 75 to 80 percent of the population still uses medicinal products as their primary form of treatment, and the utilisation of plant extract and its active ingredients makes up most of the traditional therapy. Medicinal plants have been reported to possess antimicrobial activity against various pathogens [4]. Traditional medicine (TM) is the practise of combining plant or animal-based characteristics into treatments, either separately or in combination, with the goal of treating or preventing disease as well as maintaining a person's overall health. Medicinal plants have been used in the treatment of the variety of diseases and conditions including boils, snake bite, weakness, diabetes, mouth ulcer, chronic bronchitis, women's infertility, measles, pneumonia, diabetes, and cancer [5].

Cancer is one of the major public health issues affecting thousands of people worldwide. In the US, cancer is the second leading cause of death. It is estimated that approximately 6 lakhs people in the US will die from cancer in 2023 [6]. Many Plant species have been used in the treatment of cancer [7]. Phytochemical substances and secondary metabolites found in plants are a major contributor to their therapeutic effects. Some of the plant derived anticancer agents in clinical use includes vinblastine, vincristine, paclitaxel, camptothecin, topotecan, irinotecan, podophyllotoxin, Etoposide, teniposide, Homoharringtonine and Elliptinium [8].

Results and Discussion

The world's biggest factors of illness are altering. Non-communicable diseases including cancer and cardiovascular disease are replacing infection as a primary cause. In 2027, it is predicted that there will be 34 million new cancers which will be twice number of cases recorded in 2018 [9]. Cancer is a defector system of growth that originates within the patient's body.

The fundamental unit of life is the cell. Multicellular or unicellular organisms are both possible. For proper growth and development to persist, cells commonly divide. Within the body, aberrant cell division can occasionally occur where the body does not require the divided cells. A tumor is an accumulation of tissues made up of these undesirable cells. All types of tissues can develop tumors, which can either be benign or malignant. Research on complementary and alternative medicine that addresses cancer management has received more attention [10].

Causes of Cancer

There are many causes of cancer which include exposure to ionizing radiation, chemical carcinogens, obesity, environmental factors, hereditary, pharmaceuticals, microorganisms like bacteria, fungi and virus, hormones, and consumption of tobacco [11].

Signs and symptoms

There are many symptoms associated with cancer. Most patients with cancer will experience weight loss. A sudden weight loss in the body may be indicative of cancer. Patients with pancreatic cancer suffer from high prevalence of weight loss [12]. Cancer patients often have fevers. If cancer or its treatment affects the immune system, most patients have fever. Another typical symptom for most people is tiredness. In other situations, such as leukaemia, it could occur early. Some tumours, such as bone cancer or testicular cancer, may have pain as an early symptom. A brain tumour may be the cause of a headache which never goes entirely or become improved with treatment. The symptoms of ovarian, colon, or rectum cancer can include back ache. Pain brought on by cancer typically indicates that it has already spread from its original site. Some other tumours can also result in visible changes to the skin, in addition to skin cancers.

Cancer diagnosis

Numerous methods and procedures are employed in cancer diagnosis to find or confirm the presence of malignancy. In order to make a diagnosis, a patient's medical history, clinical exams, laboratory test results, radiographic data review, microscopic analysis of tissue samples acquired through biopsy or fine-needle aspiration. 16α-18F-fluoro17β-estradiol PET/CT was useful in diagnosis of ovarian cancer with 100% specificity [13]. Recently, an artificial intelligence model Prostate Imaging Reporting and Data System (PI-RADS^{AI}) was developed to provide an alternative in the diagnosis of prostrate cancer [14].

Cancer treatment

The combination of measures, that may include psychosocial support, surgery, radiotherapy, chemotherapy, and hormone therapy, is intended to either treat the disease or significantly prolong the patient's life while additionally improving the patient's quality of life [15].

Chemotherapy is frequently used to treat several cancers. Through blood vessels and lymphatic systems, cancer cells can potentially spread across numerous parts of the body. These abnormally proliferating cells are controlled and eliminated by chemotherapy for cancer. Chemotherapy employs drugs that hunt for and kill rapidly dividing cells. To halt the spread of cancer cells, the chemotherapy drugs circulate throughout the human system. Because they divide more often than healthy cells, cancer cells are more vulnerable to chemotherapy. Many advancements have been made in chemotherapy. It is reported that a novel conjugate of Pt (IV) complex and Ru(II) complex has a great potential in chemotherapy [16]. Chemotherapy frequently affects healthy cells, which results in adverse effects. Owing to the adverse effects, utility and effectiveness of chemotherapy have restricted its use [17].

The use of medicinal plants in contemporary medicine for cancer therapy or cancer prevention is a crucial component. Hence, it is important to find substances in medicinal plants that can slow the growth of tumours and act as antitumor agents. Chemoprevention is a method of cancer prevention that uses chemical substances to pharmacologically interfere in the disease onset.

Numerous herbs have undergone clinical evaluation, and phytochemical research is currently being done on them to better understand their tumoricidal effects on various malignancies. On the basis of scientifically sound study, practitioners and academics have long been interested by the traditional Indian medical system and how it has developed over the years. Some of the plants that possess anticancer activity includes *Salix sp.* [18], *Vinca rosea* [19], *Pfaffia paniculate* [20], *Camellia sinensus* [21], *Curcuma longa* [22], *Piper nigrum and Elatarria cardomum* [23], and Ocimum basilicum [24]. Herbal medicines play an important role in the prevention and treatment of cancer.

Medicinal plants

The primary product of photosynthesis—carbohydrates, proteins and fats—plays a crucial role in the role of food crops, which provide the majority of human nutrition. Herbs, traditional medicines, essential oils, and cosmetics are typically made from secondary plant metabolic products such alkaloids, terpenoids, and flavonoids. These compounds, which are regarded as the enormous chemical library of biological systems, have evolved as reactions of plants to stress, predation, and competition. Therefore, "extracts" rather than actual plants or plant components like fruits, seeds, leaves, etc. are typically employed to provide medical effects. On the other hand, therapeutic plants have what is known as a pathological niche and take on pathogenomic structure. According to the human physiology, this indicates that numerous diseases can be treated using medicinal herbs [25]. Owing to the availability of numerous medicinal plants and its importance, medicinal plant database has been developed which serves as the repository of the available medicinal plants worldwide. Some of the database include Indonesian Medicinal Plant Database [26], Uttarakhand Medicinal Plants Database (UMPDB) [27], MPD3 [28], TCM plant genome database [29] and Phytochemica [30].

Medicinal plants as anticancer agents

Plants are being used in treating cancer since a very long time. In 1969, Hartwell in his review first published a list of more than 3000 plant species which have been used by humans against cancer. The majority of currently available anticancer medications are derived from organic materials like plants and microorganisms. Phytochemicals serves to play a dominant

role in the discovery of leads for the synthesis of conventional drugs for the treating most human diseases. Vinca alkaloids vinblastine, vincristine and podophyllotoxins derived from plant sources were some of the early used anti-cancer medicines. Since then, numerous medicines that have the potential anticancer activity have been derived from plants [31].

Garcinia sp

Garcinia L. is a member of the Clusiaceae family, which is widely distributed in tropical areas of the world. It is predominantly distributed in the western ghats of India. The evergreen trees and shrubs that make up the genus *Garcinia* L. have gum resin that is green in colour. The floral characteristics of *Garcinia* is very complex. Stipules are typically zero; leaves are subcoriaceous or leathery; Flowers are solitary, fascicled, umbelled or panicle, polygamous or dioecious; Petals are imbricate and have 4-5 leathery persistent sepals; Berries with a fleshy rind and 2 to 8 big, pulpy seeds [32]. The genus *Garcinia L.* contains valuable therapeutic plants exhibiting antibacterial and antioxidant properties [32] [33].

The cultivated species of *Garcinia sp.* Include *Garcinia atroviridis*, *G. cowa*, *G. Morella*, *G. lanceaefolia*, *G. hombroniana*, *G. prainiana* and *G. mangostana*. Members of *Garcinia* L. species produce edible fruits among which G. mangostana is often considered as most famous fruit. Hydroxy citric acid (HCA), which is used in the treatment of obesity, is present in the fruits of certain members of *Garcinia* L., which including *G. cambogia*, *G. indica* and *G. atroviridis* [34].

Garcinia cowa

Garcinia cowa, is an evergreen plant commonly referred to as Cha-muang in Thai. The young leaves and fruits are edible and have a sour taste. The bark is dark brown in colour and filled with yellow latex, and the leaves are lustrous, deep green, and oblong. The plant has unisex flowers and the fruits are globose, green when young and dull orange or yellow at maturity [35].

Garcinia cowa has many medicinal properties. Its latex has been used in the treatment of fever [36]. It is used in the treatment of diabetes. Recent findings reported the role of bioactive compounds from *Garcinia cowa* in the consumption of glucose by 3T3-L1 cells and their use as potential supplement for antidiabetic drugs [37]. Phytochemicals of *Garcinia cowa* also possess antiparasitic property [38]. Major phytoconstituent in Garcini cowa include xanthones and phloroglucinols [39].

Ethanol extract, ethyl acetate fraction and n-hexane fraction of the leaf of *Garcinia cowa* can be used as a source in cancer treatment and it also has antioxidant property. Ethanol extract possess strong cytotoxicity while ethyl acetate fraction and n-hexane fraction possess moderate cytotoxicity. Ethanol extract and n-hexane fraction are very strong antioxidants when compared to ethyl acetate fraction [40].

Chouni reported that the methanolic extract of *Garcinia cowa* leaves was more potent in antiproliferative activity especially against human lung cancer cell line, A549. It was reported to have modest potential of antiproliferative activity against other cell lines *viz*., MCF-7, HepG2, and MOLT - 4, also to some extant against MDA-MB-468 cells [41].

The butanol fractions of *Garcinia cowa* Roxb. exhibits immunomodulatory activity by enhancing TNF-α levels and phagocytic index of the cell line, Raw 264.7 macrophages. These results suggest that the butanol fraction could be a potential immunostimulant [42]. Garcowacinol C, polyprenylated benzoylphloroglucinol derivative from the twigs of *Garcinia cowa* has significant cytotoxicity against five cancer cell lines KB, HeLa S3, MCF-7, Hep G2, and HT-29 [43]. chamuangone extracted with rice bran oil from the leaves powder of *Garcinia cowa* exhibited strong cytotoxicity against human lung adenocarcinoma, human breast adenocarcinoma, and human colorectal adenocarcinoma cell lines, A549, MCF-7, and HT-29 cells respectively and this chamuangone extract could be used as a functional food in chemotherapy [44].

Conclusion

The development of human culture has been intimately correlated with the use of medicinal plants as therapeutic agents. Traditional knowledge on medicinal plants is indigenous in nature, and it is passed down through generations. Studying medicinal plants gives us extensive insights into their involvement in the treatment of many illnesses because they are a rich source of bioactive substances. The bioactive substances found in medicinal plants are crucial in the fight against cancer.

One such healing plant, *Garcinia cowa*, has demonstrated anticancer activity and may be useful in the treatment of cancer. The value of therapeutic plants is acknowledged on a global scale. On a daily basis, many individuals still rely on the use of medicinal plants. The scientific community is becoming more interested in *in silico* analysis of medicinal plants. There are plenty of medicinal plants that remain unexplored today. For the discovery and development novel therapeutic molecules that would aid combating human diseases like cancer, thorough examination of medicinal plants is crucial.

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