Comprehensive Review of the Potential Anti-Breast Cancer Properties of Various Medicinal Plants

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Abstract

Breast cancer is the most frequent cancer in women throughout the globe, and its management can be difficult due to its complex etiology. Treatment with chemotherapy, surgical procedures, radiation treatment, and hormone therapy are among the most frequently utilized treatments. However, complications and resistance to multiple drugs can cause challenges. This overview addresses how organic medicinal products obtained from edibles and plants can assist with treatment of Breast cancer. The article scrutinizes the ways by which natural substances may exert beneficial impact in the prevention and management of breast carcinoma as well as offers knowledge regarding the therapeutic plant, including its family, part used, kind of extraction, and molecular mechanisms in breast carcinoma. Following an exhaustive analysis of the various plants, we discovered that Peganum normata, Ammi visnaga, Camellia sinensis, Curcuma longa, and Allium sativam L. had potential anti-breast cancer activities. These data were gathered from PubMed, Scopus, and Google Scholar.

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Keywords: Chemotherapy; Conventional Medicine; Etiology

Introduction

Cancer has emerged as one of the biggest problems in this era because of its increased prevalence in the past few decades and its impact on all psychological, physiological, and social dimensions of individuals (1). The global incidence of this illness fluctuates between 1% to 2% in well-off countries, while in much less advanced nations each year's increase is close to 5% (2). In accordance forecasts, malignancy affects approximately seven million individuals globally. It is anticipated that the amount of newly diagnosed cancers will rise from 10 to 15 million by 2020 (3,4). In the meantime, carcinoma of the breast is the most prevalent form of carcinoma among women (5), alongside more than one million instances being diagnosed recorded annually (6). It is the most frequent cancer in women in Iran, with a prevalence of 21.4 (7). or 32% (8). It is the most often type of disease in women in the USA, with a rate of 12.5%. It has a 1-in-35 fatality rate (9). In the USA, the lifetime probability of having a breast cancer is around 12% (1-in-8) (10). It is an extremely predominant kind of malignancy & also the second most notable contributing factor to dying. This illness is the predominant cause fatalities among women aged 45 to 55 years (11) and stands as the second biggest contributor of deaths related to cancer. It affects around one among every eight women and typically requires full tissue excision, radiation therapy, chemotherapy, and hormone therapy (12). It includes a form of tissue malignancy that mostly impacts the innermost portion of glands that produce milk or lobules and ducts (minuscule tunnels which transmit milk) (13). The key risk factors for cancer include age (14), high hormone levels (15), race, socioeconomic position, and iodine deficiency in the diet (16,17). It is a several phases illness, with pathogens triggering one stage of the inflammatory process (18) Viruses have been linked to an array of malignancy types (19).

Breast cancer has become a usual and life-threatening problem around the globe, with cellular equilibrium governed by the proliferation of cells and mortality. The condition can be worsened by an abundance of intrinsic and extrinsic factors, and typically, medical therapies like radiology and chemotherapy are sometimes hazardous to recipients. Multidrug resistance (MDR) is another problem for conventional therapy, triggering the development of alternate therapies (20). That's another top reason for demise among prosperous nations, subsequent to heart disease (21,22). The cancer is characterized by an

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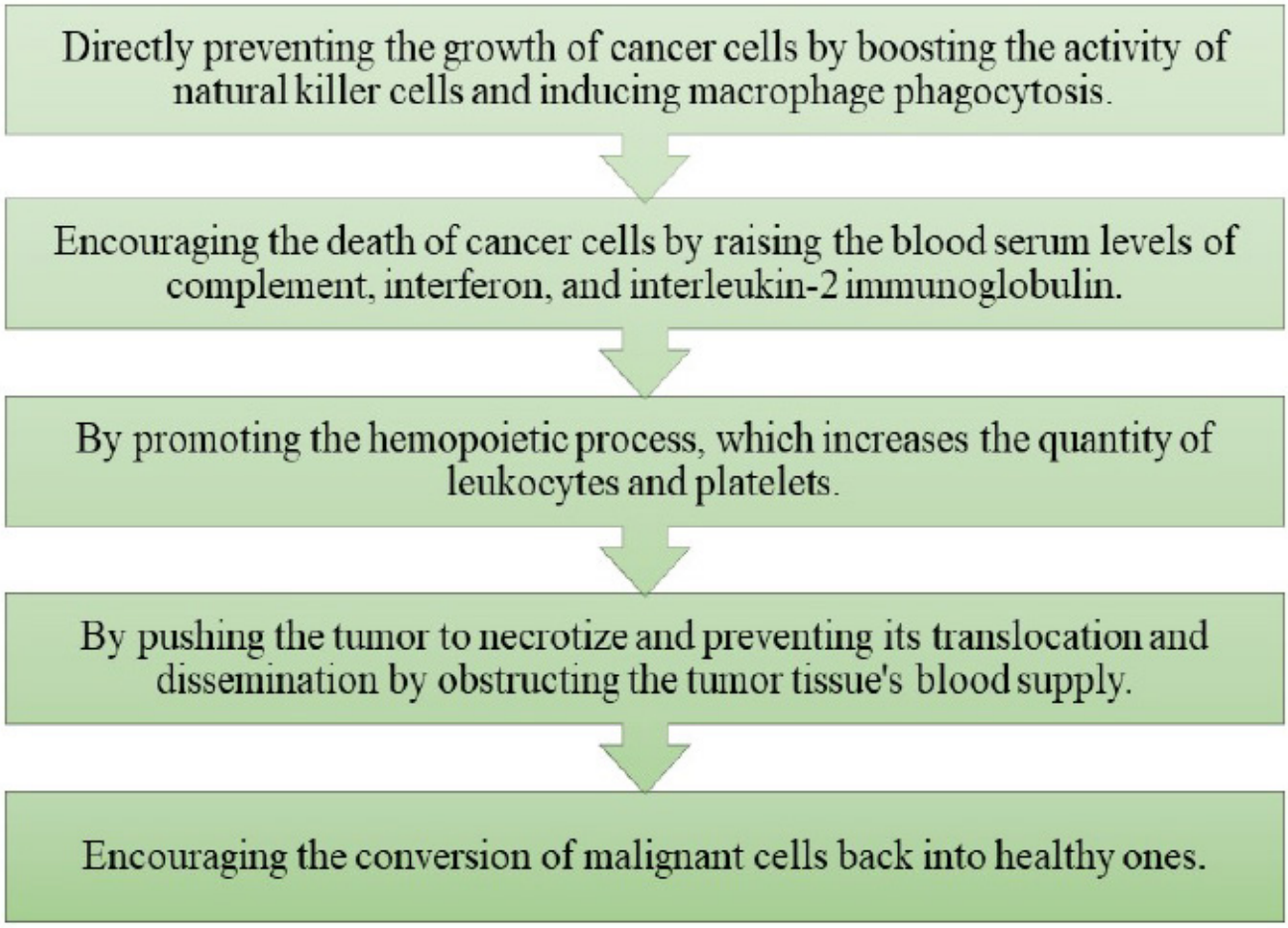
unregulated spread along with the deformation of healthy tissues (23). Mutations across various cell signalling pathways are linked with carcinoma and a group of inherited ailments (24). Unmanageable expansion of cells triggered by apoptotic abnormalities promotes tumor development, so way of life modifications is the major cause of cancer, which led to intensive exploration in search of more beneficial remedies. The phenomenon has blossomed into an important matter of health concern, encouraging robust preventive techniques (25). Breast cancer, a disease affecting ducts and milk glands, is influenced by age, hormone levels, race, economic status, and iodine deficiency. Signs include lumps, breast shape changes, skin dimpling, nipples, discharge, or red patches. Cancer is a disease characterized by the disruption of molecular networks in mammalian cells, leading to abnormal proliferation, differentiation, and cell death. This disruption occurs at various levels, affecting normal cells in various ways (25,26).

Therapeutic plants offer advantages over synthetic products due to their tolerant and non-toxic nature (27). However, radiotherapy and chemotherapy are increasingly used for cancer treatment, but they have side effects like neural, coronary, nephritic, and pneumonictoxicity (12). A new approach is needed to create fewer unsafe and powerful antineoplastic. This article explores how natural substances may benefit both the prevention and management of breast carcinoma, as well as offers knowledge about the molecular mechanisms through which medicinal plants treat breast carcinoma.

The cancer therapy mechanism (28)



Advantages of herbal drugs over conventional drugs (27)

Natural-based folk treatments have been utilized for millennia around the world, with health advantages recognized. Herbal supplements, botanicals, and phytomedicines are botanical-derived items that help to maintain or improve health. Conventional cancer medicines are costly and prone to problems, necessitating the development of novel, more efficient alternatives. Pharmacists are considering using naturally derived combinations to manufacture new medications and cure diseases because of their availability, lower frequency of side effects, drug interactions, and affordability. Although herb therapies are quiet an implicit science, they are well established in various cultures and traditions, and about 80% of rural

communities, particularly in Asia, use herbal therapies as a form of treatment. The increased interest in herbal remedies is critical for reducing illness severity and enhancing health.

Methods

The information was gathered using database searches in PubMed, Scopus, and Google Scholar. The terms "supplementary," "substitute," "plant-based," "chemotherapy-preventive," "conventional medicine," and "complex etiology" were searched.

Results

The process of gathering data involved looking through publications from 1995 to 2023, including research on animals and cell lines that assessed the potential of different medicinal herbs to prevent breast cancer.

Table 1. Summary of anti -breast cancer natural drugs studies for controlling breast cancer.

Sr.	Scientific Name	Common name	Family	Part(s) Used	Extract Used	Important Compounds	Mechanisms	Reference
1	***Taverniera spartea***	Aelijaan	***Fabaceae***	Shoot	methanol extracts	Isoflavonoid compounds and saponins	Necrosis and apoptosis induction	29
2	***Peganum harmala***	Harmel	***Nitrariaceae***	Seed	extracted by distillation	Alkaloids	Apoptosis induction (via activation of caspase and increased activity of proteolytic enzymes)	30
3	***Ammi visnaga***	Bisnaga	***Apiaceae***	Roots	--	Visnadine, cimifugin, khellol, b-sitosterol, kaempferol, quercetin	Abrupt termination of the cell cycle	31
4	***Camellia sinensis***	Tea plant	***Theaceae***	Leaf	aqueous extract	Epicatechin, epigallocatechin, epigallocatechingallate, epigallocatechin3-gallate	inhibition of the growth of cancer cells (by blocking the action of the enzyme -ºa reductase)	32
5	***Avicennia marina***	Grey mangrove	***Acanthaceae***	Leaf	Methanolic extract	Flavonoids	Antioxidant effects; induction of apoptosis	33
6	***Curcuma longa***	Turmeric	***Zingiberaceae***	Rhizome	--	Curcumin	Inhibition of cancer cells proliferation (by adjusting gene expression); inhibition of angiogenesis; induction of apoptosis	34
7	***Olea europae***	Olive	***Oleaceae***	Leaf, fruit	--	Oleic acid, pinoresinol, oleuropein, acidic triterpenes, oleanolic acid, maslinic acid	suppression of cancer cell proliferation (HER2 gene expression suppression); prevention of angiogenesis; promotion of apoptosis.	35
8	***Nigella sativa***	Black cumin	***Ranunculaceae***	Seed	distillation	Thymoquinone, dinitroquinone	Cell cycle arrest; induction of apoptosis	36
9	***Allium sativum L***	Garlic	***Amaryllidaceae***	Fruit	Ethanolic extract	Allicin, ajoene	Cell cycle arrest; induction of apoptosis	37
10	***Trigonella foenumgraceum L***	Fenugreek	***Fabacecae***	Shoot	Ethanolic extract	Flavonoids and alkaloids (such as gingerol, cedrene, zingerone, vanillin, and eugenol)	Antioxidant effects; induction of apoptosis	38
11	***Glycyrrhiza glabra***	Liquorice	***Fabaceae***	Root	Ethanolic extract	Glycyrrhizin	Inhibition of cancer cells proliferation (bcl-2 phosphorylatio); morphological changes cancer cells and induction of apoptosis	39
12	***Lagenaria siceraria Stan dl***	Bottle gourd	***Cucurbitaceae***	Shoot, fruit	Methanolic extract	Vitamins (B group and C), saponins, cucurbitacin	Cell cycle arrest	40
13	***Aegle marmelos***	Bael	***Rutaceae***	Stem bark	ethanol by maceration	Lupeol	Cell cycle arrest	41,42
14	***Alpinia galangal***	Thai ginger	***Zingiberaceae***	Rhizome	Ethanolic extract	Acetoxy-chavicol-acetate, (ACA), Pinocembrin, Galangin	inhibits cell growth and causes apoptosis; has high antioxidant, antimutagenic, and anti-inflammatory effects.	43

Table 1. Continued

Sr.	*Scientific Name*	Common name	*Family*	Part(s) Used	Extract Used	Important Compounds	Mechanisms	Reference
15	***Amoora rohituka***	Rohituka tree	***Meliaceae***	Stem bark	pet. Ether, ethyl acetate, Methanolic extract	Amooranin (a triterpene acid)	Arrests G٢/M phase of the cell cycle and induces apoptosis	44
16	***Annona muricata***	Graviola	***Annonaceae***	Fruit, seeds, leaves, and bark	macerated	Acetogenins	Blocks production of adenosine triphosphate allowing chemotherapy to be more effective, inhibits NADH oxidase and blocks ATP production in mitochondria limiting the ability of cancer cells to grow	45
17	***Arctium lappa***	Greater burdock	***Asteraceae***	Seeds, root, fruit, leaves	--	Arctigenin, Lappaol F	Prevents oncogene mutations, lowers tumor size, relieves pain, and increases survival time, arrests cell cycle at G1 and G2 phases, and promotes apoptosis.	46
18	***Azadirachta indica***	Neem	***Meliaceae***	Leaves, flowers	Ethanolic extract	Liminoids and Nimbolide	Inhibits growth and spread of various cancers by inducing apoptosis, prevents metastasis, effect activates tumour suppressor gene and inhibits VEGF and phosphoinositol PI3K/Akt pathways, suppression of NF22-κB signaling, and cyclooxygenase pathway	47
19	***Berberis vulgaris***	Common barberry	***Berberidaceae***	fruits	Ethanolic extract	Berberine, berbamine, chelidonic acid, oxycanthine and palmatine	Arrests cancer cell cycle in G-١ phase and induces apoptosis increases the penetration of some chemotherapy drugs through the blood-brain barrier	48
20	***Linum usitatissimum***	Flax	***Linaceae***	Seeds	methanolic extract	Lignans	Lignan metabolites bear a structural similarity to estrogens and can bind to estrogen receptors and inhibit the growth of estrogen-stimulated breast cancer	٤٩
21	***Ocimum sanctum***	Tulsi	***Lamiaceae***	Leaves	Ethanolic extract	Eugenol, orientin, cirsilineol,	Blocks supply of oxygen and nutrients to the cancer cells and kills them by starving	50
22	***Origanum vulgare***	Oregano	***Lamiaceae***	Whole plant	Ethanolic extract	Rosmarinic acid	Exerts a modulatory role on tissue lipid peroxidation, induced apoptosis by increasing BAX levels, decreasing BCL2 expression	51
23	***Panax ginseng***	Ginseng	***Araliaceae***	Root	ethanolic extract	Flavonoids, polysaccharides, and polyacetylenes	Inhibits growth of cancer by interfering with the DNA synthesis, regenerates the natural killer cells, stimulates the macrophages	52
24	***Pfaffia paniculata***	Suma	***Amaranthaceae***	Root	butanolic extract	Presents cytotoxic substances	Shows degeneration of cytoplasmic components and profound morphological and nuclear alterations of cancer cells	53

Table 1. Continued

Sr.	*Scientific Name*	Common name	Family	Part(s) Used	Extract Used	Important Compounds	Mechanisms	Reference
25	***Plumbago zeylanica***	Ceylon leadwort	***Plumbaginaceae***	Root	Ethanolic extract	Plumbagin	Cell cycle arrest, DNA damage, apoptosis, and suppression of telomere and telomerase activity; inhibition of proteasome and disruption of sulfhydryl homeostasis	54
26	***Viscum album***	European mistletoe	***Santalaceae***	Sprouts, fruit	--	(such as digallic acid)	Induces apoptosis via activation of caspase cascades and anti-angiogenesis activity	55,56
27	***Garcinia oblongifolia***	Lingnan Garcinia	***Clusiaceae***	Bark	Ethanol and Acetone extract	oblongifolins F and G, xanthone, nigrolineaxanthone T, and garcicowin B	cytotoxic	57
28	***Hedyotis diffusa***	sheshecao	***Rubiaceae***	--	aqueous extracts	polysaccharides, triterpenes, and anthraquinones	apoptosis and inhibitory effect on breast cancer via activation of the caspase٤-/Ca+٢/calpain pathway	58
29	***Elephantopus scaber***	Elephant's Foot	***Asteraceae***	--	ethanolic extract	Deoxyelephantopin (doe)	EAC cells showed membrane blebbing, chromatin condensation and nuclear fragmentation-signs of apoptotic cell death	59
30	***Platycodon grandiflorus***	balloon-flower	***Bellflower***	Root	--	Platycodin D	mitotic arrest and apoptosis in several cancer cells	60
31	***Rhodamnia rubescens***	Scrub stringybark, brush turpentine	***Myrtaceae***	--	--	Tetracycline diterpenoidoridonin	cell cycle arrest and apoptosis	61
32	***Cassia occidentalis***	Coffee senna, ant bush	***Caesalpiniaceae***	whole plant	hydro-alcoholic extract	phenols, phenolic acids, flavonoids, terpenoids, alkaloids, tannins	cytotoxic and antioxidant effects	62
33	***Callistemon viminalis***	Red Bottlebrush, Weeping Bottlebrush	***Myrtaceae***	Aerial Parts	٪٨٠ aqueous methanol extract	phenols, phenolic acids, flavonoids, terpenoids, alkaloids, tannins	cytotoxic and antioxidant effects	63
34	***Cleome viscosa***	Asian spiderflower or tick weed	***Capparaceae***	Bark	methanolic extrac	phenols, phenolic acids, flavonoids, terpenoids, alkaloids, tannins	cytotoxic, anti-angiogenic and antioxidant effects	64
35	***Tinosporacordifolia Wild Miers***	Guduchi	***Menispermaceae***	Leaves	methanol and aqueous extracts	alkaloids, steroids, diterpenoid lactones, aliphatics, and glycosides	--	65
36	***Ziziphus nummularia***	Sidr	***Rhamnaceae***	Leaves	٪٨٠ ethanolic extract	polyphenol, gallic acid	anti-proliferative effects	66
37	***Andrographis paniculata***	Bitterweed, King of Bitters	***Acanthaceae***	--	--	--	inhibition of PI٣K activity in triple negative breast cancer (MDA-MB٢٣١-) cells	67
38	***Centella asiatica Linn***	Asiatic pennywort	***Apiceae***	whole plant or its leaves	methanolic extract	hydrocotyline, vallerine, pectic acid, stigmasterol, flavonoids, thankunosides and ascorbic acid	direct inhibition of DNA synthesis & dependently inhibited the proliferation	68
39	***Phyllanthus amarus***	gale of the wind, carry me seed	***Phyllanthaceae***	Leaves	Dimethyl formamide leaf extract	quercetin, rutin, kaempferol, astragalin and quercitrin	cytotoxic effect	69
40	***Annona muricata Linn***	graviola or soursop	***Annonaceae***	Leaves ,fruit	ethanolic extract, aqueous extract	bullatacin, an acetogenin, annomuricins namely A and B	antitumor properties	70

Table 1. Continued

Sr.	*Scientific Name*	Common name	Family	Part(s) Used	Extract Used	Important Compounds	Mechanisms	Reference
41	***Withania Somnifera Dunal***	Ashwagandha	***Solanaceae***	roots and leaves	methanolic and aqueous extracts	withanolide A, Withaferin A, withanolides	cytotoxicity include activation of both intrinsic and extrinsic apoptosis signaling cascades, triggered by augmented generation of reactive oxygen species (ROS) and nitric oxide (NO) in cancer cells	71
42	***Annona squamosa***	Seetapalam	***Annonaceae***	Aerial part, seeds	petroleum ether, chloroform, ethyl acetate and methanol	benzyl isoquinoline alkaloid	cytotoxic effect	72,73
43	***Catharanthus roseus***	Nayantara, Sada Sawagan	***Apocynaceae***	Root	maceration method	vinblastine and vincristine	Proliferation Inhibitor	74
44	***Bidens pilosa***	Kateeli	***Asteraceae***	Leaves	n - hexane, chloroform and methanol fractioned	friedelin and friedelan - 3 beta - ol	cytotoxic effect	75
45	***Albizia lebbeck***	Siris tree	***Fabaceae***	Bark	hydroalcoholic extract	albiziasaponins	Antiproliferative activity, Apoptogenic potential was evaluated using Caspases-3 and Caspase-8 ELISA assay in MCF-7 cells.	76

Conclusion

According to the current review, herbal medicinal plants can effectively treat breast cancer, which makes them an affordable solution for developing nations. In order to develop novel medications and understand cancer causes, it may be possible to identify anti-cancer chemicals through the study of traditional medicinal plants. This may result in the creation of more potent medications and better healthcare for developing nations.

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Conflict of interest

The author claims they have no financial or other conflicts of interest.

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