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ANTICANCER HERBS AND PHYTOCONSTITUENTS FROM NATURE: A SHORT REVIEW

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ABSTRACT: Cancer is a disease of cells where uncontrolled proliferation occurs leading to death of the incumbent. There is no effective vaccine for prevention and prophylaxis of cancer. Currently available anticancer allopathic drugs have a lot of disadvantages including frequent recurrence of the disease. In this perspective, nature could be a good alternative source of anticancer herbs and phytoconstituents that may prevent the proliferation of cells and even cure the cancer. This review summaries such herbs and phytoconstituents that could give good preventive and prophylactic effect as anticancer medication.

INTRODUCTION: Cancer is a pathological condition in which an abnormal and uncontrolled cell division and spread of cells occur within the body. Neoplastic cells and tissues are characterized by abnormal genetic content, altered chromosome and uncontrolled growth, usually accompanied by loss of cellular differentiation (Anaplasia). It is one of the most devastating killer diseases and is the 2nd leading cause of death worldwide. Yearly about 17.9 million population become ill due to cancer and about 10 million deaths occur from cancer ^{1, 2}. Along with taking life, cancer increases the financial cost as well as becoming financial burden for patients. There are a lot of factors that contribute to cancer. These are increase in aging population worldwide, unhygienic food & feeding habits and lack of proper physical exercise ^{3, 4}.

Cancer is not only a global financial burden for rich nations, it is also becoming burden in developing countries as well. There are many ways to prevent and treat the cancer. Among them, herbal medicines are utilized for mitigating the pathological conditions, inhibit metastasis and improve the immunity. These are applied to minimize the adverse effects coming from use of chemotherapy or radiotherapy. In this review, I have discussed only the natural products that can prevent the cancer, that are within the reach of the poor people and affordable by the mass people.

MATERIALS AND METHODS: Pub Med, Research Gate and Google Scholar etc. have been searched for finding the suitable the literatures to find relevant research works.

The keywords, “cancer”, “natural products”, “anticancer activities”, “Anticancer”, “Cancer treatment by herbs and phytoconstituents” etc. have been applied to find expected research articles and collect information on various aspects of the herbs and phytoconstituents to be used in this study.

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The structures of phytoconstituents have been drawn by using Chem Draw Ultra software.

Findings and Discussion: As mentioned earlier, we have searched for herbs and phytoconstituents which have anticancer activities. From our extensive searches, we have found the followings herbs and phytoconstituents which have anticancer properties. These are briefly presented below:

Green Tea: All kinds of tea leaves including green ones are obtained from *Camellia sinensis*. Other leaves are black and oolong and these are made by applying different procedures. Green tea is known to prevent the process of carcinogenesis. It contains polyphenols such as epigallocatechin-3- gallate (**Fig. 1A**) along with other chemical constituents. In a variety of studies, it has been found that green tea has anticarcinogenic activity and a remarkable safety profile^{5, 6}. About one (1) gram of green tea as solids can be eaten in a day⁷. Moreover, it shows synergistic property with erlotinib, a cancer growth blocker^{8, 9}.

Curcumin: Curcumin is obtained from turmeric. It's scientific name is *Curcuma longa* which is a perennial plant of Zingiberaceae family. Turmeric has been used from antiquity as a culinary spice, a textile coloring component, in marriage rituals and in medical science as an aromatic stimulant. Curcumin (**Fig. 1B**) is a natural phytoconstituent having antitumor activity and it is obtained as a colored compound from powdered turmeric. Many researchers revealed its potential to block the proliferation of neoplastic cells in *in-vitro* experiments and change carcinogenesis in rodent models^{3, 4}. A recent review also indicated the anticancer property of *Curcuma longa*¹⁰. Like epigallocatechin-3- gallate, curcumin has a wide safety margin. About eight (8) gram can be consumed in a day¹¹. Turmeric also shows synergy with antineoplastic medicines such as fluorouracil, alkaloids obtained from *Vinca rosea* plants and gemcitabine^{12, 13, 14} and enhanced the chemopreventive actions together with other dietary polyphenols, for example, genistein, green tea and embelin^{15, 16}. These criteria led to clinical trials (phase I/II) to find out the safety, efficacy and pharmacokinetic properties of curcumin^{17, 18}. But, a big challenge to curcumin's use is its low oral bioavailability¹⁹.

Red Wines and Grapefruit Skins: Red wine is a kind of drinking alcohol prepared from dark-colored grapes. The hue of this alcohol may be intense violet to brick red and brown. The liquor from purple colored grape is greenish-white, the red color is due to anthocyan pigments that are present in the peel of the grape. The red wine production method includes extraction of color and flavor elements from the grape skin²⁰. The scientific name of grapefruit is *Citrus paradisi*. It is a subtropical citrus plant and it is famous for large, sour to semi-sweet fruit. The inner flesh is divided from each other and differs in color from pale yellow to deep pink or red. Grapefruit has been originated in Barbados in the 18th century. It is an accidental hybrid between *C. sinensis* and *C. maxima*. It has also been called the *forbidden fruit*²¹⁻²⁴.

Red wine and grapefruit skins contain resveratrol (**Fig. 1C**) which is a phytoalexin. Phytoalexin gives cardioprotective and chemopreventive activities. It can be eaten up to 5g/day and is safe²⁵.

Red Tomatoes and Processed Tomato Products: The scientific name of tomato plant is *Solanum lycopersicum*. Tomatoes are edible and liked by people of all strata²⁶⁻²⁷. Most of tomatoes become red when they are ripe. These red tomatoes and processed products of tomato are rich in lycopene (**Fig. 1D**) which is a natural antioxidant. A lot of investigators have found its capability to reduce the advancement of different types of cancer such as benign prostatic hyperplasia and prostate cancer²⁸⁻²⁹.

Green vegetables: Nature give us a lot of edible vines that are green in color and enriched in nutrients and antioxidants which gives many health benefits. Few mentionable health benefits of green colored vegetables are - (a) Decreased risk of heart disease - green vegetables are enriched in vital electrolytes such as potassium, magnesium, and dietary nitrates. These electrolytes lower blood pressure and keep the heart healthy, (b) Decreased risk of cancer - Green vegetables are full of antioxidants which helps to safeguard the cells from injury and lowers the risk of cancer, (c) Augmented GIT health - Green vegetables are excellent source of fiber that helps the digestive system to remain intact (d) Strong bones - Green

vegetables contain calcium and vitamin K both of which are necessary to keep the bones healthy (e) Smooth skin and hair - Green vegetables are rich in vitamins (vitamins A, C, and E) and minerals

which are needed for smooth skin and hair (f) Boosted energy levels - Green vegetables contains iron and B vitamins and they are needed to improve energy levels.

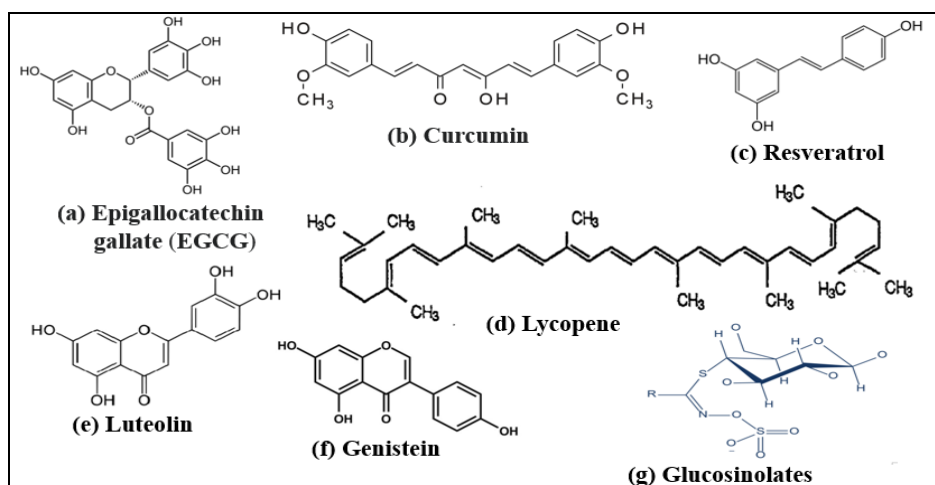


FIG. 1: CHEMICAL STRUCTURES OF PHYTOCONSTITUENTS FOUND IN DIFFERENT HERBS

Moreover, green vegetables also contain many other vital nutrients, for example - vitamins A, C, K and E, iron, calcium, and magnesium³⁰. However, all kinds of green vegetables are rich in luteolin, a flavonoid (**Fig. 1E**). Animal experiments revealed their capability to trigger anticancer actions at many organs such as GIT, liver and colon³¹⁻³³.

Soybeans: The scientific name of soybean is *Glycine max*. It is a species of legume that belongs to the Fabaceae or the bean family. Genistein (**Fig. 1F**), found naturally in soybeans has anticancer activity. The utilization of soybeans was exhibited to reduce the risk of endometrial, breast and prostate³⁵⁻³⁷. Few clinical experiments have revealed genistein's effectiveness in treating prostate cancer.

Mustard Plant: Brassicaceae, a mustard family, includes about 338 genera and more than 3,700 species that are among the most commonly consumed group of plants all over the world. The taxonomical classification of the two species, *B. campestris* (L.) and *B. nigra* (L.), are mostly used. A recent review work by Fareha *et al.*, showed that mustard plants have anticancer activity and the phytoconstituent which is responsible for anticancer activity is Glucosinolates (**Fig. 1G**)³⁸.

Carica papaya: It contains a lot of phytoconstituents. Among them, lycopene (**Fig. 1D**) showed anticancer activity. Hepatic cancer cell

line Hep G2 is affected by lycopene³⁹. The growth of cancer cell has also been prevented by ethanolic extract of *C. papaya*⁴⁰. Ribosome-inactivating proteins present in *C. papaya* has shown anticancer activity against breast cancer cell line, T47D.

Different cell lines such as stomach cancer cell line (ags), pancreatic cancer cell line (capan-1), colon cancer cell line (dld-1), ovarian cancer cell line (dov-13), lymphoma cell line (karpas), breast cancer cell line (mcf-7), neuroblastoma cell line (t98g), and uterine cancer cell line (hela) has been affected by aqueous extract of *C. papaya*. n-Hexane fraction of extract worked on leukemia HL-60 cells. Papain has been separated from this plant and it exhibited cytotoxicity by disrupting the fibrin coat on the wall of cancer cell⁴¹⁻⁴³.

Colocasia esculenta: Different parts of this plant contain a lot of phytoconstituents that have showed anticancer activities. The extract of this plant showed anticancer action against colon cancer⁴⁴. Aqueous fraction of the extract displayed anticancer activity in a murine model of breast cancer⁴⁵.

Ficus racemose: Ethanolic fruit extract of this plant showed anticancer activity against MCF7 human breast cancer cells⁴⁶. The extract of this plant showed anticancer action against lung carcinoma cell line Calu6⁴⁷.

Lippia alba: Leaf and flower extract of this plant showed cytotoxic activities⁴⁸.

CONCLUSION: It can be inferred that the current perception and concepts of cancer pathology and pathways to curb it has opened a new window for prevention and prophylaxis of cancer by herbs and phytoconstituents. The use of herbs and phytoconstituents to prevent and treat neoplasm shows another path against the allopathic cytotoxic drugs. The goal of cancer therapy is to damage the neoplastic cells while keeping the healthy cells intact. However, clinical and toxicological studies, education and awareness of the mass people about the advantages of prevention of cancer and its destructive nature are vital for use of herbs and phytoconstituents for prevention and prophylactic effect against cancer.

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REFERENCES:

1. Amin AR, Kucuk O, Khuri FR and Shin DM: Perspectives for cancer prevention with natural compounds. *J Clin Oncol* 2009; 27: 2712-2725.
2. Haque A, Brazeau D and Amin AR: Perspectives on natural compounds in chemoprevention and treatment of cancer: an update with new promising compounds. *Eur J Cancer* 2021; 149: 165-183.
3. Khan N, Afaq F and Mukhtar H: Cancer chemoprevention through dietary antioxidants: progress and promise. *Antioxid Redox Signal* 2008; 10: 475-510.
4. Li N, Chen X, Liao J, Yang G, Wang S, Josephson Y, Han C, Chen J, Huang MT and Yang CS: Inhibition of 7,12-dimethylbenz[a]anthracene (DMBA)-induced oral carcinogenesis in hamsters by tea and curcumin. *Carcinogenesis* 2002; 23: 1307-1313.
5. Sharif Mohammad Shaheen, Md. Nazir Hossen, Maruf Ahmed and Md. Shah Amran: Green Tea in Health Care: A Natural Medicine, A Natural Drink. *J Appl Sci Res* 2006; 2(6): 306-309.
6. Zhang X, Zhang H, Tighiouart M, Lee JE, Shin HJ, Khuri FR, Yang CS, Chen Z and Shin DM: Synergistic inhibition of head and neck tumor growth by green tea (-)-epigallocatechin-3-gallate and EGFR tyrosine kinase inhibitor. *Int J Cancer* 2008; 123: 1005-1014.
7. Amin AR, Kucuk O, Khuri FR and Shin DM: Perspectives for cancer prevention with natural compounds. *J Clin Oncol* 2009; 27: 2712-2725.
8. Zhang X, Zhang H, Tighiouart M, Lee JE, Shin HJ, Khuri FR, Yang CS, Chen Z and Shin DM: Synergistic inhibition of head and neck tumor growth by green tea (-)-epigallocatechin-3-gallate and EGFR tyrosine kinase inhibitor. *Int J Cancer* 2008; 123: 1005-1014.
9. Siddiqui IA, Malik A, Adhami VM, Asim M, Hafeez BB, Sarfaraz S and Mukhtar H: Green tea polyphenol EGCG sensitizes human prostate carcinoma LNCaP cells to TRAIL-mediated apoptosis and synergistically inhibits biomarkers associated with angiogenesis and metastasis. *Oncogene* 2008; 27: 2055-2063.
10. Ajmain Ishaat Khan, Fahima Aktar, Jakir Ahmed Chowdhury, Abu Asad Chowdhury, Shaila Kabir and Md. Shah Amran: A comprehensive study on biology, chemistry and pharmacology of *Curcuma long A L.* - A Review. *J Bio-Sci* 2023; 31(2): 67-85.
11. Cheng AL, Hsu CH, Lin JK, Hsu MM, Ho YF, Shen TS, Ko JY, Lin JT, Lin BR, Ming-Shiang W, Yu HS, Jee SH, Chen GS, Chen TM, Chen CA, Lai MK, Pu YS, Pan MH, Wang YJ, Tsai CC and Hsieh CY: Phase I clinical trial of curcumin, a chemopreventive agent, in patients with high-risk or premalignant lesions. *Antic Res* 2001; 21: 2895-00.
12. Koo JY, Kim HJ, Jung KO and Park KY: Curcumin inhibits the growth of AGS human gastric carcinoma cells *in-vitro* and shows synergism with 5-fluorouracil. *J Med Food* 2004; 7: 117-121.
13. Kunnumakkara AB, Guha S, Krishnan S, Diagaradjane P, Gelovani J and Aggarwal BB: Curcumin potentiates antitumor activity of gemcitabine in an orthotopic model of pancreatic cancer through suppression of proliferation, angiogenesis, and inhibition of nuclear factor-kappaB-regulated gene products. *Cancer Res* 2007; 67: 3853-3861.
14. Sen S, Sharma H and Singh N: Curcumin enhances Vinorelbine mediated apoptosis in NSCLC cells by the mitochondrial pathway. *Biochem Biophys Res Commun* 2005; 331: 1245-1252.
15. Verma SP, Salamone E and Goldin B: Curcumin and genistein, plant natural products, show synergistic inhibitory effects on the growth of human breast cancer MCF-7 cells induced by estrogenic pesticides. *Biochem Biophys Res Commun* 1997; 233: 692-696.
16. Khafif A, Schantz SP, Chou TC, Edelstein D and Sacks PG: Quantitation of chemopreventive synergism between (-)-epigallocatechin-3-gallate and curcumin in normal, premalignant and malignant human oral epithelial cells. *Carcinogenesis* 1998; 19: 419-424.
17. Cruz-Correa M, Shoskes DA, Sanchez P, Zhao R, Hyland LM, Wexner SD and Giardiello FM: Combination treatment with curcumin and quercetin of adenomas in familial adenomatous polyposis. *Clin Gastroenterol Hepatol* 2006; 4: 1035-1038.
18. Sharma RA, McLelland HR, Hill KA, Ireson CR, Euden SA, Manson MM, Pirmohamed M, Marnett LJ, Gescher AJ and Steward WP: Pharmacodynamic and pharmacokinetic study of oral Curcuma extract in patients with colorectal cancer. *Clin. Cancer Res* 2001; 7: 1894-00.
19. Adeluola A, Zulfike, AHM, Brazeau D and Amin A: Perspectives for synthetic curcumins in chemoprevention and treatment of cancer: An update with promising analogues. *Eur J Pharmacol* 2021; 906: 174266.
20. https://en.wikipedia.org/wiki/Red_wine. (Accessed on 07-07-2024).
21. Morton, Julia Frances: "Grapefruit, Citrus paradisi, In: Fruits of Warm Climates". NewCROP, New Crop Resource Online Program, Center for New Crops and Plant Products, Department of Horticulture and Landscape Architecture, Purdue University 1987; 152-158. ISBN 978-0-9610184-1-2. OCLC 16947184. Archived from the original on 2000-10-06. Retrieved 2003-03-28.

22. Carrington, Sean, Fraser and Henry C: "Grapefruit". A-Z of Barbados Heritage. Macmillan Caribbean 2003; 90-91. ISBN 978-0-333-92068-8. .
23. The American Heritage Dictionary of the English Language (1973) defines "pomelo" simply as "The grapefruit".
24. Li, Xiaomeng, Xie R, Lu Z and Zhou Z: "The origin of cultivated citrus as inferred from internal transcribed spacer and chloroplast DNA sequence and amplified fragment length polymorphism fingerprints". Journal of the American Society for Horticultural Science 2010; 135(4): 341. doi:10.21273/JASHS.135.4.341.
25. Boocock DJ, Faust GE, Patel KR, Schinas AM, Brown VA, Ducharme MP, Booth TD, Crowell JA, Perloff M, Gescher AJ, Steward WP and Brenner DE: Phase I dose escalation pharmacokinetic study in healthy volunteers of resveratrol, a potential cancer chemopreventive agent. Cancer Epidemiol. Biomarkers Prev 2007; 16: 1246-1252.
26. "Phylogeny". Molecular phylogenetic analyses have established that the formerly segregate genera *Lycopersicon*, *Cyphomandra*, *Normania*, and *Triguera* are nested within *Solanum*, and all species of these four genera have been transferred to *Solanum*
27. "Garden Tomato: *Solanum lycopersicum* L." Encyclopedia of Life. Retrieved 2014.
28. Schwarz S, Obermüller-Jevic UC, Hellmis E, Koch W, Jacobi G and Biesalski HK: Lycopene inhibits disease progression in patients with benign prostate hyperplasia. J Nutr 2008; 138: 49-53.
29. Kucuk O, Sarkar FH, Sakr W, Djuric Z, Pollak MN, Khachik F, Li YW, Banerjee M, Grignon D, Bertram JS, Crissman JD, Pontes EJ and Wood DP: Phase II randomized clinical trial of lycopene supplementation before radical prostatectomy. Cancer Epidemiol. Biomarkers Prev 2001; 10: 861-868.
30. <https://www.100daysofrealfood.com/green-vegetables/> (Accessed on 07-07-2024)
31. Ju W, Wang X, Shi H, Chen W, Belinsky SA and Lin Y: A critical role of luteolin-induced reactive oxygen species in blockage of tumor necrosis factor-activated nuclear factor-kappaB pathway and sensitization of apoptosis in lung cancer cells. Mol. Pharmacol 2007; 71: 1381-1388.
32. Lim DY, Jeong Y, Tyner AL and Park JH: Induction of cell cycle arrest and apoptosis in HT-29 human colon cancer cells by the dietary compound luteolin. Am. J. Physiol. Gastrointest. Liver Physiol 2007; 292: G66-75.
33. Selvendiran K, Koga H, Ueno T, Yoshida T, Maeyama M, Torimura T, Yano H, Kojiro M and Sata M: Luteolin promotes degradation in signal transducer and activator of transcription 3 in human hepatoma cells: an implication for the antitumor potential of flavonoids. Cancer Res 2006; 66: 4826-4834.
34. Goodman MT, Wilkens LR, Hankin JH, Lyu LC, Wu AH and Kolonel LN: Association of soy and fiber consumption with the risk of endometrial cancer. Am J Epidemiol 1997; 146: 294-306.
35. Hebert JR, Hurley TG, Olendzki BC, Teas J, Ma Y and Hampl JS: Nutritional and socioeconomic factors in relation to prostate cancer mortality: a cross-national study. J Natl Cancer Inst 1998; 90: 1637-1647.
36. Adlercreutz H, Honjo H, Higashi A, Fotsis T, Hämäläinen, E, Hasegawa T and Okada H: Urinary excretion of lignans and isoflavonoid phytoestrogens in Japanese men and women consuming a traditional Japanese diet. Am J Clin Nutr 1991; 54: 1093-1100.
37. Adeoluwa A, Adeluola and Amin RARM: Chemoprevention: Achievements and Future Perspectives, Dhaka Univ. J Pharm Sci 2022; 20(3): 359-372.
38. Fareha Anan Shristy, Fahima Aktar, Abu Asad Chowdhury, Shaila Kabir, Jakir Ahmed Chowdhury, Md. Rafat Tahsin and Md. Shah Amran: A comprehensive review on the chemical constituents and pharmacological activities of Mustard plants, Jahangirnagar University J. Biol Sci 2023; 12(1 & 2): 107-125.
39. Rahmat A, Rosli R, Endrini S and Zain SAH: Antiproliferative activity of pure lycopene compared to both extracted lycopene and juices from watermelon (*Citrullus vulgaris*) and papaya (*Carica papaya*) on human breast and liver cancer cell lines. JMS 2002; 2: 55-58.
40. Jayakumar R and Kanthimathi MS: Inhibitory effects of fruit extracts on nitric oxide-induced proliferation in MCF-7 cells. Food Chem 2011; 126: 956-960.
41. Nakamura Y, Yoshimoto M, Murata Y, Shimoishi Y, Asai Y, Park EY, Sato K and Nakamura Y: Papaya seed represents a rich source of biologically active isothiocyanate. J Agric Food Chem 2007; 55: 4407-4413.
42. Chandrasekaran R, Gnanasekar S, Seetharaman P, Keppanan R, Arockiaswamy W and Sivaperumal S: Formulation of *Carica papaya* latex-functionalized silver nanoparticles for its improved antibacterial and anticancer applications. J Mol Liq 2016; 219: 232-238.
43. Otsuki N, Dang NH, Kumagai E, Kondo A, Iwata S and Morimoto C: Aqueous extract of *Carica papaya* leaves exhibits anti-tumor activity and immunomodulatory effects. J Ethnopharmacol 2010; 127: 760-767.
44. Brown AC, Reitzenstein JE, Liu J and Jadus MR: The anti-cancer effects of poi (*Colocasia esculenta*) on colonic adenocarcinoma cells *in-vitro*. Phytotherapy Res 2005; 19: 767-771.
45. Kundu N, Campbell P, Hampton B, Lin CY, Ma X, Ambulos N, Zhao XF, Goloubeva O, Holt D and Fulton AM: Antimetastatic activity isolated from *Colocasia esculenta* (taro). Anti-cancer Drugs 2012; 23: 200.
46. Gavhane DS, Moregaonkar SD and Mhase AK: Cytotoxic and anticancer activity of *F. racemosa* fruit extract on MCF7 human breast cancer cell line by SRB method. J Anim Res 2016; 6: 43.
47. Kambli J, Patil A, Chithrashree and Keshava R: Phytochemical screening, and evaluation of antibacterial, antioxidant and cytotoxic activity of *Ficus racemosa* Linn. Int J Pharm Pharm Sci 2014; 6: 464-468.
48. Ara N, Nur MH, Amran MS, Wahid MII and Ahmed M: In vitro antimicrobial and cytotoxic activities of leaves and flowers extracts from *Lippia alba* 2009; 12(1): 87-90. doi: 10.3923/pjbs.2009.87.90.

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