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Phyllanthus Emblica (Indian Gooseberry) in the prevention of cancer

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Abstract:

Medicinal plants have been considered to be precious natural gifts to human beings that could promote disease-free life. Indian gooseberry or Amla, scientifically known as *Phyllanthus emblica,* is a tree abundantly found in the tropical and subtropical regions of Southeast Asia. The fruit of *Phyllanthus emblica* is rich in vitamin C, flavonoids like quercetin and rutin, and polyphenols like tannins, gallic acid, and ellagic acid, etc. Research reports suggested that Amla is possessed with important neuroprotective, cardio-protective, gastro-protective, nephron-protective, and chemo-preventive properties. Cancer is currently a global epidemic with an estimated 19.3 million new cancer cases and approximately 10.0 million cancer deaths taking place in 2020. The societal impact of such a staggering number of deaths is immense when we think of the quality of human life and the economy. So undoubtedly we need new, promising and effective therapies for common cancers. In recent years the potential of Amla as an effective anti-cancer agent has been scrutinized through many studies and there is certainly evidence to show that Amla extracts can be used as an anti-tumor and cancer preventive agent. In this article, we focus on the anti-cancer properties of Indian Gooseberry or Amla.

Keywords: Amla, Chemical constituents and prevention, Anticancer potential

Introduction

Indian gooseberry, or Amla, is a fruit tree found in Southeast Asia. Amla has been consumed in a variety of ways for decades, for example, eating as a raw fruit, boiled fruit, or drying it up and making fine powder out of it. The most amusing thing about Amla is that every part of the plant, including the fruit, leaves, and even the seeds, is used in traditional Indian Medicine. Ayurveda gives high regard to the medicinal properties of Amla. The medicinal properties offered by this indigenous bitter-sour fruit are plenty, and that is one of the reasons why it is being extensively studied and used in Indian Medicine.

Amla has multiple potential benefits, including heartburn reduction, anti-aging properties, protection against liver damage, maintaining blood sugar levels, and promoting a healthy heart. Its rich vitamin C content, more than that present in lemon or oranges, or tangerines, makes it the most sought-after fruit for immunity. For many years, Indian gooseberry has been used as a natural laxative. With advancements in Medicine, researchers have also suggested that Amla can be used as an anticancer agent.

Cancer, which is described as the uncontrolled and abnormal growth of cells in the human body, has been a global epidemic for decades (1) and has seen high rates of morbidity and mortality. This global health problem, cancer has grave effects on the quality of life of the suffering individual and proves a socioeconomic burden for the individual and relatives (2).

Fig. 1. Phyllanthus Emblica (Indian Gooseberry) plant with fruits and flower. A part of the figure has been designed using free resources from https://depositphotos.com.

The onset of cancer and Amla

Our normal cells in the body are very well aware of when they need to replicate and when to put a stop to this process. They are able to differentiate well, and over time these cells die, and new cells are formed. Unlike our normal somatic cells, cancerous cells divide and grow at an uncontrollable and abnormal rate and do not die. These cells later join together to form lumps or tumors and sometimes dislodge from their primary site and travel to another site, which is termed metastasis.

Research has shown that Amla or Indian gooseberry extracts have small molecules that have anti-tumor properties and potential mechanisms to promote anti-tumor activity.

When our body is exposed to harmful agents like xenobiotics (foreign chemicals) or reactive oxygen species, they can compromise the integrity and structure of our genome. This change in the genome or our set of genetic instructions can lead to rapid, uncontrollable growth of cells leading to cancer.

Reactive oxygen species (ROS)

Reactive Oxygen Species are ions, radicals, or molecules having free or unpaired electrons in their outermost shell, making them highly reactive. An increase in metabolic activity and cellular dysfunction can lead to high levels of ROS. In relation to cancer, these toxic by-products were found to be present in greater quantities, which could promote the various aspects of tumor progression. Amla happens to have potent scavenging activity for these free radicals, which help prevent ROS-induced oncogenesis.

Hydrolysable Tannins	Emblicanin A and B, Punigluconin, Pedunculagin, Chebulinic acid (Ellagitannin), Chebulagic acid (Benzopyran tannin), Corilagin (Ellagitannin), Geraniin (Dehydroellagitannin), Ellagotannin
Alkaloids	Phyllantine, Phyllembein, Phyllantidin
Phenolic compounds	Gallic acid, Methyl gallate, Ellagic acid, Trigallayl glucose
Amino acids	Glutamic acid, Proline, Aspartic acid, Alanine, Cystine, Lysine
Carbohydrates	Pectin
Vitamins	Ascorbic acid
Flavonoids	Quercetin, Kaempferol
Organic acids	Citric acid

Table 1. Chemical constituents of Amla fruit

The prophylactic chemo-preventive properties of Amla

A recent study has suggested that the Indian gooseberry extract also reduces the cytochrome enzymes from the liver cells, which may be correlated to carcinogenic properties. Amla also has anti-inflammatory activities and possesses anti-tumor activities, preventing tumor progression at the initial stages. (3)

The use of chemotherapy is very common in the treatment of cancer. It is not only expensive, but it also shows some deleterious side effects, and so chemotherapy may induce

physiological complications in our bodies. The worsening of these complications could make the healthcare provider reduce the dosage or, in some cases, discontinue the treatment. Another complication of chemotherapy is the development of chemoresistance and nonspecific toxicity to normal cells.

According to another study, Amla helps reduce and synergize the effect of two important antineoplastic drugs, namely cisplatin and doxorubicin, from its cytotoxic effects (4).

Amla is also shown to have a radioprotective effect against the harmful effects of ionizing radiation. According to a study done on mice, administration of a progressive dose of Amla per day for seven consecutive days before the exposure to a sublethal dose of radiation protected the mice against the harmful effects of radiation being nausea and death. (5)

Amla decreases the level of phase-1 enzymes, which are responsible for reactions involving reduction, oxidation, and hydrolysis. These phase-1 drug-metabolizing enzymes are responsible for the biotransformation of xenobiotics, meaning they could transform a non-toxic chemical into a harmful carcinogen. (6)

Various *in vitro* studies (studies conducted in the glass, not within human bodies) have shown remarkable improvements in reversing or restricting cancer growth. From some of the recent *in vitro* research, it is evident that Amla is successful in inhibiting the growth of breast cancer, ovarian cancer, cervical cancer, liver cancer, lung cancer, and colorectal cancer cells. Though preventing cancer cell growth while leaving the non-cancerous cells unaffected seems commendable, most of these studies are done *in vitro* and hence, cannot be given a complete approval and appraisal as there are many other non-toxic chemicals that might do the same.

Possible Mechanism of action

The mechanisms of action of Amla in the prevention of cancer can be broadly explained by its ability to stop the cancer cells from proliferating or growing while keeping the non-cancerous cells unharmed. Amla proves to be rich in antioxidants, richer than acai berries, turmeric, blueberries, and such superfoods. These antioxidant properties of Amla hunt unhealthy cells and free radicals, which could cause oxidative stress. When there is a high level of oxidative stress, the chances of being prone to cancer increase and Amla helps reduce this stress and thus prevents cancer.

Amla is a very rich source of Vitamin C. Antioxidants along with vitamin C are useful in maintaining and improving our immunity. Strong immunity helps fight diseases and aids our body to come back to its normal functioning at a much faster rate. Stronger immunity would not guarantee or protect us from cancer, but it surely would help us fight cancer, and therein, Amla as a supplement to the drugs acts as a parallel treatment regimen

for cancer. During chemotherapy and radiotherapy, when the immune system of the patient is compromised, supplementing their body with high levels of vitamin C will help the patients from being affected by any other immunosuppressant diseases or disorders.

The major differences cancer cells have as compared to normal cells are the loss of their ability to differentiate, decreased drug sensitivity, limitless replication, and metastasis. By metastasis eventually, the tumor cells spread from the primary tumor site to elsewhere in the body, which can lead to failure of treatment and ultimately death. Preclinical research has found that Amla possesses the property to prevent metastasis and Amla has been shown to inhibit lung metastasis in animal models. (4)

Anti-mutagenic effects

Cancer is caused due to the mutation of oncogenes or tumor suppressor genes of a somatic cell. Thus, in order to inhibit the process of carcinogenesis, it is very important to prevent this process of mutation. Studies carried out in the past on Indian gooseberries have shown remarkable properties of its antimutagenic effects. Amla work on the prevention of mutation and DNA damage against different mutagens and carcinogens.

Indian gooseberries reduce ODC or ornithine decarboxylase. ODC is a rate-limiting enzyme that proves to be important in polyamine synthesis. Studies have shown that a high level of ODC can prove to be a prognostic factor in tumor progression, proliferation, and even metastasis, thus having an impact on the survival of the patient. Studies on animals have shown that amla or Indian Gooseberry inhibit ODC replication which are important precursors to tumor progression. (5).

Amla- A multi-potent berry

Preclinical studies which have been carried out in the recent decades show that Amla or Indian gooseberry portrays chemo-modulatory, chemo-preventive, antineoplastic, immunomodulatory, and radio-protective effects. Apart from its role in cancer prevention, Indian Gooseberry also shows commendable benefits in other aspects of maintaining a person's overall health.

Amla works on some direct risk factors of cancer like Obesity and Diabetes. Obesity seems to have a direct correlation which certain kinds of cancer, and Amla has shown proven effects in promoting weight loss. Diabetes, which is yet another underlying risk factor for cancer, remains under control as Amla is capable of lowering the blood glucose level, and maintaining the sugar level in check. Amla also lowers cholesterol to keep the heart in healthy condition.

Amla has anti-platelet properties and is capable to slow down or prevent blood clotting and can make the blood thin. Thus, people suffering from bleeding disorders may get

benefit from taking Amla supplements after consulting physicians.

Conclusion

Evidence-based practice is mandatory in medicine, and caution needs to be taken accordingly.

The Indian gooseberry or Amla imbibes various mechanisms which are responsible for the prevention of cancer. It contains certain phytochemicals that are cytotoxic or harmful to the neoplastic or cancer cells. Though Indian Gooseberry has shown immense benefits *in vitro* studies and animal studies on the prevention and treatment of cancer, there is still an unmet need for substantial evidence on how this fruit will work well with the physiological and biochemical changes in the human body and its interaction with other drugs. But there is not doubt that Amla has medicinal properties for the overall well-being of the human body and as such, it is nothing less than a 'Wonder Berry' with all its known beneficial properties and many more that are yet to be discovered.

References:

1) Siegel, R. L., Miller, K. D., Fuchs, H. E., Jemal, A. Cancer Statistics, 2021. (2021). Jan; 71(1):7-33. https://doi.org/10.3322/caac.21654
2) Hyuna, S., Jacques, F., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. (2021). Vol. 71:209-249. https://doi.org/10.3322/caac.21660
3) Zhao, T., Sun, Q., Marques, M., & Witcher, M. (2015). Anticancer Properties of Phyllanthus Emblica (Indian Gooseberry). *Oxidative medicine and cellular longevity, 2015*, 950890. https://doi.org/10.1155/2015/950890
4) Pinmai, K., Chunlaratthanabhorn, S., Ngamkitidechakul, C., Soonthornchareon, N., Hahnvajanawong, C. Synergistic growth inhibitory effects of *Phyllanthus emblica* and *Terminalia bellerica* extracts with conventional cytotoxic agents: Doxorubicin and cisplatin against human hepatocellular carcinoma and lung cancer cells World J Gastroenterol. 2008; 14(10):1491-1497. DOI: 10.3748/wjg.14.1491
5) Baliga, M. S., Dsouza, J. J. Amla (Emblica Officinalis Gaertn), a wonder berry in the treatment and prevention of cancer, European Journal of Cancer Prevention, (2011). Vol 20(3): 225-239
6) Liou, G. Y., & Storz, P. (2010). Reactive oxygen species in cancer. *Free radical research*, *44*(5), 479–496.

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