Journal of Medicinal Plants Research Vol. 5(33), pp. 7155-7162, 31 December, 2011
Available online at http://www.academicjournals.org/JMPR
ISSN 1996-0875 ©2011 Academic Journals
DOI: 10.5897/JMPRx11.021

Review

Certain medicinal plants have anticancer potential

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Accepted 22 November, 2011

Ayurveda is the oldest existing complete medical system in the world. Its origins go back nearly 5000 years. This review make known on some Medicinal plants have therapeutic potential due to the presence of natural antioxidants functioning as reducing agents, free radical scavengers and quenchers of singlet oxygen. Majority of their antioxidant activity is due to bioactive compounds viz; flavones, isoflavones, flavonoids, anthocyanins, coumarins, lignans, catechins and isocatechins.

Key words: Few anticancer medicinal plants.

INTRODUCTION

The word 'Cancer' was coined by a Greek physician Hippocrates (460 to 370 BC), who is also considered as the "Father of Medicine." Hippocrates used the terms carcino and carcinoma to describe non-ulcer forming and ulcer-forming tumors. A human adult comprises about 10^{15} cells; scores of them divide and differentiate in order to refurbish organs and tissues, which require cell turnover (Bertram, 2001). However, if the cells do not stop dividing, they may lead to cancer. Characteristically, cancer is an unrestrained proliferation of cells which become structurally abnormal and possess the ability to detach them from a tumor and establish a new tumor at a remote site within the host (National Cancer Institute, 2009). Globally, cancer represents a substantial burden of disease in the community and appears to be a prime cause of concern. Every year over 200,000 people are diagnosed with cancer in the United Kingdom only, and approximately 120,000 die as an aftermath of the disease (Department of Health, 2000). According to the International Agency for Research on Cancer (2002), cancer killed > 6.7 million people around the world and another 10.9 million new cases were diagnosed Newman Dj et al (2003). If the results are extrapolated, at the same rate, an estimated 15 million people will have cancer, annually, by 2020. According to an estimate given by American Cancer Society (2009), about 1,500,000 new cases and over 500,000 deaths are expected in the US by 2009. The National Cancer Registry of South Africa has spotted the cancers of bladder, colon, breast, cervix, lungs and melanoma commonly among inhabitants (Mqoqi et al., 2004). Attempts are underway to work out the therapeutic and anti-neoplastic properties of medicinal plants (Ahmad et al., 1998; Datta et al., 1998; Abo et al., 2000; Graf, 2000; Ankli, 2002; Neto, 2002). Consequently, herbal medicines have received much attention as substitute anticancer drugs.

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MEDICINAL PLANTS

Plant kingdom is a potential source of chemical constituents with antitumor and cytotoxic activities owing to their enormous propensity, which synthesize a variety of structurally diverse bioactive compounds (Kim et al., 2005; Indap et al., 2006).

The rich and diverse plant sources of India are likely to provide effective anticancer agents. Medicinal plants can reduce or minimize the toxic side effect of chemotherapy and radiation treatment by reinforcing their cancer killing action. Some of the plants, selected for the present study, include:

Azadirachta indica (Neem)

Scientific classification: Kingdom, Plantae; Division, Magnoliophyta; Order, Sapindales; Family, Meliaceae; Genus, Azadirachta; Species, *A. indica*.

Figure 1. *Azadirachta indica* (Neem).

Figure 2. *Ocimum sanctum* (Tulsi).

A. indica, popularly known as neem, is abundant in India and other Asian nations. Each part of the neem tree has some medicinal property and is thus known as 'wonder plant'. During the last five decades, the chemistry of the neem compounds, its pharmacological actions, clinical studies and plausible medicinal applications has been studied. Studies conducted in Malaysia, Thailand and India show that neem helps to boost antioxidant levels and thus protects against liver damage and carcinogens. All parts of the neem tree can be used such as the fruit, seeds, bark, oil, roots, and leaves. This feature highlights its potent effects on cancers. An important mechanism that has been discovered is programmed cell death, in which cancer cells are directly killed. Research has shown that neem produces glutathione, which is a carcinogen-detoxifying enzyme and is one of the antioxidants that neem produces. Studies on neem indicate that it increases the positive effects and at the same time reduces the side effects of some traditional cancer treatments. Neem has been used and tested on quite a few cancers. These include lung, cancer, stomach, skin, prostate, breast cancer, etc. Neem based creams are used to treat skin cancer and neem based products are also taken internally to test its effect on lymphocytic cancer. Researchers are still going on to evaluate the effects of neem as an alternative treatment that can be taken alongside conventional cancer treatment (Figure 1).

Ocimum sanctum (Tulsi)

Scientific classification: Kingdom, Plantae; Division, Magnoliophyta; Order, Lamiales; Class, Magnoliopsida; Family, Lamiaceae; Genus, Ocimum; Species, *O. sanctum*.

In India Tulsi is taken as the most sacred plant. The use of *O. sanctum* (Tulsi) as an aromatic plant has been well documented in Ayurveda. Several recent investigations using these extracts have indicated that *O. sanctum* poses significant anti-inflammatory antioxidant (Maulik et al., 1997), and immuno- modulatory (Mediratta et al., 2002) properties. Various studies have been performed with *O. sanctum* for its antibacterial, antioxidant, antiulceric, antimalarial, antidiabetic, anti-inflammatory, antilipidemic, anticancer and immunomodulatory properties. The active components of *O. sanctum* consist of phenols and flavones that have been shown to have significant antioxidant (Exarchou et al., 2002; Jaleel et al., 2006) and anti-inflammatory activity both *in vivo* and *in vitro* conditions (Devi et al., 2000; Kelm et al., 2000). Overall, Tulsi is a premier adaptogen, helping the body and mind to adapt and cope with a wide range of physical, emotional, chemical and infectious stresses, and restore disturbed physiological and psychological functions to a normal healthy state (Figure 2).

Terminalia arjuna (Arjuna)

Scientific classification: Kingdom, Plantae; Division, Magnoliophyta; Class, Magnoliopsida; Order, Myrtales;

Figure 3. *Terminalia arjuna* (Arjuna).

Family, Combretaceae; Genus, Terminalia; Species, *T. arjuna*.

Several medicinal plants have been described to be beneficial for cardiac ailments in “Atharva Veda” an ancient treatise from which Ayurveda, the Indian system of Medicine owes its origin (Shatvalekar, 1943; Dwivedi and Chaturvedi, 2000). *T. arjuna* (Combretaceae) is a good hypocholesteremic, hypolipidemic, anticoagulant, antihypertensive, antithrombotic, antiviral, antifungal and antibacterial agent. Many useful phytoconstituents have been isolated from *T. arjuna which* includes, triterpenoids for cardiovascular properties, tannins and flavonoids for its anticancer properties, and so on (Figure 3).

Aloe vera (Gheekumari)

Scientific classification: Kingdom, Plantae; Order, Asparagales; Family, Xanthorrhoeaceae; Subfamily, Asphodeloideae; Genus, Aloe; Species, *A. vera*. The Aloe plant is a part of the lily family but its Aloe barbadensis is commonly called *A. vera*. Aloe was also mentioned as a laxative in the Egyptian Papyrus Ebers from 1552 BC (Taylor, 1965). The suggested medicinal use of *A. vera* is based on its historic and traditional use, and analysis of pharmacologic and toxicological research (Juneby, 1999). It contains constituents that accelerate wound healing, helps reduce inflammation, pain and itching, and acts as a wonderful moisturizing agent, penetrant and a natural hypo-allergent (Figure 4).

Bacopa monniera (Brahmi)

Scientific classification: Kingdom, Plantae; Order, Lamiales; Family, Scrophulariaceae; Genus, Bacopa; Species, *B. monnieri*.

B. monnieri is a small, creeping herb with numerous branches, small oblong leaves and light purple flowers and the entire plant is used medicinally (Chopra, 1958; Bone, 1996). *B. monnieri* extract also helps boost the immune system and is an effective antioxidant. It also

Figure 4. *Aloe vera* (Gheekumari).

has anti-inflammatory properties. In several studies conducted on Bacopa and cancer, *B. monnieri* extract has shown cytotoxic activities to sarcoma 180 cells. Studies also suggest Bacopa's ability to prevent cancer by preventing DNA replication of cancer cell line (Elangovan et al., 1995) (Figure 5).

Tamarindus indica (Imli)

Scientific classification: Order, Fabales; Family, Fabaceae; Subfamily, Caesalpinioideae; Tribe, Detarieae; Genus, Tamarindus; Species, *T. indica*.

The tamarind (*T. indica* L.) is a tree that belongs to family Caesalpiniaceae. *T. indica* contains large number of polyphenolic compounds, dominated by proanthocyanidins like catechin, procyanidinB2, epicatechin, procyanidin trimer, procyanidin tetramer, procyanidin pentamer, procyanidin hexamer, etc. In traditional Thai medicine, the fruit of the tamarind is used as a digestive aid, carminative, laxative, expectorant, and blood tonic (Komutarin et al., 2004). Other parts of the plant show antioxidant (Tsuda et al., 1994; Martinello et al., 2006), antihepatotoxic (Joyeux et al., 1995), anti-inflammatory (Rimbau et al., 1999), antimutagenic (Ramos et al., 2003), antidiabetic (Maiti et al., 2004), and antiatherosclerosis (Martinello et al., 2006) activities (Figure 6).

Withania somnifera (Ashwagandha)

Scientific classification: Kingdom, Plantae; Order, Solanales; Family, Solanaceae; Genus, Withania; Species, *W. somnifera*.

It is evident that foods rich in anti-oxidants play an important role in the prevention of cancer, cardiovascular and neurogenerative diseases. There has been a surge of research in its effect in animal models of atherosclerosis, hyperlipidemia, myocardial infarction, myocardial ischemia reperfusion injury, cerebral ischemia, cardiomyopathy, cardiac hypertrophy, cardiotoxicity and congestive heart failure. Many pharmacological studies have been conducted to investigate the properties of ashwagandha and to authenticate its use as a multi-purpose medicinal agent. Studies on *W. somnifera* suggest that it reduces tumor cell proliferation and enhances the effectiveness of radiation therapy while potentially mitigating undesirable side effects (Kaur et al., 2004) (Figure 7).

Figure 5. *Bacopa monniera* (Brahmi).

Figure 6. *Tamarindus indica* (Imli).

Figure 7. *Withania somnifera* (Ashwagandha).

Aegle marmelos (Bel)

Scientific classification: Kingdom, Plantae; Order, Sapindales; Family, Rutaceae; Subfamily, Aurantioideae; Tribe, Clauseneae; Genus, Aegle; Species, *A. marmelos*.

All parts of *A. marmelos* are medicinally useful like, leaves, fruit pulp, flower, stem bark, root bark, (Chopra et al., 1956; Chopra**,** 1968; Kirtikar and Basu, 1933). A. marmelos shows a broad spectrum of anti-bacterial, anti-fungal, (Benerji and Kumar, 1980; Pattnaik et al., 1996; Rana et al., 1997), anti-inflammatory (Gurulingappa et al., 2002), antinociceptive and antipyretic activities (Arul et al., 2005).

When taken fresh, it is useful in constipation, chronic dysentery and dyspepsia. Unripe fruit is astringent, digestive, stomachic and demulcent. Pulp is stimulant, antipyretic and antiscorbutic. Root and stem bark are used as antipyretic. *A. marmelos* is widely used in the treatment of hepatitis in folk medicine. Also, the study confirms the claim on this plant as a potential hepatoprotective agent in the traditional medicine (Rajasekaran et al., 2009) (Figure 8).

CONCLUSION

In the present time herbal products are considered to be symbols of protection in comparison to the synthetic product that are regarded as unsafe to human life and environment. Although herbs had been priced for their medicinal importance. But now everyday phytochemical and pharmacological studies are conducted on different parts of these plants.

The present literature supports the potential of certain medicinal plants. More research can be done to investigate the unknown and unexplored potential of these plants. Further analysis of these plants (active compounds) can be carried out by way of making use of different analytical methods such as HPTLC, HPLC, FTIR, NMR and UV spectrophotometer analysis.

ACKNOWLEDGEMENT

The authors express gratitude Prof. Dr. Usha Nair, Department of chemistry government, M.V.M. College for her kind support.

Figure 8. *Aegle marmelos* (Bel).

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