SUMMARY AND CONCLUSION

Cancer can be defined as a class of disease characterized by out of control cell growth. There are over 100 different types of cancer and are classified by type of cell which are initially affected. Cancer detriment the body when damaged cells proliferate destructively to form lumps or masses of tissue called tumors. Tumors grow and interfere with the digestive, nervous and circulatory systems that release hormones which alter body function. Malignant tumors are formed when a cancerous cell manages to migrate throughout the entire body using the blood or lymph systems, destroying healthy tissue by a process called invasion. Secondly these cells can manage to proliferate and raise, making development of new blood vessels to nourish itself by a process called angiogenesis. When a tumor cells efficiently migrate to distant parts of the body and grows, invading and damaging healthy tissues that is said to have metastasized.

Oxidative stress and inflammation, underlies many of the hallmarks of cancer. It have clearly recognized that oxidative stress players are expressed abnormally in cancers, which affects essential process of cancer initiation and progression, by acting on cell proliferation and anchorage independent cell growth, causing insensitivity to apoptosis, sustaining angiogenesis, by altering the migration/invasion programme through metabolic and epigenetic mechanisms. Reactive Oxygen Species (ROS) exert a key role affecting the hallmarks of cancer. ROS involved in proliferation, promoting tissue invasion and metastatic dissemination. Although inflammation has been known as a localized defensive response of tissue to irritation, injury or infection occasionally loss of function and has been a new realization of its role in cancer. While acute inflammation is a part of the defense response where as chronic inflammation could lead to cancer. Around 25% of cancer deaths worldwide are due to chronic inflammation. Cancer is now becoming a leading killer for human beings. The present
day chemotherapy drugs destroys cancer cells and has negative effect such as depression of the immune system that lead to fatal infections, destroying rapid proliferating cells (cancer cells) including other rapidly proliferating cells of the body at the same time.

Decrease in the number of white blood cells (WBC) allows the person susceptible to infection. The cells that line the stomach and intestines divide rapidly, so gastrointestinal problems occur often as adverse effects of chemotherapy. Many factors of chemotherapy induce fatigue, anemia, hepatotoxicity, nephrotoxicity, encephalopathy, cardiotoxicity, and thrombocytopenia. Therefore, alternative therapeutic approaches are needed for the management of cancer patients. The approach to treat advanced cancer using (natural) medicines has drawn much attention recently. Natural medicines have been reported to serve as biological response modifiers by activating, increasing, and or restoring the reactivity of immunological effectors mechanisms that are involved in resistance to tumor growth and metastasis. WHO estimated that 80% of the world population in the developing countries mainly relies on traditional medicines for their health care needs, most of them are plant derived. Plants are the essential and integral part in complementary and alternative medicine and due to their develop inability for the formation of secondary metabolites like flavanoids, alkaloids, steroids, and phenolic substances which is used to restore health. Medicinal plant serves as therapeutic alternative and safer choice with little or no adverse effect during cancer treatment.

Mangroves are found in tropical and subtropical tidal areas, which have a high degree of salinity. *Rhizophora apiculata* (*R. apiculata*), is an important plant used in traditional medicines by many people in Asia and African continent. Through several plants from mangroves are extensively used in traditional medicine, only some have been assessed for biological activities. *R. apiculata* contains an abundance of
biologically active compounds due to its special salt-tolerant living surroundings. Therefore, to provide validity to the claims that *R. apiculata* has numerous potential health benefits, in our study, we have evaluated and found that marine mangrove *R. apiculata* exhibits anti-inflammatory, anti-tumor, anti-ulcer and efficient immunostimulant properties.

During our initial investigation, *R. apiculata* showed significant inhibitory effect on the edema formation and by reducing serum iNOS, COX-2 and prostaglandin level of carrageenan and formalin model, suggesting that the main mechanism of action of the tested plant extract may involve interfering in histamine and prostaglandin biosynthesis pathway and may influence inflammation mediators. It is then be known that *R. apiculata* prevented carrageenan and formalin induced paw edema in a dose dependent manner showing significant anti-inflammatory effect preventing chronic inflammation and thus preventing tumor progression.

In an another study *R. apiculata* showed effective immunostimulant activity by showing increased total WBC count, hemoglobin content, relative organ weight, bone marrow cellularity, α-esterase positive cells and phagocytic index of the host determining its strong immunostimulant potentiate. *R. apiculata* also showed convincing anti-tumor activity by inhibiting melanoma cell lines *in vitro* and solid tumor development *in vivo*. In this study the *R. apiculata* significantly reduced the host tumor volume, body weight, serum gamma-glutamyltransferase, nitric oxide (NO), glutathione level and tumor necrosis factor (TNF-α). *R. apiculata* significantly increased in total WBC count, hemoglobin content, relative organ weight, bone marrow cellularity, α-esterase positive cells and increased the survival days of the host animals. *R. apiculata* also showed effective inhibition of metastasis lung nodules and significant decreased in lung tissue hydroxyproline, hexosamine, uronic acid, serum sialic acid, serum gamma-glutamyltransferase, serum NO and increased in survival rate
of metastatic tumor bearing animals which were further supported by reduction of metastasizing cells of the treated host lung histopathology. Therefore these investigations provide a valid claim that *R. apiculata* could be a plant based natural competent anti-tumor and anti-metastasis agent.

*R. apiculata* showed proficient chemoprotective effect on tumor bearing mice treated with cyclophosphamide (CTX). The plant efficiently protects the experimental mice from the adverse effect of CTX in tumor bearing mice by increased count of total WBC, differential count, hemoglobin content, organ weight, bone marrow cellularity and α-esterase positive cells and significantly reduced the serum nitric oxide and serum glutathione levels which is further supported by the that decreased the CTX induced urotoxicity in bladder and intestine of the histopathology examination. This indicated that *R. apiculata* could be an effective chemoprotectant against CTX induced toxicity in mice.

In a separate study *R. apiculata* also protects host from ulcerative colitis induced by acetic acid. *R. apiculata* decreased colonic score disease activity index, wet colon weight, serum NO, serum LDH, serum COX-2, MPO, colonic lipid peroxides, colonic TNF-α, i NOS and significantly increased colonic superoxide dismutase and colonic glutathione level. These reports were further supported showing minimal damage to the mucosa with slight sub-mucosal edema and mild inflammatory cell infiltration of colon in treated host during histopathology.

In conclusion, the results obtained from our study indicate the effectiveness of natural product *R. apiculata* in the inhibition of inflammation, tumor and metastasis since metastasis is a major rate limiting step, which is the prime cause of higher cancer mortality. *R. apiculata* as an authoritative plant with protective role over ulcerative colitis directly or through immune system activation as an effective and potential
immunostimulant. Therefore overall *R. apiculata* could be a new efficient (natural) plant based candidate for cancer therapy.