

## INTRODUCTION

Indian Medicinal plants are considered as a vast source of several pharmacologically active principles and compounds, which are commonly used in home remedies against multiple ailments. The medicinal plants play a vital role in the therapeutic armory of mankind. 80% of world's population in developing countries is totally dependent on medicinal plants for their primary health care (Gupta *et al.*, 2011a). Natural products from plant have been the basis of treatment of human diseases. Plants play an important role in the development of potent therapeutic agents. In recent years there has been an increased interest in using of herbal medicines (Aswar and Kuchekar, 2012). Over 25% of prescribed medicines in industrialized countries are derived directly or indirectly from plants. Herbal preparations can be more effective and safer than conventional medicines. There has been a growing interest in the analysis of plant products which has stimulated intense research on their potential health benefits (Mishra *et al.*, 2009 and Saklani *et al.*, 2012).

Medicinal plants continue to be an important therapeutic aid for alleviating the ailments of human kind. The search for eternal health and longevity and for remedies to relieve pain and discomfort drove early man to explore his immediate natural surroundings and led to the use of many plants in the development of a variety of therapeutic agents. Today, there is a renewed interest in traditional medicine and an increasing demand for more drugs from plant sources. This revival of interest in plant-derived drugs is mainly due to the current widespread belief that "green medicine" is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects (Joseph and Raj, 2010). Although rapid strides have been made in treatment of cancer, there still remain many stumbling blocks in achieving cancer prevention and cure. These plant species have been screened for their anticancerous activity *in vitro* and *in vivo* (Saumya *et al.*, 2011).

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Medicinal values of the plants lie in some chemical substances that produce a definite physiological action on the human body. The most important of these bioactive constituents of plants are alkaloids, tannins, flavanoids and phenolic compounds (Dhandapani and Sabna, 2008). Plant secondary metabolites such as alkaloids, tannins, steroids, terpenoids, coumarines and phenolic compounds and their semi-synthetic derivatives continue to play an important role in anticancer drug therapy (Jain and Jain, 2011).

Oxidation is essential to many living organisms for the production of energy to fuel biological processes. However, oxygen-centre free radicals reactive oxygen species (ROS), nitrogen species (RNS) and sulphur species (RSS) which are continuously produced *in vivo*, results in cell death and tissue damage. Reactive oxygen species including superoxide radicals, singlet oxygen and hydrogen peroxide are often generated as by products of biological reactions or from exogenous factors. These ROS may be very damaging and attack DNA and lipids in cell membrane inducing oxidation that causes membrane damage such as membrane lipid peroxidation. Reactive species are responsible for the oxidative damage of cellular tissues and that is implicated as a possible factor in the etiology of several human diseases including cancer, cardiovascular disease and aging (Gupta *et al.*, 2010).

In our living system there is a balance between production of free radicals and consumption of antioxidants. But, when reactive oxygen species or free radicals, produced beyond controlled limit, our body became unable to restore the damaged essential biomolecules such as proteins, DNA and lipids leading to development of several chronic diseases (Monaghan *et al.*, 2009; Hajra *et al.*, 2011 and Mathew *et al.*, 2011).

Antioxidant compounds are endogenous in nature which either prevents the generation of toxic oxidants, intercept any that are generated and inactivate them and thereby block the chain propagation reaction produced by these oxidants (Talukdar *et al.*, 2011). Antioxidants are a group of compounds that facilitate survival in plants and may promote the health of humans who consume a variety of plants foods. In plants, the term antioxidants often refers to a wide range of

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phenolic compounds that vary from simple phenolic acids to highly polymerized compounds such as tannins (Chanda *et al.*, 2011).

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. Plant produces these chemicals to protect itself but recent research demonstrated that many phytochemicals can protect humans against diseases. There are many phytochemicals in seeds, fruits and herbs and each works differently. Natural phytochemicals derived from medicinal plants have gained significant recognition in the potential management of several human clinical conditions, including cancer (Desai *et al.*, 2008 and Mehta *et al.*, 2010).

The activity of the plant against both Gram positive and Gram negative bacteria may be indicative of the presence of broad spectrum antibiotic compounds or simply general metabolic toxins in the plant. The use of medicinal plants as a source for illness can be traced back over five millennia to written documents of the early culture in China, India and the Near east, but it is, without a doubt, an art as old as mankind. The prospective of higher plants as basis of new drugs is still largely uncharted. Among the anticipated 250,000 - 500,000 plant species, only a small percentage has been investigated phytochemically and the fraction submitted to biological or pharmacological screening is even smaller. Historically pharmacological screening of compounds of natural or synthetic origin has been the source of inestimable therapeutic agents. Casual screening as tool in discovering new biologically active molecules has been most productive in the area of antibiotics. Medicinal plants signify a rich source of antimicrobial agents (Shaker *et al.*, 2012).

The microorganisms have developed resistance to many antibiotics because of arbitrary use of antimicrobial drugs that create a big dilemma in the treatment of infectious diseases. With the augment in the resistance of many microorganisms to the presently used antimicrobials and the high cost of production of synthetic compounds; in addition to many side effects; there is a need to look for the alternatives. Plants have provided a good source of antiinfective agents; emetine, quinine, berberine, tannins, terpenoids, alkaloids and

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flavonoids continue to be highly efficient instruments in the fight against microbial infections (Menghani and Soni, 2012).

Medicinal plants represent a rich source of antimicrobial agents. The traditional medicine involves the use of different plant extracts of bioactive constituents. Medicinal plants have been used as an exemplary source for centuries as an alternative remedy for treating human diseases because they contain numerous active constituents of therapeutic value. Plants are important source of potentially useful structures for the development of new chemotherapeutic agents (Manimozhi *et al.*, 2012).

Molecular docking is a computational technique that aims to predict how a particular small molecule will stably bind to a target protein. It is an important component of many drug discovery projects when the structure of the protein is available. Although it is primarily used as a virtual screening tool and subsequently for lead optimization purposes, there are also applications in target identification (Ekins *et al.*, 2007; Cases and Mestres, 2009; Anbu *et al.*, 2011 and Gaikwad *et al.*, 2011). Beyond drug discovery, these bioactive molecules can be used as chemical probes to study the biochemical role of a particular target (Xu *et al.*, 2009; Ballester and Mitchell, 2010; Abdulla *et al.*, 2011 and Lakshmi and Rajalakshmi, 2011).

*Ficus racemosa* Linn (*Moraceae*) is an evergreen, moderate to large sized spreading, lactiferous, deciduous tree, without much prominent aerial roots found throughout greater part of India in moist localities and is often cultivated in villages for its edible fruit. *Ficus racemosa* L. is a large deciduous tree distributed throughout India particularly in evergreen forests and moist localities (Singh *et al.*, 2011).

Different parts of *Ficus racemosa* are traditionally used as fodder, edible and ceremonial. All parts of this plant (leaves, fruits, bark, latex and sap of the root) are medicinally important in the traditional system of medicine in india. The astringent nature of the bark has been employed as a mouth wash in spongy gum and also internally in dysentery, menorrhagia and haemoptysis.

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Its pharmacological activities are hypoglycemic activity, hypolipidemic activity, wound healing, antidiarrhoeal, antihelmintic, antioxidant and a probable radioprotector, antidiuretic, hepatoprotective, antianalgesic, cardioprotective, anti ulcer and anti neoplastic (Yadav *et al.*, 2011).

There is no scientific validation on the extraction, screening and docking studies on the phytochemical constituents of the medicinal plant *Ficus racemosa* against the antitumor and antimicrobial targets. So, the present unique research entitled **“Antitumorigenic Effect in DLA Tumor Induced Mice and Antimicrobial Potential of *Ficus racemosa* and its Characterization by Spectral and *in silico* Studies”** aims at the finding on the antitumorigenic and antimicrobial potential of *Ficus racemosa* in five phases with the following objectives:

- ☞ To assess the *in vitro* antioxidative and antitumorigenic potential of methanolic extract of bark, fruits and leaves of *Ficus racemosa*.
- ☞ To assess the *in vivo* antioxidative and antitumorigenic efficacy of methanolic extract of bark, fruits and leaves of *Ficus racemosa* in DLA tumor transplanted Swiss albino mice.
- ☞ To assess the antimicrobial activities of methanolic extract of bark, fruits and leaves of *Ficus racemosa* against different microorganisms.
- ☞ To characterize the phytochemical constituents of methanolic extract of *Ficus racemosa* bark by chromatographic and spectral studies.
- ☞ To characterize the antitumorigenic and antimicrobial efficacy of phytochemical constituents of methanolic extract of *Ficus racemosa* bark against cancer and microbial target proteins using *in silico* Glide docking and QikProp panel.

The next chapter presents a brief review of the relevant published literature.