INTRODUCTION
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Plants and trees are considered as a great treasure to mankind. Since time immortal, people have known the multifarious values of the trees and plants. Traditional herbal remedies are used as alternative medicine by a large proportion of people worldwide. Herbals are generally perceived as safe, harmless and free from side effects (Snyman et al., 2005).

Plant and plant based products are an integrated part of most of the traditional and alternative systems of medicines worldwide. The World Health Organization (WHO) estimates that 80% of the population living in the developing countries relies on traditional medicine for their primary healthcare needs. In almost all these, medicinal plants play a major role and constitute their backbone (Mukherjee and Wahile, 2006). Plant and plant derived products have been used from time immemorial in the healthcare of humans. Traditional medicines derive the scientific heritage from rich experiences of early civilization (Shailajan et al., 2005). The indigenous systems of medicine like Ayurveda and Siddha describe the use of about 1200 plants, which can be used for curing various diseases.

Plants are the source of medication for preventive, curative, protective or promotive purposes (Sidhu et al., 2007). Plant derived foods help in the prevention of lifestyle associated diseases. Several groups of constituents in plants have been identified as potentially health promoting in animal studies, including cholesterol lowering factors, antioxidants, enzyme inducers and others (Dragsted et al., 2006). Herbal medicines are in great demand in both developed and developing countries because of their great efficacy and little, or no side effects (Trivedi, 2006).
Thus, the use of herbal or natural medicines for the treatment of various disorders has a long and extensive history. Many of these herbal medicines are finding their way into the world market as alternatives to prescribed allopathic drugs currently available to treat various disorders and ailments (Huang et al., 2005).

The interest in plants as sources of medicines is now directed towards producing therapeutically semi-purified forms, which are low in cost with no serious toxicities. This would be of significant value to countries that are poor in financial resources, but are rich in biodiversity (Gossell-Williams et al., 2006).

Phytochemicals in fruits, vegetables, spices and traditional herbal medicinal plants have been found to play protective roles against many chronic diseases, including cancer and cardiovascular diseases. Antioxidant phytochemicals exert their effect by neutralizing the highly reactive radicals (Tsao and Drug, 2005). Extracts of medicinal plants are believed to contain different chemopreventive or chemotherapeutic compounds (Ranga et al., 2005).

Oxidative stress is a factor in many human diseases, as either a cause or an effect. Oxidative stress defines an imbalance in the production of oxidizing chemical species and their effective removal by protective antioxidants and scavenger enzymes. Critical illness associated with massive oxidative stress could exacerbate organ injury and thus the overall clinical outcome. The lack of adverse effects, coupled with the minimal expense, supports the use of antioxidants in critically ill patients (Crimi et al., 2006).

In response to both external and internal stimuli, small amounts of reactive oxygen species (ROS) are constantly generated within aerobic organisms. ROS, the byproducts of cell metabolism, are also produced in
the body upon exposure to sunlight, X-rays, ozone, tobacco smoke, auto exhaust and other environmental pollutants (Prakash et al., 2007).

These ROS include hydrogen peroxide ($H_2O_2$), hydroxyl radical ($OH^\cdot$) and superoxide ($O_2^\bullet^-$) radicals, which cause damage to cellular macromolecules. This damage may initiate and promote the progression of several chronic diseases, including cancer, cardiovascular diseases and inflammation (Amatatongchai et al., 2007). In neurodegenerative diseases like Parkinson’s disease, Alzheimer’s disease and Huntington’s disease, there is increased ROS generation due to impaired mitochondrial oxidative phosphorylation (Bassenge et al., 2005).

Endogenously formed ROS continuously damage cellular constituents including DNA. These challenges, coupled with exogenous exposure to agents that generate ROS, are both associated with normal aging process and linked to cardiovascular diseases (CVD), cancer, cataract and fatty liver diseases (Vertanian et al., 2006).

Free radicals are not only produced naturally in the cell following a stress or respiration but also have been reported to be produced by radiation, bacterial and viral toxins, smoking, alcohol and psychological or emotional stress. The body produces many antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxidase, that neutralize many types of free radicals (Gamiotea-Turro et al., 2004).

ROS components such as $O_2^\bullet^-$ and $H_2O_2$ may act as second messengers, and play a role in modulating cellular function. $H_2O_2$ produces highly toxic hydroxyl radicals, which cause DNA damage, and contribute to cell death (Devasagayam et al., 2004).

Nitric oxide radical is a labile compound, which has a brief half life and is rapidly converted to the stable end products nitrite ($NO_2^-$) and
nitrate ($\text{NO}_3^-$) (Everekiloglu et al., 2003). The OH$^*$ radical reacts with nitric oxide to form peroxo nitrate. This peroxo nitrate is a more powerful oxidizing agent, more cytotoxic than nitric oxide and triggers a different proinflammatory process. It reacts with human body fluids and tissues, leading to the release of nitro tyrosines, which are known to increase the neurodegenerative diseases (Calabrese et al., 2004). It also induces nitrosation reaction that causes damage of proteins and lipids, depression of mitochondrial enzymes, depletion of glutathione and DNA strand damage (Virag et al., 2003).

DNA single strand breaks induced by ROS indicating nuclear disintegration is an important indicator of neuronal cell death (Singh et al., 2004a). ROS also induce modification in DNA bases, resulting in a variety of adverse events, including carcinogenesis (Boatout et al., 2005). ROS induce various types of DNA damage such as base and sugar damage, strand breaks and DNA-protein cross links (Dizdaroglu et al., 2002).

Oxygen free radicals cause damage to lipid membranes (LPO), which may lead to many problems such as progression of degenerative diseases (cardiovascular diseases and cancer) and lessening the effect of the immune system (Vitrata et al., 2004). LPO results in the formation of several toxic by-products such as 4-hydroxy nonenal and malondialdehyde. They form adducts with DNA and induce carcinogenicity, mutagenicity and apoptosis (Devasagayam et al., 2003).

Exogenous chemicals and radiation produce peroxidation of lipids, leading to structural and functional damage of cellular membranes. Ionizing radiation damages cellular molecules directly by transferring energy or indirectly by the generation of oxygen-derived free radicals (Lakshmi et al., 2005).
ROS, along with RNS (reactive nitrogen species), are well recognized for playing a dual role with both deleterious and beneficial effects. The “two faced” character of ROS is substantiated by a growing body of evidence that ROS within cells act as secondary messengers in intracellular signaling cascades, which induce and maintain the oncogenic phenotype of cancer cells. However, ROS can also induce cellular senescence and apoptosis (Valko et al., 2006).

The increase in intracellular ROS concentration is counteracted by defense mechanisms involving ROS scavenging enzymes and small antioxidant molecules (Zatorska et al., 2003). These antioxidants include (endogenous) enzymatic and the (predominantly exogenous) non-enzymatic antioxidants.

Antioxidants act as a defense mechanism that protects against oxidative damage, and include compounds and repair enzymes to remove or repair damaged molecules. However, the natural antioxidant compounds become important (Malpure et al., 2006). Antioxidants can prevent/retard the oxidation caused by free radicals and sufficient intake of antioxidants is supposed to protect against diseases (Celiktar et al., 2007).

Recent research on the effect of antioxidants on DNA repair suggests the effects in terms of increased removal of oxidized purines (Moller and Loft, 2004). Moreover, high intake of individual antioxidants is inversely associated with lung cancer risk and a combination of dietary antioxidants reduces the lung cancer risk (Burns et al., 2003).

Many bioactive compounds present in edible as well as in herbal plants have cancer chemoprotective potential (Selvendran et al., 2004). Additionally, endogenous antioxidants constitute important defense
systems in cells and elicit their action by suppressing the formation of ROS, by scavenging them or by repairing the damage to systems.

Medicinal plants are considered as potential sources of antioxidant compounds. There is an increased quest to obtain natural antioxidants with broad spectrum actions (Aquil et al., 2006). Herbal benefits associated with diets rich in vegetables and fruits are often attributed to the antioxidant activity of their constituent phytochemicals (Thompson et al., 2005).

Phytochemicals are emerging as a comprehensible and versatile source of antioxidants to be consumed to enhance the body’s defense against harmful ROS generated endogenously/exogenously. The presence of major phytocompounds including phenols, alkaloids, terpenoids, steroids, glycosides, flavonoids, tannins, indole and fibres are reported to be responsible for reducing oxidative stress (Nishino et al., 2005).

There is an increasing interest in the investigation of naturally occurring antioxidants from plants (Nickavar et al., 2006). The rapid increase in the consumption of traditional herbal remedies worldwide has been stimulated by several observations, which have shown their use as alternative medicine. These observations show herbal products to be safe, harmless, effective and free from side effects.

One of the plants that deserves attention in this regard is Clitoria ternatea. Clitoria ternatea (Sanskrit-Sankupushpam) belongs to the family Fabaceae, is widely used in traditional Indian system of medicine as a brain tonic (Gomez and Kalamani, 2003) and is believed to promote memory and intelligence. The leaves contain crude protein, crude fibre and antioxidants (Taranalli and Cheeramkuzhy, 2003). Clitoria ternatea is a perennial twinning herb bearing blue or white flowers. The parts used for medicinal purposes include roots, leaves and seeds (Ramesh, 2005).
Eventhough some studies have implicated the protective role of *Clitoria ternatea* leaves, so far no systematic study has been reported on the leaves. The present study was undertaken to analyze the antioxidant effects of the leaves of *Clitoria ternatea* in *in vitro* systems and confirming the effects *in vivo*. The objectives set for the study were as follows.

- To evaluate the antioxidant status of *Clitoria ternatea* leaves of two different varieties, namely white and blue flower bearing plants.
- To analyze the free radical scavenging, biomolecular protecting and antioxidant modulating effects of white and blue flowered *Clitoria ternatea* leaves *in vitro*.
- To confirm the findings observed *in vitro* using *in vivo* studies.
- To screen the phytochemical constituents of the leaves and to understand the chemical nature of the bioactive compounds responsible for its therapeutic value.

With the objectives clearly defined, the vast literature pertaining to the study was collected and scrutinized as a backdrop for the study. A very brief review of the salient points of literature reported is presented in the next chapter.