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A comparative study on the inhibtion of lipid peroxidation by *Withania somnifera* in different membrane models

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SUMMARY

Oxidative assault manifests itself by causing damaging effects to important biomolecules, the primary target being membrane lipids and the ultimate target being the DNA. Oxidants must cross the membrane barriers to exert their effects. Similarly, antioxidants must also traverse the different membranes. In the present study, an effort was made to study the efficacy of the extracts in rendering protection to biological membranes of varying lipid composition. The membranes of choice were intact cells (slice), plasma membrane devoid of intracellular membrane (RBC ghosts) and a mixture of plasma membrane and internal membranes (liver homogenate). They were challenged with oxidants and the protection rendered by the extracts was ascertained. The results obtained revealed that the maximum extent of protection was rendered in the liver homogenate, followed by RBC ghosts and intact cells. This finding suggested that the extracts render better protection to intracellular membrane lipids when exposed directly.

Key words : Oxidative stress, Lipid peroxidation, Membrane models, *Withania somnifera*.

Over the centuries, the indigenous people of the world have developed sophisticated social systems and traditional healers, through oral tradition and empirical means, have acquired and compiled detailed knowledge regarding the use of medicinal plants, which has been disseminated from generation to generation (Ahmad *et al.*, 2007). Even today, this area holds much more hidden treasure as almost 80 per cent of the human population in developing countries is dependent on plant resources for healthcare (Uniyal, 2006). Oxidative stress can arise from an imbalance between the generation and elimination of reactive oxygen species (ROS), leading to excess ROS levels, inflicting indiscriminate damage to virtually all biomolecules, leading, in turn, to various diseases and cell death (Scandalios, 2005). While ROS are generated under physiological conditions and are involved to some extent as signaling molecules and defense mechanisms, their excess generation has pathological consequences including damage to proteins, lipids and DNA (Valko *et al.*, 2006) and interference with signal transduction capable of altering all major classes of biomolecules with changes in their structure and function (Gonec *et al.*, 2005). Incomplete repair of such damages would lead to its accumulation over time, resulting in age related deterioration (Ryter *et al.*, 2007). Cell membrane phospholipids are very sensitive to oxidation and have been frequent targets of radical-induced damage that enables them to participate in free radical chain reaction (Nia *et al.*, 2001). Man has sought healing powers from the natural resources, especially from plants. Many drugs used today are based on folk remedies and subsequent ethnopharmacological studies (Koul *et al.*, 2005).

Withania somnifera, also known as Indian ginseng, is widely used in Ayurvedic medicine. It is an ingredient in many formulations prescribed for a variety of musculoskeletal conditions and as a general health tonic for elderly persons and lactating mothers (Khajuria *et al.*, 2004). Ayurvedic medicines prepared in India consist of *Withania somnifera* roots as one of the main ingredients. It is also consumed as a dietary supplement around the world. The leaves of *Withania somnifera* were used in the treatment of tumors and inflammation in several Asian countries (Jayaprakasha *et al.*, 2007).

In all these medicinal preparations and polyherbal formulations, it is the dry tubers of the plant that is being employed. Eventhough the leaves possess medicinal properties, not many studies have been reported regarding their antioxidative properties. Hence, in the present study, we attempted to study the extent of inhibition of lipid peroxidation by the leaves, fresh and dry tuber extracts in three different membrane models differing in their lipid composition and architecture.

MATERIALS AND METHODS

Oxidative assault to biological system, as manifested

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