



## ANTIOXIDANTS

Asparagus racemosus  
Emblica officinalis  
Curcuma longa  
Hemidesmus indicus  
Piper longum  
Punica granatum  
Tinospora cordifolia  
Withania somnifera

### **Asparagus racemosus**

Shatavari, botanically known as *Asparagus racemosus* is commonly found Indian Herb. This scandent, much-branched, spinous under-shrub, with tuberous roots possesses a no. of valuable medicinal properties. Well-established pharmacological properties of *Asparagus racemosus* include immunostimulation, uterine relaxation, anticancer, antiulcer, and antimicrobial etc.

The possible antioxidant effects *Asparagus racemosus* against membrane damage induced by the free radicals generated during gamma-radiation were examined in rat liver mitochondria. Antioxidant effects of *Asparagus racemosus* extract were studied against oxidative damage in terms of protection against lipid peroxidation, protein oxidation, depletion of protein thiols and the levels of the antioxidant enzyme, superoxide dismutase. *Asparagus racemosus* extract significantly inhibited lipid peroxidation and protein oxidation. Results indicate that extract from *Asparagus racemosus* have potent antioxidant properties in vitro in mitochondrial membranes of rat liver.

### **Emblica officinalis**

*Emblica officinalis* (Indian gooseberry) is an ingredient in several important medicinal preparations including Triphala ("three fruits") a laxative and carminative. *Emblica officinalis* or Amla as is commonly known is also an ingredient of the famous Chyvanaprash, a general tonic for people of all ages, which improves mental and physical well being. Shushrut, the great authority on Ayurveda, considers Amla as the best of all acid fruits and most useful for health and in treating diseases. It is

said that the ancient Sage Muni Chyawan rejuvenated himself in his late 70's and regained virility with its use.

### Antioxidant

Number of studies supporting antioxidant efficacy of *Emblica officinalis* have been reported. To site with-

One of the studies to evaluate antioxidant activity of *Phyllanthus emblica* indicated that pretreatment of rats with the butanol extract of the water fraction of *Phyllanthus emblica* fruits have been found to raise the superoxide dismutase (antioxidant enzyme) levels in the body leading to cytoprotection.

In another study, an emblicanin-A and -B enriched fraction of fresh juice of *Emblica* fruits (EOT) was investigated for antioxidant activity against oxidative stress in rat heart with vitamin E as the standard antioxidant agent. The results clearly showed that the administration of EOT given orally twice daily for 14 days prior to the sacrifice of the animals for experiments provided a significant protection against the stressor agent induced decrease in the activities of cardiac antioxidant enzymes like superoxide dismutase, catalase and glutathione peroxidase, leading to a consequent decrease in lipid peroxidation. The study thus confirmed the antioxidant effect of *Emblica officinalis* comparable to that of vitamin E along with its cardioprotective effect.

In the following study the tannoid principles of the *Emblica officinalis* were investigated on the basis of their effects on rat brain concentrations of the free radical scavenging enzymes, superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPX). The results were compared with effects induced by deprenyl, a selective MAO B inhibitor with well-documented antioxidant activity. The active tannoids of *Emblica officinalis* (EOT), induced an increase in SOD, CAT and GPX activity, with concomitant decrease in lipid peroxidation in these brain areas. The results again proved the antioxidant activity of *Emblica officinalis*.

### Immunostimulation

A study to assess the immunostimulation effects of total aqueous extract of *Emblica officinalis* in mice, in terms of its protective ability against suppressive effects of Cyclophosphamide (CP) (anticancer drug) has been reported. The observations revealed that oral treatment with *Emblica officinalis* extract at a dose of 100-mg/kg body weight for 10 days resulted in the improvement of immunological parameters in normal as well as CP treated animals. Where in it particularly provided protection against Cyclophosphamide induced suppression of humoral immunity, an important component of defense system of body. It also provided protection to antioxidant systems of kidney and liver. The reduced glutathione levels were significantly increased along with the restoration of antioxidant enzymes, in the CP treated group. Thus the study proved Immunostimulation effects of *Emblica officinalis*.

### **Hemidesmus indicus**

*Hemidesmus indicus* R. Br. (Asclepiadaceae) is a well known drug in Ayurveda system of medicine. In the present study, antioxidant activity of methanolic extract of *H. indicus* root bark was evaluated in several in vitro and ex vivo models. Further,

preliminary phytochemical analysis and TLC fingerprint profile of the extract was established to characterize the extract which showed antioxidant properties. The in vitro and ex vivo antioxidant potential of root bark of *H. indicus* was evaluated in different systems viz. radical scavenging activity by DPPH reduction, superoxide radical scavenging activity in riboflavin/light/NBT system, nitric oxide (NO) radical scavenging activity in sodium nitroprusside/Greiss reagent system and inhibition of lipid peroxidation induced by iron-ADP-ascorbate in liver homogenate and phenylhydrazine induced haemolysis in erythrocyte membrane stabilization study. The extract was found to have different levels of antioxidant properties in the models tested. In scavenging DPPH and superoxide radicals, its activity was intense (EC50 = 18.87 and 19.9 microg/ml respectively) while in scavenging NO radical, it was moderate. It also inhibited lipid peroxidation of liver homogenate (EC50 = 43.8 microg/ml) and the haemolysis induced by phenylhydrazine (EC50 = 9.74 microg/ml) confirming the membrane stabilization activity. The free radical scavenging property may be one of the mechanisms by which this drug is effective in several free radical mediated disease conditions.

### **Punica granatum**

Antioxidant-rich fractions were extracted from pomegranate (*Punica granatum*) peels and seeds using ethyl acetate, methanol, and water. The extracts were screened for their potential as antioxidants using various in vitro models, such as beta-carotene-linoleate and 1,1-diphenyl-2-picryl hydrazyl (DPPH) model systems. The methanol extract of peels showed 83 and 81% antioxidant activity at 50 ppm using the beta-carotene-linoleate and DPPH model systems, respectively. Similarly, the methanol extract of seeds showed 22.6 and 23.2% antioxidant activity at 100 ppm using the beta-carotene-linoleate and DPPH model systems, respectively. As the methanol extract of pomegranate peel showed the highest antioxidant activity among all of the extracts, it was selected for testing of its effect on lipid peroxidation, hydroxyl radical scavenging activity, and human low-density lipoprotein (LDL) oxidation. The methanol extract showed 56, 58, and 93.7% inhibition using the thiobarbituric acid method, hydroxyl radical scavenging activity, and LDL oxidation, respectively, at 100 ppm. This is the first report on the antioxidant properties of the extracts from pomegranate peel and seeds. Owing to this property, the studies can be further extended to exploit them for their possible application for the preservation of food products as well as their use as health supplements and nutraceuticals.

Pomegranate (*Punica granatum*) peel extracts have been shown to possess significant antioxidant activity in various in vitro models. Dried pomegranate peels were powdered and extracted with methanol for 4 h. The dried methanolic extract was fed to albino rats of the Wistar strain, followed by carbon tetrachloride (CCl<sub>4</sub>), and the levels of various enzymes, such as catalase, peroxidase, and superoxide dismutase (SOD), and lipid peroxidation were studied. Treatment of rats with a single dose of CCl<sub>4</sub> at 2.0 g/kg of body weight decreases the levels of catalase, SOD, and peroxidase by 81, 49, and 89% respectively, whereas the lipid peroxidation value increased nearly 3-fold. Pretreatment of the rats with a methanolic extract of pomegranate peel at 50 mg/kg (in terms of catechin equivalents) followed by CCl<sub>4</sub> treatment causes preservation of catalase, peroxidase, and SOD to values comparable with control values, whereas lipid peroxidation was brought back by 54% as compared to control. Histopathological studies of the liver were also carried out to determine the hepatoprotection effect exhibited by the pomegranate peel extract against the toxic effects of CCl<sub>4</sub>. Histopathological studies of the liver of different

groups also support the protective effects exhibited by the MeOH extract of pomegranate peel by restoring the normal hepatic architecture.

### **Withania somnifera**

The effect of Ashwagandha (*Withania Somnifera*) root powder (0.7 & 1.4 g/kg b.w/day) administered for 15 and 30 days was studied on lipid peroxidation (LPO) superoxide dismutase (SOD) and catalase activities in mice. While 15 days treatment didn't produce any significant changes, 30 days treatment produced significant decrease in LPO and increase in SOD and catalase. These findings indicated that *Withania Somnifera* root powder possesses free radical scavenging activity, which is proposed to be responsible for its pharmacological activity.

In another study chemopreventive effect of *Withania Somnifera* root extract (WSRE) was investigated on 7-B-dimethylbenz (a) anthracene induced skin papillomagenesis in Swiss albino mice. WSRE was administered at the maximum tolerated dose of 400 mg/kg orally 3 times/week on alternate days one week before DMBA and continued for 24 weeks thereafter. The results of the study revealed a significant decrease in incidence and average number of papillomas in mice as compared to DMBA alone at the end of 24th week. From the cited study it was inferred that WSRE possesses potential chemopreventive activity in this experimental model of cancer. The chemopreventive activity was proposed to be linked to the antioxidant or free radical scavenging constituents present in the extract.

*Withania somnifera* has been shown to possess protective action against many other pathophysiological conditions by virtue of its antioxidant properties.

### **Tinospora cordifolia**

*Tinospora cordifolia* (TC) is an indigenous medicinal plant with a potent immunostimulant activity. According to the Ayurvedic lexicons *Tinospora cordifolia* is referred to as 'Amrita'. The term 'Amrita' is attributed to this drug in recognition of its ability to impart youthfulness, vitality and longevity to its patron. Therefore it is categorized in Ayurveda as "Rasayana".

Oral administration of 2.5 g and 5.0 g/kg body weight of the aqueous extract of the roots of *Tinospora cordifolia* for 6 weeks resulted in a significant increase in reduced glutathione (GSH), catalase (CAT) and superoxide dismutase (SOD) in alloxan diabetic rats. Thus the study lended support to the fact that TCREt exhibits antioxidant activity.

Another study to evaluate the protective effects of *Tinospora cordifolia* (TC) against myelosuppression induced by single doses of cyclophosphamide (CP) has been reported. The results of this study indicated that *Tinospora cordifolia* treatment caused increased production of leucocytes and neutrophils the important weapons of the immune system. When compared to control group, *Tinospora cordifolia* prevented, to varying degrees, leucopenia produced by cyclophosphamide. Thus it has been concluded, therefore, that *Tinospora cordifolia* is a potent immunostimulant.

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