SUMMARY AND CONCLUSION
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Armed Forces personnel experiences different kinds of stress as a part of day to day activity. The manifestation of stress will aggravate based on the physical conditions of deployment such as high altitude and desert regions. Herbal extracts have long been used in the traditional systems of medicine for treatment of neuronal stress because of their potent antioxidant activity and lesser or no side-effects. Recently, there is a surge of interest toward the search of natural substances with neuroprotective and performance enhancing activity that can scavenge free radicals and protect cells from oxidative damage and apoptosis because of the adverse effects of conventional medicines. This prompted us to undertake the present investigation. So that we could develop food supplement with herbal additives that could be supplied to Armed Forces and people in general need to reduce fatigue associated stress and to enhance performance of the individuals and at the same time has no/ least unwanted side effects. For this study three herbs were short listed based on literature survey. The herbs were *Cyperus rotundus, Celastrus paniculatus, Eclipta alba*.

Chapter I

Literature survey

Literature relevant to the topic has been surveyed exhaustively.

Chapter II

Phytochemical analysis and *in vitro* antioxidant activity

The phytochemical composition of 70% ethanolic fractions of *C. rotundus* and *E. alba* were analyzed by LC-ESI-MS/MS whereas *C. paniculatus* was analyzed by GC-MS. The results indicate that the hydro alcoholic extract of *C. rotundus* is more effective than *E. alba* and *C. paniculatus* extracts in preventing the oxidative stress. The CRE showed significant prokaryotic and eukaryotic DNA damage protection on plasmid and genomic DNA and also exhibited significant protection against protein oxidation and nitration induced by AAPH and SIN-1. Moreover, CRE showed acetylcholine esterase inhibitory activity. Therefore, *C. rotundus* could be used as a source of antioxidants for dietary supplementation to alleviate oxidative stress related disorders.
Chapter III

Evaluation of neuroprotection in vitro

It was observed that *C. rotundus* hydro alcoholic extract can ameliorate the \( \text{H}_2\text{O}_2 \)-induced oxidative stress by improving the antioxidant status, mitochondrial membrane integrity, regulating the apoptotic markers and maintaining the BDNF level. Further the results demonstrate that the CRE efficiently modulated SIN-1 induced reactive nitrogen species mediated stress and ameliorated mitochondrial and plasma membrane damage, restored the cellular morphology and improved the antioxidant status by regulating the oxidative stress biomarkers. Further, CRE regulated NO formation by downregulating i-NOS expression and restored the MMP. The extract also regulated bcl-2 expression, caspase-3 cleavage and prevented the SIN-1 induced DNA damage and apoptosis. The study gives information on the potential effects of CRE against \( \text{H}_2\text{O}_2 \) and SIN-1 induced oxido-nitrosative stress.

Chapter IV

Evaluation of the effects on physical performance

The data suggests that *C. paniculatus* hydroalcoholic extract enhances the swimming endurance capacity by improving the muscle metabolic rate as evidenced by biochemical markers such as, lactic acid and glycogen which are the principal parameters to evaluate fatigue activity. AMPK phosphorylation, mitochondrial biogenesis, glucose transport, antioxidant status and VEGF expression were elevated alone with exercise as well as exercise + 50 mg/kg b/wt CPSE supplementation which explain the beneficial effects of exercise as well as *C. paniculatus* seed extract. The extract supplementation enhanced the lactic acid transport and also regulated the HSP-70 expression which demonstrates the anti-stress effects of CPSE. Further the study demonstrates that *C. paniculatus* seed extract inhibits t-BHP induced muscle cell cytotoxicity, apoptosis, mitochondrial and DNA damage and restores the antioxidant status. These results demonstrate the possible application of CPSE to treat strenuous exercise/fatigue induced oxidative damage of muscle cells.
Chapter V

Evaluation of the effects on hypoxia induced cognitive impairment

The observations demonstrate that hypoxia induced memory impairment and damaged the nervous system. However, the total oligomeric flavonoid fraction of *C. rotundus* supplemented rats rescued cognitive impairment and also protected the neuronal system against hypoxia induced oxidative stress. The TOF fed rats regulated the antioxidant enzymes level, neurotransmitter content, ROS generation, protein carbonyls formation, ACh and AChE levels. Further protected the DNA damage of pyramidal cells of CA3 region, regulated the expression of HIF-1α and VEGF proteins and also down-regulated GFAP expression. Histological and protein expression studies describe that oxygen deficiency induced oxidative stress and apoptosis damage in rats was regulated in supplementation with TOF of *C. rotundus*.

Chapter VI

Evaluation of effects on amyloid peptide-induced neuronal damage (Alzheimer’s disease)

In continuation the results also demonstrated the *in vivo* neuroprotective effects of TOF extract against amyloid peptide induced Alzheimer’s disease. TOF extract effectively inhibited the amyloid peptide oligomerization. The TOF pre-treatment inhibited Aβ 25-35 induced cytotoxicity, ROS generation, lipid peroxidation, Ca^{2+} release, MMP and regulated apoptosis and neuronal marker genes such as BDNF and TH expression and also attenuated DNA damage in SH-SY5Y human neuronal cells. Thus TOF extract might be used as a protective supplement to regulate the Alzheimer’s disease induced neurotoxicity.

Thus it can be concluded that regular intake of *C. rotundus* and *C. paniculatus* extracts along with balanced diet will improve longevity, and alleviate, fatigue, neuronal and age associated disorders.