Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

Effect of *Costus speciosus and Wedelia chinensis* on Brain Neurotransmitters and Enzyme Monoamine Oxidase Following Cold Immobilization Stress

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ABSTRACT:
The effect of alcoholic extracts of *Costus speciosus* rhizomes and *Wedelia chinensis* leaves were evaluated on stress induced changes in brain neurotransmitters and enzyme monoamine oxidase levels in albino rats. The extracts were found to possess normalizing activity against cold immobilization stress induced changes in norepinephrine (NE), dopamine (DA), 5-hydroxy tryptamine (5-HT), 5-hydroxy indole acetic acid (5-HIAA), and enzyme monoamine oxidase (MAO), The results obtained provide biochemical evidence for antistress activity of the tested extracts.

Keywords: antistress activity, brain neurotransmitters, cold immobilization stress, *Costus speciosus*; Monoamine oxidase, *Wedelia chinensis.*

INTRODUCTION:

Stress is a daily phenomenon faced by every human, normal functioning of every individual is dependent on optimum levels of stress. It is a vital that stress is kept under control and normal functioning is not hampered due to excess of stress [1]. Many marketed formulations claim to possess antistress action, but still many herbs which have claims to be general tonics need to be investigated and their claims be authenticated. In recent era there is great thrust on screening of herbs for their antistress activity.

Costus speciosus (Zingiberaceae) and *Wedelia chinensis* Merrill (Asteraceae) are widely used in the Indian system of medicine for their tonic properties [2]. The antioxidant activity of the said plants has been evaluated by us previously [3, 4].The experimental evidence has shown that the lipid peroxide free radicals modulate neurotransmission under physiological conditions; In addition reactive oxygen species (ROS) may influence the modulation of neurotransmission [5]. As the said plants have free radical scavenging power and traditionally used as a tonic, considering all these facts the present study has been carried out to assess the mechanism of antistress activity of *Costus speciosus* and *Wedelia chinensis* by studying their effect on brain norepinephrine (NE), dopamine (DA), 5-hydroxy tryptamine (5-HT), 5-hydroxy indole acetic acid (5-HIAA), and enzyme monoamine oxidase (MAO) levels.

MATERIALS AND METHODS:

Plant materials:

The *Costus speciosus* rhizomes and *Wedelia chinensis* leaves were procure from the Plant Physiology Division, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Krishi Nagar, Jabalpur, (M.P.) and authenticated by Dr.Anjula Pandey, taxonomic division, National Herbarium of Cultivated Plants, National Bureau of Plant Genetic and Resources, Pusa Campus, New Delhi. Voucher specimens **NHCP/NBPGR/2007/98/2225 dated 22/08/2007,** (*Costus speciosus*) and

NHCP/NBPGR/2007/99/2225 dated 22/08/2007 (*Wedelia chinensis***)** were retained in our laboratory for further reference.

Plant extract:

The plant materials were dried under shade and reduced to moderately coarse powder and was extracted successively with petroleum ether (60-80^{o}C) and ethanol using soxhlet apparatus. The ethanolic extracts were dried under vacuum (yield 10.78%, 9.47% respectively) and then suspended in 20% (v/v) propylene glycol –water to give a concentration of 500 mg/ml.

Animals:

The Institutional Animal Ethics Committee, (IAEC) review the protocol and approved the use of animals for the studies**, (Ethical clearance number: 711/02/a/CPCSEA).**

Wistar albino rats of both sexes (150±20 g b.w.) were used for the present studies. They were housed in clean polypropylene cages (3 in each cage) and maintained under standard laboratory condition at an ambient temperature25±2°C with 55-64% relative humidity and 12 h light -dark cycle. They were allowed free access to standard pellet diet (Hindustan Lever, Kolkata, India) and water *ad libidum*.

Assessment of activity:

The rats were divided in to four groups of six rats in each. Group I served as control, Group II served as restraint control and Group III and Group IV served as *Costus speciosus* and *Wedelia chinensis* treated respectively. The control animals received vehicle (1ml), and the treated group received the extracts as a suspension at a dose of 500 mg/kg, b.w. once daily in the morning for 16 days through gastric intubation. One hour after the administration of the last dose, stress was induced by individually placing the animals in a restrainer for 3 h at 4°C [6]. Thereafter , the animals were sacrificed by cervical dislocation , whole brain was rapidly frozen at -5°C and brain NE, DA, 5-HT, 5-HIAA were spectrofluorimetrically estimated by the methods of Ansell and Beeson [7] as modified by Cox and Perhach [8]. Brain MAO levels was estimated spectrometrically by McEween's method [9].

Statistical analysis:

All observations are presented as mean ± SEM. The data was analyzed by student's-*t* test. Differences were considered significant at the 5% level.

RESULTS AND DISCUSSIONS:

The results are presented in Table 1. A variety of stressor induces a significant alteration in the metabolism and function of various neurotransmitters in the CNS as well as peripheral nervous system. Cold immobilization stress causes depletion of norepinephrine and dopamine levels in the brain [10].

It appears that norepinephrine is utilized during stress and dopamine levels in the brain rise as a compensatory mechanism, thus acting as a precursor for the synthesis of more norepinephrine to cope up with demand.

Drug treatment was found to prevent the stress induced depletion of norepinephrine and dopamine levels thus helping the organism to cope up better during stress. Pretreatment with plant extracts was found to significantly reduce the stress induced rise in brain 5-HT, 5-HIAA levels by preventing the alarm reaction which elicits a significant

Table 1: Effect of ethanolic extracts of *Costus speciosus* and *Wedelia chinensis* on brain bioamine and MAO levels following cold immobilization stress.

Treatment Group	Noradrenalin (ng/gm)	Dopamine (ng/gm)	5-Hydroxy tryptmine (ng/gm)	5-Hydroxy Indole acetic acid (ng/gm)	Monoamine oxidase Units/mg
Normal control	433.39±20.63	846.02±22.98	652.39±26.78	510.16±50.22	4.87.±0.25
Restraint control	382.30±27.15	673.20±64.52	743.47±64.33	723.22±18.65	4.29±0.35
EECS (500 mg/kg)	521.99±61.02***	887.82±12.98***	397.16±20.88****	568.23±44.29**	7.88±0.23
EEWC (500 mg/kg)	491.95±88.57	897.66±58.32*	378.59±23.32****	468.29±37.41**	7.48±0.64

n=6, Values are expressed as mean ± SEM
p<0.05; **p<0.02; ***p<0.01; ****p<0.001, compared to restraint control.
EECS= Ethanolic extract of *Costus speciosus*
EEWS= Ethanolic extract of *Wedelia chinensis*

rise in 5-HT and 5-HIAA levels [11] , thereby arresting the genesis of stress related disorders.

The enzyme MAO is mostly concern with the maintenance of the optimum level of biogenic amines in the brain [12] and it is postulated that the predominant function of MAO is to prevent the release of 5-HT [13]. Cold immobilization stress causes decrease MAO activity which in turns increases the 5-HT and 5-HIAA levels [14].

Pretreatment with drug extract has resulted in the increase in MAO activity above normal control values (Table 1), thereby decreasing the elevated levels of 5-HT and 5-HIAA induced by stress. Thus the antistress activity of these plant drugs could be attributed to the modulation of this enzymatic activity.

CONCLUSION:

An exponential rise in world population coupled with rapid industrial growth has a direct impact on environment and society thus making man easily vulnerable to stress conditions. These , in-turn , causes disturbances in the normal physiological functioning of the body by way of increased free radical generation culminating in hypertension, neurosis, immune suppression and other physical and mental disorders. Global search is on, for the development of an effective antistress drug from natural source which could effectively tone up the disturbed physiological functioning of the subjects affected by such stress problem [15]. The remarkable results are in agreement with normalizing affect of *Costus speciosus* and *Wedelia chinensis* in rats against a variety of stressors by us, thereby indicating its adaptogenic potential. Further studies are in progress to identify active principle(s) responsible for is antistress activity and to find out synergy among different compounds present in *Costus speciosus* and *Wedelia chinensis.*

ACKNOWLEDGEMENT

The authors are thankful to Dr. Anjula Pandey, Senior Scientist, Taxonomic Division, National Herbarium of Cultivated Plants, National Bureau of Plant Genetic and Resources, New Delhi for plants identification and its authentication.

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