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Short communication

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Effect of *Annona muricata* and *Polyalthia cerasoides* on brain neurotransmitters and enzyme monoamine oxidase following cold immobilization stress

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Abstract

Objective: To evaluate the effect of alcoholic extracts of *Annona muricata* Linn. and *Polyalthia cerasoides* Bedd. on stress induced changes in brain neurotransmitters and enzyme monoamine oxidase levels. Materials and methods: Stress was induced by cold immobilzation in albino rats. Results: 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) levels. Conclusion: The results obtained provide biochemical evidence for adaptogenic activity of the tested extracts.

Keywords: *Annona muricata* and *Polyalthia cerasoides* ; cold immobilzation stress; antistress activity; brain neurotransmitters; Monoamine oxidase.

1. Introduction

A. muricata Linn. finds a variety of medicinal uses in the traditional system of medicine. The leaves are used as suppurative, febrifuge; its bark as tonic; roots as antispasmodic, parasiticidal; flowers as bechic; unripe fruit as antiscrobutic and seeds as insecticidal, astringent, fish-poison. Some of the genus *Polyalthia* are used in the Indian system of medicine as bitter, tonic, abortifacient, febrifuge, a cure for scorpion stings, high blood pressure and as a respirator stimulant [1]. Literature does not mention any medicinal use of *P. cerasoides*, although the stem bark of the same is used by local medical practitioners in Tirunelveli district (Tamilnadu, India) in patients as tonic in combating conditions of stress. The present study has been carried out to assess the mechanism of the antistress activity of *A.muricata* and *P. cerasoides* by studying their effect on brain norepinephrine (NE), dopamine (DA), 5-hydroxy tryptamine (5-HT), 5-hydroxy indole acetic acid (5-HIAA) and monoamine oxidase (MAO) levels.

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2. Materials and methods

2.1 Plant material

The stembark of *A. muricata* and *P. cerasoides* were obtained from Tirunelveli district and indentified by Dr.V.Chelladurai, Survey of Medical Plant Unit, Government Siddha Medical College, Tirunelveli. Voucher specimens are in the Department of Pharmaceutics, Banaras Hindu University.

2.2 Extraction

The dried stembarks of *A. muricata* (500 g) and *P. cerasoides* (300 g) in moderately coarse powder were successively Soxhlet extracted with petroleum ether (60-80°C) and ethanol (95%). The alcoholic extracts were dried under vacuum (48g and 14.5g, respectively) and then suspended in 20% (v/v) propylene glycol-water to give a concentration of 100 g/ml.

2.3 Animals and methods

Inbred male albino rats of Charles Foster strain (150±20g, b.w.) were housed in polypropylene cages (3 in each cage) at an ambient temperature of 25° ± 2°C with 55-64% relative humidity and a 12 h light-dark cycle. The extracts were administered as a suspension at a dose of 100mg/kg, b.w., once daily in the morning for 16 days through gastric intubation. Control animals received drug vehicle (1 ml). 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.

Thereafter, the animals were sacrificed by cervical dislocation, whole brain was rapidly frozen at –5°C and the brain NE, DA, 5-HT, 5-HIAA were spectrofluorimetrically estimated by the methods of Ansell and Beeson [2] as modified by Cox and Perhach [3]. Brain MAO levels was estimated spectrometrically by McEween's method [4].

2.4 Statistical analysis

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

3. Results and discussion

The results are presented in Table 1. A variety of stressors induce a significant alteration in the metabolism and function of various neurotrasmitters in the CNS as well as peripheral

Table 1.
Effect of *A. muricata* and *P. cerasoides* on brain bioamine and enzyme MAO levels following cold immobilisation stress.

Treatment Group	Noradrenaline (ng/gm)	Dopamine (ng/gm)	5-Hydroxy tryptamine (ng/gm)	5-Hydroxy Indole-acetic acid (ng/gm)	Monoamine oxidase units/mg protein
Normal Control	445.99 ± 22.53	892.02 ± 32.19	679.22 ± 59.53	533.38 ± 59.53	5.00 ± 0.28
Restraint Control	376.30 ± 29.19	699.77 ± 72.66	750.10 ± 67.12	731.43 ± 19.72	4.24 ± 0.37
A.muricata treated	588.99 ± 62.34[c]	930.82 ± 13.32[c]	402.76 ± 22.24[d]	588.24 ± 47.25[b]	8.10 ± 0.15[d]
P.cerasoides treated	515.95 ± 91.05	912.34 ± 69.33[a]	393.00 ± 25.73[d]	480.15 ± 38.44[d]	7.28 ± 0.35[d]

n=7; Values are expressed as mean ± SEM
[a]P<0.05; [b]P<0.02; [c]P<0.01; [d]P<0.001 compared to restraint control. Student's *t* - test.

nervous system. Cold immobilization stress causes depletion of norepinephrine and dopamine levels in the brain [5].

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 the 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 and 5-HIAA levels by preventing the alarm reaction which elicits a significant rise in 5-HT and 5-HIAA levels [6], thereby arresting the genesis of stress related disorders.

The enzyme MAO is mostly concerned with the maintenance of the optimum level of biogenic amines in the brain [7] and it is postulated that the predominant function of MAO is to prevent the release of 5-HT [8]. Cold immobilisation stress causes decrease MAO activity which in turn increases the 5-HT and 5-HIAA levels [9].

Pretreatment with drug extract has resulted in the increases 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.

The results are in agreement with the normalizing affect of *A. muricata* and *P. cerasoides* in rats against a variety of stressors by us [10], thereby indicating its adaptogenic potential.

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