Research Article

www.ijrap.net

ANTIDEPRESSANT ACTIVITY OF *NARDOSTACHYS JATAMANSI* IN ELECTRON BEAM IRRADIATED MICE

Deepa B[1], Suchetha K[2], Satheesh Rao[3]*

[1]PhD Scholar, Department of Pharmacology, KSHEMA, Mangalore, India

[2]Professor, Department of Biochemistry, KSHEMA, Mangalore, India

[3]Professor and Head, Department of Psychiatry, K.S. Hegde Charitable Hospital, Mangalore, India

Received on: 06/10/12 Revised on: 20/11/12 Accepted on: 13/12/12

***Corresponding author**

E-mail: bdeepa05@gmail.com

DOI: 10.7897/2277-4343.04135

Published by Moksha Publishing House. Website www.mokshaph.com

All rights reserved.

ABSTRACT

Electron beam radiation, a form of Ionizing radiation has an important role in diagnosing and treatment of many diseases. But the deposition of this energy in tissues results in damage to DNA and eradicates the cell's ability to replicate indefinitely. During the past few years due to their widespread use in hospitals, concern regarding the hazardous effect of electron beam radiation has developed. This pre-clinical work was designed to test the antidepressant activity of *Nardostachys jatamansi* ethanolic root extract on whole body electron beam radiation induced depression in Swiss albino mice, using established models for depression. The aim of the present study was to investigate antidepressant effect of *Nardostachys jatamansi* ethanolic root extract in electron beam irradiated mice. *Nardostachys jatamansi* ethanolic root extract at the dose of 200 mg/kg, orally was administered in electron beam radiated mice for screening its antidepressant effect using two validated experimental models for depression i.e., Forced Swimming Test and Tail Suspension Test. The duration of immobility (in seconds) was noted in both the tests. The electron beam radiated mice treated with *Nardostachys jatamansi* ethanolic root extract has shown a significant reduction in the duration of immobility (in seconds) in both the tests on comparing with non treated electron beam radiated mice. The data suggest that exposure to low levels of electron beam radiation can cause depression, which can be abolished by the administration of *Nardostachys jatamansi* ethanolic root extract.

Key Words: Electron beam radiation, Depression, Swiss albino mice, *Nardostachys jatamansi*, ethanolic root extract, Antidepressant.

INTRODUCTION

Radiation is a form of energy which arises from unstable atoms. Radiation travels from its origin in the form of energy waves or energized particles. Many forms of "radiation" are encountered in the natural environments which are produced by modern technology. Since it is naturally around us, exposure to radiation cannot be prevented. They have both beneficial and harmful effects. There are mainly two kinds of radiations, ionizing and non-ionizing. The ionizing radiation can knock electrons out of atoms. It carries a health risk as it affects the atoms in living beings and thereby changing cell structure and damaging the DNA. The most important risk from exposure to ionizing radiation is cancer. However, they can damage health in many ways other than cancer. Ionizing radiation includes x-rays, gamma rays, alpha particles, beta particles, neutrons and the varieties of cosmic rays. Ionizing radiation is widely used in hospitals to diagnose and treat diseases. Most medical exposure to these radiations comes from the use of X-rays and CT scans to diagnose injuries and diseases in patients. Certain types of cancer are treated by very high localized radiation doses. Radioactive substances are used in consumer products such as smoke detectors and to sterilize food products. Ionizing radiation is also used to test materials, inspect welds, generate heat and electricity for space travel, determine soil moisture content, and track the movement of various elements in the environment[1-5]. Since the use of these radiations has become an inevitable part in our day to day life, there arises a concern about the deleterious effects of these high energy radiations on living beings. In this context, the necessity of a radio protective agent comes into the picture. Plants and plant derived phytoconstituents have a major role in this aspect.

Nardostachys jatamansi belongs to the family Valerianaceae. It is commonly found in the alpine Himalayas from Punjab to Sikkim, Bhutan, and South West China at the altitude range of 3000-5000 meters. Various sesquiterpenes (such as Jatamansic acid and Jatamansone), lignans and neolignans have been reported to be present in the roots of this plant. Jatamansi has a long history of use as ethnomedicine. It is used to treat epilepsy, hysteria and syncope. It helps to promote physical and mental health, augment immunity and has shown potent free radical scavenging activity. It has also shown to have marked tranquillizing activity, as well as hypotensive, hypolipidemic, anti-ischemic, antiarrhythmic, hepatoprotective, anticonvulsant and neuroprotective activities. Recently a study has reported about the radioprotective effects of *Nardostachys jatamansi* [6-10].

Hence, the present study was designed to explore the antidepressant effect of *Nardostachys jatamansi* ethanolic root extract (NJEE) on whole body electron beam radiation (EBR) induced depression in Swiss albino mice.

MATERIALS AND METHODS

Experimental Animals

Healthy adult Swiss albino mice of either sex weighing 20-25g were used after obtaining approval from the institutional animal ethics committee (KSHEMA/AEC/01/2010). They were kept in propylene cages with husk as bedding and maintained at a room

temperature of 27±1°C, 12:12 hour light/dark cycle. They had free access to standard pellet diet & water.

Radiation procedure

The irradiation work was carried out at Microtron centre, Mangalore University, Mangalore, Karnataka, India. A variable energy accelerator, Microtron was used for giving radiation. The unanaesthetised animals were restrained in well-ventilated perspex boxes and exposed to whole-body EBR at a distance of 30 cm from the beam exit point of the Microtron accelerator at a dose rate of ~100 Gy/min. EBR was given at a dose of 6Gy.

Instruments/ Apparatus

Soxhlet apparatus, Plexiglass cylinder, Metal tripods

Plant Extract

***Nardostachys jatamansi* ethanolic root extract (NJEE)**

Nardostachys jatamansi root powder was obtained from Rajesh Chemicals Mumbai. A weighed quantity (500 g) of the coarse powder was taken and extracted with ethanol (90 %) in a Soxhlet apparatus. The extract was concentrated on a water bath at a temperature not exceeding 60ºC. The percentage yield of the extract was 6 %. NJEE was administered at a dose of 200 mg/kg/day orally for 15 days after the irradiation.

Assessment of Depression

In the present study, the animals were divided into 3 different groups. Each group consisted of 12 animals (6 males and 6 females).

Group I: Normal control.

Group II: EBR (6Gy).

Group III: EBR (6Gy) + NJEE (200mg/kg, orally for 15 days)

On 15th day, after 60 minutes of administration of the drug, the animals were taken for experiments to investigate antidepressant activity of NJEE using established models of depression i.e Forced swimming test & Tail suspension test[11-14]. Briefly the tests are as follows.

Forced Swim Test (FST)

The FST is the most widely used pharmacological model for assessing antidepressant activity. The development of immobility when the rodents are placed in an inescapable cylinder of water reflects the cessation of persistent escape-directed behavior. The apparatus consisted of a clear Plexiglas cylinder (20cm high X 12 cm diameter) filled to 15 cm depth with water. During the test session, the immobility time was recorded for 5minutes, when the mice make no further attempts to escape, and makes only movements to keep its head above the water.

Tail Suspension Test (TST)

The TST is the second method used for assessing the depressive state. A cord of about 50 cm in length was stretched between two metal tripods at a height of 70 cm, to which the mice were attached by the tail with sticky tape. After the initial period of vigorous motor activity, the mice became still and the immobility time was measured with a stopwatch, for a total duration of 5 minutes. Mice were considered immobile when they hung passively and completely motionless.

Statistical Analysis

All the groups were subjected to analysis of variance by using one-way ANOVA followed by Tukey krammer test.

Table 1: Antidepressant effect of NJEE by Forced Swimming Test

Group	Drugs	Duration of immobility in seconds
I	Normal Control	137.16 ± 28.736
II	EBR (6 Gy)	[a] 244.66 ± 11.96
III	EBR (6 Gy) + NJEE(200mg/kg ,orally for 15 days)	[b] 149.83 ± 6.191
Results are expressed as Mean ±S.D ;N=12, One way ANOVA followed by Tukey Krammer test. [a]: p<0.001, considered very high significant on comparing Group II with Group I, [b]: p<0.001, considered very high significant on comparing Group III with Group II		

Table 2: Antidepressant effect of NJEE by Tail Suspension Test

Group	Drugs	Duration of immobility in seconds
I	Normal Control	163.11 ± 31.950
II	EBR (6 Gy)	[a] 268.16 ± 12.65
III	EBR (6 Gy) + NJEE(200mg/kg, orally for 15 days)	[b] 147.66 ± 8.06
Results are expressed as Mean ±S.D ;N=12, One way ANOVA followed by Tukey Krammer test. [a]: p<0.001, considered very high significant on comparing Group II with Group I, [b]: p<0.001, considered very high significant on comparing Group III with Group II		

RESULTS

Forced Swim Test (FST)

There was a significant increase ($p<0.001$) in the duration of immobility for EBR treated animals [Group II] on comparing with the normal rats [Group I]. There was a significant decrease ($p<0.001$) in the duration of immobility for EBR + NJEE treated animals [Group III] on comparing with the EBR rats [Group II]. (Table-1)

Tail Suspension Test (TST)

There was a significant increase ($p<0.001$) in the duration of immobility for EBR treated animals [Group II] on comparing with the normal rats [Group I]. There was a significant decrease ($p<0.001$) in the duration of immobility for EBR + NJEE treated animals [Group III] on comparing with the EBR rats [Group II]. (Table-2)

The above observations clearly shows that exposure to EBR can cause depression, which can be abolished by NJEE.

DISCUSSION

With the development of modern technology, there is more and more public concern for the biological effects of ionizing radiation[15,16]. Many studies showed that ionizing radiations like X-rays had significant effect on

neurochemistry and physiologic rhythm[17]. EBR induced depression as seen in this study can be due to their deleterious effects on monoamine neurotransmitters, including catecholamines and indole-amines, which play a significant functional role in biological systems[18, 19]. The harmful effects on these bioamines can be due to the release of free radicals by EBR[20]. Depression is one of the five leading causes of disability and disease burden worldwide[21].Various studies have shown that under-activation of serotonergic and noradrenergic systems play a major role in the pathogenesis of depression[22].

Results showed that NJEE at the dose of 200mg/kg administration has abolished EBR induced depression.

The antidepressant activity of *Nardostachys jatamansi* can be attributed to its inhibitory effect on MAO enzyme[23]. Inhibition of this enzyme causes reduction in the metabolism of biogenic amines and subsequent increase in the levels of catecholamines and indole-amines[24].The antioxidant activity of *Nardostachys jatamansi* can be another reason for its antidepressant activity[20].

As there is rapid development in technology, radiation pollution has started showing deleterious effects on health of living beings. Hence, there is an urgent need to take precautionary steps to prevent radio-toxicity. Enormous studies are required to find out suitable radio-protective agents.

REFERENCES

1. Radiation, facts, risks and realities. United states Environment Protection Agency. Available from: http://www.epa.gov/radiation/docs/402-k-10-008.pdf
2. Radiation in the Environment. Available from: http:// www. Lbl .gov /abc/ wallchart/ teachers guide/pdf/Chap15.pdf
3. Environmental Ionizing Radiation. Available from: http://www.eolss.net/Sample-Chapters/C09/E1-08-12.pdf
4. Environmental Radiation fact sheet-Health Physics society. Available from: http://hps.org/documents/environmental_radiation_fact_sheet.pdf
5. Ionizing Radiation- Argonne National Laboratory. Available from: http:// www.evs.anl. gov/ pub/doc/ionizing-radiation.pdf
6. Chauhan RS, Nautiyal MC. Seed germination and seed storage behaviour of Nardostachys Jatamansi DC., an endangered medicinal herb of high-altitude Himalaya. Current Science 2007; 92(11):16-20.
7. Sandhya S, Vinod KR, Sravan Kumar. Herbs Used for Brain Disorders. Hygeia. J.D. Med 2010;2(1):38-45
8. Amritpal S,Anil K,Sanjiv D. Nardostachys jatamansi ,potential herb with CNS effects. Journal of Pharmaceutical Research and Health Care 2009;1(2): 276-290.
9. Nazmun L, Dipankar B, Tapas KS, Santanu M, Suhrita P, Suparna C, Antony G. Stress modulating antioxidant effect of *Nardostachys jatamansi*. Indian Journal of Biochemistry & Biophysics 2009;46:93-98.
10. Sharma SK, Singh AP. Standardization and preliminary phytochemical screening of Nardostachys jatamansi. Int. J. Res. Ayur. Pharm 2011; 2 (3): 978-982
11. Santhosh P, Venugopal R, Nilakash AS, Kunjbihari S, Mangala L. Antidepressant activity of methanolic extract of Passiflora foetida leaves in mice. Int J Pharm Pharm Sci 2011;3(1):112-115.
12. Hosseinzadeh et al. Antidepressant effect of kaempferol, a constituent of saffron (Crocus sativus) petal, in mice and rats. Pharmacologyonline 2007; 2: 367-370.
13. Thamarai Selvi P, Senthil Kumar M, Rajesh R, Kathiravan T. Antidepressant activity of ethanolic extract of leaves of Centella asiatica Linn by In vivo methods. Asian J. Res. Pharm. Sci. 2012; 2(2):76-79.
14. Sudhakar et al. Antidepressant activity of aqueous extract of fruits of Emblica officinalis in mice. International Journal of Applied Biology and Pharmaceutical Technology 2010;1(2):449-454.
15. Cai L,Cherian MG. Adaptive response to ionizing radiation-induced chromosome aberrations in rabbit lymphocytes: effect of pre-exposure to zinc, and copper salts. Mutat. Res. 1996;369:233–241. http://dx.doi.org/10.1016/S0165-1218(96)90028-2
16. Robbins ME, Payne V, Tommasi, E, Diz D I, Hsu FC, Brown W R, Wheeler KT, Olson J, Zhao W. The AT1 receptor antagonist, L-158,809, prevents or ameliorates fractionated whole-brain irradiation-induced cognitive impairment. Int. J. Radiat. Oncol. Biol. Phys. 2009; 73:499-505 http://dx.doi.org/10.1016/j.ijrobp.2008.09.058 PMid:19084353 PMCid:2631653
17. Henry Lai and Narendra P. Singh .Magnetic field induced DNA strand breaks in brain cells of the rat. Environmental Health Perspectives 2004; 112 (6): 687-694. http://dx.doi.org/10.1289/ehp.6355 PMid:15121512 PMCid:1241963
18. Xu F, Gao M, Wang L, Jin L. Study on the effect of electromagnetic impulse on neurotransmitter metabolism in nerve cells by high-performance liquid chromatography–electrochemical detection coupled with microdialysis. Analytical Biochemistry 2002;307:33–39. http://dx.doi.org/10.1016/S0003-2697(02)00020-9
19. A Mori, N Ogawa. Effect of an in vivo 60 Hz magnetic field on monoamine levels in mouse brain, Pathophysiology2000;7:115–119. http://dx.doi.org/10.1016/S0928-4680(00)00037-7
20. P Naveen et al. Radioprotective effect of Nardostachys jatamansi against whole body electron beam induced oxidative stress and tissue injury in rats. Journal of Pharmacy Research 2011;4(7):2197-2200.
21. Depression: A Global Crisis - World Federation for Mental Health. Available from: http://www.wfmh.org/2012DOCS/WMHDay%202012%20SMALL%20FILE%20FINAL.pdf
22. Sirijit Suttajit MD. The role of neurotransmitters hormones and brain derived neurotrophic factors in the pathogenesis of depression. Chiang Mai Med J 2009;48(1):35-41.
23. Prabhu V, Karanth KS, & Rao A. Effects of Nardostachys jatamansi on biogenic amines and inhibitory amino acids in rat brain. Planta Med. 1994; 60:114.http://dx.doi.org/10.1055/s-2006-959429 PMid:8202559
24. Dinesh Dingra, Praveen Kumar Goyal. Inhibition of MAO and GABA: probable mechanisms for antidepressant like activity of Nardostachys jatamansi in mice. Indian Journal of Experimental Biology 2008;46(4):212-218.

Cite this article as:
Deepa B, Suchetha K, Satheesh Rao. Antidepressant activity of Nardostachys jatamansi in electron beam irradiated mice. Int. J. Res. Ayur. Pharm. 2013; 4(1):101-103

Source of support: Nil, Conflict of interest: None Declared