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EVALUATION OF HEPATOPROTECTIVE, ANALGESIC AND ANTIPYRETIC ACTIVITY OF AQUEOUS EXTRACTS OF *BOERHAAVIA DIFFUSA* AND *ANISOCHLILUS CARNOSUS*

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ABSTRACT

An aqueous extracts of stem and leaves of *Boerhaavia Diffusa* (Aq.EBD) and leaves of *Anisochilus Carnosus* (Aq.EAC) was studied for hepatoprotective, analgesic and antipyretic activity. Hepatotoxicity was introduced in Albino rats of either sex by intraperitoneal injection of CCl_4 (in olive oil). Tail immersion method and Hot plate method in mice were studied for analgesic activity, Yeast induced pyrexia method in rats was followed to evaluate antipyretic activity. Aq.EBD and Aq.EAC were administered to the experimental animals at the dose levels 150mg and 300mg/kg body weight, 200mg and 400mg/kg body weight of Aq.EBD and Aq.EAC respectively. The hepatoprotective effects of the extracts were evaluated by the assay of liver function biochemical parameters like Serum Glutamate Oxaloacetate Transaminase (SGOT), Serum Glutamate Pyruvate Tranaminase (SGPT), Serum Alkaline Phosphatase (SALP), Total and Direct Serum Bilirubin. It was concluded that, the Aq.EBD and Aq.EAC possess hepatoprotective activity against CCl_4 induced hepatotoxicity in rats, in both analgesic methods the extracts has shown significant activity and the dose was also shown significant results for antipyretic activity.

KEY WORDS: ***Boerhaavia Diffusa, Anisochilus Carnosus*, Hepatoprotective, Analgesic, Antipyretic.**

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INTRODUCTION

Liver injury may be either acute or chronic. Acute liver injury may present with non-specific symptoms of fatigue and abnormal LFTs, or with jaundice and acute liver failure. Chronic liver injury is defined as hepatic injury, inflammation and/or fibrosis occurring in the liver for more than 6 months. In the early stages patients can be asymptomatic with abnormal LFTs. With more severe liver damage, however the presentation can be with jaundice, portal hypertension or other signs of cirrhosis. Any cause of liver damage can produce acute liver failure, provided it is sufficiently severe. Acute viral hepatitis is the most common cause world-wide, whereas paracetamol toxicity is the most frequent cause in the UK. Acute liver failure occurs occasionally with other drugs, or from Amanita phalloides (mushroom) poisoning, in pregnancy, in Wilson's disease, following shock and, rarely, in extensive malignant disease of the liver. In 10% of cases the cause of acute liver failure remains unknown and these patients often labeled as having non-A-E viral hepatitis or cryptogenic acute liver failure[(1)]. Pain is commonly categorized as being either somatic or visceral. As with any other complaint, pain should not be treated as a nonspecific disorder when a specific etiology can be identified and treated[(2)]. Analgesics are the drugs which relieve pain without causing loss of consciousness. Analgesics can be evaluated in various ways: a) Prevention or relief of artificially induced pain in experimental animals, b) Relief of experimental pain in human volunteers induced by radiant heat, ischemia induced with sphygmomanometer cuff or intraperitoneal bradykinin and c) Relief of pathological or incision pain, post-puerperal pain, post-operative pain and pain due to malignancy. Although the body surface temperature is ordinarily measured in clinical practice, it is the body core temperature which is physiologically important. The rectal temperature (which reflects core temperature closely) is about 0.6ºC higher than oral temperature and about 1.4ºC higher than axillary temperature. The generally accepted normal limits of rectal temperature in adults are 36.1ºC and 37.8ºC; the body temperature is higher in infants. If the core temperature rises by more than a few degrees in man, mental changes occur. It is well known that an individual with high fever is often confused and delirious. The working of many tissue enzymes is also adversely affected and hyperpyrexia may result in death. However, core temperature below 40.5ºC is generally tolerated by most individuals[(3)]. *Boerhaavia Diffusa* belongs to the family Nyctaginaceae, which is commonly known as Horse-purslane, Hogweed and Pig weed in English. Atikimamidi, Atima mamidi, Punarnava in Telugu. It is a diffuse herb with shout root-stocks. Leaves are thick-chartaceous in unequal pairs, ovate or elliptic-oblong, subfleshy. Anthocarps club-shaped, 5-ribbed, glandular hairy, top rounded; seeds erect. It is commonly distributed weed along roadsides, felds and waste places throughout the Chittoor district of Andhra Pradesh, India. The whole plant is used for the treatment of jaundice, dyspnoea, constipation, arthritis, anaemia, cardiac diseases and liver diseases.

Anisochilus Carnosus belongs to the family Lamiaceae, which is commonly known as thick-leaved lavender in English. Saugudu ganapa, ritchu-rodda and karpuravalli in Telugu. It is an annual erect herb,stems guadrangular, sparsely pubescent, brownish from prolonged exposure to sun. Leaves fleshy, broadly ovate, deeply crenate, obtuse or acute, base rounded, verrucose above, and pubescent beneath. It is commonly distributed in rock crevisces on hills. On the way from Papanasam to Kumaradhara theertham (tirumala), dhanambanda area in Talakona. The whole plant used as diaphoretic, stimulant, expectorant, liver disorders, cough and cold. Leaf used for cough, dropsy, indigestion and sores in the leg fingers[(4)]. Antibacterial activity of *Boerhaavia Diffusa* L.leaves[(5)] ,

Chemopreventive action of *Boerhaavia Diffusa* on DMBA-induced skin carcinogenesis in mice[6], anti-ulcer activity of *Anisochilus Carnosus* leaf extract in pylorus ligated rats[7] has been reported. A detailed literature reviews indicated that, the hepatoprotective, analgesic and antipyretic activity of aqueous extracts of stem and leaves of *Boerhaavia Diffusa* and leaves of *Anisochilus Carnosus* has not been clinically evaluated so for. In the present study, the hepatoprotective, analgesic and antipyretic activity of aqueous extracts of *Boerhaavia Diffusa* and *Anisochilus Carnosus* is reported.

MATERIALS AND METHODS

Plant material

The stem and leaves of *Boerhaavia Diffusa* and leaves of *Anisochilus Carnosus* were collected from Sri Venkateswara University campus, Tirumala gardens of Chittoor district of Andhra Pradesh and the same were authentified by Assistant Professor, Dr.K.Madhava Chetty, Department of Botany, S.V.University, Tirupati, AP. Voucher specimens were deposited at department of pharmacognosy for further reference.

Extraction and Phytochemical screening

The shade dried plant materials were reduced to moderately coarse powder and extracted successively with alcohol using Soxhlet apparatus after defatting. The prepared extracts were subjected to identify the presence of various phytoconstituents[8,9].

Experimental animals

Wistar albino rats weighing between 200-250gm and male albino mice between 20-30gm were obtained from Venkateswara Enterprises, Bangalore, Karnataka, India. The animals were maintained on the suitable nutritional and environmental conditions throughout the experiment as per the rules and regulations of the Institutional animal ethics committee. Experimental protocols for the pharmacological and toxicity studies were reviewed and approved by the Institutional animal ethical committee (1423/PO/a/11/CPCSEA).

Acute toxicity studies

Acute toxicity studies were performed for the extracts of Aq.EBD and Aq.EAC using different doses according to the method described under OECD guidelines[10]. For the hepatoprotective, analgesic and antipyretic studies, the amount of dose administered were adjusted on the basis of observation during the toxicity studies.

CCl_4 Induced hepatotoxicity

The entire animals were fasted over night and administered with respective drugs as per the mentioned dosage schedule. Animals were divided into seven groups of six rats in each group.

Group I: Normal control animals received 2ml/kg of 1%NaCMC p.o.

Group II: Toxic control animals received 0.7ml/kg of CCl_4 in a 50% olive oil solution i.p. once daily for 7 days.

Group III: Drug control animals received simultaneously 1ml/kg of Liv-52 p.o. and 0.7ml/kg of CCl_4 i.p. once daily for 7 days.

Group IV: Treated animals received simultaneously Aq.EBD 150mg/kg in 1% NaCMC p.o.and 0.7ml/kg of CCl_4 i.p. once daily for 7 days.

Group V: Treated animals received simultaneously Aq.EBD 300mg/kg in 1% NaCMC p.o.and 0.7ml/kg of CCl_4 i.p. once daily for 7 days.

Group VI: Treated animals received simultaneously Aq.EAC 200mg/kg in 1% NaCMC p.o.and 0.7ml/kg of CCl_4 i.p. once daily for 7 days.

Group VII: Treated animals received simultaneously Aq.EAC 400mg/kg in 1% NaCMC p.o.and 0.7ml/kg of CCl_4 i.p. once daily for 7 days.

On the 8th day, the animals were euthanized by decapitation under ether anaesthesia and blood was collected from retro-orbital and allowed to clot for 45mins at room

temperature. Serum was separated by centrifugation and subjected to various biochemical estimations of SGOT, SGPT, SALP, Serum total bilirubin and direct bilirubin[11-13].

Analgesic and Antipyretic activity of AEBD and AEAC

Analgesic Activity-Tail immersion method

Thirty six mice were weighed and prior to analgesic experiments, the animals were screened for the sensitivity test by immersing the tail of the mice gently in hot water maintained at 55-56ºC. Any animal failing to withdraw its tail within 5 sec is rejected from the study. The selected animals were then divided into six groups of six rats each.

Group I: Control group animals received 2ml/kg of 1% NaCMC.

Group II: Standard group animals received Pentazocine at dose of 10mg/kg i.p.

Group III: Received Aq.EBD 150mg/kg in 1% NaCMC p.o.

Group IV: Received Aq.EBD 300mg/kg in 1% NaCMC p.o.

Group V: Received Aq.EAC 200mg/kg in 1% NaCMC p.o.

Group VI: Received Aq.EAC 400mg/kg in 1% NaCMC p.o.

After administration of the above scheduled drugs, the reaction time was measured in seconds at 0 min (before drug challenge), 15, 30 and 60 minutes.

Analgesic Activity-Hot plate method

Thirty six mice were weighed and the basal reaction time by observing hind paw licking or jump response (whichever appears first) in animals when placed on hot plate maintained at constant temperature (55ºC) was taken. The animals were divided into six groups of six rats each.

Group I: Control group animals received 2ml/kg of 1% NaCMC.

Group II: Standard group animals received Aspirin at dose of 100mg/kg p.o.

Group III: Received Aq.EBD 150mg/kg in 1% NaCMC p.o.

Group IV: Received Aq.EBD 300mg/kg in 1% NaCMC p.o.

Group V: Received Aq.EAC 200mg/kg in 1% NaCMC p.o.

Group VI: Received Aq.EAC 400mg/kg in 1% NaCMC p.o.

After administration of the above scheduled drugs, the reaction time was measured in seconds at 0 min (before drug challenge), 15, 30, 60 and 120 minutes.

Antipyretic activity- yeast induced pyrexia method

Antipyretic activity was assessed using brewer's yeast induced pyrexia method. Thirty six rats were divided into six groups of six rats each. . The normal body temperature of each rat was measured rectally at 1 hour interval on a thermometer. After measuring the basal rectal temperature, animals were given a subcutaneous injection of 2ml/kg of 15% w/v brewer's yeast suspended in 0.5% w/v methyl cellulose solution. The site of injection is massaged in order to spread the suspension beneath the skin. Rats were then returned to respective cages. After 19 hour of yeast administration, the following dose schedule was administered.

Group I: Served as control received vehicle 5ml/kg p.o.

Group II: Received Paracetamol dissolved in distilled water 150mg/kg p.o.

Group III: Received Aq.EBD 150mg/kg p.o. suspended in 2% w/v gum acacia solution.

Group IV: Received Aq.EBD 300mg/kg p.o. suspended in 2% w/v gum acacia solution

Group V: Received Aq.EAC 200mg/kg p.o. suspended in 2% w/v gum acacia solution.

Group VI: Received Aq.EAC 400mg/kg p.o. suspended in 2% w/v gum acacia solution.

The rats were allowed to remain quiet in the cage for some time. A flexible thermister probe coated with lubricant was inserted 3-4cm deep into the rectum and fastened to the tail by adhesive tape. The temperature was measured on a thermometer in ºC at 1 hour interval up to 23 hour after yeast injection[14-19].

Statistical Analysis

Experimental results were expressed as mean±SEM (n=6).Statistical analysis was performed with one way ANOVA followed by Dunnett's test using GraphPad InStat 3.

RESULTS AND DISCUSSION

The acute toxicity study of both extracts revealed no mortality when administered orally up to a dose of 5g/kg body weight. At this dose there were no behavioral changes. The comparative efficacy of the extracts tested for their hepatoprotective activity along with the relationship between the doses, which are depicted in table-1. In group II animals, Carbon tetrachloride intoxication in normal rats produced elevated levels of serum biochemical parameters as follows: SGOT (292.57±3.12), SGPT (257.70±2.18), SALP (251.33±1.99), Total bilirubin (2.03±0.04) and Direct bilirubin (1.59±0.07) compare to control group I animals having SGOT (154.77±2.31), SGPT (95.90±1.66), SALP (187.12±1.98), Total bilirubin (0.83±0.05) and Direct bilirubin (0.19±0.03) indicating acute hepatocellular damage and biliary obstruction. When compared to the CCl_4 toxic control group, the group treated with Aq.EBD at doses 150&300 mg/kg in CCl_4 intoxicated rats exhibited a significantreductionofSGOT(290.08±3.10&240.20±3.38),SGPT(247.76±3.69&145.12±3.80),SALP(244.60±3.65&205.03±3.90), Total bilirubin (1.60±0.17&1.34±0.11) and Direct bilirubin (1.38±0.12&1.20±0.13) levels. When compared to the CCl_4 toxic control group, the group treated with Aq.EAC at doses of 200&400 mg/kg in CCl_4 intoxicated rats exhibited a significantreductionofSGOT(279.10±3.51&221.95±4.09), SGPT (244.63±4.07&139.37±4.41), SALP(240.10±3.85&199.46±3.18),Totalbilirubin (1.55±0.12&1.29±0.09) and Direct bilirubin (1.31±0.06&0.59±0.05) levels.

Table-1

Effect of Aq.EBD and Aq.EAC on biochemical estimation of SGOT, SGPT, SALP, Total bilirubin and Direct bilirubin.

	Groups	SGOT (IU/L)	SGPT (IU/L)	SALP (IU/L)	Total Bilirubin (mg/dl)	Direct Bilirubin (mg/dl)
I	Control	154.77±2.31	95.90±1.66	187.12±1.98	0.83±0.05	0.19±0.03
II	CCl_4 (1ml/kg)	292.57±3.12	257.70±2.18	251.33±1.99	2.03±0.04	1.59±0.07
III	Standard (1ml/kg)	193.03±3.15**	115.80±1.95**	189.73±2.94**	0.87±0.06**	0.29±0.05**
IV	Aq.EBD 150mg	290.08±3.10	247.76±3.69	244.60±3.65	1.60±0.17*	1.38±0.12
V	Aq.EBD 300mg	240.20±3.38**	145.12±3.80**	205.03±3.90**	1.34±0.11**	1.20±0.13*
VI	Aq.EAC 200mg	279.10±3.51*	244.63±4.07*	240.10±3.85	1.55±0.12*	1.31±0.06
VII	Aq.EAC 400mg	221.95±4.09**	139.37±4.41**	199.46±3.18**	1.29±0.09**	0.59±0.05**

Each value represents the mean±SEM, n=6. * p<0.05, ** p<0.01, Statistical significant test for comparison was done by ANOVA , followed by Dunnett's test. Groups III to VII are compared with group II.

In tail immersion method, when mice tail was immersed in water bath (thermostatically maintained at 55-56ºC), the withdrawal time of the tail from hot water in seconds was noted as the reaction time or tail flick latency. The tail flick latency of Aq.EBD and Aq.EAC at various doses at 60 minutes was comparable with that of standard drug Pentazocine at 10mg/kg. The results were shown in table-2. A cut off period of 10-12 sec was observed to prevent damage to the tail.

Table-2
Analgesic effect of Aq.EBD and Aq.EAC by Tail immersion method in mice

Groups		Reaction time (Seconds)			
		0 min	15 min	30 min	60 min
I	Control	2.33±0.33	2.50±0.22	2.16±0.31	2.83±0.31
II	Standard	2.33±0.42	4.17±0.48*	5.50±0.43**	9.17±0.30**
III	Aq.EBD 150mg	2.16±0.48	2.50±0.43	2.83±0.31	3.66±0.33
IV	Aq.EBD 300mg	2.67±0.66	3.16±0.31	3.50±0.56	6.17±0.40**
V	Aq.EAC 200mg	2.50±0.43	3.00±0.36	3.33±0.33	4.83±0.80*
VI	Aq.EAC 400mg	2.00±0.36	3.66±0.33	4.17±0.70*	7.00±0.36**

Each value represents the mean±SEM, n=6. * p<0.05, ** p<0.01, Statistical significant test for comparison was done by ANOVA , followed by Dunnett's test. Groups II to VI are compared with group I.

The result of the hot plate (Table-3) revealed that the reaction time for mice was significantly increased in a dose dependent manner. A cut off period of 15 sec was observed to avoid damage to the paws.

Table-3
Analgesic effect of Aq.EBD & Aq.EAC in mice by hot plate method

Groups		Reaction time (Seconds)				
		0 min	15 min	30 min	60 min	120 min
I	Control	7.16±0.48	7.00±0.58	6.67±0.33	7.16±0.31	7.00±0.36
II	Standard	6.67±0.42	8.83±0.48*	10.83±0.60**	12.67±0.42**	14.33±0.33**
III	Aq.EBD 150mg	7.00±0.58	7.00±0.36	7.17±0.47	7.67±0.49	8.66±0.55
IV	Aq.EBD 300mg	6.66±0.42	7.17±0.48	7.66±0.61	9.00±0.58*	10.50±0.56**
V	Aq.EAC 200mg	6.83±0.40	7.00±0.45	7.33±0.50	8.16±0.47	9.33±0.67*
VI	Aq.EAC 400mg	6.50±0.43	7.50±0.22	8.67±0.55*	10.00±0.52**	11.83±0.54**

Each value represents the mean±SEM, n=6. * p<0.05, ** p<0.01, Statistical significant test for comparison was done by ANOVA , followed by Dunnett's test. Groups II to VI are compared with group I.

The effect of different doses of Aq.EBD and Aq.EAC on yeast induced hyperpyrexia is expressed in Table-4. The extracts exhibited significant antipyretic activity at 20, 21, 22 and 23 hour of yeast administration as compared to control.

Table-4
Antipyretic effect of Aq.EBD and Aq.EAC on Yeast induced Pyrexia in Rats

Groups		Rectal temperature in ºC at various time					
		0 hour	19th hour	20th hour	21st hour	22nd hour	23rd hour
I	Control	37.42± 0.19	39.23± 0.29	39.60± 0.15	39.47± 0.18	39.23± 0.18	38.95± 0.19
II	Standard	37.67± 0.13	39.47± 0.24	38.78± 0.12*	38.61± 0.11**	38.15± 0.21**	37.75± 0.10**
III	Aq.EAB 150mg	37.30± 0.27	39.28± 0.26	39.10± 0.26	39.00± 0.18	38.88± 0.20	38.56± 0.16
IV	Aq.EBD 300mg	37.55± 0.26	39.10± 0.33	38.83± 0.28	38.75± 0.24*	38.56± 0.21	38.20± 0.15*
V	Aq.EAC 200mg	37.42± 0.36	38.97± 0.34	38.82± 0.20	38.80± 0.17	38.65± 0.19	38.28± 0.15*
VI	Aq.EAC 400mg	37.28± 0.31	39.02± 0.31	38.83± 0.19	38.70± 0.16*	38.46± 0.20*	37.86± 0.21**

Each value represents the mean±SEM, n=6. * p<0.05, ** p<0.01, Statistical significant test for comparison was done by ANOVA , followed by Dunnett's test. Groups II to VI are compared with group I.

CONCLUSION

From the above discussions, it is quite apparent that aqueous extracts of *Boerhaavia Diffusa* and *Anisochilus Carnosus* possesses hepatoprotective, analgesic and antipyretic effect against different stimuli. Also the study accounts the scientific validation of reported use of the said plant in folklore use.

CONFLICT OF INTEREST

No conflict of interest associated with this work.

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REFERENCES

1. Nicki RC, Brian RW, Stuart HR. Davidson's Principles & Practice of medicine, 21st Edn. Churchill Livingstone-Elsevier: 929-933, (2010)
2. 2.Erich TH, Dick RG, Linda LH. Clinical Pharmacy and Therapeutics, 4th Edn, Wolters Kluwer (India) Pvt. Ltd: 945-952, (1988)
3. 3.Satoskar RS, bhandarka SD, Nirmala N.Rege. Pharmacology and Pharmacotherapeutics, 21st Edn, Popular Prakashan Pvt.Ltd: 159 (2010)

4. Madhava CK, Sivaji K, Tulasi Rao. Flowering Plants of Chittoor District Andhra Pradeh, India, 1st Edn, Student Offset Printers, Tirupati:285 & 273 (2008)
5. Umamaheswari A., Nuni A., Shreevidya R. Evaluation of antibacterial activity of *Boerhaavia Diffusa* L.leaves. Int J. Green Pharmacy, 4(2):75-78, (2010)
6. Rupjyoti B., Mohammed RHA., Jawahira T. Chemopreventive action of *Boerhaavia Diffusa* on DMBA-induced skin carcinogenesis in mice. Indian J Physiol Pharmacol, 47(4):459-464, (2003)
7. Ravikumar J., Santhosh HY., Nagashruthi MN., Mohammed Asad. Antiulcer activity of *Anisochilus Carnosus* leaf extract in pylorus ligated rats, 45(12):979-981, (2008) Available from: http://www.pharmainfo.net/ravi-kumar/publications/antiulcer-activity-anisochilus-carnosus-leaf-extract-pylorus-ligated-rats
8. Kokate CK. Practical Pharmacognosy, 4th Edn, Vallabh Prakashan, Pune: (1996)
9. Khandelwal KR. Practical Pharmacognosy, 13th Edn, Nirali Prakashan, Pune: (2005)
10. Organization for Economic Co-operation and Development (OECD). OECD guidelines for the testing of chemicals. Test no.425: Acute oral Toxicity: Up-and Down Procedure 2008. [Online]. Available from: http://lysander.sourceoecd.org [Accessed on March 21,2009].
11. Pulok kM. Quality Control Herbal Drugs-An approach to evaluation of botanicals. Business Horizons, New Delhi: (2010)
12. Sandhir R., Gill KD. Hepatoprotective effects of Liv-52 on Ethanol-induced Liver damage in Rats. J. Exp. Biology, 37(8): 762-766, (1999)
13. Manigaunha A., Ganesh N., Kharya MD. Hepatoprotection by *Kaempferia Galanga* Against Carbon Tetrachloride Induced Liver Damage in Rats. Ind.Drugs, 47(4): 55-60, (2010)
14. Kulkarni SK. Hand Book of Experimental Pharmacology, 3rd Edn, Vallabh Prakashan: (2007)
15. Ghosh MN. Evaluation of analgesic agents, Fundamentals of Experimental Pharmacology, 2nd Edn, Scientific Book Agency: (1984)
16. Parmer NS and Shiv Prakash. Screening methods in Pharmacology, 1st Edn, Narosa Publishing House Pvt. Ltd: (2011).
17. Anuj KA., Mohd. Khaliquzzama and Sanjaya KP. Evaluation of analgesic activity of methanolic extract of *Trapa natans l.var. Bispinosa roxb*. Roots. Journal of Current Pharmaceutical Research, 01: 8-11 (2010)
18. Hatapakki BC and Hukkeri VI. Antipyretic Activity of Root of *Climatis triloba Heyne ex. Roth* in Rats. Pharmacie Globale (IJCP), 2(06): 1-3, (2010)
19. Nardev S., Atul KG., Vijay J., Renu C. Antipyretic activity of Bergenia Ligulata Wall. Int J Pharm Bio Sci, 1(3): 1-5, (2010)