IAMJ

Research Article *International Ayurvedic Medical Journal* *ISSN:2320 5091*

MEMORY ENHANCING EFFECT OF *GAMBHARI PHALA* (*GMELINA ARBOREA)* IN THE ELECTROSHOCK INDUCED AMNESIA IN WISTAR ALBINO RATS- AN EXPERIMENTAL STUDY

Sankh Kuber Ashwini H.S. Huded Shiva Prasad Lingadore K.
Gummadi Sonia V. Asha H.N.
Dept. of Dravya Guna, JSSAMC & H, Mysore, Karnataka, India

ABSTRACT

In *Ayurveda*, for the maintenance of mental health, '*Pragna*' is the prime factor. *Pragna* is composed of the *Dhee*, *Dhruti* and *Smruti*. If *DheeDhruti* and *Smruti* do not function normally then it leads to *Dukha* (Roga). Loss of memory is one of the symptoms in disorders like cognitive dysfunction disorder, epileptic disorder, Alzheimer's disease, senile dementia, Parkinson's disease. In this article, the effect of *Gambhari phala* (*Gmelina arborea Linn)* as *Medhya* has been reported. The main objective was to evaluate the memory enhancing effect of *Gambhari phala* (*Gmelina arborea Linn)* in electroshock induced Amnesia in albino rats using Y-MAZE paradigm. Another objective is to compare the action of the test drug in Aqueous and Alcoholic extract at different dose levels with control and standard drug treated group. Aqueous and alcoholic extract of *Gambhari phala* was given orally with 3 different doses i.e, 500 mg/kg, 750mg/kg and 1000mg/kg for 21days in two groups of rats. The entire test drug treated group showed highly significant result ($p<0.001$). Comparatively alcohol extract showed faster and better results than aqueous extract. Through this experimental study, it is established that *Gambhari phala* is an effective memory booster.

Keywords: *Smruti*, Memory, Alzheimer's disease, *Gambhari phala*, Y-Maze

INTRODUCTION

Smruti is defined as remembrance of things directly perceived, heard and experienced earlier[1]. When *Manas* is covered with excessive *raja* and *tamogunas* then the *Smrutinasha* will manifest[2]. *Smrutinasha* is one of the symptoms in *Apasmara*[3], *Unmada*[4], *Jarajanya Smrutinasha*[5].

Memory is defined as the ability to recall the past experience[6]. It is the centre to all cognitive processes such as perception, language, comprehension, problem solving, reasoning and decisionmaking[7]. Nootropic agents such as, piracitam, pramiracetam, aniracetam are being primarily used to improve memory, mood and behaviour[8]. However, the resulting adverse effects associated with these agents like mild G.I upset, skin rashes, itching[9] etc. have limited their use.

Several herbs have been described in *Ayurveda*, which are claimed to promote learning, memory and intelligence. Among them *Gambhari phala* is one which is stated as *Medhya* in *Sushruthasamhitha*[10], *Bhavaprakasha Nighantu*[11] and *Kaiyadeva Nighantu*[12].

Gambhari (*Gmelina Arborea Linn*) belongs to family Verbenaceae. It is a medium sized, unarmed deciduous tree and can be found throughout India[13]. *Gambhari phala* is having *tikta*, *madhura* and *amlarasa*; *guru* and *snigdha guna*;

sheetha virya and *madhura vipaka*. It acts as *vrshya*, *medhya*, *keshya* and *rasayana*[11,12].

In the present study memory enhancing effect of *Gambhari phala* in the electroshock induced amnesia in wistar albino rats is carried out with an objective to find a therapeutically efficacious, safer, cost effective and easily available drug.

MATERIALS AND METHODS

Place of Work: The study and preparation of extracts of *Gambhari phala* wasconducted at Dept. of Pharmacology, JSS College of Pharmacy, Mysore.

Animals: The required numbers of rats weighing between 120-200gms were procured from 'Shree Venkateshwara Enterprises', Subrahmanya Nagar, Bangalore – 21.

The animals were housed in polypropylene cages inside a well-ventilated room.

They were maintained under standard laboratory conditions of temperature 24-28°C, relative humidity 60-70% and 12 hour light/dark cycle. They were fed a standard commercial pellet diet and water *ad libitum*. All animal procedures were in accordance with the standards set forth in guidelines for the care and use of experimental animals by Committee for Purpose of Supervision of Experiments on Animals (CPCSEA). The study was cleared by the Ethical Committee of the institute dated 25.04.12 with the number bearing JSSAMC 954/ EC/ 2012- 2013.

Preparation of animals:

Training of Animals**:** All Albino rats used for the experiment were trained in Y-Maze for 10 minutes daily for 20 days prior to the induction of amnesia as a part of experiment to make rats discriminate shock motivated brightness.

The Procedure was as follows[14]:

1. The Rats were individually placed in non-illuminated Y-Maze for 10 minutes to adapt to the new environment.
2. The Y-Maze is so programmed that the alley on the left of the start box (where the rats are placed) is non-illuminated. Shock current flows via the floor to all parts of the Y-Maze except the illuminated alley (terminal box), so that the rat should finally enter the illuminated alley to escape the foot shock.
3. When the rat entered the illuminated alley (terminal box) the shock current was switched off for about 25 sec.
4. A run was considered positive when the animal immediately runs into the illuminated alley & negative if it runs into the non-illuminated alley.
5. Each reading was taken for the period of one minute.
6. Average time interval between two successive foot shocks was 60 seconds.
7. The direction of the alley illumination was automatically changed after three runs to avoid position discrimination.

Induction of Amnesia: Amnesia to the trained rats was induced to all the groups except control group-I using electro-convulsometer at 10 mA of current for 0.2 sec through ear clip electrodes available with the instrument.[15]

Source of the Drug: Botanically identified *Gambhari* fruit was collected from area surrounding Gadag, Shirasi, Dharawad and Koppa.

Preparation of Drug (Powder): *Gambhari* fruits were dried in shade and after drying in shade, the drug is subjected to powdering by pulveriser, under 20 No. mesh. Aqueous and Alcohol extracts were prepared as per the Ayurvedic pharmacopoeia of India[16].

Effective dose of alcohol and aqueous extract: According to the pilot study

conducted, 500mg/kg (as low dose) 750mg/kg (as intermediate dose) and 1000mg/kg body wt. (as high dose) are considered as the effective dose of aqueous and alcoholic extract of *Gambhariphala*.

Mode of administration of drug: Drug is administered through intragastric tube using 2ml syringe fitted with 20 gauze steel needle provided with suitable smooth catheter to avoid injury to the rats during drug administration. Known quantity of suspended drug was loaded in syringe and pushed directly into the stomach after inserting the catheter into the oesophagus.

Vehicle for administration of drug: Both the alcohol and aqueous extracts were administered by making a suspension of extract. Water added at 150mg/ml and the corresponding quantities of it were administered after calculation according to the body weight of rat.

Experiment schedule: 54 animals selected for the experimental study were divided into 9 groups, consisting of 6 animals in each group of uniform sex, age, and weight.

Control group I: consists of 6 trained rats; amnesia was not induced; no drug was given and kept for 42 days.

Control group II consists of 6 trained rats, amnesia was induced;no drug was given and kept for 42 days.

Standard group: consists of 6 trained rats, amnesia was induced and treated with piracetam at 250 mg/kg P.O for 21 days.

Test group I: consists of 6 rats which were trained for 20 days and amnesia was induced followed by administration of Alcohol extract at 500 mg/kg for 21 days

Test group II: consists of 6 trained animals, amnesia was induced which was followed by administration of alcoholic extract at 750 mg/kg for 21 days.

Test group III: consists of 6 trained animals, amnesia was induced which was followed by administration of alcoholic extract at 1000 mg/kg for 21 days.

Test group IV: consists of 6 trained animals, amnesia was induced which was followed by administration of aqueous extract at 500 mg/kg for 21 days.

Test group V: consists of 6 trained animals, amnesia was induced which was followed by administration of aqueous extract at 750 mg/kg for 21 days.

Test group VI: consists of 6 trained animals, amnesia was induced which was followed by administration of aqueous extract at 1000 mg/kg for 21 days.

During the experiment, all animals were trained for 20 days using automatic Y-maze. On 21st day, amnesia was induced using electro convulsometer. After amnesia induction, again the Y-maze readings were taken at the duration of 0th(amnesia induced day), 5th,10th, 15th and 21stday. Each readingwas taken for period of 1 minute with an average interval of 60 sec between each reading.

Recording of Results: The values of the Y-maze were recorded under two parameters.

Parameter I: Time taken by the rats to cross from one alley of Y-maze to another (shock zone to shock free zone)

Parameter II: No. of negative runs or No of mistakes committed by rats in discriminating the illuminated alley.

Evaluation of results: The mean values of time taken in second cec. and number of mistakes committed by the rats were tabulated & statistically analyzed using ANOVA of variance and changes within the group and between the groups were analyzed by Tukey's comparison method. Significance of variance was calculated as significant (< 0.05); highly significant (<0.001) and not significant.

RESULTS& DISCUSSION

The data pertaining to each of the parameters studied in respect of untreated, standard drug treated, test drug treated groups have been statistically analyzed. Results are compared within each group, and in between the groups at all durations of treatment (0, 5, 10, 15, 21 days).

Mean values of time taken in seconds and the number of mistakes committed by the rats to discriminate the illuminated alley in the automatic Y-maze with 5 readings (1 reading of one minute) in the control I & II, standard drug treated, test drug treated groups are recorded after training, after induction of amnesia, and on the 5th, 10th, 15th and 21st day of treatment.

Time taken in seconds and number of mistakes committed by the rats to cross over from the shock zone area to shock free area are analysed using The ANOVA of variance.Comparison between the groups and within the treated groups pertaining to time taken in seconds and the number of mistakes committed by the rats to cross over from shock zone area to shock free area are analysed using the Tukey's comparison method.

Parameter I:Time taken by rats to discriminate the illuminated alley in automatic Y-Maze

Table 1: Mean values of time taken in seconds to cross the shock zone to shock free zone in control, standard and test drug treated groups

Groups	After Training	After induction of amnesia	On 5th day	On 10th day	On 15th day	On 21st day
GroupI(non amnesia)	21.48	23.28	23.05	20.42	23.63	34.42
Group II	17.98	163.11	250.8	208.42	215.62	202.08
Standard drug Treated	25.42	210.2	53.33	53.33	19.73	6.42
Alcohol Extract 500 mg	24.47	230.1	91.92	30.80	23.67	6.28
Alcohol Extract 750 mg	24.63	230.2	26.95	28.07	19.03	5.68
Alcohol Extract1000 mg	23.65	178.1	22.77	28.85	15.72	5.68
Aqueous Extract 500 mg	21.22	158.6	119.40	45.0	18.10	11.47
AqueousExtract 750 mg	33.45	155.4	51.8	25.0	14.70	6.35
Aqueous Extract1000mg	26.45	172.2	20.80	20.37	9.61	6.73

Table 2: Anova of Variance of Time Taken in Seconds to cross from shock zone To shock free zone

Groups	D.F	S.S	MSS	F.value	P.Value	Remarks
Control I	5	6.556	1.311	3.371	0.592	N.S
Control II	5	11.72	234.4	92.14	>0.05	N.S
Standard Drug Treated Group	5	10.77	215.4	472.8	<0.001	H.S
Alcoholic Ext. 500 mg/kg	5	11.89	237.8	135.4	<0.001	H.S
Alcoholic Ext 750 mg	5	11.41	228.1	83.8	<0.001	H.S
Alcoholic Ext 1000 mg	5	11.41	228.1	148.2	<0.001	H.S
Aqueous. Ext500 mg	5	10.02	200.5	58.58	<0.001	H.S
Aqueous. Ext 750 mg	5	11.61	232.3	189.2	<0.001	H.S
Aqueous. Ext 1000mg	5	11.87	237.4	173.7	<0.001	H.S

In all the experimental groups of animals, including the untreated showed high significant increase in time taken to cross over to the illuminated alley after the induction of amnesia.

In-group I: no change in time taken after 21days, in which no treatment was given.

In control group II: no statistical significance was observed in time taken to cross over to the illuminated alley. This showed that there was no improvement in the impaired memory at the end of 21days.

The therapeutic effect of the drug in all the test drug treated groups was

similar to standard drug treated group, which clearly denotes that the test drug is equally potent enough to the standard drug.

In the test drug treated group: There was highly significant decrease in time taken by the animals while crossing over to the illuminated alley, which clearly shows that all the treated doses of aqueous and alcohol extract were therapeutically effective when compared to untreated groups .

The alcohol and aqueous extract treated group showed similar therapeutic effects by the end of 5th day itself, with further gradual decrease in time taken by rats on 10th, 15th, 21st days of treatment, which suggests that memory was regained on 5th day and improved on further continuation of treatment.

Parameter II: number of mistakes committed by the rats in discriminating the illuminated alley.

Table 3: Mean Values Of number Of Mistakes Committed By The Experimental Rats In Control, Standard & Test Drug Treated Group

Group	No.of mistakes After training	No.of mistakes After amnesia	No.ofmistakes on 5th day	10th day	15th day	21st day
ControlI	0.00	0.00	0.00	0.00	0.166	1.16
Control II	0.00	16.67	14.17	15.00	14.17	15.67
Std.drug treated	0.00	14.83	0.50	0.33	0.00	0.00
Alco.Exract 500mg	0.00	15.67	1.67	0.00	0.00	0.00
Alco.Exract 750mg	0.00	15.17	0.33	0.00	0.00	0.00
Alco.Exract 1000mg	0.00	15.17	0.33	0.00	0.00	0.00
Aq.Extract 500mg	0.00	14.67	3.33	1.00	0.00	0.00
Aq.Extract 750mg	0.00	15.33	0.50	0.00	0.00	0.00
Aq.Extract 1000mg	0.00	15.50	0.50	0.00	0.00	0.00

Table 4: Anova Of Variance In Number Of Mistakes Committed By Experimiental Rats Of Control,Standard Drug Treated & Test Drug treated Group

Groups	D.F	S.S	MSS	F.value	P.Value	Remarks
Control I	5	6.556	1.311	3.371	0.592	N.S
Control II	5	11.72	234.4	92.14	>0.05	N.S
Standard Drug Treated Group	5	10.77	215.4	472.8	<0.001	H.S
Alcoholic Extract 500 mg/kg	5	11.89	237.8	135.4	<0.001	H.S
Alcohol Extract 750 mg/kg	5	11.41	228.1	83.8	<0.001	H.S
Alcohol Extract 1000 mg/kg	5	11.41	228.1	148.2	<0.001	H.S
Aqueous. Extract 500 mg/kg	5	10.02	200.5	58.58	<0.001	H.S
Aqueous Extract 750 mg/kg	5	11.61	232.3	189.2	<0.001	H.S
Aqueous Extract 1000mg/kg	5	11.87	237.4	173.7	<0.001	H.S

All the experimental groups of animals except control group I showed highly significant increase in number of mistakes committed by the rats in discriminating the illuminated alley after the induction of amnesia.

In control group I, the rats started committing the mistakes after 21st day. This shows that the rats started forgetting the discrimination of illuminated alley at single chance and also reveals that, the learned matter was not retained for longer time even in normal animals.

In control group II, the rats continued to commit mistakes even after 21 days that means rats did not get back the memory on 21st day.

Alcohol extract treated groups, showed significant decrease in number of mistakes on 5th day of treatment itself, but number of mistakes came to zero on 10th day whereas, in control group no change was

seen. This clearly shows that alcohol extract of *Gambhari phala* is effective in bringing back the memory

Aqueous extract treated groups showed significant decrease in number of mistakes on 5th day of treatment itself, but number of mistakes came to zero on 10th day except in 500mg treated group wherein number of mistakes came to zero on 15th day. This clearly shows that aqueous extract at 750mg, 1000mg are capable to bring back the memory on 10th day whereas 500mg on 15th day.

The therapeutic effect of the drug with respect of number of mistakes in all the treated groups were similar to standard drug which clearly denotes that the test drug is equally potent as that of standard drug. It is already proved that the long term use of piracetam may cause adverse effect like nausea, G.I upset etc. but we did not find any side effects in extracts. So in this aspect,*Gambhari phala* is superior to standard drug.

CONCLUSION

In this experimental study, comparatively alcohol extract showed faster results than aqueous extract, though both the extracts were capable of exhibiting the results by 5th day with reference to both the parameter I and II.

With reference to the time parameter, alcoholic extract is more effective with 750mg, 1000mg/kg body wt., compared to 500mg/kg body wt.

With reference to number of mistakes, alcoholic extract is more effective with all the 3 doses compared to standard drug as well as aqueous extract. Whereas aqueous extract was effective only at the dose of 750mg and 1000mg/kg body wt.

Alltest drug treated group showed highly significant result($p<0.001$). So, *Gambhari phala* can be used in both alcohol and aqueous forms alternative to standard drug for the loss of memory and to promote memory.Through this experimental study,it is established that *Gambhari phala* is an effective memory booster.

REFERENCES

1. Agnivesha, Charaka Samhita, shareera sthana, chapter 1, Sloka 3, Kashinatha shastri editor, 21st ed reprint, Varanasi,Chaukhamba Bharati Academy, 2008. Pg. 833
2. Agnivesha, Charaka samhita, Shareera sthana, Chapter 1, Shloka 101, Vidyotini hindiCommentary, 17thedition, edited by Pandit krishnath Shastri and gorakhanath chaturavedi, Varanasi, Choukamba Bharati Academy, 1990, Pg.824
3. Agnivesha, Charaka Samhita, chikitsa sthana, chapter 10, Sloka 3, Kashinatha shastri editor, 21st ed reprint, Varanasi, Chaukhamba Bharati Academy, 2005, Pg. 328.
4. Ibid. 9/7 sloka Pg. 307.
5. Agnivesha, Charaka Samhita, vi*Manas* sthana, chapter 8, Sloka 122, Kashinatha shastri editor, 21st ed reprint,Varanasi, Chaukhamba Bharati Academy, 2005, Pg. 782
6. K. sembulingam, Prema Sembulingam,Essentials of medical physiology,5thedition,Jaypee publications,2010,pg.898
7. Mishra girishwar, Broota K.D,Introduction to psychology, part 1,publ.NCERT,Ed 1,2002,pg.185
8. D.S.Reddy, Assessment of nootrophic and amnestic activity of centrally acting agents, Indian journal of Pharmacology.Pondicherry, JIPMER;1997,Pg. 208-221
9. http://en.wikipedia.org
10. Sushruta, Sushruta Samhita, sutrasthana, Chapter 46th, Shloka 184, with Nibhandha Sangraha commentary by Yadavaji Trikamaji, 12th edition, by

Dalhanacharya Nyayachandrika, Varanasi; Published by Chaukambha Orientalia, 1998, P. 228

11. Bhavaprakasha, Bhavaprakasha Nighantu, Guduchyadi Varga edited by K. C. Chunekar and G. S. Pandey, 7th edition,Varanasi; Choukamba bharati academy, 1984, P. 276
12. Kaiyadeva Nighantu, edited by Dr. Sharma P.V and Dr.Sharma G.P, Varanasi, Chaukhambha Orientalia, U.P, India, 1976, 1st edition, Oushadhi Varga
13. Dr. K.M. Nadakarni, Indian Materia Medica ,Vol 1, 3rd edition, Bombay, popular Prakashan Pvt. Ltd.1982, P.585.
14. Instruction manualof Techno Y-maze, Techno electronics, Lalbagh, Lucknow, U.P, India – 226001
15. Indian Journal of Physico Pharmacology 1992, 36; 29-34
16. The Ayurvedic pharmacopoeia of India, part 1, vol 2nd, 1st Ed, New Delhi,Ministry of health and family welfare, Govt of India, 1999, p.213.

CORRESPONDING AUTHOR

Dr. Kuber Sankh
Assistant Professor of Dravya Guna
JSSAMC & H, Mysore, Karnataka, India
Email: kuberss@live.com

Source of support: Nil
Conflict of interest: None Declared