

A CLINICAL STUDY TO EVALUATE ROLE OF AYURVEDIC TREATMENT FOR MANAGEMENT OF CEREBRAL PALSY IN CHILDREN W.S.R TO GROSS MOTOR FUNCTION CLASSIFICATION SYSTEM

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ABSTRACT

Cerebral palsy is a disorder of motor dysfunction due to non progressive brain damage in its early developing stage. It is often accompanied by disturbances of sensation, perception, cognition, behavior, seizures and by secondary musculoskeletal problems restricting them from independency. So the present clinical study was formulated with an aim to improve function on gross motor scale, quality of life and to establish optimal independence by potentiating the effects of Physiotherapy treatment along with *Ayurvedic* modality for better results in management of Cerebral Palsy. The study was performed on forty five participants of age group one to twelve years of either sex satisfying standard guidelines for Gross motor function classification system (GMFCS) for Cerebral Palsy. Patients were therapeutically randomized into three groups and received treatment for six months. In each group, fourteen patients managed to complete their trial. Group A received Physiotherapy; Group B was treated with Physiotherapy along with *Ayurvedic* procedures while Group C was treated with Physiotherapy, *Ayurvedic* procedures and Syrup *Ayurvedic* compound (an hypothetical compound). Students paired and unpaired 't' test was adopted for statistical analysis. The effect of therapy observed on GMFCS at the end of six month was statistically significant ($p < 0.02$) in Group A with gain of 12.9% while in Group B and C it was statistically highly significant ($p < 0.001$) with a gain of 25.87% and 30.35% respectively. The effect observed in group B and C was enhanced by effects of *Ayurvedic* modality for better improvement in gross motor function by improving muscle tone, gain in muscle strength and prevention from contractures and deformities.

Keywords – Cerebral Palsy, *Ayurvedic* modality, Physiotherapy, GMFCS

INTRODUCTION

Cerebral palsy (CP) is a disorder of motor dysfunction due to non progressive brain damage in its early developing stage. It is often accompanied by disturbances of sensation, perception, cognition, behavior, seizures and by secondary musculoskeletal problems restricting them from independency. The condition poses therapeutic challenge for treating physicians due to

range of disability from mild to severe. The disability forces the child to be dependent on others for their needs.

Multidisciplinary approach is needed for management of CP. Physiotherapy is accepted worldwide as standard therapy for rehabilitation. Medical management of spasticity, seizures etc. are complex and associated with minimal and more untoward side effects.

Modern medicine has no treatment in order to reverse the brain damage being done but *Ayurvedic* management can limit the difficulties by stimulating the brain into the development of alternative information transmission route. According to *Ayurvedic etiopathogenesis* CP is viewed as a disease with vitiation of all three *Dosha* with predominance of *Vata*, manifesting clinically all over the body (*Vatadhika Sannipata Sarvanga roga*) with the site of lesion in brain (*Mastishka*). It manifest with clinical presentation like Monoplegia (*Ekanga Vata*), Hemiplegia (*Pakshaghata*), Diplegia (*Pangu*), Quadriplegia (*Sarvanga Vata*) etc. Marked involvement of five types of *Vata*, *Sadhka Pitta*, *Tarpaka* & *Sleshaka kapha* is noted. Keeping in view of *doshic* and *sub-doshic* involvement, the treatment was formulated with consideration of *Ayurvedic* procedures like *Abhyanga*, *Shastik Sali Pinda Sweda*, *Matra basti* and *Shirodhara* along with oral compound containing ingredients with *Medhya*, *Balya*, *Brimhana* and *Vatahara* properties. The principle was to bring out normalcy of vitiated *dosha*, providing better nourishment to *dhatu*s and to compensate for brain damage up to certain extent with concept of regenerating neurons and improving cognition. Due to of complexity of treatment plan, different routes of medication were tried to bring out improvement in the neurodevelopmental pattern of the affected children.

AIMS AND OBJECTIVES:

- To improve quality of life in affected individuals
- To reduce spasticity and prevent from development of deformities and contractures.
- Early rehabilitation to improve functional capacity of the child.

- To establish optimal independence by improving gross motor function

MATERIAL AND METHODS:

For the present clinical study total 45 cases of diagnosed cerebral palsy (irrespective of type and cause) were selected from O.P.D and I.P.D of Balroga, National institute of Ayurveda, Jaipur. Duration of the trail was for six months. Out of them 3 cases did not turn up for complete follow up hence were dropped out from the study and trail was completed on 42 patients.

Selected patients were therapeutically randomized into three groups. Group A received Physiotherapy treatment, Group B received Physiotherapy and *Panchkarma* procedures and Group C was treated with *Panchkarma* procedures, *Syp. Ayurvedic* compound and Physiotherapy. In each Group A, B and C 14 patient managed to complete their trial for 6 month duration

CRITERIA ADOPTED:

1. Inclusion criteria: Age group one to twelve years of either sex or diagnosed case of Cerebral palsy (irrespective of type and cause).
2. Exclusion Criteria: Individuals below one yr and above twelve yrs. of age. Progressive neurologic disorders.
3. Discontinuation Criteria: Parents / guardian not willing to continue treatment and the patients who develop life threatening complication during treatment.
4. Assessment Criteria: Gross Motor Function Classification System for CP (GMFCS)

A. TRAIL COMPOUND

Syp. Ayurvedic compound - A Hypothetical compound containing eleven herbs were selected for the present study. It was prepared by the Institute pharmacy in the form of syrup for making it palatable.

Table no. 1: Showing Ingredients of Syp. Ayurvedic compound

Sr. no	Drug name	Botanical name	Part used
1.	<i>Brahmi</i>	<i>Baccopa monnerie</i>	<i>Panchanga</i>
2.	<i>Mandookparni</i>	<i>Centella asiatica</i>	<i>Panchanga</i>
3.	<i>Vacha</i>	<i>Acorus calamus</i>	Root
4.	<i>Jatamansi</i>	<i>Nordostacyhs jatamansi</i>	Rhizome
5.	<i>Ashwagandha</i>	<i>Withania somnifera</i>	Root
6.	<i>Madhuyasthi</i>	<i>Glycyrrhiza glabra</i>	Root
7.	<i>Bala</i>	<i>Sida cordifolia</i>	Root
8.	<i>Guduchi</i>	<i>Tinospora cordifolia</i>	Stem
9.	<i>Vidarikanda</i>	<i>Pueraria tuberosa</i>	Tubers
10.	<i>Kapikacchu</i>	<i>Mucuna pruriens</i>	Seed
11.	<i>Pippali</i>	<i>Piper longum</i>	Fruit, root

Drug dose and duration: - Doses were calculated according to the body weight of the child (1ml/kg/day) in three divided doses for six months. Children were called for follow up after end of every one month. Any discomfort or untoward side effects were noticed.

B. Ayurvedic procedures – The following table highlights the details of procedure carried out during therapy and their duration respectively.

Table no. 2: Showing Ayurvedic Procedures applied during therapy and their respective duration

Procedures	Ingredients / Medications	Duration of therapy (Same for all age group)
1. <i>Abhyanga</i>	<i>Kshirbala Taila</i>	15 mins. per day continuously for six months
2. <i>Shastik Sali pinda sweda</i>	<i>Shastik Sali, Balamula kwatha and Godugdha</i>	30 mins. per day for 21 days continuously followed by a rest of 7 days. Such one cycle was repeated for 6 times.
3. <i>Matra basti</i>	<i>Kshirbala taila</i>	10 days continuously once in a 2 month period. Such one cycle was repeated for 3 times.
4. <i>Shirodhara</i>	<i>Balamula kwatha with godugdha</i>	30 mins. per day for 10 days continuously once in a 2 month period. Such one cycle was repeated for 3 times.

C. Physiotherapy – A set of exercise containing passive and gentle stretching was performed on individual joints. It was also carried out coupled with *Abhyanga* once in a day in form of repetitive passive range of motion exercises to improve and maintain joint mobility.

STATISTICAL ANALYSIS – By using Students paired and unpaired ‘t’ test

RESULT

The study reported max no. of cases from age group 1 – 4 yrs (54.76%), followed by 5 – 8 yrs (35.71%) & age group 9 – 12 years (8.33%). Affected male were 66.66% & female with 33.34%. Among total registered cases 37 were spastic (88.10%) in nature followed by 4 (9.52%) cases of Hypotonic and 1 (2.38%) case of Dyskinetic. Of the total Spastic CP cases, the maximum no of patients i.e. 14

(37.83%) were found to be Quadriplegic followed by 13(35.13%) patients of Diplegic in nature. 7(18.91%) cases were

found to have Hemiplegic pattern, 2(5.40%) cases were Monoplegic and 1(2.70%) of Double hemiplegia in nature.

Table No. 3: Showing Effect on Gross Motor Function Scale in Group A

Sr. no	Duration	Mean (n=14)			% change	S.D. (±)	S.E. (±)	't' value	'p' value	Result
		BT	AT	Diff						
1	2 month	4.4286	4.4286	0	0	0	0	-	-	-
2	4 month	4.4286	4.1429	0.2857	6.4516	0.4688	0.1253	2.2804	< 0.05	Sig.
3	6 month	4.4286	3.8571	0.5714	12.903	0.7559	0.202	2.8284	<0.02	Sig.

Table No. 4: Showing Effect on Gross Motor Function Scale in Group B

Sr. no	Duration	Mean (n=14)			% change	S.D. (±)	S.E. (±)	't' value	'p' value	Result
		BT	AT	Diff.						
1	2 months	4.1429	4.0714	0.071	1.7241	0.2672	0.0714	0	> 0.10	In sig
2	4 months	4.1429	3.5714	0.571	15.80	0.5136	0.1373	4.1633	< 0.01	Sig.
3	6 months	4.1429	3.0714	1.071	25.87	0.6157	0.1646	6.5109	<0.001	H Sig.

Table No. 5: Showing Effect on Gross Motor Function Scale in Group C

Sr. no	Duration	Mean (n=14)			% change	S.D. (±)	S.E. (±)	't' value	'p' value	Result
		BT	AT	Diff.						
1	2 months	4.0	3.8571	0.1429	3.5714	0.3631	0.0971	1.472	> 0.10	In. Sig.
2	4 months	4.0	3.3571	0.6429	16.071	0.4972	0.1329	4.8374	<0.001	H. Sig
3	6 months	4.0	2.7857	1.2143	30.357	0.6993	0.1869	6.4972	<0.001	H. Sig

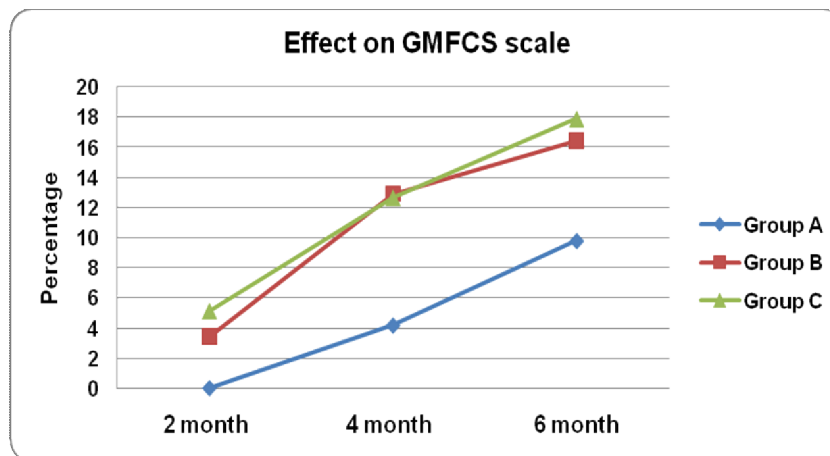
Table No. 6: Showing Effect on Gross Motor Function Scale in Inter Group (Pre)

Sr. no	Inter Group Comparison	Mean df (n = 28)	S.D. (±)	S.E. (±)	't ₂₆ ' value	'p' value	Result
1	A – B	0.2857	0.710	0.268	1.06	> 0.10	0.7857
2	A – C	0.4286	0.8645	0.3267	1.311	> 0.10	1.0714
3	B – C	0.1428	0.825	0.3119	0.457	> 0.10	0.28571

Table No. 7: Showing Effect on Gross Motor Function Scale in Inter Group (Post)

Sr. no	Inter Group Comparison	Mean df (n = 28)	S.D. (±)	S.E. (±)	't ₂₆ ' value	'p' value	Result
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1	A – B	0.7857	1.012	0.3826	2.06	< 0.05	Sig.
2	A – C	1.0714	1.1447	0.4326	2.48	< 0.01	Sig.
3	B – C	0.28571	0.90481	0.3419	0.835	> 0.10	In. Sig.



Graph no.1 - Showing effect of therapy in various groups on Gross Motor Function Classification system scale (GMFCS)

GMFCS has been widely accepted internationally to group individuals with CP into one of five levels based on functional mobility or activity limitation.

The effect of Physiotherapy treatment observed in Group A at the end of 2 months showed no change, but the improvement noted at the end of 4 & 6 months was statistically significant ($p < 0.05$ & $p < 0.02$) with gain percent of 6.45% & 12.90% respectively. (See Table no.3) The effect observed in Group B at 2 months of interval was statistically insignificant ($p > 0.10$) with gain percent of 1.72% At end of 4 & 6 months of treatment the improvement was gain percent was 15.80% which was statistically significant and highly significant ($p < 0.01$ & $p < 0.001$) with gain of 15.80% and 25.87% respectively. (See Table no. 4) The effect noted in Group C at 2 months of interval resulted in 3.57% of change which was statistically insignificant ($p > 0.10$) while improvement at the

end of 4 & 6 months which was statistically highly significant ($p < 0.001$) with gain of 16.07 % & 30.35 % of change respectively. (See Table no. 5)

Before analyzing the effectiveness of treatment of one group over the other, the Mean BT of both Inter groups were compared by using Unpaired 't' test to check the uniformity of sample. The inter Group difference analyzed in all three inter groups showed statistically insignificant result ($p > 0.10$) which indicates uniformity of sample size. (See table no. 5) The Mean AT of both Inter groups were compared by using Unpaired 't' test. The Inter group difference test showed that in Group A – B , Group B showed advantage over Group A which was statistically significant ($p < 0.05$). In Group A – C, Group C showed over Group A which was also statistically significant ($p < 0.01$) whereas in Group B – C the result obtained was statistically insignificant ($p > 0.10$) (See table no.6)

DISCUSSION

The observed results shows that the *Ayurvedic* treatment modality was better in achieving results compared to Physiotherapy group alone. At the end of six months, effect of treatment observed in Group B and C with a gain of 25.87% and 30.35% compared to Group A with gain of 12.90%. Similarly, analysis of inter group difference test clearly shows that Group C and B were more better than Group A in terms of improvement. Thus it signifies the effectiveness of combined approach incorporated with positive improvement.

Probable mode of Action

A. Trial drug (Syp. Ayurvedic Compound) - The purposes of selection were based on drugs having neuronal regeneration capacity, anti convulsant action, cognition enhancement and with properties of *Balya*, *Medhya* and *Brimhana* for the proper nourishment of *dhatu*.

On basis of *Ayurvedic* pharmacodynamical properties, the ingredients of Syp. *Ayurvedic* compound are composed of *Madhura*, *Tikta*, *Katu* and *Kashaya rasa*; *Snigdha*, *laghu* and *Guru guna*; *Ushna* and *Sheeta Virya* ; *Madhur* and *Katu Vipaka*; *Tridosha shamaka* and with *Medhya* and *Balya* properties.

Madhura rasa is *Sarvadhatu Vardhaka*, *Balya*, *Brimhana*, *Jeevaniya*, *Preenana* and *Sthairyakarana*. *Madhura rasa* along with *Tikta* and *Katu* rasa may help in the proper development of neuron synapses and thereby generating a process of regeneration in neuronal precursor cells. *Katu rasa* is responsible for *Indriyaautojetaka* (to receive information from senses), *Agnidipana* (secretion of hormones in synaptic vesicles) and *Margana vivraunati* (for proper channelization and replacement of damaged neurons) so it can be postulated

that it may provide stimulus to brain cells that are capable of regeneration especially hippocampal region. *Ushna virya* helps to increase the blood supply in cells while *Sheeta virya* with *stambhana* and *sthirikarana kriya* may restrict the excessive neuronal discharge that is seen in case of convulsions. *Madhura vipaka* increases the *Sharir dhatu* while *Katu vipaka* increases overall metabolism in the body, proper enzymatic secretions, thereby minimizing the nutrients deficiencies which is common in case of CP. Mechanism of *Medhya* drugs is not properly understood but they increases the overall functional capacity of the brain by any one of these mechanism i.e. by increasing perfusion, metabolism and improving the chemical imbalance in brain. *Rasayana* drugs are supposed to increase all the *sharira dhatu* both quantitatively and qualitatively. *Balya* drugs provides the revitalizing strength to the body which is ailing due to chronic disease while *Brimhana* drug increases the production of healthy *dhatu* in the body.

I. Drugs capable of Regenerating Neurons are - *Mandookparni* ; [1,2,3] *Ashwagandha*:[4,5]

II. Drugs having Neuroprotective role are *Jatamansi*:[6] *Mandookparni*:[3] *Ashwagandha*; [7] *Vacha*:[8] *Pippali*:[9] *Yasthimadhu*:[10] *Kapikacchu*.[11]

III. Drugs having Anti convulsant action are *Jatamansi*:[12] *Ashwagandha*:[13] *Yasthimadhu*. [14]

IV. Drugs showing effect on cognition, learning and memory are *Jatamansi*:[15] *Brahmi*:[16] *Mandookparni*:[12] *Vacha*:[17] *Guduchi*:[18] *Yasthimadhu*.[19,20]

V. Drugs having *Balya* and *Brimhana* effect are *Bala*, *Vidarikanda*, *Ashwagandha* and *Kapikacchu*.

Hence the oral preparation formulated with above properties will have maximum effect when used in early intervening period, because it is stage where development of brain continues till age of 3 years.

Effect of *Abhyanga* - *Kshirbala taila* was used for *Abhyanga*. The ingredients of *Kshirbala taila* are *Bala*, *Tila taila* and *Godugdha*. With the help of oil media, *Bala* with properties of *Balya*, *Brimhana* and *Vatashamak* absorbed locally provides nourishment to muscular tissue preventing from atrophic changes and improves muscular tone. Pressure applied during procedure may stimulate superficial mechanoreceptors or deep tendon receptors may help to reduce hyper excitability of neurons by inhibiting the alpha motor neurone activity. In a study, cerebral palsy symptoms in children were decreased following massage therapy but the mechanism behind it was not explained.[21] In this way *Abhyanga* acts through the properties of *Sneha* as discussed above that help to encounter vitiated *Vata*.

Effect of *Shastik Sali Pinda Sweda* - *Shastik rice (Oryza sativa linn.)* is *Snigdha*, *Bala vardhana* and *Deha dardhyakrita*. The heat provided by bolus of *Shastik sali* dipped in *Balamula kwatha* with *Godugdha* may increase the blood flow locally, relieve muscle spasm, increase tendon extensibility and provide pain relief.

Thus *Abhyanga*, *Shastik Sali Pinda Sweda* and Physiotherapy cumulatively help in reduction of spasticity and facilitate free movement of joint preventing from deformities and contractures.

Effect of *Matra Basti* – *Basti* is best treatment modality for treating neurological disorders. The ingredients of *Kshirbala taila* are *Vatashamak* and *Balya*. When medicated oil reaches rectum and colon, presence of short chain fatty acids in oil allows direct diffusion of drugs from epithelial cells into capillary blood villi and showing its generalized effect. Gastrointestinal tract is richly supplied by network of nerve fibers and works in synergism with central nervous system. Hence *Basti* pacifies the vitiated *Vata* at root level of its origin thereby normalizing and influencing its *sub-doshic* level at other distant sites too. Thus the effect of *Basti* at gastrointestinal system will definitely affect other system thereby achieving a level of homeostasis. Thus it helps to control and regulate symptoms of CP.

Effect of *Shirodhara* –The chemical constituent of *Shirodhara* may modulate the secretions of various neurotransmitter and hormone at brain cellular level. Thereby controlling seizures, cognitive impairment and behavioral problems like anxiety, attention – deficit hyperactivity disorder etc. associated with CP.

All of the above with their respective way of mechanism help to improve the functional limitations and mobility in patients of Cerebral Palsy. This combined approach help in releasing of spasticity, improvement in joint mobility, creating environment of neuroplasticity in brain and providing psychological support to patients.

CONCLUSION:

The overall result of clinical study shows that the effect of physiotherapy was enhanced by *Ayurvedic* procedures and Syp. *Ayurvedic* Compound (with properties of *Medhya*, *Balya* and *Brimhana*) for better

improvement in terms of gross motor function by reducing spasticity, preventing joint deformities and contractures. It also promotes improvement in activities of daily living by improving muscle tone, gain in muscle strength, proper nourishment of *dhatu*s and intelligence for better skill performance. Thus the study emphasizes that *Ayurvedic* modality treatment should be used in early intervening period where maximum benefits can be attributed to affected individuals of CP. The study also suggests for further extensive researches in areas of application of *Panchkarma* procedures like *Abhyanga*, *Shastik pinda sweda*, *Shirodhara* and *Basti* for understanding better way of mechanism with the help of modern medical aids like EMG, EEG etc.

REFERENCES:

1. K.G.Mohandas Rao, S.Muddanna Rao and S.Gurumadhva Rao. Enhancement of Amygdaloid Neuronal Dendritic Arborization by Fresh Leaf Juice of *Centella asiatica* (Linn) During Growth Spurt Period in Rats. Oxford Journals Medicine Evidence-based Compl. and Alt. Medicine. 2007 Vol 6; Number 2 Pg. 203-210.
2. Amala Soumyanath, Yong-Ping Zhong, Xiaolin Yu, Dennis Bourdette, Dennis R. Koop, Sandra A. Gold and Bruce G. Gold. *Centella asiatica* accelerates nerve regeneration upon oral administration and contains multiple active fractions increasing neurite elongation in-vitro Journal of Pharmacy and Pharmacology, Volume 57 Issue 9, Pages 1221 – 1229.
3. Lee MK, Kim SR, Sung SH, Lim D, Kim H, Choi H, Park HK, Je S, Ki YC. Asiatic acid derivatives protect cultured cortical neurons from glutamate induced neurotoxicity. Res Commun Mol Pathol Pharmacol. 2000 Jul-Aug; 108 (1-2): 75-86.
4. Tohdha , Chihiro. Dendrite extension by methanol extract of *Ashwagandha* (roots of *Withania somnifera*) in SK-N-SH cells. Neuropharmacology. 26 June 2000; Volume 11 - Issue 9; p 1981-1985.
5. Kuboyama T, Tohda C, Zhao J, Nakamura N, Hattori M, Komatsu K. Axon – or dendrite predominant outgrowth induced by constituents from *Ashwagandha*". Neuroreport 2002 Oct7; 13(14): 1715-20.
6. Salim S, Ahmad M, Zafar KS, Ahmad AS, Islam F. "Protective effect of *Nordostachys jatamansi* in rat cerebral ischemia" Pharmacol. Biochem Behav. 2003 Jan; 74(2): 481-6
7. Sushma Jain, Sunil Dutt Shukla, Kanika Sharma, Maheep Bhatnagar. Neuroprotective Effects of *Withania somnifera* Dunn. in Hippocampal Sub-regions of Female Albino Rat Phytotherapy Research Volume 15, Issue 6, pages 544–548, September 2001
8. S.R. Yende, U.N.Harle, V.V.Bore, A.O.Bajaj, K.K.Shroff, Y.D.Vetal Reversal of neurotoxicity induced cognitive impairment associated with phenytoin and phenobarbital by *Acorus calamus* in mice Journal of Herbal Medicine and Toxicology 2009; 3 (1) 111-115
9. Min Fu, Zhao-hui Sun and Huan-cong Zuo. Neuroprotective Effect of Piperine on Primarily Cultured Hippocampal Neurons Biological & Pharmaceutical Bulletin. 2010;Vol. 33, No. 4 598
10. P. Muralidharan, G. Balamurugan and Venu Babu Cerebroprotective effect of

- Glycyrrhiza glabra Linn. root extract on hypoxic rats Bangladesh J Pharmacol 2009; 4: 60-64.
11. T. Maheswaria, D. Vijayrajaa, R. Kundhavai Natchiyara, K. Kalaivania, S. Rajasankarb K. Tamilselvama and T. Manivasagama. Synergistic neuro-preventive effect of *withania somnifera* root powder and *mucuna pruriens* seed powder in parkinsonic mice model Journal of Herbal Medicine and Toxicology.2010; 4 (2) 63-69.
 12. Rao VS, Rao A, Karanth KS. Anticonvulsant and neurotoxicity profile of *Nardostachys jatamansi* in rats. J Ethnopharmacol 2005; 102:351-6.
 13. Kulkarni, S K Akula, Kiran Kumar Dhir, Ashish Effect of *Withania somnifera* Dunal root extract against pentylenetetrazol seizure threshold in mice: Possible involvement of GABAergic system. IJEB 2008; Vol.46(06).
 14. Nassiri-Asl, M., Saroukhani and F. Zamansoltani. Anticonvulsant effects of aqueous extract of *Glycyrrhiza glabra* root in PTZ-induced seizure in mice. Int. J. Pharmacol.,2007;3: 432-434.
 15. Hanumanthachar Joshi, Dr.Milind Parle. "Nardostachys jatamansi Improves Learning and Memory in Mice." Journal of Medicinal Food. Mar 2006, Vol. 9, No. 1:113-118.
 16. Roodenrys S, Booth D, Bulzomi S, Phipps A, Micallef C, Smoker J. Chronic effects of *Brahmi* (*Bacopa monniera*) on human memory. Neuropsychopharmacology 2002 Aug; 27(2): 279-81.
 17. Dey C.D, Bose S and Mitra S; Effect of some centrally active phytoproducts on maze-learning of albino rats. Indian J. Physiol Allied Sci.1976; 30, 88-90.
 18. Ashutosh Agrawal et al, Effect Of *Tinospora Cordifolia* On Learning And Memory In Normal And Memory Deficit Rats: Indian Journal of Pharmacology 2002; 34: 339-349
 19. Dinesh Dhingra and Amandeep Sharma Antidepressant-like activity of *Glycyrrhiza glabra* L. in mouse models of immobility tests. Progress in Neuro-Psychopharmacology and Biological Psychiatry May 2006; Vol 30, Issue 3, Pg449-454.
 20. Dinesh Dhingra, Milind Parle, S.K. Kulkarni. Comparative Brain Cholinesterase-Inhibiting Activity of *Glycyrrhiza glabra*, *Myristica fragrans*, Ascorbic Acid, and Metrifonate in Mice Journal of Medicinal Food. Summer 2006, 9(2): 281-283.
 21. Maria Hernandez-Reif, Tiffany Field, Shay Lergie, Miguel Diego, Natasha Manigat, Jacqueline Seoanes and Joan Bornstein, Cerebral palsy symptoms in children decreased following massage therapy, Early Child Development and Care Vol. 175, No. 5, July 2005, pp. 445-456.

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