



# EVALUATION OF *BRAHMI GHRITA* FOR IMPROVEMENT IN LEARNING AND MEMORY OF HIGH SCHOOL CHILDREN

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**Abstract** : Depressed memory, lesser retention and slow recall are frequent problems in today's stressful and competitive world. Children are also facing same problem in this competitive era in concentration on study. It's necessary to add any substitute to enhance their memory and learning capacity. Brahmi is a famous plant used for memory enhancing property and increase in concentration. It is also used in combination with other herbs to increase its potency on CNS. Brahmi churna is processed in cow ghee is mentioned in Ashtanghridaya especially for various CNS conditions of children. Thus, the present study was undertaken to prepare & standardized and established the drug (*BG*) and investigates the effects on cognitive function of children. Improvement in learning and memory activity was studied using JPIP test for numerical ability and test of higher mental ability in science in children of age group 10 to 16 years. BG of study group and goghrita of control group was administered in one dose of 10 gms per day to participant. Scores was recorded and analyse statistically by using 't' test and ANOVA for result. In this study it showed that learning and memory is significantly ( $p < 0.005$ ) increased in children after 30 days of BG treatment of study group compared to goghrita of control group and plain group.

**IndexTerms** - *Brahmi ghrita*, JPIP, Memory and learning activity

## I. INTRODUCTION

Human health is defined by WHO as a state of complete physical, mental, social and spiritual well-being and not merely the absence of disease or infirmity. In *Ayurved* the healthy individual is represented by equilibrium of Dosha (Vata, Pitta, Kapha), Agni (metabolic activity), Dhatu (metabolism), Mala (waste products), Atma (soul), Indriya (sense organ) and Mana (mind). Functions of mind are correlated with the Buddhi (intellect), Dhi (perception of true knowledge.), Dhruiti (Control over the Mind, grasping and retention capacity) and Smriti (memory or subjects ability to recall things). Dhi, Dhruiti and Buddhi takes part as a key role for grasping and learning of the subject, while Smriti helps to regain or subject ability to recall things.

In Modern science, Learning is the process of acquirement of information and skills, while subsequent retention of that information is called memory. Learning and memory together called as cognition. Memory is the ability of an individual to record sensory stimuli, events, information etc., retain them over a short or long period of time and recall the same at later date when needed.

In today's life academic performance is impacted, because students develop confidence issues, depression around them, which makes students less likely to focus their energy on academic achievement. Some of the most important social skills for children to learn are different resolution, understanding and forming positive social interactions, valuing other people and their ideas and taking responsibility for their own actions. The race of life to achieve big goals and comfortable life begins from the school age. So there is a need of study in proper way to enhance the learning ability of high school children.

In Ayurveda, It is stated that Ghee promotes memory, intellect, and power of digestion etc. According to Ayurvedic classical texts various types of Ghritas are recommended for treatment of CNS disorders namely Panchagavya Ghrita, Mahapanchagavya Ghrita, Kalyanak Ghrita and Mahakalyanak Ghrita etc. So Ghrita is the drug of choice prescribed to normalize vitiated entities [Dosha] and to nourish, to regain the strength of Brain. These lipophilic medicaments are more helpful to regularize the function of intellect and mind as it crosses the blood brain Barrier.

Brahmi Ghrita (BG) is one of the formulations recommended in Ashtanga Hridya Balrogadhikara as medhya and Smritivardhak. This drug is mainly having Medhya, Rasayana, Krimihara, Shodhana, Hridya, Dipana, Pachana properties. In totality ingredient possess Tikta, Katu Rasa, Ushna Virya, Katu Vipaka. Due to these properties it may acts as Kaphavatahar, Medha and smriti vardhak.

It contains Brahmi which is proven medicine for number of disorders, particularly those involving intellect and poor memory. The plant has prominent action on CNS, where it improves understanding, memory, intellect, and speech. Its act as antipsychotic, antistress, antidepressant, memory booster and learning facilitator. Goghrit possess Buddhi, smritivardhak, agnivardhak property. So conclusion for literary study is that almost all the drugs possess medhya activity.

Brahmi Ghrita (BG) has been evaluated for its nootropic and antipsychotic activity in animal models and showed positive result .However till date no work has been conducted on clinically assessment for improvement of learning and memory in high school children.

Hence Brahmi Ghrita (BG) is selected for clinical study, and it may help to increase the learning and memory capacity of the children.

#### **Materials & Methods:-**

Prior study clearance from ethical committee was taken.

#### **Study design:**

Non-Randomized positive controlled clinical trial.

#### **Participants/Subjects:**

90 healthy students of high school.

#### **SELECTION CRITERIA:**

##### **Inclusion criteria**

- Students who was physically and mentally healthy.
- Students who was included by health assessment.
- Student of age group 10-16 years.
- Student of either gender.
- Students with irrespective of socioeconomic status.

##### **Exclusion criteria:**

- Students who was suffering from psychological disorders, learning disabilities and memory dysfunctions.
- Students below age 10 years and above age of 16 years.

Groups	Number Of participants	Drug Dose	Anupana	Duration	Time
Group A Plain group	30	No Drug	----	30 days	-----
Group B control group (GG)	30	10gm.OD	Koshnajal (lukewarm water)	30 days	Morning on empty stomach
Group C study group (BG)	30	10gm.OD	Koshnajal (lukewarm water)	30 days	Morning on empty stomach

#### **Other instructions:**

There was no intervention in daily diet, exercise and their routine school work.

#### **Informed Consent:**

Consent of parents, permission of **principal** and **assent** of children was taken prior to commencement of clinical trial.

#### **Grouping of student:**

- ❖ Plain group - No drug treatment
- ❖ Control group - *Goghrita*
- ❖ Study group - *Brahmi Ghrita*

#### **Drug Dose:**

10 gm once a day (early morning mixed with sugar powder).

- ❖ **Rational for Drug Administration:** According to *Ayurvedic* literature the dose of *Sneha kalpa* for *shodhana* purpose is mentioned as 1 *pala* [40gms] for *Dipta Agni*, 3 *Karsha*[30gms] for *Madhyama Agni* and 2 *Karsha*[20gms] for *Alpa Agni*<sup>1</sup>. In classics there is no specific dose recommended for *shaman* purpose. According to various *Ayurvedic* practitioners, the dose of *Snehakalpa [ghrita]* for *Shaman* is prescribed as 10 to 20 gms. It is also revealed that as per *Ayurvedic* Formulary of India (AFI) the dose of '*Ghrita*' formulations used for *Shaman* is 12gm<sup>2</sup>. It is observed that the drug dose used in two research papers i.e. for *Naladadi Ghrita* and *Kushmanda Ghrita* was 0.5 gms twice a day<sup>3,4</sup>. Thus considering all these concepts and research work references, in present study the dose of *BG* was administered to

Children in 10 gm once a day. While administering to the student, sugar powder was mixed with 10 gm of the *BG* and *Goghrita*.

#### Method of Administration:

Students were asked to consume 2 tea spoons (10gms) of drug with Luke warm water once a day i.e in morning on empty stomach for *BG* and *GoGhrita* groups.

**Drug Dose Duration:** 30 days.

#### Rational of drug dose duration:

- ❖ According to *Ayurvedic* literature the name *mastulunga* is derived from the *majja dhatu*, *mastulunga* is situated in *Shira and Shira* plays an important role in formation of *Buddhi* (seat of intelligence). So *Buddhi* and *Majja* are related with each other<sup>5</sup>.
- ❖ Body is made up of seven *Dhatus*. *Ayurveda* gives the sequential transformation of next *dhatu* from the former *dhatu* which is termed as *Dhatu Parinaman Krama*. Based on this theory *Ahara-rasa* gets transformed into *shukra* dhatu within a span of 30 days<sup>6,7</sup>. So it is assumed that effect of the formulation towards *Majja Dhatu* is seen within 30 days as the last dhatu *shukra* formed in 30 days.
- ❖ Considering this guideline on the effect of medicated ghee might be seen in this time period. Thus the duration of drug consumption (*BG* and *Goghrita*) to healthy subjects was decided as 30 days continuously to get the expected effect of improvement in memory & Learning.

#### Health assessment form:

It consists 19 questions designed on the basis of physical, physiological & psychological characters described in *Ayurveda*. This helped to know the physical and mental health of the students of age group of 10-16 years which was included in this study.

#### Diary:

It consists basic details of student, doctor visits, their follow up and PGI memory scale scores filled by the researcher. A calendar for drug dose marking and any symptoms they observed during drug consumption filled by the participants.

#### JPIP Learning & Memory test :

- Numerical Ability Test
- Test of Higher Mental Ability in Science

#### METHODOLOGY:

- ❖ Students were contacted from different academic institute i.e. Bharati vidhyapeeth English medium school, Katraj Pune & Vision science academy, Indira nagar, Pune and willing participants were allocated into 3 groups Group A, Group B, Group C.
- Consent was taken by students and their parents.
- Self health assessment form of 19 questions was filled from each student.
- After grouping each participant was asked to perform learning and memory test on day zero.
- From day 1 to day 30, each individual from all groups was received the respective treatment. Diary was prepare and given to students which contain the basic details of student, a calendar to mark the day of drug dose consumption and any symptoms they observed during drug consumption. Students were asked to fill the records as instructed on day 0. Telephonic contact to each Student was done on alternate day for reminding them for drug consumption as well as to note down any problem they were facing by drug consumption.
- Student's follow-up on every 15<sup>th</sup> day from day 0, Learning and Memory test scores was recorded.
- On day 31<sup>ST</sup> post assessment test was conducted.
- Student who missed more than 4 drug dose continuously was drop out from the study and new students was recruited.

Data from the dairy record was organized and analyzed.

Sr.no	Day 0 Pre-assessment	Day 1to Day 30	Day 31 Post-assessment
Performance test* in Numeric ability	✓	×	✓
Performance test* in Higher mental ability	✓	×	✓
Drug administration	×	✓	×

\*These test are internationally approved by APA (American Psychological Association)

#### Outcome Measure:

- JPIP Learning & Memory Scale Test- Increase in memory scores i.e before and after drug administration by 1 unit indicated Memory enhancement.

#### CRITERIA FOR ASSESSMENT:

- ❖ Individual test record was maintained.
- ❖ A group wise computerized chart was prepared at appropriate time.
- ❖ A performance indicator for each test was followed as per standard protocol.

#### METHOD OF STATISTICAL ANALYSIS:

- Every Groups, Group A- Plain group (No Drug), Group B- Control group (*Goghrita*), Group C- Study group (*Brahmi Ghrita*) were assessed pre and post treatment using paired 't' test.

- ❖ Between groups i.e. C (BG) & B(GG), C(BG) & A(ND), B(GG) & A(ND) were assessed by using ANOVA's followed by turkey's test.

### Results / Observations

**TABLE NO.OR-1 AGE WISE DISTRIBUTION OF STUDENTS**

Age	Frequency	Percentage
13 Years	3	3.3
14 Years	57	63.3
15 Years	26	28.9
16 Years	4	4.4
TOTAL	90	100

**Interpretation-** In the present study, Out of 90 students, (3%) belongs to age group 13years, (63%) belongs to age group 14 years, (29%) belongs to age group 15 and (5%) belongs to age group 16 years.

**TABLE NO.OR-2 GENDER WISE DISTRIBUTION**

Gender	Frequency	Percentage
Male	47	52.2
Female	43	47.8
TOTAL	90	100

**Interpretation-** According to Gender, students were divided into 2 groups:

- 1) Total number of Male students - 47 (52%)
- 2) Total number of Female students - 43 (48%)

**TABLE NO.OR-3 Using paired-t test in Plain group**

Plain Group		N	Mean	Std. Deviation	Std. Error Mean	t-Value	P-Value	Interpretation
Science	Pre Test	30	12.93	4.07628	.74422	-1.510	0.142	Not significant
	Post Test	30	13.57	3.94517	.72029			
Mathematics	Pre Test	30	13.43	5.84718	1.06754	.155	0.878	Not significant
	Post Test	30	13.37	5.05817	.92349			

**Interpretation-** P-Value for Science Score and Mathematics is greater than 0.05 therefore there is no significant increase in Science and Mathematics score in Plain Group.

**TABLE NO.OR-4 Using paired-t test in Control group**

Control Group		N	Mean	Std. Deviation	Std. Error Mean	t-Value	P-Value	Interpretation
Science	Pre Test	30	14.43	3.72950	.68091	-1.100	0.280	Not significant
	Post Test	30	15.13	4.12506	.75313			
Mathematics	Pre Test	30	14.29	6.51503	1.18948	-4.797	0.000	significant
	Post Test	30	18.92	5.35871	.97836			

**Interpretation-** P-Value for Science Score is greater than 0.05, while for Mathematics score is less than 0.05 therefore there is significant increase in Mathematics score in Control Group. Average Science Score of 30 students is increased from 14.43 to 15.13 but it is not significant, while average Mathematics Score of 30 Students is significantly increased from 14.29 to 18.92

**TABLE NO.OR-5 Using paired-t test in Study group**

Study Group		N	Mean	Std. Deviation	Std. Error Mean	t-Value	P-Value	Interp-retaion
Science	Pre Test	30	14.07	3.10654	.56717	-6.205	0.000	significant
	Post Test	30	16.53	3.01414	.55030			
Mathematics	Pre Test	30	17.57	6.32526	1.15483	-7.508	0.000	significant
	Post Test	30	24.45	4.54379	.82958			

**Interpretation-** P-Value for Science Score and Mathematics score is less than 0.05 therefore there is significant increase in Science and Maths score in Study Group. Average Science Score of 30 students is significantly increased from 14.07 to 16.53 while Average Mathematics Score of 30 Students is Significantly increased from 17.57 to 24.45.

**TABLE NO.OR-6 ANOVA test comparison between science score of three groups:**

Science	Sum of Squares	df	Mean Square	F	P-Value	Interp-retaion
Between Groups	64.867	2	32.433	4.390	0.015	significant
Within Groups	642.733	87	7.388			
Total	707.600	89				

**Interpretation-**By using ANOVA test, P-Value is less than 0.05, therefore there is significant difference in science score increase in three groups.

**TABLE NO.OR-7 Turkey's Test pair wise comparison between the groups:**

Group 1	Group 2	Mean Difference	Std. Error	P-Value	Interp-retaion
Plain Group	Study Group	-1.83333*	.70179	0.028	significant
	Control Group	-.06667	.70179	0.995	Not significant
Control Group	Study Group	-1.76667*	.70179	0.036	significant
	Plain Group	.06667	.70179	0.995	Not significant
Study Group	Control Group	1.76667*	.70179	0.036	significant
	Plain Group	1.83333*	.70179	0.028	significant

**Interpretation-**By using Tukey's Test, It is clear that P-Values for all Pairs except Control group and Plain group are less than 0.05 hence there is significant difference in the pairs except control group and plain group.

**TABLE NO.OR-8 ANOVA test comparison between mathematics score of three groups:**

Mathematics	Sum of Squares	df	Mean Square	F	P-Value	Interp-retaion
Between Groups	752.895	2	376.448	19.535	0.000	significant
Within Groups	1676.484	87	19.270			
Total	2429.380	89				

**Interpretation-**From this ANOVA table we can observe that, P-Value is less than 0.05, we conclude that there is significant difference in increase of mathematics score in three groups.

**TABLE NO.OR-9 Turkey's Test pair wise comparison between the groups:**

Group 1	Group 2	Mean Difference	Std. Error	P-Value	Interpretation
Plain Group	Study Group	-6.94533*	1.13343	0.000	significant
	Control Group	-4.68367*	1.13343	0.000	significant
Control Group	Study Group	-2.26167	1.13343	0.019	Significant
	Plain Group	4.68367*	1.13343	0.000	Significant
Study Group	Control Group	2.26167	1.13343	0.019	Significant
	Plain Group	6.94533*	1.13343	0.000	Significant

**Interpretation-**From Turkey's Test, it is clear that P-Values for all Pairs are less than 0.05 hence there is significant difference in the pairs.

## **DISCUSSION AND CONCLUSION**

### **Selection of topic-**

In India 4.3 to 8.7 million people are suffering from mental illness. As per *Ayurvedic* knowledge grasping, learning and retention is reliant on four main factors i.e. *Buddhi, Medha, Smruti and dhriti* which are correlate with memory in modern science. Memory is the process where the acquired knowledge is coded, stored and again retrieved<sup>7</sup>. Some modern medicine used as cognitive enhancer (piracetam, aniracetam etc.) but side effects are noticed. *Ayurvedic* formulations are effective in cognitive functions. so there is a necessity to focus on this area. .

### **Selection of Brahmi Ghrita-**

The formulation *Brahmyadi ghrita* has been mentioned in *Ashtangahridaya* in the *Uttarsthana*, *adhyaya 1<sup>st</sup>* i.e. *Balopacharaniya Adhyaya* in which care of newborn baby and formulation to protect baby from physical and mental health has been explained. The cumulative properties of *Brahmi ghrita* have effect in *vata* and *kapha* dominant psycho-neurological disorders. The base drug i.e. *Goghrita* possesses *smritivardhaka* (memory enhancing) and *buddhivardhaka* (intellect promoting) property. *Ghrita* is lipophilic in nature and it has property to cross blood brain barrier. All ingredients of *Brahmi Ghrita* shows action towards CNS. So *Brahmi Ghrita* was selected for the study.

### **Formulation of Brahmyadi Ghrita**

In the reference of BG in *ashtangahridya*, there is no specification regarding the Ratio of ingredients to be used. Hence, The General Recommended Proportion in *Sharangdhar Samhita* for preparation of *Siddha snehaKalpana* i.e. **1:4:16**. (*Kalka Dravya* : *Oil/Ghee* : *Drava Dravya*) was adopted and formulation was manufactured. *Brahmi* was taken in double quantity by the rule of *Shushka* and *Ardra dravya praman* given in *sharangdhar samhita*. BG manufactured in three batches. The standard values were established.

### **Discussion on healthy volunteries & grouping-**

Experimental study was carried out on animal in past, thus clinical trials has been chosen. This study is carried out under clinical trial - phase 1 and healthy volunteers were selected as per guideline and 90 students as a participant were selected.

For analyse improvement in learning and memory ability of drug effect, 3 groups were made as group A for plain, group B control group and group C for study group.

**Group A-** It was decided to not give any drug to participant of group A to compare with result of group B and group C. Only JPIP learning and memory scale test was recorded to compare score of participants including in group B and group C.

**Group B-** *Goghrita* was used as base ingredient & processed along with mentioned group of ingredients of *Brahmi ghrita* in presence of water. *Goghrita* itself has *smritivardhak* and *medhya* property. So its necessity to rule out that result will be due to the combined effect of ingredient of BG or just the inherent properties of base drug. Hence *Goghrita* was selected for control group B.

**Group C-** As mentioned earlier BG was selected for study group C.

### **Discussion on Observation and Results**

#### **Effect of therapy by Brahmi Grita:**

Treated group showed from 14.07 to 16.53 improvements in learning (Science) after treatment which is statistically highly significant ( $P < 0.005$ ).

Treated group showed from 17.57 to 24.45 improvements in memory (Maths) after treatment which is statistically highly significant ( $P < 0.005$ ).

#### **Effect of therapy by Go Ghrita:**

Control group showed from 14.43 to 15.13 not significant improvements in learning (Science) after treatment which is statistically highly significant ( $P > 0.005$ ).

Control group showed from 14.29 to 18.92 i.e.; significantly increased improvement in memory (Maths) after treatment which is statistically high ( $P < 0.005$ ).

## CONCLUSION

### Pharmaceutical study

- SOP's for manufacturing of BG and standard parameters for BG were established.

### Clinical study

- According to **ANOVA Test, increased science score** the medhya effect of Brahmyadi ghrita is statistically significant in the subjects score. ( $F_{\text{calculated}} = 4.390$ ;  $p = 0.015$ )
- According to **ANOVA Test, increased mathematics score** the medhya effect of Brahmyadi ghrit is statistically significant in the subjects score. ( $F_{\text{calculated}} = 19.535$ ;  $p = 0.000$ )
- According to **Turkeys Test, increased science score** the medhya effect of Brahmyadi ghrit is statistically significant in the subjects score
- According to **Turkeys Test, increased mathematics score** the medhya effect of Brahmyadi ghrit is statistically significant in the subjects score.
- In science and mathematics score **Study group is more effective** than control group and Plain group.

**Brahmyadi ghrita shows improvement in learning and memory as compare with goghrita.**

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