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Evaluation of comparative Efficacy of Jyotishmati and Yastimadhu granules in Enhancing IQ and Memory in Children having different Prakriti –A double blind Randomized Clinical Trial

Research Article

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Abstract

Background: Children with high IQ and memory have lower rates of poverty and dependency. *Jyotishmati* and *Yastimadhu* are both *Medhya dravya* to enhance IQ and memory describe in numerous *Ayurveda* classical texts. Aim &objectives: To compare the efficacy of *Jyotishmati* with *Yastimadhu* on IQ and Memory in children with various *Prakriti* types. Material & Methods: Total 60 healthy participants are enrolled and randomly divided into 2 equal main groups and 6 subgroups (*VataPitta, VataKapha, PittaVata, PittaKapha, KaphaVata, KaphaPitta)*. Group-J (Intervention group) given *Jyotishmati* granules and Group-Y (Control group) given *Yastimadhu* granules both the interventions were administered for 60 days and follow up for 60 days. Observations & Result: While comparing Group J and Group Y, it showed highly significant at follow up in *kapha-pitta* groups with $p<0.001$ in IQ and statistically significant with $p<0.05$ in memory. Discussion: *Kapha Pitta Prakriti* dominant groups showed significant results in follow-up, because *Kapha Prakriti* persons are bestowed with *Gunas* (qualities) like *Chirgrahi*(slow grasping), *Dhritiman* (good retaining power) and *Smritiman* (good memory). *Pitta Prakriti* persons are *Medhavi*(sharp grasping) and *Nipunmati*(good retention power), together with the action of *Jyotishmati* granules, showed significant dominance over other *Prakriti Doshas*. Conclusion: The prevalence of low IQ at pre-treatment in Group J was 3.32 % and Group Y was 6.7%. In memory, Group J was 16.7% and Group Y was 10% are on Average memory. Both the groups were 100% improve to Average IQ, and 100% improve to Good memory in Group J but 96.7% in Group Y at post-treatment and follow-up. *Jyotishmati* and *Yastimadhu* granules were significant in enhancing IQ and memory.

Keywords: *Buddhi, Smriti, Medhya dravya, Jyotishmati, Yastimadhu,* IQ, Memory.

Introduction

Intelligence and memory are essential components of mental wellness. They are crucial particularly in a child's formative years (0–8 years). Since these cognitive processes are organised during the early years of life. High gripping capability and rapid brain development are characteristics of early childhood. These early years are crucial since it's during this time that a child develops their morals, values, and beliefs. A constrained definition of intelligence would be the capacity to learn new things and apply that knowledge and understanding to a variety of unexpected situations. This capacity allows the person to interact with real-world events and get intellectual value from sensory experiences (1). Children at school have far higher memory demands than adults do, and they are constantly exposed to new information in a variety of subjects, whether or not it piques their interest. Additionally, it is required of youngsters to learn these, retain them, and use them again during tests. Children are unaware of their intellectual level until there is a clear deviation from the norm. For instance, those who are brilliant do not recognise their brilliance, those who are stupid do not recognise their dullness, and those who are average take their intellect for granted (2).

In *Ayurvedic* Classical text *Buddhi* can be understood as the capacity of the mind for logic and reasoning or as a means of achieving actual knowledge. One definition of *Buddhi* is *Jnana* (knowing) (3). According to *Darshana*, perception from memory and perception from senses and logic are referred to as the *Buddhi* (4). A *Buddhi* is thought to be the driving force behind all of the person's actions (5). It is a phenomenon that spurts an individual to operate in a specific way. The source of definitive knowledge is *Buddhi* (6)

Smruti is a perspective derived from past events imprinted in one's mind. When collected, retained, and replicated, the same knowledge is referred to as *Smruti* (7). It is a kind of knowledge that results from

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information processing (8). The only reason one can remember past skills or retrieve prior knowledge is because of *Smruti* (9). Within *Ayurvedic* literature, the term "*Smruti*" has the following definitions: knowledge storage ability, academic proficiency, particularly in math, awareness, and the ability to recollect prior experiences.

One of Ayurveda greatest contributions is the idea of *Prakriti* (An individual's innate state). Examining *Prakriti* has received a lot of attention. This is important because understanding the initial condition of functioning is necessary to understanding the possible interruption in body function. Since maintaining health in a healthy individual is also the major goal of *Ayurveda* (10). Understanding *Prakriti* is essential for drug selection according to *Prakriti* type. To increase effectiveness, it is ideal if herbs are prescribed in accordance with *Prakriti* and other principles. Predominant *Deha Prakriti* of individual are blessed with differences in their physical and psychological characteristics (11).

In this clinical trial, *Jyotishmati* (*Celastrus paniculatus* Wild) and *Yastimadhu* (*Glycyrrhiza glabra* Linn) are the nootropic medicines. They are prepared in the form of granules. Acharya Charaka (12), Sushrut (13), and Vagbhat (14) had described *Jyotishmati* and *Yastimadhu* as *Medhya*, but *Kaidev Nighantu* (15), *Dhanvantari Nighantu* (16), *Raj Nighantu* (17), and *Bhavaprakash Nighantu* (18) have specifically mentioned *Jyotishmati* as *Medhya dravya*. Recent research on animals has demonstrated that *Jyotishmati* (19) and *Yastimadhu* (20) improve memory and cognition. However, there haven't been any reliable randomized clinical trials done up to date to evaluate the efficacy of *Jyotishmati* granules in comparison with *Yashtimadhu* granules in enhancing IQ and memory based on *Prakriti* in the age group of 8 to 13 years. This clinical trial was conducted as a randomized, double-blind study. The difference was noted before initiating treatment, after treatment, and after follow-up (without treatment for 2 months). It was evaluated by using C-DAC for *Prakriti* (21), PGI children scale for memory (22) and the Draw a Man test for IQ (23).

Aim:

To evaluate the comparative efficacy of *Jyotishmati* and *Yastimadhu* Granules in enhancing IQ and memory in school-going children having different *Prakriti*- A double-blind randomized clinical trial.

Objectives

- To evaluate the efficacy of *Jyotishmati* and *Yastimadhu* individually on IQ and memory in children with different *Prakriti* types.
- To compare the IQ and memory enhancing efficacy of *Jyotishmati* and *Yastimadhu* in children with different *Prakriti* types.
- To find the relative prevalence of various *Prakriti* types in the research population.
- To find the connections between IQ and memory in various *Prakriti*.

Material and Methods

Sample size

60 healthy participants were enrolled for this study between 8-13 years. 30 participants were distributed for Group J and Group Y respectively and divided into 6 sub-groups *VataPitta, VataKapha, PittaVata, Pitta Kapha, KaphaVata, KaphaPitta.* Stratified samplings of 5 participants were distributed into each subgroup respectively.

Research Design

The study was designed as an interventional, clinical, randomized, standard -controlled, double-blind, parallel group.

Ethical Clearance

The trial has been registered in CTRI with the reference no CTRI/2021/09/036950. IEC reference no MGACHRC/IEC/July-2021/353.

Source of data

The study was carried out on healthy volunteers enrolled from schools nearby to the Mahatma Gandhi Ayurved College, Hospital, and Research Centre, Salod, Wardha, using school surveys.

Study Types: Interventional study.

Source of drug

The raw materials were brought from authentic source for the preparation of *Jyotishmati* granules and *Yastimadhu* granules and were prepared at a well-established pharmacy with a well-equipped pharmacy at the institute as per the classical technique of granule (*khanda*) preparation. Botanical name, Part used, Properties, Quality of a drug are described in table no.1

Table 1: Botanical Name, Part used, Properties, Quality of a drug

Sr. no	Name of Drugs	Botanical Name	Part used	Properties of drugs	Quantity
1	*Jyotishmati*	*Celastrus panniculatus* wild	Seed	*Medhya, Vatahara, Dipana, Rasayana, Shiro virechana*	1 part
2	*Yastimadhu*	*Glycyrrhiza Glabra* Linn	Stem	*Medhya, Kanthya, Mrudu Virechana*	1 part
3	*Guda*	Jaggery			2 part
4	*Go ghrita*	Ghee			1 part

Method of Preparation of drug

Fine powder of *Jyotishmati* seeds\ *Yastimadhu* stem was made by grinding in mixer and Sieve through 72 number meshes

⇩

Melt the two parts of jaggery by heating them in a vessel at 200 degrees Celsius.

⇩

Add one part of the fine powder (*Jyotishmati/Yastimadhu*) and heat it until it solidifies.

⇩

Add one-tenth of the cow ghee to the mixture and mix vigorously and continuously.

⇩

To achieve the desired granule size, the mass is kept in the granulating machine for 30 to 50 minutes.

⇩

The granules are kept to dry in a drying machine.

⇩

The resulting granules will then be sealed and placed inside a container.

Method of collection of data

60 healthy children fulfilling the inclusion criteria were randomly selected for the study from February 2022 to February 2023. After explaining the intention and the outlines of the clinical trial to the children and parents mainly, informed consent was obtained from the participants and the parents, of which a copy is attached to the proforma in the annexure. Participants between the ages of 8 and 13 years, irrespective of caste, religion, sex, habits, occupation, and socioeconomic status.

Criteria for the Selection of Children

Inclusion criteria

- Children of dominant *Vataj, Pittaj,* and *Kaphaj Prakriti.*
- Children between the ages of 8 and 13.
- Children whose gaurdian have signed the informed consent.

Exclusion criteria

- Children who have been diagnosed with mental illness
- Children who are below average in IQ (using draw a man test for assessing IQ)

Withdrawal criteria

- Inability of the child or parents to continue the studies.
- Emergency of any severe sickness necessary for hospitalisation.
- Emergency of serious adverse medication reactions.

Intervention

Jyotishmati granules were given to Group J, and *Yastimadhu* granules were given to Group Y, in doses based on age and divided into two doses. The drug was given continuously for 60 days.Intervention of *Jyotishmati* and *Yastimadhu* Granules details are describe in table no.2.

Table 2: Intervention of *Jyotishmati* and *Yastimadhu* Granules

	Jyotishmati granules (Group J) & *Yastimadhu* granules (Group Y)
Types of formulation	Granules
Dose	As per Young's formula / half BD
Administration route	Oral
Time of administration	Twice daily 5AM & 7PM
Anupana	Milk
Duration	60days

Posology

For *Jyotishmati* and *Yastimadhu* granules, determine the dosage in accordance with Young's Formula.

$$\text{Child dose} = \frac{\text{Adult dose x Age of the child in years}}{12 + \text{Age in year}}$$

The recommended dosage for adults is 5 gram of *choorna* (powder). For children, the recommended dosages are as follows for *Jyotishmati* and *Yastimadhu* granules.

8 year = 5x8/20 = 2gm × 2 = 4gm ≈ **4gm**
9 year = 5x9/21 = 2.142 gm × 2 = 4.284 gm ≈ **4.3 gm**
10 year =5x10/22 = 2.272gm × 2 = 4.544gm ≈ **4.6gm**
11 year = 5x11/23 = 2.39 gm × 2 = 4.782 gm ≈ **4.8 gm**
12 year = 5x12/24 = 2.5 gm× 2 = 5 gm ≈ **5gm**
13 year= 5x13/25 = 2.6 gm × 2 = 5.2 gm ≈ **5.2 gm**

Criteria for Assessment

***Prakriti* Assessment (21)**

- Prior to enrolling in the study, each participant's *Prakriti* was evaluated.
- The Centre for Development of Advanced Computing (C-DAC)'s AyuSoft software's "*Prakriti Vichaya*" module, which includes a thorough questionnaire tailored to age and gender, will be used to evaluate *Prakriti.*
- With useful answers for each inquiry, it covers history, anatomical, physiological, and psychological evaluation.

Memory Assessment (22)

Memory was assessed before and after treatment using the "PGI Memory Scale for Children." The PGIPGI Memory Scale for Children is a downward extension of the adult PGI Memory Scale. Ten subtests make up the scale they are, recognition of common objects, verbal retention for similar pairs, verbal retention for dissimilar pairs, delayed recall, immediate recall, mental balance, attention, and concentration; remote memory; recent memory; and visual retention**.**

Scoring of memory

Table 3: Scoring of memory with grading and percentage

Grading	Percentage
Good memory	Above 60 %
Average memory	40-60 %
Poor memory	Below 40 %

IQ Assessment:

- **Draw-A-Man-Test : (23)**

A pre- and post-treatment assessment of IQ was done through Draw-A-Man-Test. In accordance with their knowledge, Paper and pencils will be provided to the children to draw a man or a woman. The score is determined by a variety of body components, including the attire, accessories, environment surrounding the characters, and the eyes, ears, nose, hands, trunk, legs, and feet.

Scoring of IQ

Table 4: Scoring of IQ with grading and percentage

Grading	Percentage
Very Superior	Above 130 %
Superior	120-129 %
High Average	110-119 %
Average	90-109 %
Low Average	80-89 %
Borderline	70-79 %
Extremely Low	Below 69 %

Based on the parameters, the clinical trial evaluation was conducted. Prior to the start of the medication, a preliminary assessment was completed, followed by an assessment after the administration of drugs for 60 days. The final assessment was done without treatment for 2 months from the start of the trial, i.e., on the 120th day. IQ and memory assessments were done pre-treatment, post-treatment, and without treatment for 2 months as follow-up.

Statistical Analysis

Statistics were used to analyzed the collected data. The study's hypothesis was evaluated using the chi-square test, an ANOVA, and a Student's unpaired t-test. Statistical significance was defined as a P value < 0.05, while high significance was associated with p values <0.001 and <0.01. The significance level was interpreted appropriately.

Assessment of Results:

Assessment of the results was done after 60 days of treatment, i.e., post-treatment, and after 120 days, i.e., follow-up (2 months without treatment). An assessment scale was used to assess the improvement of the participants. The percentage of improvement was calculated and classified under the following headings:

Improving of Memory:

- Good (memory above 60 %) – 100% in Group J and 98.3% in Group Y
- Average memory (40-60 %) -1.7% in Group Y
- Poor memory (40 %) – 0%

Improving of IQ:

- Very Superior (130 % and above)-0%
- Superior (120-129 %)-0%
- High Average (110-119 %)-0%
- Average (90-109 %)-100 % in Group J and 100% in Group Y
- Low Average (80-89)-0%
- Borderline (70-79)-0%
- Extremely Low (69 and below)-0%

Observations and Results

In present clinical trial total of 60 participants were collected for the study, 30 each in Group J and Group Y. Female 21 (70.0%) and male 9 (30%) in Group J, while female 27 (90%) and male 3 (10%) in Group Y. *Prakriti*, *Kapha-Pitta* (KP), *Kapha-Vata* (KV), *Pitta-Kapha* (PK), *Pitta-Vata* (PV), *Vata-Kapha* (VK), *and Vata-Pitta* (VP), each group having 5 (16.7%) samples, both in Group J and Group Y, respectively. In Group J, 20 (66.7%) were mixed and 10 (33.3%) were vegetarian. In Group Y, 22 (73.3%) were mixed and 8 (26.7%) were vegetarian. In Group J, 24 (80.0%) have good appetite and 6 (20.0%) have poor appetite, and in Group Y, 26 (86.7%) have good appetite and 4 (13.3%) have poor appetite. In Group J, 2 (6.7%) have disturbed sleep and 28 (93.3%) have sound sleep, and in Group Y, 3 (10%) have disturbed sleep and 27 (90%) have sound sleep. As per socio-economic, Middle class were 25 (83.3%) for Group J and 26 (86.7%) in Group Y. Poor class were 5 (16.7%) for Group J and 4 (13.3%) in Group Y. IQ and memory score of group J&Y pre-treatment, post treatment and follow-up are described in table no 5,6,7,8,9,10 respectively. Total IQ and memory of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y) are described in table no 11 & 12. Overall total IQ and memory of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y) are described in table no 13 & 14.

Table 5: Distribution of participants in IQ score of Group J & Group Y at Pre-treatment

IQ	Category	Group J (Jyotishmati)		Group Y (Yastimadhu)		Total		Chi Sq	P-value
Pre-treatment		Frequency	%	Frequency	%	Frequency	%	0.351	0.553617
	80-89 (Low Average)	1%	3.3%	2	6.7%	3	5.0%		
	90-109 (Average)	29	96.7%	28	93.3%	57	95.0%		
Total		30	100.0%	39	100.0%	60	100.0%		

Table 6: Distribution of participants in IQ score of Group J & Group Y at Post-treatment

Post Treatment		Group J (Jyotishmati)	Group Y (Yastimadhu)	Total	Chi Sq	P-value
90-109 (Average)	Frequency	30	30	60	0	1
	%	100.0%	100.0%	100.0%		

Table No.7: Distribution of participants in IQ score of Group J & Group Y at Follow-Up

Follow –up		Group J (Jyotishmati)	Group Y (Yastimadhu)		Chi Sq	P-value
90-109 (Average)	Frequency	30	30	60	0	1
	%	100.0%	100.0%	100.0%		

Table 8: Distribution of participants in Memory score of Group J & Group Y at Pre-treatment

Memory assessment		Group						Chi Sq	P-value
		Group J (Jyotishmati)		Group Y (Yastimadhu)		Total			
Pre-treatment	40-60 (Average)	Frequency	%	Frequency	%	Frequency	%	0.577	.44752
		5	16.7%	3	10.0%	8	13.3%		
	Above 60 (Good)	25	83.3%	27	90.0%	52	86.7%		
	Total	30	100.0%	30	100.0%	60	100.0%		

Table 9: Distribution of participants in Memory score of Group J & Group Y at Post-treatment

Memory assessment		Group						Chi Sq	P-value
		Group J (Jyotishmati)		Group Y (Yastimadhu)		Total			
		Frequency	%	Frequency	%	Frequency	%		
Post-treatment	40-60 (Average)	0	0	1	3.33%	1	3.33%	1.017	0.313
	Above 60 (Good)	30	100%	29	96.7%	59	98.3%		
	Total	30	100.0%	30	100.0%	60	100.0%		

Table 10: Distribution of participants in Memory score of Group J & Group Y at Follow-Up

Memory assessment		Group						Chi Sq	P-value
		Group J (Jyotishmati)		Group Y (Yastimadhu)		Total			
		Frequency	%	Frequency	%	Frequency	%		
Follow-up	40-60 (Average)	0	0	1	3.33%	1	1.7%	1.017	0.313
	Above 60 (Good)	30	100%	29	96.7%	59	98.3%		
	Total	30	100.0%	30	100.0%	60	100.0%		

Table 11: Total IQ of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y)

IQ	Assessment	Category	N	Mean	Std. Deviation	Std. Error Mean	t-test	P-value
Vata Pitta	Pre-Treatment	*Jyotishmati*	5	93.0000	2.54951	1.14018	-0.41804	0.686913
		Yastimadhu	5	93.6000	1.94936	0.87178		
	Post-Treatment	*Jyotishmati*	5	98.6000	3.57771	1.60000	-0.44582	0.667544
		Yastimadhu	5	99.4000	1.81659	0.81240		
	Follow Up	*Jyotishmati*	5	98.6000	3.57771	1.60000	0.313625	0.761827
		Yastimadhu	5	98.0000	2.34521	1.04881		
Vata Kapha	Pre-Treatment	*Jyotishmati*	5	94.4000	2.07364	0.92736	0.632456	0.544737
		Yastimadhu	5	93.8000	0.44721	0.20000		
	Post-Treatment	*Jyotishmati*	5	98.4000	1.67332	0.74833	1.270001	0.239776
		Yastimadhu	5	97.4000	0.54772	0.24495		
	Follow Up	*Jyotishmati*	5	98.4000	1.67332	0.74833	1.870829	0.098282
		Yastimadhu	5	97.0000	0.00000	0.00000		
Kapha Vata	Pre-Treatment	*Jyotishmati*	5	93.2000	1.09545	0.48990	0.640345	0.539851
		Yastimadhu	5	91.8000	4.76445	2.13073		
	Post-Treatment	*Jyotishmati*	5	96.4000	1.81659	0.81240	-0.58277	0.576101
		Yastimadhu	5	97.0000	1.41421	0.63246		
	Follow Up	*Jyotishmati*	5	96.0000	1.58114	0.70711	-0.49656	0.632852
		Yastimadhu	5	96.6000	2.19089	0.97980		
Kapha Pitta	Pre-Treatment	*Jyotishmati*	5	92.0000	4.94975	2.21359	0.594964	0.56831
		Yastimadhu	5	90.0000	5.65685	2.52982		
	Post-Treatment	*Jyotishmati*	5	98.2000	1.48324	0.66332	3.030458	0.016298
		Yastimadhu	5	95.2000	1.64317	0.73485		
	Follow Up	*Jyotishmati*	5	97.8000	1.09545	0.48990	4.525483	0.001936
		Yastimadhu	5	94.6000	1.14018	0.50990		
Pitta Kapha	Pre-Treatment	*Jyotishmati*	5	91.8000	1.78885	0.80000	-1.066	0.317534
		Yastimadhu	5	92.8000	1.09545	0.48990		
	Post-Treatment	*Jyotishmati*	5	96.4000	3.13050	1.40000	-0.40825	0.6938
		Yastimadhu	5	97.0000	1.00000	0.44721		
	Follow Up	*Jyotishmati*	5	96.2000	2.77489	1.24097	-0.46291	0.65576
		Yastimadhu	5	96.8000	0.83666	0.37417		
Pitta Vata	Pre-Treatment	*Jyotishmati*	5	94.0000	2.23607	1.00000	1.825742	0.105322
		Yastimadhu	5	92.0000	1.00000	0.44721		
	Post-Treatment	*Jyotishmati*	5	98.4000	1.14018	0.50990	1.549193	0.159928
		Yastimadhu	5	97.2000	1.30384	0.58310		
	Follow Up	*Jyotishmati*	5	97.6000	1.14018	0.50990	1.38675	0.202934
		Yastimadhu	5	96.6000	1.14018	0.50990		

Table No .12: Total memory of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y)

Memory	Assessment	Category	N	Mean	Std. Deviation	Std. Error Mean	t-test	P-value
Vata Pitta	Pre-Treatment	*Jyotishmati*	5	66.8000	4.38178	1.95959	-0.39911	0.700251
		Yastimadhu	5	68.0000	5.09902	2.28035		
	Post-Treatment	*Jyotishmati*	5	74.4000	0.89443	0.40000	0.408248	0.6938
		Yastimadhu	5	74.0000	2.00000	0.89443		
	Follow Up	*Jyotishmati*	5	73.6000	1.67332	0.74833	0	1
		Yastimadhu	5	73.6000	2.19089	0.97980		
Vata Kapha	Pre-Treatment	*Jyotishmati*	5	66.0000	6.63325	2.96648	0.258199	0.802772
		Yastimadhu	5	65.0000	5.56776	2.48998		
	Post-Treatment	*Jyotishmati*	5	71.6000	3.28634	1.46969	0.679366	0.516077
		Yastimadhu	5	70.4000	2.19089	0.97980		
	Follow Up	*Jyotishmati*	5	70.8000	3.03315	1.35647	0.67082	0.521227
		Yastimadhu	5	69.6000	2.60768	1.16619		
Kapha Vata	Pre-Treatment	*Jyotishmati*	5	69.6000	1.67332	0.74833	1.911274	0.09235
		Yastimadhu	5	61.6000	9.20869	4.11825		
	Post-Treatment	*Jyotishmati*	5	74.2000	2.86356	1.28062	1.131371	0.290671
		Yastimadhu	5	72.6000	1.34164	0.60000		
	Follow Up	*Jyotishmati*	5	73.2000	2.28035	1.01980	0.507093	0.625769
		Yastimadhu	5	72.6000	1.34164	0.60000		
Kapha Pitta	Pre-Treatment	*Jyotishmati*	5	69.6000	3.28634	1.46969	0.474713	0.64768
		Yastimadhu	5	68.0000	6.78233	3.03315		
	Post-Treatment	*Jyotishmati*	5	74.2000	1.48324	0.66332	0.708572	0.498714
		Yastimadhu	5	72.0000	6.78233	3.03315		
	Follow Up	*Jyotishmati*	5	73.4000	2.40832	1.07703	0.57735	0.579584
		Yastimadhu	5	71.6000	6.54217	2.92575		
Pitta Kapha	Pre-Treatment	*Jyotishmati*	5	68.0000	3.74166	1.67332	0	1
		Yastimadhu	5	68.0000	5.65685	2.52982		
	Post-Treatment	*Jyotishmati*	5	71.6000	3.28634	1.46969	-0.08771	0.932266
		Yastimadhu	5	71.8000	3.89872	1.74356		
	Follow Up	*Jyotishmati*	5	70.4000	2.60768	1.16619	-0.30943	0.764903
		Yastimadhu	5	71.0000	3.46410	1.54919		
Pitta Vata	Pre-Treatment	*Jyotishmati*	5	68.4000	1.67332	0.74833	0.856349	0.416716
		Yastimadhu	5	66.2000	5.49545	2.45764		
	Post-Treatment	*Jyotishmati*	5	74.0000	2.44949	1.09545	0.884652	0.402149
		Yastimadhu	5	72.8000	1.78885	0.80000		
	Follow Up	*Jyotishmati*	5	72.2000	4.71169	2.10713	-0.08944	0.930929
		Yastimadhu	5	72.4000	1.67332	0.74833		

Table 13: Overall total IQ of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y)

IQ assessment	Group	N	Mean	Std. Deviation	Std. Error Mean	t-test	P-value
Pre-Treatment	*Jyotishmati*	30	93.0667	2.66437	0.48644	0.968755	0.33669
	Yastimadhu	30	92.3333	3.17678	0.58000		
Post-Treatment	*Jyotishmati*	30	97.7333	2.31834	0.42327	1.005706	0.318735
	Yastimadhu	30	97.2000	1.74988	0.31948		
Follow Up	*Jyotishmati*	30	97.4333	2.22344	0.40594	1.625818	0.10941
	Yastimadhu	30	96.6000	1.71404	0.31294		

Table 14: Overall total IQ of *Jyotishmati* (Group J) and *Yastimadhu* (Group Y)

Memory assessment	Group	N	Mean	Std. Deviation	Std. Error Mean	t-test	P-value
Pre-Treatment	*Jyotishmati*	30	68.0667	3.84110	0.70129	1.430405	0.157966
	Yastimadhu	30	66.1333	6.32855	1.15543		
Post-Treatment	*Jyotishmati*	30	73.3333	2.63050	0.48026	1.358282	0.179634
	Yastimadhu	30	72.2667	3.40318	0.62133		
Follow Up	*Jyotishmati*	30	72.2667	2.97035	0.54231	0.567325	0.572683
	Yastimadhu	30	71.8000	3.38760	0.61849		

Discussion

The total number of participants was 60. In which 30 participants were distributed for Group J and Group Y, respectively and divided into 6 sub-groups: *VataPitta, VataKapha, PittaVata, Pitta Kapha, KaphaVata, and KaphaPitta.* Stratified samplings of 5 participants were distributed into each sub-group, respectively. In the IQ category, Group-J (*Jyotishmati*) has 1 (3.3%) participant and Group-Y (*Yastimadhu*) has 2 (6.7%) participants with a low average IQ (80–89%). All the participants in both groups improved to the average IQ (90–109%) at post-treatment and follow-up. While comparing the IQ of *Prakriti* dominant Group-J and Group-Y in post-treatment and follow-up, the following *Prakriti* dominant groups: *Vata Pitta, Vata Kapha, Pitta Kapha, Pitta Vata, and Kapha Vata,* showed non-significant results, while the Kapha *Pitta* group in follow-up showed highly significant results with a p-value <0.001. In the memory category, Group J has 5 (16.7%) participants, and in Group Y, 3 (10%) participants were in average memory (40–60%). In Group J, all the participants improved to good memory (i.e., above 60%) at post-treatment and follow-up, but in Group Y, only 2 (6.3%) participants improved to good memory (i.e above 60%) at post-treatment and follow-up, while 1 (3.3%) participant was still in average memory (40–60%). While comparing the memory of *Prakriti* dominant Group-J (*Jyotishmati*) and Group-Y (*Yastimadhu*) in post-treatment and follow-up, the following *Prakriti* dominant groups: *Vata Pitta, Vata Kapha, Pitta Kapha, Pitta Vata, and Kapha Vata,* showed non-significant results, while the Kapha *Pitta* group in follow-up showed statistically significant results with a p-value <0.05.

Probable mode of action of the drugs: (24)

- *Yastimadhu Guna* (Qualities) are *Guru* (heavy) and *Snigdha* (oily). These *guna* nourished the *Smruti* (Memory), and *Medha* (intellect).
- *Jyotishmati Guna* (qualities) is *Tiskshna* (sharp) *Guna.* Which enhance *Jathara agni* (Digestive power), this produces *Medha* (intellect).
- *Yastimadhu Rasa* (Taste) is *Madhura* (sweet) this nourishing the *Smruti* (memory), and *Medha* (Intellect), with *Madhura Rasa* (sweet taste) stimulate the *Kapha*, particularly *Tarpaka kapha* (provide nourishment to the head region*)*.
- *Jyotishmati Rasa* (Taste) is *Katu* (pungent) and *Tikta (bitter) Rasa*. The *Agni* (digestive fire) is stimulated by the *Katu* and *Tikta Rasa* which produce *Amapachana* (Purify *Ama* (toxins)), which eliminates *Mala* (waste product) and in turn eliminates *Jadya's* (stupidity) over *Medha* (intellect).
- *Yastimadhu Vipaka* is *Madhura* (sweet). *Smruti* (Memory) and *Medha* (intellect) are nourished by the *Madhura Vipaka Dravya*.
- *Jyotishmati Vipaka* (Effect after digestion of the drug) is *Katu* (pungent). *Katu Vipaka dravya* have *Medhya* (nootropic) effects, but they accomplish these tasks by stimulating *Agni* (digestive fire) and purifying *Srotasa* (channels of circulation).
- Promoting and nourishing *Medha* (Intellect) is the join responsibility of *Ushna* (Hot) and *Sheeta* (cold) *Veerya* (potency of the drug). *Yastimadhu* has *Sheeta Veerya*, while *Jyotishmati* has *Ushna Veerya.*

Jyotishmati granules (Group J) improved 100% in both IQ and memory and *Yastimadhu* granules (Group Y) improved 100% in IQ and 97.3 % in memory. *Jyotishmati* showed effectiveness in all *Prakriti* dominant groups *Kapha-Vata* (KV), *Pitta-Kapha* (PK), *Pitta-Vata* (PV), *Vata-Kapha* (VK), *and Vata-Pitta* (VP) when compared to *Yastimadhu* granules in both IQ and memory, especially the *kapha-Pitta* (KP) group, which were highly significant in IQ with p-value <0.001 statistically significant in memory with p-value <0.05 in follow-up (2 months without treatment). This proved that *Jyotishmati* granules were effective even after two months without treatment.

Kapha Pitta Prakriti dominant groups showed significant results in follow-up (which was without treatment for 2 months) because *Kapha Prakriti* persons are bestowed with *Guna* (qualities) like *Chirgrahi* (slow in grasping), *Dhritiman* (very good in retaining power) and *Smritiman* (good memory power). *Pitta Prakriti* persons are *Medhavi* (sharp in grasping) and *Nipunmati* (good retention power) (25). *Kapha* and *Pitta Doshas* already having very good *Buddhi* (IQ) and *Smriti* (memory) power, together with the action of *Jyotishmati* granules, showed highly significant dominance over other *Prakriti Doshas.*

Conclusion

This study was an interventional trial to compare the equivalent efficacy of *Jyotishmati* granules with *Yastimadhu* granules for the augmentation of IQ and memory. Subnormal IQ and memory which may lead to academic stress condition is usually seen in paediatric age groups in school-going children. Both the interventions have shown safety evidences without any adverse reactions. In terms of its palatability, the medication was favourably accepted by children. *Jyotishmati* granules (Group J) improved 100% outcome in both IQ and memory and *Yastimadhu* granules (Group Y) improved 100% in IQ and 97.3 % in memory outcome. *Jyotishmati* showed effectiveness in all *Prakriti* dominant groups when compared to *Yastimadhu* granules, especially the *kapha Pitta* group, in both IQ and memory. These were highly significant in follow-up period (2 months without treatment). This proved that *Jyotishmati* granules were effective even after two months without treatment. However, this clinical study was only a preliminary trial that was directed as a part of a post-graduation research programme with a limited 30 number of Participants and a fixed dose. Further, a multi-centric research trial with a large sample size is requisite to establish the gradation of efficacy (superiority over equivalence) of *Jyotishmati* granules and *Yastimadhu* granules in IQ and memory.

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