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RESEARCH ARTICLE

CLINICAL STUDY ON MEDHYA EFFECT OF SUVARNAPRASHANA ON INTELLIGENCE QUOTIENT (IQ) IN SCHOOL-GOING CHILDREN

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Abstract

Background: Suvarnaprashana is indeed a traditional Ayurvedic practice that involves the oral administration of Gold, typically in the form of Gold Bhasma (goldnanoparticle) mixed with Ghrita and honey. This practice is primarily recommended for infants and young children and is believed to have several health benefits, including immune system support, cognitive development, and overall well-being.

Aims: To evaluate the Medhya effect of Suvarnaprashana in enhancing the Intelligence quotient in school-going children.

Methodology: Children were randomly selected from OPD and IPD of Balrog Department of Sanjeevani Ayurveda Hospital of Postgraduate Institute of Ayurved, Dr. S.R. Rajasthan Ayurved University, Jodhpur, Rajasthan, and nearby schools of Jodhpur. In the study mentioned, 60 children were selected from the age group of 6-15 years. The dose of Suvarnaprashana was calculated by Young's formula. The duration of treatment was 30 days. The assessment in this study focused on evaluating the impact of Suvarnaprashana on the Intelligence quotient (IQ) in children.

Result: The mean value for IQ was 99.05 before treatment which increased to 118.37 after treatment with an improvement of about 19.50% showing a significant change in the parameter (P-Value < 0.05).

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Introduction:-

Suvarnaprashana (oral administration of gold as electuary) is a unique practice documented in Ayurveda under the field of child healthcare. Kashyapa Samhita, which is the authoritative textbook of Kaumarabhritya (pediatrics), depicts this unique formulation under the context of Lehana (licking procedure by electuary). Lehana has been indicated for those children who are healthy, but have compromised breastfeeding and are having minor functional problems of metabolism.[1] It is contraindicated in seriously ill children and daily.

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As a general tonic, it can be administered in any age group. For the benefit of an immunomodulator, it can be administered in children at an early age as this period of one year is the most vulnerable time for infections due to an immature immune system. It can be even administered in case of immunodeficiency states if there is no serious illness associated with it. The action of gold in the immune system can be justified by the following studies. Pharmacological studies showed specific and nonspecific immune responses, which were modified positively in Suvarna Bhasma-treated mice. It also had a stimulatory effect on peritoneal macrophages, which may be helpful to fight against infections. [2-3]

In adolescence, there is the appearance of secondary sexual characters, which signify the development of the reproductive system. This could be the right period to get the benefit of Suvarnaprashana as a fertility enhancer. In a study measuring trace elements in endometrium and decidua, looking for cyclic variations, including those during pregnancy, gold was found in human endometrium and decidua.[4] The reported levels of gold were slightly lower around mid-cycle than at other stages of the cycle. In the male reproductive system, gold was measured in semen, and reported that semen is the richest source of gold in biological materials.[5] Another study suggests a significant stimulatory effect of gold chloride on female reproductive activity in immature rats.[6]

It has been explained that gold should be triturated along with water, honey, and Ghrita on a pre-washed and clean stone; facing the eastern direction and the mixture should be given to the Shishu/infant in a semisolid form. Among the benefits attributed to this practice, its effects are mentioned on Medha (intelligence quotient), Agni (digestion and metabolism), and Bala (physical strength and immunity) of children. If administered for 1 month, the baby will become Parama Medhavi (highly intelligent) and Vyadhibhir Na Cha Drusyate(will not be affected by any disease), and administered for 6 months, the baby will become Srutadhara (will be able to remember the things, which are just heard).To get benefit as an enhancer of intelligence, Suvarnaprashana can be given from birth and specifically for a period of 1 or 6 months continuously as mentioned in the classic. In a study, colloidal gold was found to improve cognitive functioning, which was measured by IQ scores.[7]A person desires not only a better quality of life but also an efficient, effective, and meaningful life. To survive in such a competitive era every parent wants his child to be an excellent performer in every field by using his superior mind with superior cognitive functions.This study was conducted to evaluate the assumption of Acharya Kashyap's "MaasatParama Medhavi" as the Medhyaeffect ofSuvarnaprashana in the management of school-going children

Methodology:-

Study design:

The study was a single-arm open-labeled intervention study.

Study Setting:

Children for the present study were screened out from the OPD of Kaumarbhritya Department, Sanjeevani Ayurveda Hospital of Postgraduate Institute of Ayurved (formally known as University Postgraduate Institute of Ayurved Studies and Research & University College of Ayurveda), Karwar, Jodhpur and nearby school jodhpur. The trial was approved by the institutional ethics committee's order no.DSRRAU/UPGIA&R/IEC/20-21/407 dated 12/06/2022 and registered in the CTRI -CTRI/2022/09/045563.Written informed consent from the parents was obtained for including their children in the study.

Selection of Patients

(A) Inclusion Criteria

1. Children aged between 6-15 years of either sex, who were physically and mentally healthy.
2. Children with an Intelligence Quotient of 80 to 110.

(B) Exclusion Criteria

1. Children with disorders such as systemic disorder / chronic disorder, learning disorders, and genetic disorders.
2. Children with gross brain damage causing mental retardation.
3. H/O hypersensitivity to any of the trial drugs or any of its ingredients.

(c) Assessment Criteria

Before and after the trial the children were assessed based on the IQ assessment with the Wechsler's intelligence scale (Malins Intelligence Scale for Indian Children).

Intervention

69 children between 6 to 15 years of both sexes were screened out from the above source, out of which 9 children have discontinued due to some personal reasons, and 60 children have continued the 30-day treatment. Children were included in the study complete physical examination and detailed evaluation for growth and development and Intelligence quotient (IQ) was documented in a specially prepared clinical research form.

Preparation of drug and dosage

The trial drug consists of Suvarna Bhasma (calcined powder of gold), honey, and Ghrita. The dosage of Suvarna Bhasma was fixed by following the Youngs formula by considering the adult dose of Suvarna Bhasma as 30 mg. Suvarna Bhasma, Ghrita, and honey with Agmark grade were procured from the local market. Honey and Ghrita were tested for microbial contamination at the Microbiology laboratory. Suvarnaprashana was prescribed in doses according to the age of children 1 drop/year/day (1mg Suvarna Bhasma per drop) having honey and Ghrita proportion (60:40 in drops) was mixed and prepared and blended to maintain the dosage form as drops in the pharmacy of the Postgraduate Institute of Ayurved (formally known as University Postgraduate Institute of Ayurved Studies and Research & University College of Ayurveda), Dr. S. R. Rajasthan Ayurved University, Jodhpur under the supervision of a pharmacist. (Table No-1)

Table No 01:-Depicts the dose of Suvarna Bhasma as per Age.

Sr.no	Children age	Suvarna Bhasma Doses
1	6-7	5- 5.52 mg
2	8-9	6- 6.42 mg
3	10-11	6.80-7 mg
4	12-13	7.5- 7.8 mg
5	14-15	8- 8.5 mg

Duration of the trial and follow-up

The duration of the study was 30 days with one review (at the 15th day) in between. Follow-up was for 60 days.

Observation:-

The observation of 60 subjects was based on - children aged 6 to 15 years of which 77.33% were in the age group of 6-10 years. The majority of the children in the study were male, which may be due to parents being more conscious of the special needs of male children. 81.67 % were Hindu, possibly reflecting the predominance of the Hindu community in the study area. lower-middle class, which might be because lower-income families tend to seek treatment in government hospitals. The 70% majority of cases belonged to nuclear families; this is supported by the Indian study of Usha Naik which reported a higher prevalence of behavioral problems in nuclear families. Educational status of parents: A significant number of fathers had 45% graduate or secondary education, while mothers had 55% secondary education and primary education, this showed awareness about children's academic performance. Most cases had a vegetarian diet, possibly due to the dominance of the Hindu community. Sleep pattern: 33.33% of children had less or moderate, one scientific study concluded that the performance of basic visual discrimination tasks improved after a normal night's sleep. (A. Jarni. & D. Tanneet al 1994). The 48.33% of children showed average academic performance, if academic performance is Average or above average then IQ will be good that is the demand of our study. The study suggests a link between Vata-Pitta Prakriti and poor mental conditions in children. 35 % of Children showed Rajasika-Sattvika Manashika Prakriti.

Table No 02:- Showing Academic Performance distribution of subjects (n=60).

S. NO.	Academic Performance	Frequency	Percentage
1.	Excellent	3	5.00%
2.	Average	29	48.33%
3.	Good	20	33.33%
4.	Poor	8	13.33%
	Total	60	100.00%

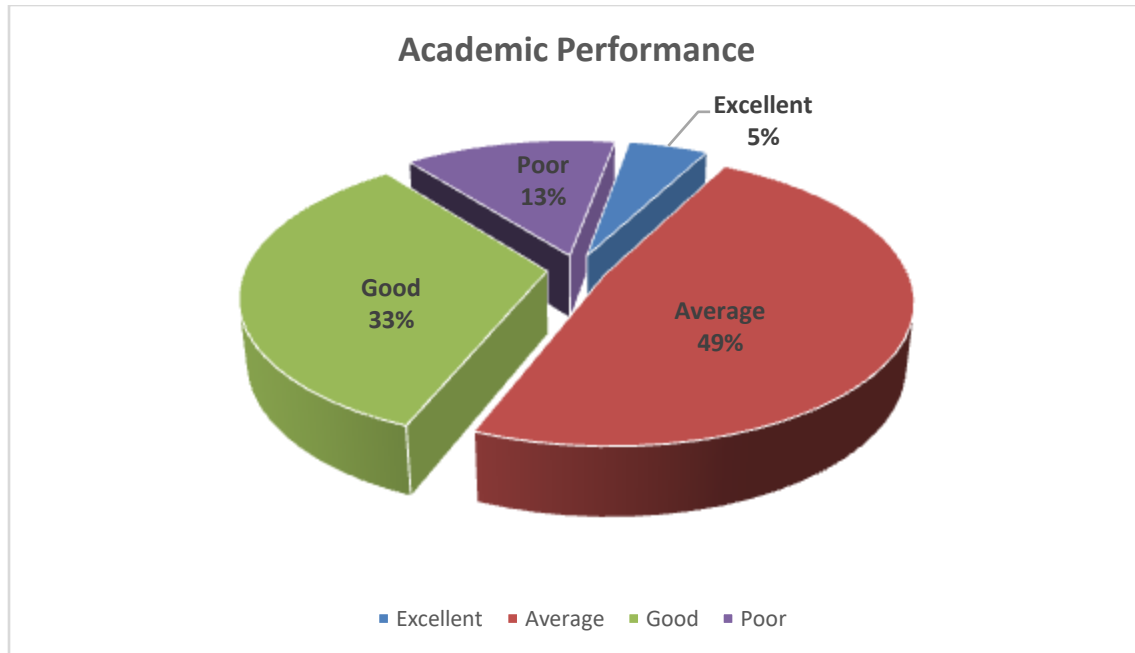


Table No. 03:- Showing sleeping pattern distribution of subjects (n=60).

S.NO.	Sleep	Frequency	Percentage
1.	Delayed	3	5.00%
2.	Disturbed	6	10.00%
3.	Excessive	11	18.33%
4.	Less	20	33.33%
5.	Moderate	20	33.33%
	Total	60	100.00%

Result:-

Table No 04:-Shows a statistical analysis of verbal IQ level after treatment.

Subtests		Mean	N	SD	SE	t-value	P-Value	% Change	Result
Information	B.T.	95.33	60	11.90	1.54	-8.087	0.00000000	17.95	Sig
	A.T.	112.45	60	10.05	1.30				
Comprehension	B.T.	95.85	60	11.16	1.44	-7.583	0.00000000	16.95	Sig
	A.T.	112.10	60	12.55	1.62				
Arithmetic	B.T.	97.15	60	14.58	1.88	-5.563	0.00000068	15.34	Sig
	A.T.	112.05	60	16.85	2.17				
Similarities	B.T.	102.25	60	12.40	1.60	-4.621	0.00002122	12.47	Sig
	A.T.	115.00	60	17.24	2.23				
Vocabulary	B.T.	89.88	60	15.51	2.00	-4.437	0.00004045	12.65	Sig
	A.T.	101.25	60	17.41	2.25				
Digit Span	B.T.	94.68	60	15.05	1.94	-5.568	0.00000066	15.19	Sig
	A.T.	109.07	60	15.60	2.01				
Verbal IQ	B.T.	96.19	60	10.54	1.36	-7.681	0.00000000	14.28	Sig
	A.T.	109.93	60	10.02	1.29				

(B.T.-Before treatment A.T.-After treatment, S.D. -Standard deviation, S.E.- Standard Error, Significant, Sig Significant)

The mean score before treatment of IQ was 96.19 which was increased to 109.93 after treatment showing a 14.28 % improvement and It has been observed that P-value < 0.05 in all parameters. Hence, it can be concluded that significant improvement is observed in all parameters.

Table No 05:-Shows a statistical analysis of Performance IQ level after treatment.

Subtest		Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Picture Completion	B.T	101.97	60	15.56	2.01	-6.821	0.00000001	22.54	Sig
	A.T	124.95	60	19.08	2.46				
Block Design	B.T	105.48	60	13.26	1.71	-5.445	0.00000106	22.45	Sig
	A.T	129.17	60	16.21	2.09				
Object Assembly	B.T	97.47	60	19.46	2.51	-4.962	0.00000626	22.55	Sig
	A.T	119.45	60	23.86	3.08				
Coding	B.T	109.80	60	18.28	2.36	-4.526	0.00002968	22.48	Sig
	A.T	134.48	60	22.40	2.89				
Mazes	B.T	102.78	60	14.07	1.82	-6.167	0.00000007	22.56	Sig
	A.T	125.97	60	17.28	2.23				
Performance IQ	B.T	101.92	60	10.04	1.30	-8.959	0.00000000	24.42	Sig
	A.T	126.80	60	13.38	1.73				

(B.T.-Before treatment A.T.-After treatment, S.D. -Standard deviation, S.E.- Standard Error, Sig- Significant)

The mean score before treatment of IQ was 101.92 which was increased to 126.80 after treatment showing a 24.42 % improvement, it has been observed that P-value < 0.05 in all parameters, and significant improvement is observed in all parameters.

TableNo.06:-Shows a statistical analysis of IQ level after treatment.

Subtest		Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Verbal IQ	B.T	96.19	60	10.54	1.36	-7.681	0.00000000	14.28	Sig
	A.T	109.93	60	10.02	1.29				
Performance IQ	B.T	101.92	60	10.04	1.30	-8.959	0.00000000	24.42	Sig
	A.T	126.80	60	13.38	1.73				
IQ	B.T	99.05	60	9.22	1.19	-5.841	0.00000024	19.50	Sig
	A.T	118.37	60	12.35	1.59				

(B.T.-Before treatment A.T.-After treatment, S.D. -Standard deviation, S.E.- Standard Error, Sig- Significant)



The mean score for Verbal IQ before treatment was 96.19 and the mean score for Performance IQ was 101.92, which was increased to 126.80 after treatment showing a 19.50 % improvement, it can be concluded that significant improvement is observed in all parameters.

Discussion:-

IQ tests provide a more standardized and comparative measure of intelligence across different age groups. Wechsler Intelligence Scale for Children (WISC) IQ tests have become more prevalent in contemporary assessments due to their standardized nature and ability to provide a numerical score. In this study, 60 children were selected whose IQ was between 80 to 110, which is average or below average according to the WISC.

The patients were treated in a single group by administration of Suvarnaprashana orally. The results were observed and evaluated for IQ scores with WISC. The clinical efficacy of the drug was analysed statistically on all parameters mentioned in the criteria. The obtained results were statistically analysed by using the "Students paired-t-test" for the significance of the effect seen in individuals. The study's findings revealed noteworthy improvements across various cognitive parameters following treatment. Information and Comprehension scores both exhibited substantial gains, with Information increasing from 95.33 to 112.45 (17.95% improvement) and Comprehension from 95.85 to 112.10 (16.95% improvement). Similarities, Vocabulary, and Digit Span demonstrated significant enhancements of 12.47%, 12.65%, and 15.19% respectively. Verbal IQ also saw a commendable rise, improving by 14.28%. These consistent positive changes underscore the treatment's efficacy in enhancing cognitive performance. Picture Completion, for instance, witnessed a significant transformation, with the mean score rising from 101.97 to 124.95 post-treatment—a substantial improvement of around 22.54%. A similar trend was observed in Block Design, where the mean score increased from 105.48 to 129.17, reflecting a noteworthy 22.45% enhancement. Likewise, Object Assembly demonstrated a significant improvement, with the mean score increasing from 97.47 to 119.45, representing a substantial 22.55% change. Coding exhibited a comparable pattern, with the mean score rising from 109.80 to 134.48, marking a substantial 22.48% improvement. Additionally, Mazes displayed a parallel improvement, where the mean score increased from 102.78 to 125.97, signifying a notable 22.56% enhancement. Lastly, Performance IQ exhibited remarkable progress, with the mean score escalating from 101.92 to 126.80, indicating an impressive 24.42% improvement. In all cases, the changes were statistically significant, as indicated by the P-Values being less than 0.05, highlighting the treatment's efficacy in enhancing these cognitive parameters. Notably, improvements in picture completion, block design, object assembly, coding, mazes, and performance IQ range from 22.45% to 24.42%. These consistent enhancements across diverse cognitive domains underscore the broad impact of the treatment on participants' cognitive abilities. The treatment's impact was observed across various cognitive domains, shedding light on its efficacy in enhancing cognitive functions.

The therapeutic attributes of Suvarna Bhasma encompass characteristics such as a sweet taste (Madhura Rasa), post-digestive sweetness (Madhura Vipaka), cooling potency (Sheeta Virya), unctuousness (Snigdha), lightness (Laghu Guna), and the ability to balance the three doshas (Tridoshashamaka). It is considered invigorating (Vrushya), longevity-promoting (Ayushaya), complexion-enhancing (Varnya), strength-bestowing (Balya), digestion-enhancing (Dipana), alleviating respiratory issues (Shwasa Kasahara), relieving loss of appetite (Aruchi), countering irregular fever (Vishamjwaranashaka), nourishing (Brimhana), aphrodisiac (Vajikara), anti-tuberculosis (Rajyakshmahara), enhancing vitality (Ojowardhana), alleviating anemia (Pandunashan), countering various poisons (Sarvavishapaham), combating weakness (Garharam), and mitigating disorders of the throat and nose (Granhnyadidoshanashanam). [8-9] The efficacy of Suvarna Bhasma in various conditions, including asthma, rheumatoid arthritis, immune-suppressive disorders, and dental problems, [10] has been attributed to its anti-inflammatory and immunomodulatory attributes. This effect is due to its capacity to scavenge free radicals. Suvarna Bhasma suppresses diverse immunological responses mediated by cells triggered by different mitogens and antigens. [11] Gold compounds possess immunomodulatory properties. As the main ingredient of Suvarnaprashana, Suvarna Bhasma bolsters immunity through phagocytosis and exhibits some efficacy in motor neuron diseases when administered in moderate doses. The toxicity of Suvarna Bhasma (gold nanopowder) was investigated using imaging techniques on both cancerous (HeLa) and noncancerous (HFF-1) cells to assess their spectral characteristics. The data revealed that gold ash particles did not compromise the viability of either HeLa or HFF-1 cells, even at elevated concentrations and extended incubation periods. [12] Experimental models involving acute oral administration of Suvarna Bhasma to mice (up to 1 ml/20 g body weight of Suvarna Bhasma solution containing 01 mg of medicine) demonstrated no mortality. [13]

Probable mode of action of Suvarna Prashana

Suvarnaprashana is defined as the administration of electuary-containing gelatin (Suvarna Bhasma) mixed with a lipid (Ghrita) and a sweetener (honey) in the current study. All the ingredients of Suvarnaprashana, i.e. Suvarna Bhasma, Ghrita, and honey are mixed to produce an emulsified mixture like small fat globulins chylomicrons which help in absorption through the oral mucosa. Small quantities of fatty acids are absorbed directly into the portal blood rather

than being converted into triglycerides and absorbed by lymphatics and intestinal epithelial cells allowing direct diffusion into the capillary blood of the intestinal villa. Antigens in the honey are taken up by dendritic cells which interact with T lymphocytes triggering the Immunological response and the body produces antibodies against antigens. Gold nanoparticles bind with ghee and honey then cross the Blood Brain Barriers and give Medhya (intellect-promoting) effect. The blood-brain barrier (BBB) has a lipophilic molecular structure. This makes the lipids and lipid-soluble drugs pass easily through BBB. So, the drugs are given in the form of Ghrita which are lipids rapidly absorbed in the target areas of the central nervous system. Honey polyphenols prevent memory disorders and induce memory production at the molecular level. The channel to the mind is also cleared and thus reduces stress at a physical and biological level. The property of ghee in enhancing cognitive abilities and balancing chemical changes in the brain is appreciable.

Conclusion:-

Suvarnaprashana showed a value for Intelligence quotient (IQ) was 99.05 before treatment which increased to 118.37 after treatment with an improvement of about 19.50% showing a significant change in the parameter (P-Value < 0.05). The intervention of Suvarnaprashana enhances every parameter of IQ verbal and performance IQ.

Limitation and suggestion

The small sample size and fewer Intelligence quotient (IQ) parameters of assessment were the limitations of the study. IQ is a development that continues throughout life, it is not enough to assess with these parameters.

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