

Impact of integrated yoga practice on the cognitive function of mentally challenged persons

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Abstract

Background and Objectives: To investigate if integrated yoga practice affects the cognitive performance of mentally challenged persons.

Materials and Methods: Eighty clinically diagnosed mentally challenged persons aged between 12 - 25 years were randomly allotted to control and study groups. Study group practiced Pranayama (Nadishodhan and Kapalbhathi), Aum chanting and Meditation for 30 minutes daily, 6 days in a week for 3 weeks. Control group carried on with their normal school routine. Cognitive Functions Tests (CFT) were performed as per the standard guidelines for the verbal comprehension, under the subcategories of picture vocabulary, verbal analogies and general information. The parameters were measured twice, first before the starting of the intervention and later at the end of the follow-up period.

Results: Both the groups were comparable in their baseline scores of CFT. At follow-up, the scores of picture vocabulary and verbal analogies subcategories were higher in both the groups but the improvement in study group was significantly higher as compared to control group. The general information subcategory showed significant improvement only in study group.

Interpretation and Conclusion: This study demonstrates the beneficial influences of pranayama and meditation on verbal comprehension which requires semantic memory and word processing. Thus we interpret that regular integrated yoga practice has positive influence on the hippocampus, medial temporal lobe and Wernicke's area which are involved in verbal comprehension. It may further contribute in improvement of overall intelligence of mentally retarded persons.

Keywords: Nadishodhan, Kapalbhathi, Aum, Pranayama, Meditation, Mental retardation, Cognitive, Comprehension

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Introduction

Esquirrel described the Mental Retardation (MR) as a disorder of development instead of a disease, which onset during childhood or adolescence. During recent past, MR is established as a functioning disorder which includes abnormal intellectual functioning and commensurate deficits in adaptive functioning¹. During the nineteenth century brain used to be viewed in terms of coarse simple matter which does not change much after the childhood. But today we know that the brain is a continually changing organ, not only in its function but also in its structures. This opens up the possibilities of that the persons with MR can be trained and helped at any stage of their life to be able to lead a near normal social and family life. French educator Seguin was among the first to propagate the view of "special training" to MR children¹.

Yogic practices are known to affect the cardiac, respiratory and mental status of people. Mental repetition of 'AUM' results in a physiological state characterized by reduced physiological alertness, increased sensitivity as well as synchronicity to sensory transmission². Pranayama makes use of the voluntary regulation of breathing to make respiration rhythmic and calm the mind. Subbalakshmi et al found that practice of Nadishodhan Pranayama modulates cardiac autonomic status with improved cardio-respiratory performance and higher functions of brain³. Kapalbhathi Pranayama, promotes decarboxylation and oxidation mechanisms in the lungs which are believed to "quiet" the respiratory centres while stimulating the other nerves⁴. Meditation can aid in the treatment of some specific disabilities and psychiatric disorders⁵. Yoga can improve the concentration in children with disabilities⁶. Specific behaviours related to symptoms and problems of Attention Deficit/Hyperactivity Disorder was decreased, resulting in increased academic achievement and decrease in behavioural problems after Yoga session incorporated in the school curriculum for 3 months⁷. Yoga can bring improvement in frontal lobe functions of children with autism⁸. Deaf and dumb children improved in self-confidence, emotional stability, overall social adjustment and intelligent quotient after yogic practices⁹. After yoga

practice, children with MR can be improved considerably in the intellectual performance and social adaptation¹⁰.

The various reports on beneficial effects of yoga prompted me to research further the impact of Pranayama (Nadishodhan and Kapalbhathi) and Aum chanting on the cognitive functions of mentally challenged children.

Materials and Methods

The present study was designed as a randomized control trial of "Integrated Yogic Practice" on mentally challenged children attending St. Agnes Special School, Mangalore, Karnataka, India. The study was conducted after obtaining approval of institutional ethical committee and written approval and consent of the principal of this special school.

Study Subjects: Out of 100 clinically diagnosed persons with MR, 80 persons aged between 12 to 25 years were included in the study and were randomly and equally allotted to the control and the study group.

Exclusion criteria: Twenty subjects suffering with severe mental retardation, cerebral palsy, severe sensory deficit, severe hyperkinetic syndrome, and

physically handicapped were excluded from the present study as they were not at all able to follow the instructions.

Intervention: Study group (40 subjects) were trained for 3 days consecutively for "Integrated Yogic Practice" which included Nadishodhan Pranayama, Kapalbhathi Pranayama, 'AUM' chanting and meditation. Later, pranayama and meditation was practiced under the strict supervision of investigator and other school teachers for 30 minutes daily during 9 AM to 9.30 AM, 6 days in a week excluding Sunday, for 3 weeks.

The yogic procedures were based on the descriptions of the book "Hatha Yoga Pradipika" and simplified for the easy grasp and practice by mentally retarded persons.

Nadishodhan Pranayama (alternate nostril breathing): It is slow and deep uni-nostril breathing. Sitting in cross legged posture, keeping the spine and head erect and straight, 1st the right nostril is kept close during first exhaling and then inhaling through the left, then, left nostril is kept close while first exhaling and then inhaling through the right¹¹. The process was repeated for 5 minutes.



Fig. 1: Nadishodhan Pranayama: Being Instructed & Being Performed

Kapalbhathi Pranayama (fast and forceful exhalation with abdomen contraction): A type of diaphragmatic breathing where sitting in cross legged posture, keeping the spine and head erect and straight, expiration is done forcefully through both the nostrils together by contracting the abdominal muscle while inspiration remains spontaneous and effortless¹². The process was repeated for 5 minutes.



Fig. 2: Kapalbhathi Pranayama: Being Instructed & Being Performed

Aum chanting and Meditation: Aum chanting was done for 5 minutes. All three syllables of 'AUM' were chanted separately in a single breath, keeping it slow and as long as possible. Meditation was done sitting in cross legged posture, keeping the spine and head erect and straight, and palms were kept comfortably on respective knees. Eyes were closed while mind observed the movement of the breath over the abdomen. Meditation was done for 15 minutes after the pranayamas.

Control group subjects were matched for chronological age, sex, waist-hip ratio, BMI, and environmental background to that of the study group. They did not participate in yogic practice; instead, were left to carry on with their normal school routine.

Cognitive Functions Tests (CFT) was done according to the guidelines provided by Woodcock-Johnson III Tests of Cognitive Abilities (WJ III COG)^{13,14}. Cognitive functions were evaluated for verbal comprehension under the sub categories of picture vocabulary, verbal analogies and general information. Sample Questions are given in Fig. 3.



Fig. 3

The parameters were measured twice. 1st recording was done before the starting of the intervention and 2nd at the end of follow-up period in both control and study groups.

The obtained data was analysed using SPSS 2012 version 7.5. Unpaired-t test was applied to unpaired data of independent observations made in two separate groups. Paired t test was applied to paired data of independent observations from one sample only. T-

values and p-values were compared. Statistical significance was taken to be a p value of less than 0.05.

Results

Out of 40 subjects in the control group, only 36 were available for follow-up.

The baseline mean score of subcategory of verbal comprehension namely, picture vocabulary, verbal analogies and general information were comparable between the groups, as shown in Table 1.

Table 1 - Comparison of baseline score of each sub-category of verbal comprehension test between the control and the study groups

Parameters	Control group	Study group	t-value	p-value
	(Mean \pm SD)	(Mean \pm SD)		
Picture Vocabulary	0.89 \pm 1.06	0.75 \pm 0.93	0.608	0.54 ns
Verbal Analogies	0.94 \pm 1.12	0.85 \pm 0.95	0.398	0.69 ns
General information	7.47 \pm 2.10	7.40 \pm 1.89	0.158	0.87 ns

ns = non-significant

After 3 weeks of yoga practice, the improvements in all these 3 parameters were highly significant in study groups as compared to their baseline score, as shown in Table 2.

Table 2. Comparison between the baseline score and the follow up score of verbal comprehension test response in study group

Parameters	Baseline	Follow-up	Mean difference	t-value	p-value
	(Mean \pm SD)	(Mean \pm SD)	(Mean \pm SD)		
Picture Vocabulary	0.75 \pm 0.93	2.3 \pm 0.89	-1.55 \pm 0.90	10.84	<0.001**
Verbal Analogies	0.85 \pm 0.95	2.27 \pm 0.93	-1.42 \pm 1.11	8.143	<0.001**
General information	7.40 \pm 1.89	8.50 \pm 1.32	-1.10 \pm 1.33	5.208	<0.001**

**p value \leq 0.005 is highly significant

The improvements in follow-up scores were significantly higher in study group as compared to the control group, as shown in Table 3.

Table 3. - Comparison of follow up score of verbal comprehension of study and control group

Parameters	Control group	Study group	t-value	p-value
	(Mean \pm SD)	(Mean \pm SD)		
Picture Vocabulary	1.39 \pm 1.31	2.3 \pm 0.89	3.58	<0.001**
Verbal Analogies	1.28 \pm 1.23	2.27 \pm 0.93	4	<0.001**
General information	7.63 \pm 1.77	8.50 \pm 1.32	2.415	0.018*

*p value \leq 0.05 is significant & **p value \leq 0.005 is highly significant

The improvements in follow-up scores in control group were also noticeable in picture vocabulary and verbal analogies. The general information subcategory showed no significant improvement compared to their baseline scores, as shown in Table 4.

Table 4 - Comparison between the baseline score and the follow up score of verbal comprehension test response in control group

Parameters	Baseline	Follow-up	Mean difference	t-value	p-value
	(Mean \pm SD)	(Mean \pm SD)	(Mean \pm SD)		
Picture Vocabulary	0.89 \pm 1.06	1.39 \pm 1.31	-0.50 \pm 0.81	3.701	<0.001**
Verbal Analogies	0.94 \pm 1.12	1.28 \pm 1.23	-0.33 \pm 0.79	2.523	0.016*
General information	7.47 \pm 2.10	7.63 \pm 1.77	-0.167 \pm 0.94	1.063	0.29 ns

*p value \leq 0.05 is significant; **p value \leq 0.005 is highly significant;

ns = non-significant (p value \geq 0.05)

Discussion

Yoga had been shown to positively influence the cognitive functions and the academic performances of both normal and mentally retarded population^{7,9,10}. The results of the present study are in agreement with the previous research works demonstrating the beneficial effects of pranayama and meditation on the cognitive functions, especially the verbal comprehension in mentally challenged population.

The control group was not completely controlled for intervention. While the study group was practicing Yoga for half an hour in the morning, the control group participated in routine school work schedule, which included twice a week Yogasanas (but not pranayama and meditation), once a week singing, dancing and March past. This may explain why in the subcategories of picture vocabulary and verbal analogies, the

improvement was observed in both study & control groups (Table 2 and 4), although the degree of improvement was significantly higher in study group (Table 3) after practicing 3 weeks of yoga.

The present study shows that although the practice of pranayama and meditation improves verbal comprehension as whole, it has more effect on the general information ability of persons with MR. Verbal comprehension requires semantic memory and word processing ability. Semantic memory formation is achieved through hippocampus and medial temporal lobe whereas word-processing is the function of Wernicke's area of temporal lobe^{15,16,17}. Thus we hypothesize that regular practice of Nadishodhan, Kapalbhathi pranayama, Aum chanting and meditation may have positive influence on these brain areas which

may further contribute in improvement of overall intelligence of mentally retarded population.

This study was carried out within the frame work of special school curriculum. Therefore this study is with certain limitations:

1. Owing to the practical difficulties faced in handling and assessing mentally retarded children, all the subjects could not be assessed together. The time taken for CFT evaluation extended for 8 days. Therefore, only long lasting effects of yogic practice could be established.
2. This was a study on “Integrated Yoga” combining of pranayama, ‘AUM’ chanting and meditation. So, individual effect of each yogic practice couldn’t be investigated.
3. This study did not evaluate the complete woodcock Johnson III cognitive function test battery.
4. The same set of task was repeated at baseline and at follow-up.

Conclusion

The practice of integrated yoga is beneficial in improving the cognitive functions of mentally challenged children. It has more effect on the ability of general information of verbal comprehension. The curriculum followed in this school also improves the cognitive functions though not to the extent of additional integrated yogic practice.

Integrated Yoga practice proved beneficial for this group of subject. Further, research is needed to incorporate more numbers of subjects and to investigate the cognitive functions more thoroughly to be able to extrapolate the result to general cohort.

Conflict of Interest

It was self-funded research work and none of the author has any financial and personal relationships with other people or organizations that could inappropriately influence (bias) our work.

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