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Immediate effect of single session *Mula Banda* practice on cognitive functions among adolescents

Zalak Patel¹, Vijayakumar PS², Sahana AU³

¹Research scholar, MSc (Yoga), Department of Astanga Yoga, Lakulish Yoga University, Chharodi, Ahmedabad, Gujarat, India.

²Associate Professor, Department of Astanga Yoga, Lakulish Yoga University, Chharodi, Ahmedabad, Gujarat, India.

³Clinical Psychologist, Department of Astanga Yoga, Lakulish Yoga University, Chharodi, Ahmedabad, Gujarat, India.

ABSTRACT

Background: Adolescence is a critical period of neurobiological processes that underlie higher cognitive functions and social and emotional behaviour; cognitive functions are important skills for academic performance. Today's adolescents are struggling to enhance their cognitive abilities due to various new demands and options. There is also an increased academic stress & peer pressure to succeed in school, partly due to increased competition and also due to a diverse range of options available. Techniques to improve these skills are not taught either in education courses. Any practice which can improve these skills will be of value in schools, universities, and workplaces. The objective of the study was to determine whether single session of *Mula Banda* could enhance the cognitive functions. **Material & Methods:** 30 adolescents who had enrolled for the single session *Mula Banda* intervention. Their ages ranged between 12 to 18 years (group average \pm S.D., 14.4 ± 1.3 years; both genders). Those who have eye problem, neurological problems and mental illness, and those who are not willing to participate were excluded. *Mula Banda* was given for 10 minutes in a single session. Before and after the session, all participants completed DLST, SLCT and DVT tests. **Result:** single session *Mula Banda* practice showed significant change in DLST scores, increase (P-value < 0.000) in total attempted score, significant increase (P-value < 0.000) in net score, significant reduction in wrongly attempted score (P-value < 0.000). Significant change in SLCT scores, significant increase (P-value < 0.000) in total attempted score, similarly, significant increase (P-value < 0.000) in net score, significant reduction in wrongly attempted score (P-value < 0.000). Also, significant change in DVT scores, significant increase (P-value < 0.000) in total time taken, similarly, significant reduction (P-value < 0.000) in errors. **Conclusion:** findings suggest that even a single session *Mula Banda* practice could enhance the cognitive function among adolescents.

Key words: Cognitive functions, *Mula Banda*, Adolescents, SLCT, DLST, DVT.

INTRODUCTION

Adolescence is a time of developmental changes and reorganization in the brain and stress systems; Indeed, adolescence is characterized by functional maturation of cognitive processes, in particular of

attention and executive functions.^[1] Adolescents in today's world face numerous expectations and constant stimulation through technological advancements. Globalization is exposing the adolescents to various new demands and options. There is also an increased academic stress & peer pressure to succeed in school, partly due to increased competition and also due to a diverse range of options available. Further the society offers plenty of distractions and unwelcome attractions.^[2] Several studies demonstrating that early-life stress in humans represents a neurodevelopmental risk with implications for subsequent cognitive abilities.^[3] Given the paucity of data on the key factors contributing to the detrimental effects of adolescence stress on cognitive functions, no effective strategies have been developed to prevent or cure these problems. Schools, in particular, have increased the

Address for correspondence:

Zalak Patel

Research scholar, MSc (Yoga), Department of Astanga Yoga, Lakulish Yoga University, Chharodi, Ahmedabad, Gujarat, India.

E-mail: zalakpatel139@gmail.com

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implementation of yoga in educational curriculums in response to increased stressors as a means to positively impact overall student health including fitness, mental health, social relationships, and self-awareness.^[4] In this respect, Mulabanda is one of the key Yogic practice that could contribute to enhance cognitive functions. Hence, the present study was designed to assess whether single session Mulabanda would enhance the performance in cognitive tasks specific for sustained attention and alertness.

MATERIAL AND METHODS

Thirty adolescents who had enrolled for single session Mulabanda intervention. Their ages ranged between 12 to 18 years (group average \pm S.D, 14.4 \pm 1.3 years; both genders). We have fully explained the potential risks and benefits in the study before written informed consent was obtained from the participants; the study was approved by the ethics committee of the institution, Lakulish Yoga University, located in Ahmadabad, Gujarat, India. The selection criteria included: Subjects who were healthy, age between-12-18yrs, those knowing English, willing to participate were included. In this study we adopted a convenient sampling method to recruit the subjects who were undergoing single session Mulabanda practice, a single group pre-post design was used.

Intervention

Mula Bandha is a most important part of the Hatha Yoga tradition often shadowed of its real grace and benefits due to lacunae of proper knowledge. The Sanskrit word *Mula* means "root, source, basis, lowest part or bottom, foundation." *Bandha* means "lock, restrain, shut or close." The heel should press the perineum, the muscles should be contracted and the gas (*Apana Vayu*) should be lifted upwards. This results in *Mula Bandha*. (H.Y.P 3/61). At the physical level, the practice of *Mula Bandha* tones and strengthens the muscles of the pelvic region, especially the perineum, also playing a major role in increasing the parasympathetic activity, Studies have suggested that sensations from the pelvis are conveyed within the sacral parasympathetic system, with a lesser contribution from the sympathetic

thoracolumbar system.^[5] Increased Parasympathetic arousal is associated with states of heightened attention and well-being^[6] thus *Mula Banda* practice enhances cognitive functions, also in the treatment of Mild cognitive decline, *Mula Bandha* may be used as both a therapeutic and preventive practice.

Mechanism of Mula Banda

The probable mechanism of *Mula Bandha* on cognitive functions has been shown in Figure 1.

Assessments

SLCT - Cancellation tests require visual selectivity and a repetitive motor response. A six-letter cancellation test was administered to assess functions such as selective and focused attention, visual scanning, and the activation and inhibition of rapid responses. The six letter cancellation test has been used in similar type of design on Indian population.^[7] The six letter cancellation task worksheet consists of an array of random alphabets, A-Z, in 14 rows and 22 columns. Participants were asked to sit with the worksheet distributed to each one. The instructions are given asking them to cancel as many target digits as possible in the specified time. They are asked to cancel as their wish whether horizontally, vertically, or selecting a particular letter one at a time randomly in the row. Finally, after knowing the test instructions they are asked to start the test, each test was conducted for 90 seconds on a standard stopwatch.

DLST - Digit letter substitution test contains flexibility at mind level, visual scanning, attention and psychomotor speed of processing information. It is used with same type of design on Indian population.^[7] DLST worksheet consists a row of random digits, 1-9, in 8 rows and 12columns. The coding sheet contains instructions about the test with example of substituting a specific letter for specific digit 1-9, the same code is applicable to entire test. Subjects were instructed to make their choice of letter substitution process, whether horizontally, vertically, or selecting a particular digit randomly in the row one at a time. In given time of 90 seconds' substitute as many target digits as possible.

DVT - Sustained attention was measured using a digit vigilance test (DVT) of proven validity and reliability,^[8] which consisted of the numbers 1 to 9 arranged randomly in rows. Each sheet had 50 rows with 30 digits per row. The participants were instructed to cancel only 2 digits (6 and 9) as quickly as they could. They were asked not to: (i) cancel other digits or (ii) miss any of the target digits (6 and 9). The total time taken to complete the test and the number of errors made were noted.

Data Analysis

The data recorded before and immediately after the single session of Mula banda practice were compared with t-test and wilcoxon signed rank test for paired using SPSS version 16.0.

RESULTS

A total of 30 subjects were participated in the study 30 subjects completed the study, which was conducted at the end of single session *Mula Banda* practice; Mean values and standard deviation for total scores, wrong substitutions, and net scores of six-letter cancellation task and digit-letter substitution task along with digit vigilance test scores.

DLST : Digit substitution test

Immediately after single session of *Mula Banda* it showed that 6.1% significant increase ($P < 0.000$) in total attempted score on DLST. Similarly, there was 6.2% significant increase ($P = 0.000$). However, there was 70% decrease in wrongly attempted score. [Table 1].

SLCT: Six letter cancellation test

Immediate after one session of *Mula Banda* it showed that 10.9% significant increase ($P < 0.000$) in total attempted score on SLCT. Similarly, there was 11.03% significant increase ($P < 0.000$). However, there was 80% decrease in wrongly attempted score. [Table 2].

DVT: Digit vigilance test

Immediately after single session of *Mula Banda* it showed that 10.6% decrease in total time taken and 70% decrease ($P < 0.0001$) in error scores for DVT [Table 3].

DISCUSSION

The present study intended to study the immediate effect of single session of *Mula Banda* practice on the performance in cognitive tasks among adolescents. Improvement in the performance of cognitive task not only requires sustain attention and psychomotor speed, but also visual scanning and cognitive flexibility. Decrease in total time taken and error scores in SLCT, DLST and DVT following single session *Mula Banda* practice suggest improvement in cognitive task performance. Thus, the present study suggests a significant increase in sustain attention, cognitive flexibility, vigilance in adolescents following single session of *Mula Banda* practice. Although the application of Mind-body practices, such as yoga, in adolescents is an emerging field of scientific inquiry. Recent evidences support this concept, whereby Mind-body practice strengthen basic cognitive and emotional neural processes, which in turn result in improved cognitive and behavioural functioning in the classroom.^[9] Previous findings clearly state that yoga practice improves several aspects of cognition and executive functions in adolescents.^[10] Improvement of cognitive functioning not only requires sustain attention, but also cognitive flexibility, working memory, and inhibition control.^[11] Decrease in total time taken and error scores in SLCT, DLST and DVT following *Mula Banda* practice suggest improvement even in Executive Function (EF). Yoga practices include regular practice of maintaining attention on a particular sensory experience, such as the sensation of breathing or somatic experience such as muscle contraction during *Mula Banda*. By maintaining this state of awareness leads to activation of the parasympathetic nervous system, cognitive abilities to regulate attention and emotion are reinforced, However, there is preliminary evidence supporting the notion that physiological mechanisms such as improved regulation of the autonomic nervous system and increased Parasympathetic activity.^[12] May help to explain the effect of *Mulabanda* on cognitive functions. Present study suggests that even single session of *Mula Banda* practice could help to enhance the cognitive functions, that intern promote their

academic progress. Limitation of the present study was that it was a single session intervention without have a control group.

CONCLUSION

A single session of *Mula Banda* practice was successful in improving cognitive functions, particularly sustain attention, working memory capacity among adolescents, a longer follow-up period will enable researchers to thoroughly examine neuro-cognitive changes. Although this was limited by single session, small sample size, lack of heterogeneous population, this finding suggest rigorous systematic approaches and advanced imaging techniques to examine Mula banda as a potential tool to enhance executive functions and promotes academic performance among adolescents.

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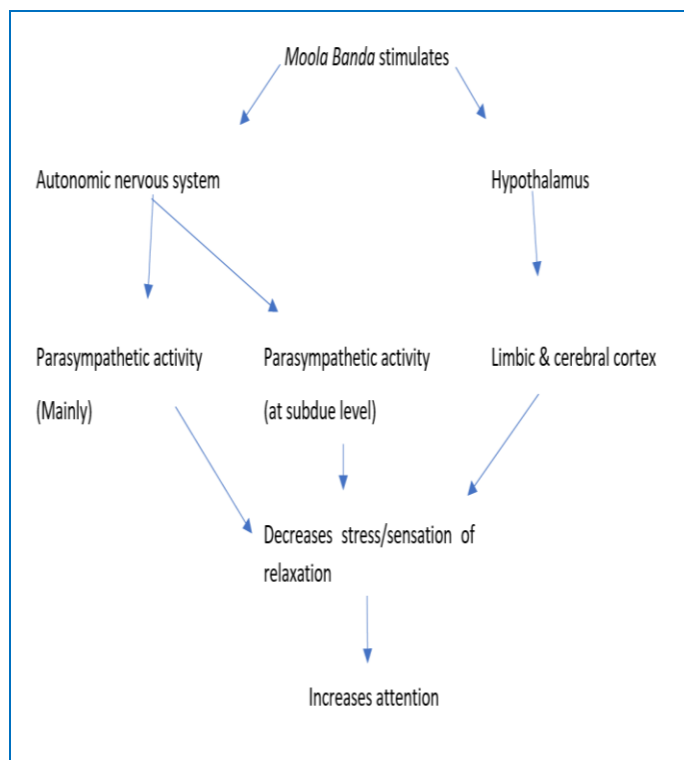


Fig. 1: Schematic representation of Mula Banda on cognitive functions

Table 1: DLST changes immediately after single session of Mula Bandha

DLST Score	Practice of Bandhas Before	Practice of Bandhas After	% Change	p
Total Attempt	58.73 ± 8.64	62.33 ± 9.2	6.12	0.000***
Wrong Attempt	0.1 ± 0.36	0.03 ± 0.42	70	0.000***
Net Score	58.63 ± 8.61	62.30 ± 9.15	6.25	0.000***

*significant at P<0.05, ** significant at P<0.01, ***significant at P<0.00

Table 2: SLCT changes after practicing Moola Bandha

SLCT Score	Practice of Bandhas Before	Practice of Bandhas After	%Change	P-Value
Total Attempt	44.46 ± 11.24	49.33 ± 12.78	10.95	0.000***
Wrong Attempt	0.1 ± 0.40	0.02 ± 0.23	80	0.000***
Net Score	44.4 ± 11.21	49.30 ± 12.78	11.03	0.000***

*significant at P<0.05, ** significant at P<0.01, ***significant at P<0.00

Table 3: DVT changes after practicing Moola Bandha

Variables	Pre Mean± SD	Post Mean± SD	% Change	P-value
DVT task: Time Taken (in minutes)	5.00	4.47	10.6	0.000***
DVT task: No. of errors	0.13	0.03	70	0.000***

*significant at P<0.05, ** significant at P<0.01, ***significant at P<0.00

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