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# Effects Of Slow Deep Breathing Exercise Versus 'OM' Chanting On Attention Memory In School Children

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*Abstract :* Slow Deep breathing (SDB) is slow nasal inspiration occurring more slowly than the resting respiratory rate. 'OM' chanting is the most effective ayurvedic tool to heal the mind from the deepest layer to its surface action and allow us to change the energetic structure of the mind. Attention is defined as involving a number of processes including filtering perceptions, balancing multiple perceptions and attaching emotional significance to these perceptions. Memory involves ability to learn and perform tasks and holding information briefly until it gets converted to long term memory. There is dearth of evidence in pediatric population about effects of SDB and OM with respect to attention and memory. Letter cancellation Task (LCT) and Delayed Recall Memory Test (DRMT) are valid and reliable simple tests. School children were recruited after permission from IEC, CTRI and school authorities. Pre assessments of two divisions showed baseline match. Interventions were given online due to Covid pandemic. The post intervention of SDB and OM chanting groups showed improvement in the attention and memory scores within the groups but no statistical difference was found between the groups.
Hence we conclude that both SDB and OM chanting are effective but the effects on LCT and DRM tests were similar.

***IndexTerms*** **- om chanting, slow deep breathing, neuro physiotherapy**

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## I. INTRODUCTION

Breathing in humans is innate ability. The development of speech, attention, memory, occurs simultaneously. Speech is associated with breathing. Quiet breathing is done automatically, but it also has cortical control. Slow deep breathing (SDB) is one of the techniques given as part of physiotherapy treatment. It enhances cardio-respiratory, cognition and behavior functions through its influences on various systems of body. Inspiration is an active process. Expiration is a passive process. But during controlled or forced expiration, the muscles of expiration contract, which include: Anterior abdominal wall muscles and Internal intercostal muscles. Regulation of respiration is automatic as well as voluntary. Respiration is produced by rhythmic discharge of motor neurons that innervate the respiratory muscles. This discharge is totally dependent on a nerve impulse from the brain. It is managed by nervous and chemical mechanisms. Systems responsible for automatic control of respiration are located in the brainstem specifically upper medulla and pons. This respiratory center is located in the ventrolateral medulla overlying the olivary nucleus. The respiratory neurons show rhythmic discharge with varying frequencies and are of two type called inspiratory neurons and expiratory neurons.

**Slow Deep breathing (SDB)** is slow nasal inspiration occurring more slowly than the typical respiratory rate. Since breathing practices involve large volume inhalation through the nose with slow controlled exhalation through the mouth, sensory afferent input from these pathways may essentially guide cognitive centres during breathing exercises. SDB initiates neural activity reverberating to the whole brain. (3,4) Baroreceptor afferents detect elevated blood pressure during exhalation and stimulate parasympathetic outflow to the heart to lower blood pressure. SDB may modify cognition by promoting relaxation, reduced stress reactivity, enhance memory, mediated via olfactory bulb-driven neural oscillations that travel to the piriform cortex and onward to the hippocampal oscillatory activity and enhances memory performance in humans. (4,5) Slow nasal respiration is linked with slow brain rhythms and modulate local gamma activity in the medial prefrontal cortex, organizing prefrontal network activity. Thus, a global meditative state is achieved that is characterized by cognitive and behavioral relaxation, alertness, and improved memory. Physiological basis of attention and breathing can be detected in fMRI studies, as increase in beta activity in left frontal, midline, occipital brain regions, associated with enhanced attention, memory and executive functions. (5-7)

Speech activity involves the precisely coordinated muscle actions of the tongue, lips, jaw, and vocal tract to produce the recognizable sounds that make up language. Voice is the sound we make as air from our lungs is pushed between vocal folds in our larynx, causing them to vibrate. (8)

Speech Production: The speech organs consist of the lungs, trachea, larynx which contains the vocal cords, pharynx, nose, and mouth. When considered together, these organs comprise a "tube" referred to as the *vocal tract*, which extends from the

lungs to the lips. Moving the tongue, lips, and any other parts of the tract vary vocal tract shape. Changes in the configuration of the vocal tract act to modify the aerodynamic qualities of the air stream during speech. The primary function of the vocal organs is breathing and swallowing. Breathing for life-sustaining purposes are far more rapid than for speech production. A full cycle of inhalation/exhalation takes approximately 5 seconds, whereas while speaking we control the breathing rate according to the demands of the words and sentences, we are producing, sometimes reducing the rate of breathing to as little as 15% devoted to inhalation. When speaking, we generally take in enough air to vocalize a complete thought and we exhale the air gradually during the production of the thought. The steady stream of air exhaled from the lungs is the source of energy for speech production, which is made audible by the rapid vibration of thevocal cords. Neuroimaging research has reported findings that reflect the complexity of motor planning and control of vocal cord movement for voice production, showing that subcortical and cortical interactions control the movement of the vocal cords. Speech and language development in first 3 years of life, when the brain is developing and maturing, is the most intensive period for acquiring speech and language skills. (9

Louder and longer phonation requires deeper inspiration and, sometimes, active expiration to produce a sound than one with regular breath cycle. (10)

**'OM'** is the most sacred, powerful and significant of all syllables. It is the combination of three letters, A, U, M and it is the syllable of the past, the present and the future. OM is the force behind all thoughts and chanting OM will cause quiet mental state. (11) The practise of OM can be used as a powerful means of enhancing memory. Since ancient times, sacred sounds like 'OM'have influenced the emotional and intellectual progression of the human race. 'OM' chanting is the most effective ayurvedic tool to heal the mind from the deepest layer to its surface action and allow us to change the energetic structure of the mind. (11-13)

'OM' chanting creates vibration in cranial region, activates the prefrontal cortex, vagus nerve, amygdala also increasing the power and amplitude of the brain wave-theta increases the efficiency of brain, increasing attentiveness, concentration while eliminating disruption. (15,16)

**Attention** is defined as involving a number of processes including filtering perceptions, balancing multiple perceptions and attaching emotional significance to these perceptions. (15)

Attention develops from age of 6 months until middle to late childhood. (15,18). Attention mechanism is responsible for self –control, improving the ability to visually focus, listen and comprehend speech, while filtering out background stimulations. (15). Attention impacts self-control, working memory and cognitive flexibility. It is the first step in learning. (18,19). Sustained attention is a component of a general arousal system involved in attention. Areas of the brain involved in this general arousal/attention systems.

The general attention system is functional in early infancy but shows considerable development across infancy and early childhood with increased magnitude of heart rate response, increased periods of sustained attention, and decreased distractibility occurring with increasing age. (18,19). Selective attention, the ability to enhance the processing of certain stimuli while suppressing the information from other con-current stimuli, is critical for regulating external sensory input and occurs within and across sensory modalities This cognitive ability is fundamental for academic success (Blair and Razza, 2007; Rueda et al., 2010; reviewed in Stevens and Bavelier, 2012).

Auditory attention in particular is highly relevant to a school setting in which instruction and completion of assignments may occur in an acoustically noisy environment with competing speech streams. (20-,22). While the auditory system is maturing, the neural substrates supporting attention modulation of early sensory processing, such as frontal and parietal cortices are also maturing. 23)

**Memory** is defined as the ability to recover information about past events or knowledge. (24,25) It increases during middle childhood, where attention is crucial for encoding memory. (26) Implicit memory tasks depend on selective attention. Better memory improves social life and academics. (26). Working memory is the ability to learn and perform basic tasks, holding information briefly, and helping in transfer of information to long term memory. This ability increases from 4 to 14years. (26) Verbal memory refers to the storage of phonological information. This is strongly associated with auditory ability.

Spatial memory is defined as the ability to store information of color, shape, movement and location. (26) Both these abilities are a part of psychosocial and cognitive development.

**Letter cancellation Task** is a standardized paper and pencil test, with open access, which is used to assess selective attention. Common formats follow a tests pattern in which rows of letters or symbols or numbers are randomly interspersed with designated targets. Test participants are asked to identify targets while ignoring similar non-target distracter items. Participant's performance may be scored analyzing correct responses to targets, type and pattern of error responses, and time to task completion. Poor performance may indicate a variety of neuropsychological impairments. It is a valid and reliable tool for assessing attention in middle childhood and adolescent years. (r=0.781, p=0.002) [27]

The concept of working memory is used in multiple cognitive tasks. The Delayed Recall Memory test (DRMT) is used to measure cognitive performance (assessing verbal and spatial memory) in children, college students, elderly individuals and various brain damaged populations, with open access being available to use freely. The common element in these tasks is that, it involves processing and storage components. with a good validity and reliability value. (r= 0.74, p<0.05). [28]

**3.1Population and Sample**

36 standard 6th students of division A and 36 standard 6th students of division B of Gokhale Education Society, R.M. Bhatt High School and Junior College, Parel, Mumbai-12, SSC school

The students raged from 11- 12 years.

**3.2 Data and Sources of Data**

LCT and DRMT score of both groups were recorded with pen and paper. The students sent pics of the tests to email id provided. Both pre and post tests were mailed in view of pandemic and school being run online.

**3.3 Theoretical framework**

Provisional approval was sought in March 2021 from Gokhale Education Society, R.M. Bhatt High School and Junior College, Parel, Mumbai-12, SSC school for conducting study on students of 6th standard. Approval for study was later obtained from Institutional Ethics Committee in May 2021. (EC/84/2021). A MOU was made between principal Investigator and school authorities. Teachers and principal helped coordinate the pre assessment, intervention and post intervention time so that regular academic program was not disturbed. Orientation of parents was scheduled via a Google meet platform. Informed consent was taken from the parent/guardian by giving hard copies and fetching them back from school after 2 days. Written accent was taken from the children. The two groups, were SDB group1(n=36) and ii.OM group(n=36) were participants belonging to two divisions of 6th standard. Divisions were randomized to either of groups.

The base line scores for attention and memory, were taken on day 1 for the LCT and DRMT (Verbal and Spatial Memory Test) respectively.

Training of one week was given to all students. Training and intervention happened through google meet meetings scheduled each day on specified time. Investigator coordinated in teacher's presence to ensure attendance and participation each day.

For Slow deep breathing exercise: SDB group- The participants were trained by investigator and were allowed to practice SDB for 1 week, prior to the study.

The participants were seated comfortably & they were asked to place their palm on the belly. The instructions given were 'Focus on taking more air in your belly. Feel your belly rise, to the count of 3, given by investigator during breathing in and feel your belly falling during breathing out', to the count of 6. Later the intervention for deep breathing was for a duration of 2weeks. Repetition of the above, in the same way, for 10mins was daily for 5 days a week, for 2weeks, during school hours.

For 'OM' chanting: OM group Method:

Participants were seated comfortably with eyes closed and were asked to inhale deeply and silently. Exhalation was uttering Ommmm i.e Vowel 'O' for 5secs continuing into consonant 'M' for the next 10secs

Repetition of the above both interventions in the same way was done for 10mins daily for 5 days a week, for 2weeks, during school hours.

Both the groups were delivered the outcome measures on last day of the intervention.

## IV. RESULTS AND DISCUSSION

**4.1 Results of Descriptive Statics of Study Variables**

SDB group had 19 girls and 17 boys. Om chanting group had 18 girls and 18 boys.

The data obtained underwent statistical analysis in the IBM SPSS application. The following results were obtained.

Pre test comparison of LCT and DRMT between groups showed p value of 0.3 and 0.28 respectively suggesting a baseline match.

Table - Comparison of LCT and DRMT in each groups

| | **SDB group** | | **OM chanting group** | significance |
|---|---|---|---|---|
| Pre intervention | LCT | Mean: 18.333; S.D.: 7.2486 | Mean: 17.861 S.D. 6.985 | P=0.329; CI: 23-27 **NS** |
| | DRMT | Mean:5.614; S.D.: 1.380 | Mean: 5.805 S.D. 1.327 | P=0.285; CI:0.771-0.824 **NS** |
| Post intervention | LCT | Mean: 24.527; S.D. 6.403 | Mean: 23.91; S.D.: 5.015 | **p value= 0.08 C.I. 0.173 NS** |
| | DRMT | Mean: 6.194; S.D. 1.141 | Mean: 6.705; S.D. 1.327 | **P value= 0.082 CI 0.184 NS** |
| Pre-Post Significance | LCT | P value= 0.01; C.I.: 0.772- 0.088 **S** | P value: 0.002; CI 1.214- 1.71 **S** | |
| Pre-Post significance | DRMT | P value: 0.02; C I: 0.27-0.35 **S** | P value: 0.001; C I 0.65-0.74 **S** | |

Post intervention in SDB group the LCT mean scores increased from 18.33 to 24.52. The difference was statistically significant with p value 0.01
Post intervention in OM chanting group the LCT mean scores increased from 17.86 to 23.9. The difference was statistically significant with p value 0.002
DRMT mean score in SDB group increased from 5.6 to 6.1 with difference being statistically significant i.e p value 0.02
DRMT mean score in OM chanting group increased from 5.80 to 6.7 with difference being statistically significant i.e p value 0.001.
Comparing post intervention scores between groups showed p value of 0.08 for LCT scores and 0.082 for DRMT scores.

***Discussion***

Students reported better performance on the attention and memory tests taken after their sessions for slow deep breaths. The results show that taking a slow deep breath and following a regimen for the same for a duration of 10 minutes for once in the day, helps in directing attention towards one bodily physiological parameter and cause an overall improved attention and memory process [6, 28].
Probable mechanism for improvement is that Oxygen is an important constituent of brain chemical functioning and is proportionally linked to increase in re-vitalization of the brain process by its action on neurotransmitter release [28].
The major neurotransmitters associated with attention and memory are phenylethylamine (PEA), norepinephrine and dopamine by their action on reticular activating system. SDB causes greater lung excursion therefore increasing surface area for exchange of neurotransmitters. corticosteroid activity in the body. Corticosteroids are shown to decrease activity of MAO in brain, heart, liver and spleen. So, probably they would also decrease MAO activity in lungs thereby causing increased blood levels of PEA. This would increase PEA levels in the brain [28]. Thus, responsible for wakefulness and arousal.
While SDB, children focused on the breathing, this regular training probably caused the cortex to improve the ability to concentrate [28]. This supports our Hypothesis that slow deep breathing creates a better state of mind which allows for better performance on attention and memory tasks, which is consistent with a study conducted by Kiat hui Khng (2017).
While our short-term intervention may have limited immediate effects on attention and memory, a large sized study with a longer period of intervention is suggested to determine the lasting effects and potentially improved attention and memory.
Despite its modest effects, slow deep breathing is a simple breathing intervention with minimum technical challenges, requiring minimum resource.
The study substantiates that slow deep breathing can be easily taught and effectively learned even for a short duration in children as young as 11 years. The efficacy of the technique can be improved with practice and with longer time duration. It is an easily accessible relaxation tool, which when learnt can become self-regulatory and bring a better state of mind and improved performances in academics and other facets of development [6].
Post-intervention for 'OM' group, shows significant increased value. This is an improved effect of 'OM' chanting causing increased arousal [30] . OM' chanting probably causes increase in alpha band power activity, and theta band power activity, on the bodily functions therefore improving the ability to concentrate [29,31]. It suggests that there is activation in bilateral hippocampi during silent mantra meditation. The hippocampus is the storage and/or consolidation site of memories [29,30]. Other theories propose that the hippocampus serves as the librarian for memories and may also be tagging memories with respect to context; that is, the hippocampus keeps track of where memories are stored and in what context the memories were originally acquired. Thus, memory consolidation could be one possible explanation of hippocampal activation during meditation. Visuospatial memory was enhanced after a session with Buddhist deity meditation.[31]. Other areas with significant activation in the present study were the middle cingulate cortex and the precentral cortex. These areas are regarded to be involved with motor control and execution. The middle cingulate cortex is thought to be involved in orienting the body position in response to sensory stimuli and the precentral gyrus is defined as the motor cortex. The active areas can be involved in body awareness and sensations during meditation [29].
The study revealed that there was an improvement in both attention and memory in both the groups after both the interventions.

While comparing the post intervention test results of slow deep breathing and 'OM' chanting group signifying no profound superiority of either of the interventions on each other.

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