International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

To Study the Effect of Exclusive Unilateral Left Nostril Breathing on 'Visuo-Spatial Short Term Memory' in Undergraduate Medical Students

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Received: 16/06//2014 *Revised: 09/07/2014* *Accepted: 14/07/2014*

ABSTRACT

Visuo-spatial memory is the part of memory responsible for recording information about one's visual environment and its spatial orientation. Studies have shown that improvement in right hemisphere specific spatial memory after exclusive left unilateral nostril breathing in school children. In a medical college, practical classes involve demonstration of experiments to the students which are an integral part of teaching. Medical students need to have a good visuo- spatial memory in order to learn and reproduce the experiments that is demonstrated to them. However, not much information is available regarding such studies on visuo-spatial short term memory among medical students. The present study aims to establish significant correlation between exclusive left unilateral breathing with the right hemisphere related task using an easy to perform computerized test. A group of 10 medical students who practiced 'exclusive left unilateral breathing' formed the 'Test'group' while the remaining who did not, formed the 'Control group'. The visuo-spatial short term memory was assessed by administering the Corsi block-tapping test- a computerized psychological test once before and once after a round of exclusive unilateral left nostril breathing and measuring the difference in the score. The results were compared between pre and post on day 1 as well as day 10 for both the groups. In the test group, the difference in the Corsi score between pre and post test on the 10th day was highly significant (p=0.005). Further ,in the same test group, the comparison of Corsi span between the results of day-1 pre with that of day-10 post test showed even more significant difference (p=0.004).

Key Words: visuo-spatial short term memory, exclusive left unilateral nostril breathing, Corsi block-tapping test, Corsi-span, Corsi-score.

INTRODUCTION

In cognitive psychology and neuroscience, visuo-spatial memory is the part of memory responsible for recording information about one's visual environment and its spatial orientation.[(1)] Working memory (WM) is the cognitive system responsible for the temporary storage and manipulation of information. It plays an important role in both learning and focusing attention.

Short-term memory simply involves retaining information in mind for short period of time. Working memory, in contrast, involves mentally manipulating or 'working' with retained information and comes into play in a wide range of learning activities. [(2)] For example, a person's spatial

memory is required in order to navigate around a familiar city. With respect to this, in a medical college, practical classes involve demonstration of experiments to the students which are an integral part of teaching. Medical students need to have a good visuo- spatial memory in order to learn and reproduce the experiments that is demonstrated to them.

Studies have shown that improvement in right hemisphere specific spatial memory after 'yogic breathing' in school children. [(3)] Unilateral nostril breathing is said to influence cardiovascular and autonomic nervous system activity. [(4,6)] However, not much information is available regarding such studies of exclusive unilateral left nostril breathing (ELUNB) on visuo-spatial short term memory (VSSTM) among medical students.

The VSSTM is assessed by administering the Corsi block-tapping test, [(5)] a computerized psychological test once before and once after a round of exclusive unilateral left nostril breathing and measuring the difference in the score. The computerized test has the advantage of minimizing manual errors. Further the participants find the test enjoyable.

If a correlation is established between the two, it would provide an easy, accurate, cost effective and a harmless method of improving 'skills learning by observing' not only among medical students but also in those professions where it is an integral part. The results were statistically analyzed for significance by using Wilcoxon Signed Ranks Test- a type of NPar test.

Review of literature:

Rhythms of alternating cerebral dominance have been demonstrated in humans and other mammals during waking and sleeping. Human studies have used the methods of psychological testing and electroencephalography (EEG) as measurements to identify the phase of this natural endogenous rhythm. The periodicity of this rhythm approximates 1.5-3 hours when a person is awake. This cerebral rhythm is tightly coupled to another rhythm known as the nasal cycle, which is regulated by the autonomic nervous system, and is exhibited by greater airflow in one nostril, later switching to the other side. Relatively greater cognitive ability in one hemisphere corresponds to unilateral forced nostril breathing in the contralateral nostril. Cognitive performance can be influenced by forcibly altering the breathing pattern. [(7)]

The rhythm of cerebral dominance has also been identified by studies with tests of lateralized cognitive performance using left and right hemisphere dependent tasks. This rhythm plays an important role in cognitive performance, memory processes, visual perception, levels of arousal and performance, mood, and individual and social behavior. [(8)]

Sherley Telles et al have shown right nostril yoga breathing facilitates the activity of contralateral (left) hemisphere, in the performance of the P300 task. Yoga breathing through a particular nostril is associated with contralateral event-related potential changes. [(9)] An association has been reported between the dominant nostril through which we breathe and the cerebral hemisphere found to be active. However there are contradictory reports regarding nasal cycle influencing contralateral cerebral function. [(10,11)]

Some of the previous studies required an elaborate setup of recording EEG, while others have tested on left hemisphere dependant tasks. Not many studies are available which test the influence on right hemispheric dependant tasks. Hence the present study aims to establish significant correlation between exclusive left unilateral nostril breathing with the right

hemisphere related task using an easy to perform computerized test.

Aims & Objectives:

To observe any changes in the visuo-spatial short term memory after exclusive unilateral left nostril breathing in undergraduate medical students by using Corsi-block tapping test.

MATERIALS & METHODS

Study Sample: Healthy undergraduate medical students aged 18-20 years who can communicate in English, are chosen as subjects after obtaining their informed consent.

Sample size: 20 of which 10 formed the 'Test' group and the remaining 10 'Control' group

Subject Selection:

Inclusion Criteria

- Healthy medical students who did not have any nasal block or running nose, and have average comprehension, aged between 18-20 years.

Exclusion criteria

- Those with nasal block or running nose.
- The students who have been practicing unilateral nostril breathing.

A computer with internet connection was used to administer the online Corsi –block tapping

Procedure:

The participating medical students were asked to come to the department of Physiology after their classes. The subjects were asked to be seated in a comfortable sitting posture, with straight back. They were taught the procedure of exclusive unilateral left nostril breathing which involved normal inspiration and normal expiration through left nostril while firmly closing the right nostril. The procedure starts with closing the right nostril with the thumb of the right hand, followed by hold and exhalation through the left nostril and inhalation slowly through the same nostril. This forms 'one round'. This, they were asked to repeat 27 times. [4, 6]

Their visuo-spatial short term working memory [1] was assessed once before and once after performing unilateral left nostril breathing by administering the "Corsi- block tapping test".

The Corsi-block tapping test is a computerized online test that assesses visuo-spatial short term working memory (Fig-1). The process of Corsi-block tapping test requires the subject to observe the sequence of blocks lit up (illumined) in the computer screen, and then repeat the sequence back in order. The task starts with a small number of blocks and gradually increases in length upto nine blocks. The sequence starts out simple, usually using two blocks, but becomes more complex until the subject's performance suffers. This number is known as the "*Corsi-span*" (Block Span) and averages about 5 for normal human subjects. [12] The test measures both the number of correct sequences and the longest sequence remembered by the subject. When a subject commits mistakes twice, the test is taken as "over" and immediately the computer screen displays both the longest sequence remembered by the subject (Corsi span) and the total score of correct sequences (Corsi score). The test group practiced 27 rounds of exclusive left nostril breathing daily for 10 days under the direct supervision of the investigator whereas control group did not.

The results were compared between pre and post on day 1 as well as day 10 for both the groups. Since the comparisons are done in the two related groups; one between pre & post of control and test group and the other between day 1 and day 10 in the same participants, a

nonparametric statistical test, NPar Test-Wilcoxon Signed Ranks Test was applied to analyze the data to determine the statistical significance of the difference. For small numbers with unknown distributions this test is even more sensitive than the Student t-test. [13]

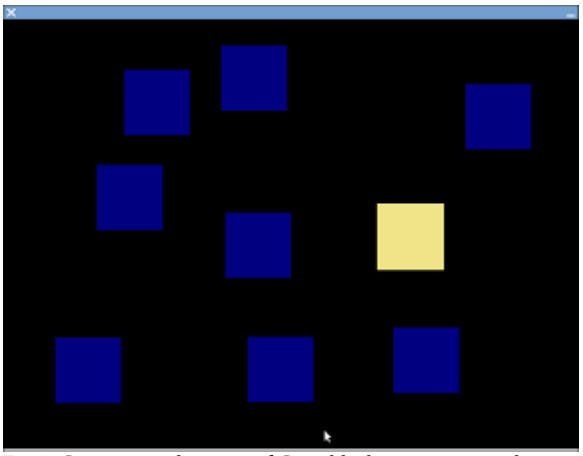


Fig-1. Computerized version of Corsi block tapping test with one illumined block.

On the day-1, the average 'Corsi span' in the control group and the test group was 5.4 and 5.5 respectively, while after a minute of normal breathing, it was 5.7 in the control and after 27 rounds of unilateral left nostril breathing it was 5.8 in test group.

Similarly, the average 'Corsi score' in the control group and test group was 45 and 47.2 respectively, while after a minute of normal breathing it was 50 in the control group and after 27 rounds of unilateral left nostril breathing 51.4 in the test group. It may be noted that these changes were not significant.

On the day-10, the average 'Corsi span' in the control group and the test group was 5.7 and 5.9 respectively, while after a minute of normal breathing, it was 5.7 in the control and after 27 rounds of unilateral left nostril breathing it was 7.0 in test group.

Similarly, the average Corsi score in the control group and test group was 52.5 and 52.7 respectively, while after a minute of normal breathing it was 49.6 in the control and after 27 rounds of unilateral left nostril breathing 74.9 in the test group.

OBSERVATIONS & RESULTS

Table 1: Results of Corsi block tapping test

	Control group (n=10)			Test group(n=10)		
Days		CORSI SPAN (average)	CORSI SCORE (average)		CORSI SPAN (average)	CORSI SCORE (average)
Day-1	Pre*	5.4	45	Pre**	5.5	47.2
	Post*	5.7	50	Post**	5.8	51.4
	Probability	0.257	0.206	Probability	0.083	0.225
Day-10	Pre*	5.7	52.5	Pre**	5.9	52.7
	Post*	5.7	49.6	Post**	7	74.9
	Probability	1	0.491	Probability	0.005***	0.005***
Comparison between day-1 pre test results with that of day-10 post test	**Probability**	**0.18**	**0.31** 6	**Probability**	**0.004*** **	**0.005*** **

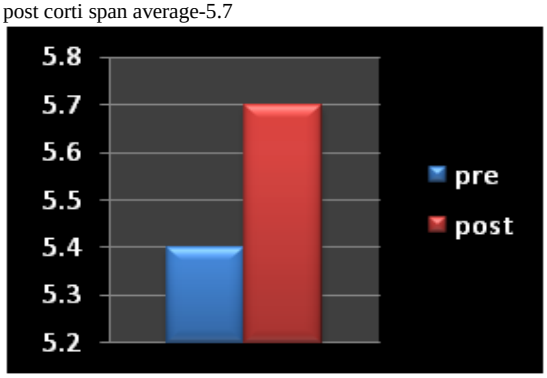
**Pre and post for control subjects means before and after 1 minute of normal breathing*
*** Pre and post for test subjects means before and after 27 rounds of left unilateral nostril breathing)*
**** Probability is <0.05: significant, <0.005:highly significant*

In the test group, the difference in the Corsi score between pre and post test on the 10th day was highly significant (p=0.005). Further, in the same test group, the comparison of Corsi span between the results of day-1 pre with that of day-10 post test showed even more significant difference (p=0.004).

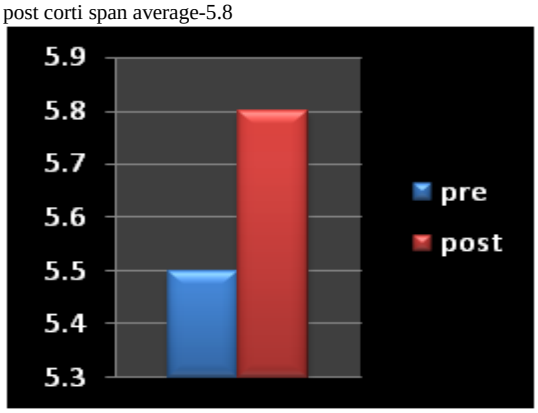
Note: The graphs showing the results are arranged one below the other on the right

hand side for the control group and Left hand side for the test groups respectively

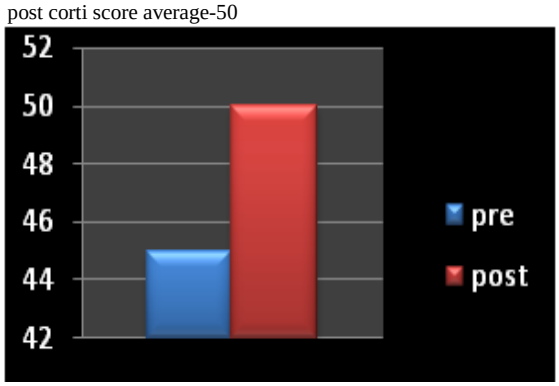
CONTROL SUBJECTS
DAY 1-PRE AND POST(CORTI SPAN)
{probability: 0.257}
pre corti span average-5.4
post corti span average-5.7



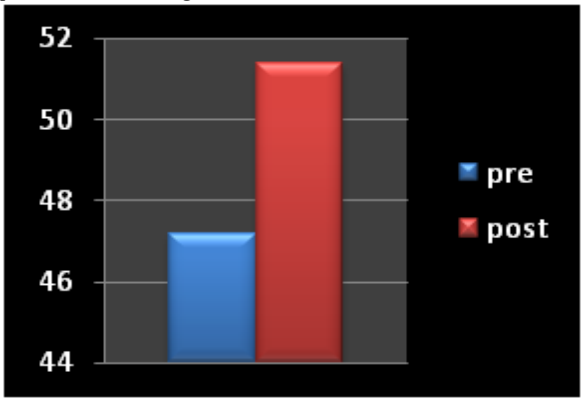
TEST SUBJECTS
DAY 1-PRE AND POST(CORTI SPAN)
{probability: 0.083}
pre corti span average-5.5
post corti span average-5.8



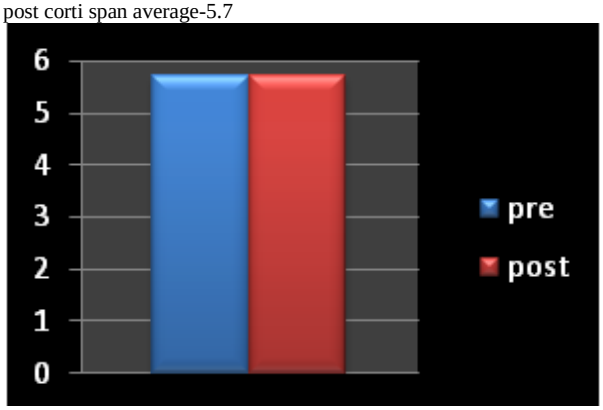
CONTROL SUBJECTS:
3.DAY 1-PRE AND POST(CORTI SCORE)
{probability: 0.206}
pre corti score average-45
post corti score average-50



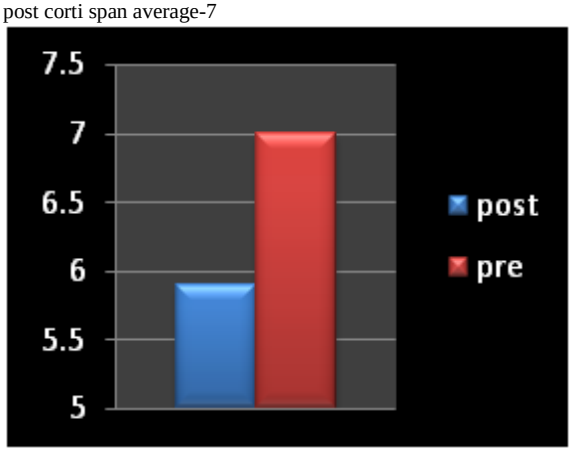
TEST SUBJECTS:
4.DAY 1-PRE AND POST(CORTI SCORE)
{probability: 0.225}
pre corti score average-47.2
post corti score average-51.4



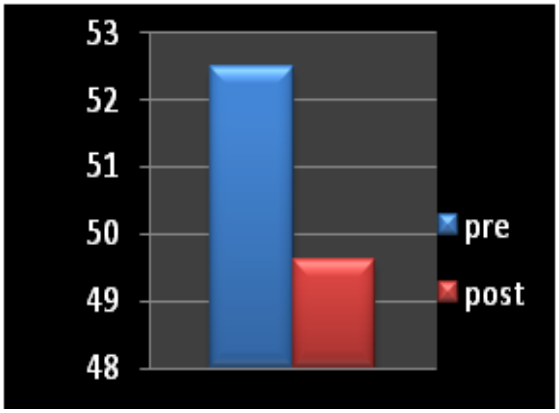
CONTROL SUBJECTS:
5. DAY 10-PRE AND POST(CORTI SPAN)
{probability: 1}
pre corti span average-5.7
post corti span average-5.7



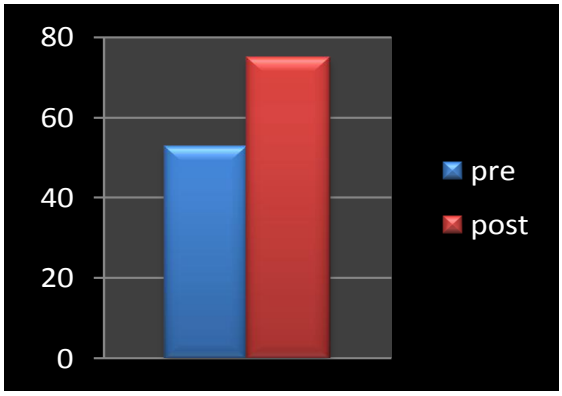
TEST SUBJECTS
6. DAY 10-PRE AND POST(CORTI SPAN)
{probability: 0.005}
pre corti span average-5.9
post corti span average-7



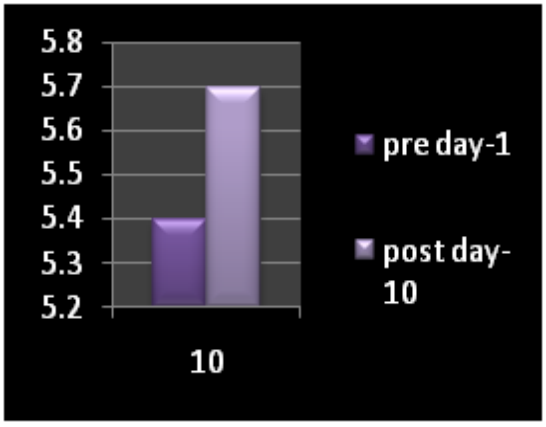
CONTROL SUBJECTS
7. DAY 10-PRE AND POST(CORTI SCORE)
{probability: 0.491}
pre corti score average-52.5
post corti score average-49.6



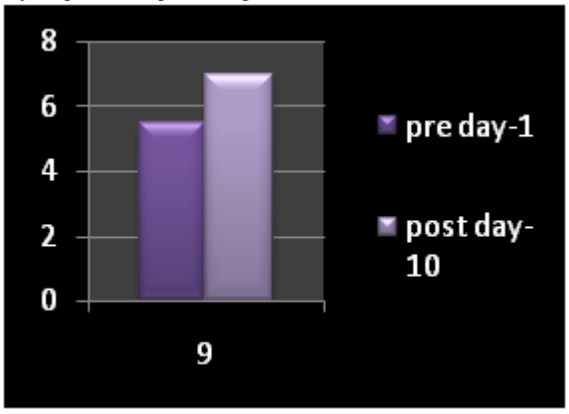
TEST SUBJECTS
8.DAY 10-PRE AND POST(CORTI SCORE)
{probability: 0.005}
pre corti score average-52.7
post corti score average- 74.9



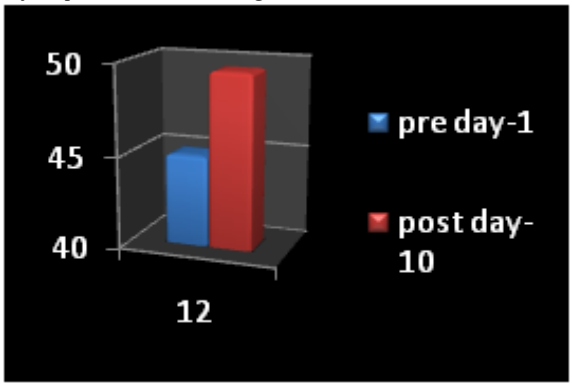
CONTROL SUBJECTS
9.COMPARISION OF CORTI SPAN PRE DAY-1 AND POST DAY-10 (probability 0.18)
day-1 pre corti span average-5.4
day-10 post corti span average-5.7



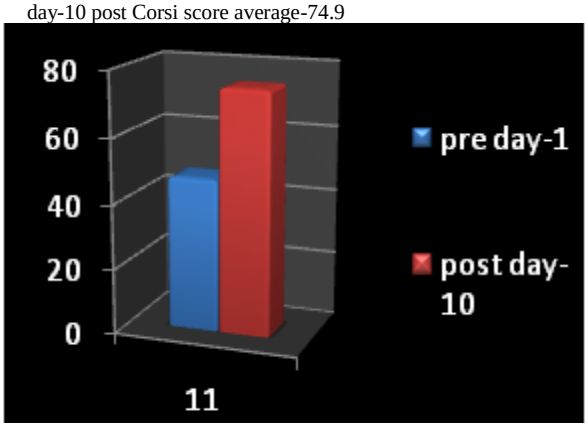
TEST SUBJECTS
10. COMPARISION OF CORTI SPAN PRE DAY-1 AND POST DAY-10 (probability 0.004)
day-1 pre corti span average-5.5
day-10 post corti span average-7



CONTROL SUBJECTS
11.COMPARISION OF CORSI SCORE OF PRE DAY-1 AND POST DAY-10 (probability 0.31)
day-1 pre Corsi score average-45
day-10 post Corsi score average-49.6



TEST SUBJECTS
12. COMPARISION OF CORSI SCORE OF PRE DAY-1 AND POST DAY-10 (probability 0.005)
day-1 pre Corsi score average-47.2
day-10 post Corsi score average-74.9



DISCUSSION

This study confirms the observations of some of the earlier studies that there is a definite relationship between the unilateral nostril breathing (UNB) and contralateral hemispheric function. Further, the highly significant enhancement of visuo-spatial memory (a right hemispheric function) after exclusive left nostril breathing is a strong proof of the hypothesis, that nasal cycle and the contralateral cerebral function rhythm are tightly coupled. [(8)] An increase in Corsi score suggests an increase in the retention of short term memory, whereas an increase in Corsi span suggests an increased capacity to retain the sequence for a longer duration. The fact that the test was done on a computer screen which appeared more like a game than a test might possibly could have helped the participant's motivation which might have helped them to focus better and consolidate better. The exact mechanism by which uni lateral nostril breathing influences cerebral hemispheric activity is not known. However, previous experiments studying the effect of hyperventilation through the nose on EEG activity in the cortex suggests that this is produced by a neural reflex mechanism in the superior nasal meatus. [(9)]

The procedure adopted by the subject was neither complicated, nor the test used to measure the results required any elaborate and costly apparatus. There are not any previous studies, which can explain the mechanism by which UNB influences contralateral hemispheric function. Hence further investigation needs to done in this area.

CONCLUSION

Based on this study, it is concluded that there was a significant improvement in visuo-spatial short term working memory in medical students who practiced exclusive left unilateral nostril breathing when compared to those who did not. This was evident from the significantly improved Corsi block span and Corsi score among test group in the Corsi block tapping test-an easy, computerized test to assess visuo-spatial memory.

Suggestions:

A study on the effect of exclusive UNLB on contralateral cerebral blood flow might offer some clue as to the possible mechanism of action. Since the study was conducted in a small group of only 10 healthy medical students, a study involving a larger group may be necessary before arriving at a final conclusion. In the light of this study, exclusive left unilateral breathing could provide an easy, cost effective and harmless method of improving learning by observing practical skills not only in medical students but also in all those professions where visuo-spatial memory is required like; artists, designing and architecture, drivers/pilots who need to navigate their way by remembering visual environment.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the sponsorship of Indian Council for Medical Research for this work under STS-2013 programme.

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How to cite this article: Jyothsna J, Rao BGS. to study the effect of exclusive unilateral left nostril breathing on 'visuo-spatial short term memory' in undergraduate medical students. Int J Health Sci Res. 2014;4(8):152-159.

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