

SHORT COMMUNICATION

IMMEDIATE EFFECTS OF RIGHT AND LEFT NOSTRIL BREATHING ON VERBAL AND SPATIAL SCORES

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Abstract : The immediate effect of two yoga breathing techniques was assessed on verbal and spatial memory tasks, considered hemisphere-specific. Forty-five participants (24 males; age range 20 to 45 years (mean age 27.1 ± 8.1 years) were randomly allocated to three groups (n=15 each) and were assessed immediately before and after 45 minutes of three breathing practices i.e., right nostril yoga breathing, left nostril yoga breathing, or breath awareness as a control intervention. Spatial memory scores increased after left nostril yoga breathing compared to before (by 16 percent, $P=0.03$, paired t-test). Hence, breathing through the left nostril increased performance in a spatial cognitive task, corresponding to the cerebral hemisphere contralateral to the patent nostril.

Key words : Yoga voluntarily regulated breathing spatial memory
verbal memory

INTRODUCTION

The nasal cycle is characterized by alternating patency of the nostrils every two to eight hours (1), with a rhythmic and alternating shift of activity in the autonomic nervous system and cerebral activity (2). Alternating cerebral activity facilitates performance in cerebral hemisphere specific tasks along with relatively greater EEG amplitudes recorded contralateral to the dominant nostril.

Alternating cognitive performance with

phases of the nasal cycle was first studied in eight subjects who were asked to perform verbal and spatial tasks every 15 minutes for eight hours (3). Spontaneous changes in nostril dominance brought about changes in cognitive performance. The best performance on the verbal task was 180 degrees out of phase with the best performance on the spatial task.

Similar results were reported with unilateral forced nostril breathing. A study on undergraduate students who practiced forced left uni-nostril breathing showed

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increased spatial performance on a cognitive task (4). However in this study right forced uni-nostril breathing did not show any increase in verbal performance on a task modeled after the Miller Analogies and Scholastic Aptitude Tests (SAT).

Yoga voluntarily regulated breathing techniques are called *pranayamas* in Sanskrit. These are practices where the breath is manipulated. An earlier study assessed the effect of yoga breathing with nostril manipulation on cerebral hemisphere specific memory tasks in children (5). The children were considered as four groups of 26 children each, who were assessed before and after ten days of yoga practice. The four groups practiced three different yoga breathing techniques, i.e., right nostril yoga breathing, left nostril yoga breathing, alternate nostril yoga breathing, and the fourth group practiced breath awareness. There was an increase in the spatial memory scores in all groups (86%), with no lateralized effect.

Another study on school children compared the effects of yoga and a fine arts program on spatial and verbal memory scores (6). The yoga group was attending a ten day yoga training camp and the fine arts group was attending a ten day camp where they learned drama, pottery and other arts. The yoga group had a 43 percent increase in the spatial memory scores, with no change in the fine arts group.

The present study aimed at assessing performance in verbal and spatial memory scores immediately after the practice of right nostril yoga breathing, left nostril yoga breathing, and breath awareness.

METHODS

The study included forty-five right-handed participants of both sexes with group mean age (\pm S.D.), 27.1 ± 8.1 years (24 males) who were participants in a one month yoga program. Participants were randomly divided into 3 groups (n=15 each). Each group was allotted to one of three different yoga breathing practices of 45 minutes each, viz., right nostril yoga breathing, left nostril yoga breathing, and breath awareness.

The participants were given the memory test immediately before and after 45 minutes of intervention. The test material was projected on a screen, allowing 10 sec for each slide. After the 10 slides were shown, an arithmetic problem (e.g., $+7 - 4 + 6 - 5 - 8 + 2$) was projected on the screen. Immediately after this, subjects were asked to recall and write down (or in case of spatial memory, to draw) within 60 sec the 10 test items which were shown to them. For the verbal memory test standard nonsense syllables of 3 letters e.g., 'x o l' were selected from a prepared list (5). Two different sets of 10 nonsense syllables were presented before and after the intervention. The test for spatial memory consisted of 10 simple line drawings. Geometrical or other shapes which could be described and remembered verbally, such as a square or a circle were not used. The drawings were simple and easy to reproduce. As described for verbal memory, there were two separate, similar sets of 10 line drawings each for immediate assessments before and after the interventions. For both the verbal and for the spatial memory test a correct response was scored as 1 and incorrect as '0'.

The three groups each practiced a different yoga breathing practice of 45 minutes each. These were (i) right nostril yoga breathing which involves breathing exclusively through the right nostril while the left nostril is gently occluded, (ii) left nostril yoga breathing involves breathing through the left nostril while the right nostril is gently occluded, and (iii) breath awareness, for which the subjects maintained awareness of the breath without manipulation of the nostrils.

The data were analyzed using SPSS (version 10.0), comparing data obtained before and after each practice using the t- test for paired data.

RESULTS

‘Group mean values ± S.D. for the memory task for the three groups are in Table I.

Following left nostril yoga breathing, there was an increase in spatial memory

TABLE I: Memory scores immediately before and after three yoga breathing practices.

Groups	Verbal memory test		Spatial memory test	
	Before	After	Before	After
Right nostril yoga breathing	4.53±2.67	5.13±2.97	5.67±2.72	6.73±2.37
Left nostril yoga breathing	4.67±2.06	4.47±1.73	6.20±1.32	7.13±1.96*
Breath awareness	3.73±2.34	4.47±2.07	5.20±1.93	5.40±1.92

*P=0.03, t-test for paired data, ‘After’ compared to ‘Before’.

scores (P=0.03). There were no other significant changes.

DISCUSSIONS

This study assessed the effect of right nostril yoga breathing, left nostril yoga breathing and breath awareness on delayed recall in a spatial and a verbal memory test, both of which are considered to be cerebral hemisphere specific. After left nostril yoga breathing spatial memory scores increased.

These results are similar to earlier studies conducted on spontaneous breathing shifts and unilateral forced nostril breathing which showed improved performance in a hemisphere-specific cognitive task with improvement contralateral to the dominant nostril (3, 4). An earlier study which supports the present results assessed the effects of three nostril manipulated breathing techniques on performance in a letter cancellation, verbal task (7). After the practice of right and alternate nostril yoga breathing there was an increase in letter cancellation task scores, which is a letter detection task and hence is left hemisphere-specific. Hence the increased performance after right nostril yoga breathing also suggested a contra-lateral effect though the effect of alternate nostril yoga breathing did not suggest this.

The present study used a task for delayed recall where after showing the ten slides of the actual test, a mathematical problem was shown and immediately after this, subjects were asked to recall and write down the test items which had been shown to them.

Reduced anxiety can improve the performance on tasks requiring learning and memory (8). Yoga practice helps in reducing anxiety (9). In particular, the practice of yoga breathing for eight weeks resulted in reduced anxiety scores and psychophysiological scores of arousal in patients with anxiety neurosis. The possibility of an anxiety-reducing effect of left nostril yoga breathing may be considered based on the fact that during a month of left nostril yoga breathing sympathetic activity decreased evidenced by an increase in skin resistance (10).

The possible mechanism which underlies the effect uni-nostril breathing has on the central nervous system is not understood. The mechanical receptors in the nasal mucosa are activated with airflow into the nostril, and this signal is unilaterally transmitted to the hypothalamus (1). The hypothalamus is considered the highest centre for autonomic regulation. The yoga breathing practices studied here have been shown to influence autonomic functions. The way in which unilateral breathing influences central nervous system functions remains to be worked out.

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