

Indian J Physiol Pharmacol 2004; 48 (3) : 353–356

## SPATIAL AND VERBAL MEMORY TEST SCORES FOLLOWING YOGA AND FINE ARTS CAMPS FOR SCHOOL CHILDREN

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( Received on May 27, 2003 )

**Abstract :** The performance scores of children (aged 11 to 16 years) in verbal and spatial memory tests were compared for two groups (n = 30, each), one attending a yoga camp and the other a fine arts camp. Both groups were assessed on the memory tasks initially and after ten days of their respective interventions. A control group (n = 30) was similarly studied to assess the test – retest effect. At the final assessment the yoga group showed a significant increase of 43% in spatial memory scores (Multivariate analysis, Tukey test), while the fine arts and control groups showed no change. The results suggest that yoga practice, including physical postures, yoga breathing, meditation and guided relaxation improved delayed recall of spatial information.

**Key words :** yoga fine arts spatial memory verbal memory

### INTRODUCTION

The practice of Transcendental Meditation (TM) was shown to improve academic performance in university students (1). While the above study examined how meditation influenced the process of remembering, a subsequent study examined the effects of a combination of yoga practices on hemisphere-specific memory tasks (2). Groups trained in yoga showed a significant increase in spatial test scores at retest, but no change in verbal test scores, suggesting that yoga breathing improved performance in a right hemisphere– specific memory test.

Among other factors which influence right hemisphere performance, both scientific and subjective reports of high achievers in arts, sciences and industry reveal a correlation between creative thinking and right hemisphere specialization (3). Among arts topics, asymmetric electroencephalographic (EEG) changes were obtained as 'method' actors generated emotions, with specific right hemispheric activation related to sexual arousal (4).

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The above mentioned references indicate that both yoga training and even creative activities activate the right hemisphere. If yoga influences memory via this hemisphere, it is also possible that training in fine arts may affect memory positively. The present study investigates this hypothesis.

## METHODS

### Subjects

The subjects were children with ages between 11 and 16 years, who were attending either yoga or fine arts vacation camps ( $n = 30$  each). The two camps were conducted at the same site, at different times during the summer vacation. The group average ages were as follows : (i) Yoga group (mean age  $\pm$  SD,  $13.8 \pm 1.8$  years, 13 girls) and (ii) Fine arts group (mean age  $\pm$  SD,  $13.1 \pm 2.3$  years, 16 girls). Also, in order to understand the test-retest effect, a control group of 30 children was similarly assessed. This group had no intervention but carried on with their activities during the vacation. The control group average age was :  $13.6 \pm 1.5$  years (14 girls). The hand dominance was determined by using a specific questionnaire and it was found that all the subjects were right hand dominant (5).

### Design

All three groups were assessed on Day 1, and after the intervention on the Day 10. Both yoga and fine arts groups were given training in yoga and fine arts activities (such as drama, and dance training), respectively. The control group carried out their routine activities.

### Assessment

The verbal and spatial memory tests were assessed for 15 subjects at a time. The test material was projected on a screen, allowing 10 seconds for each slide. After the 10 slides were shown, a mathematical problem (e.g., 3 minus 8 plus 5 minus 2 plus 9 plus 7 minus 4 plus 6) was projected on the screen. Immediately after this, the subjects were asked to recall and write down (or in the case of spatial memory, to draw) within 60 seconds the 10 test items which had been shown to them (2).

To test verbal memory, standard nonsense syllables of three letters, e.g., XOL, were selected from a prepared list (6). Two different sets of 10 nonsense syllables were presented on Days 1 and 10. The test for spatial memory consisted of 10 simple line drawings. Geometrical or other shapes which could be described verbally, e.g., a square or a circle, were not used. The drawings were very simple and easy to reproduce. As described for verbal memory, there were two separate, similar sets of 10 line drawings each for Days 1 and 10. For both verbal and spatial memory tests a correct answer was scored as "1" and a wrong answer was scored "0". The subjects were told that the memory tests were for their self assessment to understand the benefit they derived from the course. They were subsequently given a report, so they were enthusiastic and interested. The control group was also told that the tests were for their self assessment and were also given a report. The informed consent of their guardians was taken.

## Analysis

Data were analyzed using the statistical software (SPSS version 10.0). The Day 1 and Day 10 data of all three groups were assessed with the tests for normality distribution using both graphic presentations (box-plot and stem-and-leaf plot) as well as Shapiro-Wilk test. The one – way 'F' test for variance was used to evaluate the variance of the data. A multivariate analysis was performed where the Between Subjects factor was the Groups (Yoga, Art, Control) and the Within subjects factor(s) were Assessments (Verbal: pre and post; Spatial: pre and post; hence giving 4 factors). The Tukey test for multiple comparisons of mean values was used for post-hoc analysis.

TABLE I : Means  $\pm$  standard deviations of memory scores of verbal and spatial memory tasks for three groups (n = 30, each) on days 1 and 10.

|           |         | Verbal memory |               | Spatial memory |                |
|-----------|---------|---------------|---------------|----------------|----------------|
|           |         | Day 1         | Day 10        | Day 1          | Day 10         |
| Yoga      | Mean SD | 4.2 $\pm$ 1.5 | 5.0 $\pm$ 2.0 | 4.0 $\pm$ 1.9  | 5.7 $\pm$ 1.9* |
| Fine arts | Mean SD | 4.3 $\pm$ 1.9 | 4.5 $\pm$ 2.2 | 4.4 $\pm$ 1.9  | 5.6 $\pm$ 2.6  |
| Control   | Mean SD | 3.9 $\pm$ 1.8 | 4.4 $\pm$ 1.6 | 3.9 $\pm$ 1.6  | 4.3 $\pm$ 2.0  |

\*P=.002, two tailed, Tukey test comparing the means of Day 10 versus Day 1 values.

## Fine arts camp

The fine arts camp lasted for 8 hours each day, consisting of: drama (240 min) and games, e.g., cricket or volleyball, 60 min. The training also included a special session of creative activities such as dance, singing classical Indian compositions, pottery, painting, sketching, and paper craft (120 min). Each day children were allowed to show individual talent by giving presentations e.g., songs, mimicry, or elocution (60 min).

## Yoga camp

The yoga program consisted of training in yoga for approximately 8 hours a day, for 10 days. It included specialized physical postures (yogasanas, 90 min), voluntary regulation and slowing of the breathing (pranayama, 60 min), internal cleansing practices including eye-cleansing techniques (kriyas, 30 min), meditation and devotional sessions (90 min), and guided relaxation (30 min). In addition to these specialized practices, the training also included games (120 min) as well as the telling of meaningful stories (60 min) to foster a sense of values and feelings of responsibility, which is also an essential part of yoga.

## RESULTS

The Day 1 and Day 10 data of all three groups were found to be (i) normally distributed and (ii) not of unequal variance. Hence parametric statistics were used for analysis. The multivariate analysis : The test of Between-Subjects effects showed significant difference for the Yoga group [F (3,116) =5.569, P = .001]. For the arts group [F (3,116)

= 2.230,  $P = .088$ ] and the control group [ $F(3,116) = 0.727$ ,  $P = .538$ ] there was no significant difference. Post-hoc analysis using the Tukey test showed a significant difference between the spatial memory test scores of the yoga group on Day 10 versus the scores on Day 1 ( $P = .002$ ). There were no other significant differences. Group mean  $\pm$  standard deviation of memory test scores obtained by the three groups for both verbal and spatial memory tests at initial and final assessments are given in Table I.

## DISCUSSION

In the present study, the group trained in yoga showed a significant increase in spatial memory test scores, while verbal memory test scores remained the same in all of them. The results resemble those of a previous study (2), which showed that 108 children of a similar age range also showed an increase in spatial memory scores following 10 days of yoga training. Drama requires actors to recall their lines (7), which was shown to be contextual and facilitated by the availability of spatialvisual information. In the present study, the fine arts camp which included 4 hours of drama did not significantly influence the recall of spatial or verbal information. Since the camp activities included 4 hours of other activities (e.g., dance, pottery, extempore presentations), it is possible that these activities did not have the same effect as drama on memory, even though they would be expected to influence right hemispheric function. Also, spatial memory is just one dimension of right hemispheric function and the present study did not examine other functions. It is also possible that a longer duration of training in fine arts may have influenced spatial memory scores, but the present study intended to compare equal durations of the two interventions. Improvement in spatial memory scores following yoga could be related to the fact that reduced anxiety can improve performance on tasks requiring learning and memory (8) and the anxiety reducing effects of meditation are well known (9). While the positive effects of motivation on learning are well known (6), it is not likely that motivation influenced the outcome, as the verbal scores did not change, and it is unlikely that motivation would influence the outcome of one test alone. The lower scores of the control group at baseline may suggest that this group was less motivated than the two intervention groups. The absence of change in the control group shows that retesting after 10 days did not influence the scores.

Hence, the present study suggests that yoga practice, including physical postures, yoga breathing, meditation and guided relaxation improves delayed recall of spatial information.

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