EFFECT OF YOGA TRAINING ON MAZE LEARNING

Shirley Telles* , Vempati Ramaprabhu and Satish Kumar Reddy

Vivekananda Kendra Yoga Research Foundation,
9, Appajappa Agrahara, 1st Main, Chamarajpet, Bangalore - 560 018

(Received on October 4, 1999)

Abstract: The performance in a maze learning task was assessed in adults of either sex (n=31) before and after 30 days of yoga training and in an age and gender matched control group of subjects who did not receive training in yoga. Subjects were blind folded and used the dominant hand to trace the path in a wooden pencil maze. At each assessment, subjects were given 5 trials, without a gap between them. Performance was based on the time taken to complete the maze and the number of blind alleys taken. The time and error scores of Trial 1 were significantly less after yoga (two-factor ANOVA, Tukey test). Repeating trials significantly decreased time scores at Trial 5 versus Trial 1, for both groups on Day 1 and for the control group on Day 30. Hence the yoga group showed improved performance in maze tracing at retest 30 days later, which may be related to this group being faster learners and also the effect of yoga itself. Yoga training did not influence maze learning, based on the performance in 5 repeat trials.

Key words: maze learning; yoga; performance.

INTRODUCTION

Maze tracing is a task which gives data related to the highest levels of mental functioning, including the process of choosing, trying, and rejecting or adopting alternative courses of conduct or thought. Performance in this task improves with repetition (i.e., maze learning) (1). Maze tracing also has a motor component, which contributes to scores of the time taken to complete tracing the path(2).

Following yoga practice, volunteers were found to have improved static motor performance (3, 4) and manual dexterity (5). However, the effects of yoga practice on mental functions such as planning have not been studied.

The present study was designed to determine if yoga practice changes: (i) performance scores in a maze tracing task on retest after 30 days, and (ii) maze learning based on performance with 5 repeated trials.

METHOD

Subjects

There were two groups of 31 volunteers each, of either sex (16 males, 15 females), with group average age ± SD, 28.0 (± 8.9 years - yoga); (+ 7.0 years - control). The yoga group attended a 1-month residential yoga training camp. The control group did not receive yoga training. All subjects were right hand dominant, based on questions about the hand used to throw a ball, look for change in a purse, and to write.

Design of the study

Assessments of both yoga and control groups were made on Day 1 and a month later (Day 30). Between assessments, the yoga group received yoga training, while the control group carried on with their routine activities.

Apparatus

The wooden pencil maze had two layers of wood. The bottom layer served as the base on which paper was kept, and the upper layer as the maze walls (Anand Agencies, Pune, India). A pencil tracing of the path that was approximately 1.2 cm wide could be obtained on the recording paper (6). There were 16 blind alleys of varying lengths and only one correct solution pathway.

Procedure

The maze was placed horizontally on a table, in front of the subject. The experimenter was seated across from the subject. Subjects were asked to trace the path in the wooden pencil maze with the dominant hand, while blindfolded and without lifting the pencil from the paper (7). The time taken to successfully complete the maze (in seconds) and number of errors, i.e., blind alleys taken, were noted. Each subject was given 5 trials, without a gap in between. Hence after completing one trial, the subjects hand was guided to bring the pencil to the starting point to begin the next trial. The time taken in seconds was noted using a stopwatch. The number of errors was noted after the experiment based on the pencil trace of the path on the paper. The scores (time and error) at Trial 1 gave the 'absolute' performance scores for maze tracing, whereas the difference between Trial 5 and Trial 1, gave an indication of the effect of repetition, related to maze learning.

Yoga practice

The yoga group received 30 days training in yoga postures (asanas, 90 min), voluntarily regulated breathing (pranayama, 60 min), yoga cleansing practices (kriyas, 30 min), meditation 20 min, devotional sessions 60 min, guided relaxation 60 min and lectures on the theory and philosophy of yoga for 60 min.

Data analysis

The data were analyzed using separate two factor analyses of variance for the two groups (yoga and control), with assessments (Day 1, Day 30) as Factor A and the 5 trials as Factor B. The Tukey test was used to test multiple comparisons for significant differences.

DISCUSSION

The time taken to trace the maze and the number of errors were significantly decreased after 30 days of yoga practice, whereas the control group did not show this change. Over 5 trials both yoga and control groups showed a significant decrease in time taken to complete the maze on Day 1. On Day 30 the control group continued to show a significant decrease with repeated trials, which. was not observed in the yoga group. However, the number of errors was significantly less at Trial 5 compared to Trial 1, for the yoga group on Day 1, but not on Day 30. The control group did not show any differences in number of errors over 5 trials.

Maze learning based on time taken, was improved in both groups on Day 1. On Day 30 the control group showed a decrease in time taken at Trial 5 compared to Trial 1. However, the yoga group showed no significant effect of repetition on Day 30, for time and errors. This may have been related to the fact that on Day 30 at Trial 1, both time and error scores were significantly lower for the yoga group compared to Trial 1 scores on Day 1, and there was not much scope for further reduction. These trends are evident from Fig. 1.

Also, on Day 1, the time taken to complete the maze came down from (mean) 97.3 sec to 35.2 sec in 5 trials in the yoga group, whereas in the control group it came down from 98.3 to 54.1 sec.

Thus on Day 1 itself the yoga group had subjects who were fast learners, and therefore the two groups were not well matched for maze learning.

This decrease in time and error scores in the yoga group after 30 days of yoga practice compared with before may be related to this difference between the groups at baseline. At baseline the two groups did not take significantly different time to complete the maze. However, while the yoga group showed maze learning with reduced errors on Day 1, this change was not observed in the control group. This was another difference between the groups at baseline.

The effect of yoga on maze learning may also be related to factors such as motor performance, with improved motor performance seen as an increase in the speed of tracing the maze path. All subjects were right-hand dominant and used their right hand to trace the maze. Right hand activity in maze tracing involves more of left-hemispheric, abstract-conceptual strategy where the spatial configuration of the maze is learned as a series of left or right turns, with some interspersed up or down movements (9). In the present study, maze tracing may be believed to be carried out by left-right orientation. The decrease in time and error scores after yoga could also be related to better motor performance and improved left-right orientation, though baseline group differences prevent any definitive conclusion being made.

In summary, (1) The five trials on Day 1 and the five trials on Day 30 behave like 10 successive trials which lead to progressive improvement in both groups. (2) The yoga group has subjects who are fast learners compared to subjects in the control group. Hence the differences between the groups may be due to differences between the groups at baseline, rather than be the effect of yoga itself. To understand whether the effects of yoga training on maze learning observed in this study are related to baseline differences between groups, or to factors such as improved motor performance or left-right orientation, future studies may be planned with well matched groups and parameters selected to differentiate these contributing factors.

REFERENCES

1. Porteus SD: The maze test and clinical psychology Palo Alto, CA, Pacific Books, 1959.

2. Levin HS, Goldstein FC, Williams DH, Eisenberg HM. Acalculia. In Heilman KM, Valenstein E, eds. Clinical Neuropsychology. New York, Oxford University Press, 1991.

3. Telles S, Hanumanthaiah BH, Nagarathna R, Nagendra HR. Improvement in static motor performance following yogic training of school children. Percept Mot Skills 1993; 76: 1264-1266.

4. Telles S, Hanumanthaiah BH, Nagarathna R, Nagendra HR: Plasticity of motor control systems demonstrated by yoga training. Indian J Physiol Pharmacol 1994; 38(2): 143-144.

5. Manjunath NK, Telles S: Factors influencing changes in tweezer dexterity scores following yoga training. Indian J Physiol Pharmacel 1999; 43(2): 225-229.

6. Stoddard J, Vaid J: Asymmetries in intermanual transfer of maze learning in right and left-handed adults. Neuropsychol 1996; 34(6): 605-608.

7. Oxendine JB: Psychology of motor learning. New Jersey, Prentice-Hall, 1984.

8. Zar JH: Biostatistical analysis. London, Prentice- Hall, 1984.

9. Ward JP, Alvis GR, Sanford CG, Dodson DL, Pusakulich RL: Qualitative differences in tactuo-spatial motor learning by left-handers. Neuropsychol 1989; 27(8): 1091-1099.