AYU

Access this article online
Website: www.ayujournal.org
DOI: 10.4103/0974-8520.123117
Quick Response Code:

Clinical Research

Efficacy of *Yoga* for sustained attention in university students

Sheela, Hongasandra Rama Rao Nagendra[1], Tikhe Sham Ganpat[2]

M. Sc. Scholar, [1]Chancellor, Swami Vivekananda Yoga Anusandhana Samsthana, [2]Assistant Professor, Swami Vivekananda Yoga Anusandhana Samsthana University, Kempegowda Nagar, Bangalore, Karnataka, India

Abstract

Sustained attention (SA) is a vital function mediated by the right frontal - parietal cortex. The digit vigilance test (DVT) measures SA. Assessment of SA in students for their academic excellence is considered to be an essential part of a neuropsychological evaluation. The objective of this study is to determine SA in students undergoing training of integrated *Yoga* module (IYM). A total of 66 university students aged between 18-37 years participated in this study with a single group pre-post design. The DVT data was collected before and after the IYM. Statistical Package for Social Sciences version 19 was used for data analysis. The Kolmogorov-Smirnov test showed that the data were not normally distributed. The Wilcoxon's signed ranks test was used to compare means of data. The data analysis showed 11.66% decrease ($P < 0.001$) in total time taken for DVT and 31.90% decrease ($P < 0.001$) in error scores for DVT. The present study suggests that IYM can result in improvement of SA among students, thus paving the way for their academic excellence. Additional well-designed studies are needed before a strong recommendation can be made.

Key words: Academic excellence, integrated *Yoga* module, sustained attention, university students

Introduction

Attention is an essential element of cognition and has been characterized in two ways, that is, either as a resource or capacity or as a skill of resource deployment. Sustained attention (SA) is the capacity to attend to a task in hand for a required period of time. It is closely associated with task difficulty or complexity.[1] SA is easier for simple tasks than complex tasks. It is closely associated with the mental effort required by the task in hand.[2] The capacities to study and listen to a lecture for an extended length of time are examples of SA. Various brain areas mediate attention, different ones being responsible for different types of attention. The right frontoparietal area mediates SA. Damage to the right prefrontal cortex is associated with poor SA.[3] Imaging studies have shown that vigilance tasks requiring SA activate a network of neurons in the right frontal and parietal cortices.[4] Previous reports on SA suggest that reduced anxiety can improve performance on tasks requiring SA[5] and *Yoga's* anxiety reducing effects[6] could also have facilitated this. Similarly, modern education system and *Gurukula* education system improve SA in school children, but *Gurukula* education system is more effective.[1] Several studies have been published analyzing the effect of different aspects of *Yoga* including physical postures and meditation on SA. Integrated *Yoga* module (IYM) consisting of physical postures (*Asana*), voluntary regulation of breathing (*Pranayama*), maintaining silence and visual focusing exercises (*Trataka*) improve attention span in school children.[7-9] However, the changes in SA that characterize the efficacy of IYM for university students have not been reported adequately. Hence, it the present study was designed to assess the efficacy of IYM for academic excellence in university students using digit vigilance test (DVT). The objective of this study was to assess SA using DVT in university students undergoing IYM.

Address for correspondence: Dr. Tikhe Sham Ganpat, Assistant Professor, Swami Vivekananda Yoga Anusandhana Samsthana University, (Prashanti Kutiram), 19, Eknath Bhavan, Gavipuram Circle, Kempegowda Nagar, Bangalore - 560 019, Karnataka, India.
E-mail: rudranath29@gmail.com

Materials and Methods

Subjects

A total of 66 university students (28 males and 38 females) undergoing IYM with 28.03 ± 9.38 years of mean age participated in the present study.

Inclusion criteria

- Both male and females aged between 18-37 years were enrolled in the study.

Exclusion criteria

- Students with serious medical conditions
- Students taking medication, psychiatric drugs, alcohol or tobacco in any form
- Using any other wellness strategy.

Design

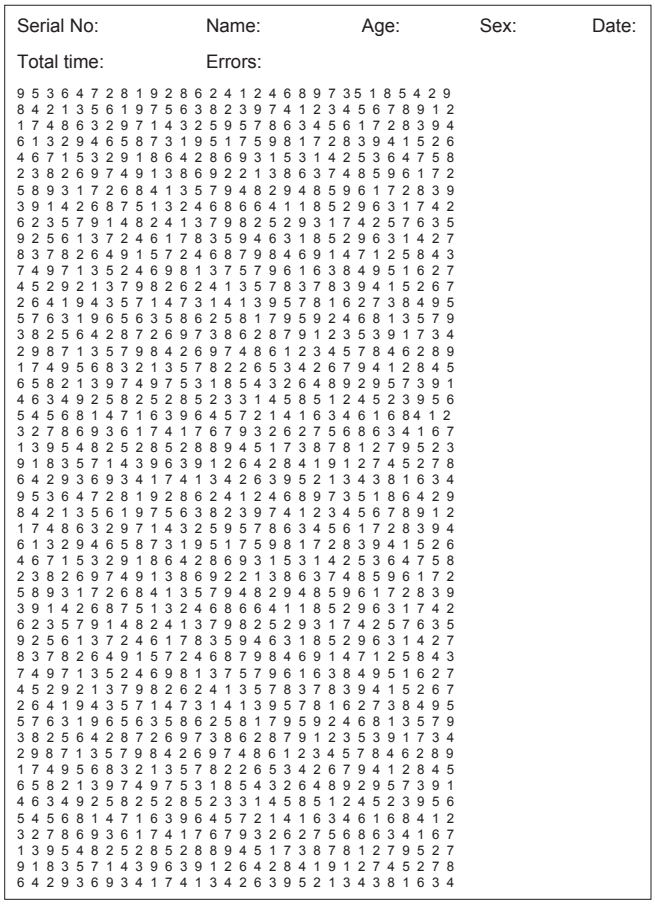
The study was designed as a Single group pre-post test and was carried out at Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA) University, Bangalore.

Informed consent

An informed consent was obtained from all the participants before initiating the study. The study was approved by the Institutional Review Board (IRB) of S-VYASA University.

Assessment

The DVT developed by Kelland and Lewis, which is a valid and reliable test to measure SA was used in the present study.[10] It consisted of numbers 1-9 arranged randomly in rows.[11] There were 30 digits per row and 50 rows per sheet [Figure 1]. The subjects were instructed to cancel the digits 6 and 9 as fast as they can. They were asked not to cross other digits and miss any of target digits. The total time taken to complete the test and errors made was noted.


Serial No: Name: Age: Sex: Date:

Total time: Errors:

9 5 3 6 4 7 2 8 1 9 2 8 6 2 4 1 2 4 6 8 9 7 3 5 1 8 5 4 2 9
8 4 2 1 3 5 6 1 9 7 5 6 3 8 2 3 9 7 4 1 2 3 4 5 6 7 8 9 1 2
1 7 4 8 6 3 2 9 7 1 4 3 2 5 9 5 7 8 6 3 4 5 6 1 7 2 8 3 9 4
6 1 3 2 9 4 6 5 8 7 3 1 9 5 1 7 5 9 8 1 7 2 8 3 9 4 1 5 2 6
4 6 7 1 5 3 2 9 1 8 6 4 2 8 6 9 3 1 5 3 1 4 2 5 3 6 4 7 5 8
2 3 8 2 6 9 7 4 9 1 3 8 6 9 2 2 1 3 8 6 3 7 4 8 5 9 6 1 7 2
5 8 9 3 1 7 2 6 8 4 1 3 5 7 9 4 8 2 9 4 8 5 9 6 1 7 2 8 3 9
3 9 1 4 2 6 8 7 5 1 3 2 4 6 8 6 6 4 1 1 8 5 2 9 6 3 1 7 4 2
6 2 3 5 7 9 1 4 8 2 4 1 3 7 9 8 2 5 2 9 3 1 7 4 2 5 7 6 3 5
9 2 5 6 1 3 7 2 4 6 1 7 8 3 5 9 4 6 3 1 8 5 2 9 6 3 1 4 2 7
8 3 7 8 2 6 4 9 1 5 7 2 4 6 8 7 9 8 4 6 9 1 4 7 1 2 5 8 4 3
7 4 9 7 1 3 5 2 4 6 9 8 1 3 7 5 7 9 6 1 6 3 8 4 9 5 1 6 2 7
4 5 2 9 2 1 3 7 9 8 2 6 2 4 1 3 5 7 8 3 7 8 3 9 4 1 5 2 6 7
2 6 4 1 9 4 3 5 7 1 4 7 3 1 4 1 3 9 5 7 8 1 6 2 7 3 8 4 9 5
5 7 6 3 1 9 6 5 6 3 5 8 6 2 5 8 1 7 9 5 9 2 4 6 8 1 3 5 7 9
3 8 2 5 6 4 2 8 7 2 6 9 7 3 8 6 2 8 7 9 1 2 3 5 3 9 1 7 3 4
2 9 8 7 1 3 5 7 9 8 4 2 6 9 7 4 8 6 1 2 3 4 5 7 8 4 6 2 8 9
1 7 4 9 5 6 8 3 2 1 3 5 7 8 2 2 6 5 3 4 2 6 7 9 4 1 2 8 4 5
6 5 8 2 1 3 9 7 4 9 7 5 3 1 8 5 4 3 2 6 4 8 9 2 9 5 7 3 9 1
4 6 3 4 9 2 5 8 2 5 2 8 5 2 3 3 1 4 5 8 5 1 2 4 5 2 3 9 5 6
5 4 5 6 8 1 4 7 1 6 3 9 6 4 5 7 2 1 4 1 6 3 4 6 1 6 8 4 1 2
3 2 7 8 6 9 3 6 1 7 4 1 7 6 7 9 3 2 6 2 7 5 6 8 6 3 4 1 6 7
1 3 9 5 4 8 2 5 2 8 5 2 8 8 9 4 5 1 7 3 8 7 8 1 2 7 9 5 2 3
9 1 8 3 5 7 1 4 3 9 6 3 9 1 2 6 4 2 8 4 1 9 1 2 7 4 5 2 7 8
6 4 2 9 3 6 9 3 4 1 7 4 1 3 4 2 6 3 9 5 2 1 3 4 3 8 1 6 3 4
9 5 3 6 4 7 2 8 1 9 2 8 6 2 4 1 2 4 6 8 9 7 3 5 1 8 6 4 2 9
8 4 2 1 3 5 6 1 9 7 5 6 3 8 2 3 9 7 4 1 2 3 4 5 6 7 8 9 1 2
1 7 4 8 6 3 2 9 7 1 4 3 2 5 9 5 7 8 6 3 4 5 6 1 7 2 8 3 9 4
6 1 3 2 9 4 6 5 8 7 3 1 9 5 1 7 5 9 8 1 7 2 8 3 9 4 1 5 2 6
4 6 7 1 5 3 2 9 1 8 6 4 2 8 6 9 3 1 5 3 1 4 2 5 3 6 4 7 5 8
2 3 8 2 6 9 7 4 9 1 3 8 6 9 2 2 1 3 8 6 3 7 4 8 5 9 6 1 7 2
5 8 9 3 1 7 2 6 8 4 1 3 5 7 9 4 8 2 9 4 8 5 9 6 1 7 2 8 3 9
3 9 1 4 2 6 8 7 5 1 3 2 4 6 8 6 6 4 1 1 8 5 2 9 6 3 1 7 4 2
6 2 3 5 7 9 1 4 8 2 4 1 3 7 9 8 2 5 2 9 3 1 7 4 2 5 7 6 3 5
9 2 5 6 1 3 7 2 4 6 1 7 8 3 5 9 4 6 3 1 8 5 2 9 6 3 1 4 2 7
8 3 7 8 2 6 4 9 1 5 7 2 4 6 8 7 9 8 4 6 9 1 4 7 1 2 5 8 4 3
7 4 9 7 1 3 5 2 4 6 9 8 1 3 7 5 7 9 6 1 6 3 8 4 9 5 1 6 2 7
4 5 2 9 2 1 3 7 9 8 2 6 2 4 1 3 5 7 8 3 7 8 3 9 4 1 5 2 6 7
2 6 4 1 9 4 3 5 7 1 4 7 3 1 4 1 3 9 5 7 8 1 6 2 7 3 8 4 9 5
5 7 6 3 1 9 6 5 6 3 5 8 6 2 5 8 1 7 9 5 9 2 4 6 8 1 3 5 7 9
3 8 2 5 6 4 2 8 7 2 6 9 7 3 8 6 2 8 7 9 1 2 3 5 3 9 1 7 3 4
2 9 8 7 1 3 5 7 9 8 4 2 6 9 7 4 8 6 1 2 3 4 5 7 8 4 6 2 8 9
1 7 4 9 5 6 8 3 2 1 3 5 7 8 2 2 6 5 3 4 2 6 7 9 4 1 2 8 4 5
6 5 8 2 1 3 9 7 4 9 7 5 3 1 8 5 4 3 2 6 4 8 9 2 9 5 7 3 9 1
4 6 3 4 9 2 5 8 2 5 2 8 5 2 3 3 1 4 5 8 5 1 2 4 5 2 3 9 5 6
5 4 5 6 8 1 4 7 1 6 3 9 6 4 5 7 2 1 4 1 6 3 4 6 1 6 8 4 1 2
3 2 7 8 6 9 3 6 1 7 4 1 7 6 7 9 3 2 6 2 7 5 6 8 6 3 4 1 6 7
1 3 9 5 4 8 2 5 2 8 5 2 8 8 9 4 5 1 7 3 8 7 8 1 2 7 9 5 2 7
9 1 8 3 5 7 1 4 3 9 6 3 9 1 2 6 4 2 8 4 1 9 1 2 7 4 5 2 7 8
6 4 2 9 3 6 9 3 4 1 7 4 1 3 4 2 6 3 9 5 2 1 3 4 3 8 1 6 3 4

Figure 1: Digit vigilance test Instructions: Please look at this sheet. There are different digits arranged in rows. The digits are randomly arranged. Please cancel the digits 6 and 9 as fast as you can. Do not cross other digits and be sure not to miss any of target digits. Do as fast as you can

Intervention

The IYM[12] of 21 days duration was practiced by all the subjects. The program was conducted in the serene and peaceful atmosphere of the S-VYASA University in a residential set up with a schedule starting from 5 AM to 10 PM. The Raja Yoga (yogic practices) in the form of Yogic *Kriya* (cleansing techniques), *Asanas* (postures), *Pranayama* (breathing techniques), *Shavasana* *Abhyasa* (relaxation), *Dhyana* (meditation), *Bhaktiyoga* (devotional sessions), *Jnanayoga* (discourses from experts), *Karmayoga* (daily 1 h of the session of selfless service in the university campus), *Sattvika* diet (high-fiber low-fat vegetarian and balanced diet) and cultural events were the key essence of this program. The program was based on the integrated approach of *Yoga* therapy developed at S-VYASA University for holistic development of personality.

Data collection

The DVT data was collected before and after 21 days of the IYM.

Data analysis

The subjects were asked to cancel out digits 6 and 9. The time to complete the test along with the number of correct responses and errors was noted.[10,11] Statistical analysis was performed with the help of Statistical Package for Social Sciences version 19. The Kolmogorov-Smirnov test showed that the data was not normally distributed. Hence, Wilcoxon signed ranks test was used to compare means of the data collected before and after the IYM.

Results

The data analysis showed 11.66% decrease ($P < 0.001$) in total time taken and 31.90% decrease ($P < 0.001$) in error scores for DVT [Table 1].

Discussion

Yoga has emerged as a treatment modality to reduce cognitive deficits, with the expectation that improvement of cognition would result in clinical improvement as well as improvement of psychosocial functioning.[13,14] Improvement of psychosocial functioning not only require SA, but also visual scanning and activation and inhibition of rapid responses. Decrease in total time taken and error scores in DVT following IYM suggest improvement in SA. Thus, the present study suggests a significant increase in SA scores in university students following IYM. The DVT requires selective and SA as well as the ability to shift attention.[15] The mechanism underlying the improvement of SA may be related to the fact that IYM is associated with increased sympathetic activity and increased sympathetic tone is associated with better vigilance.[16] Moreover, previous study

Table 1: Data analysis

DVT	Before IYM	After IYM	% decrease (↓)	*P*
Total time	6.69±1.35	5.91±1.21	↓11.66	0.0001***
Errors	10.94±8.81	7.45±7.03	↓31.90	0.0001***

Data represent mean±SD values, ***$P<0.001$. DVT: Digit vigilance test, IYM: Integrated *Yoga* module, SD: Standard deviation, IYM: integrated *Yoga* module

on *Yoga* reported enhanced SA as a result of the practice of *Yogic* way of life. The result indicates the importance of *Yoga* to improve academic excellence. [8,9] The present study is consistent with these findings, suggesting that a systematic practice of the *Yoga* may enhance SA, which leads to academic excellence.

Conclusion

The present study suggests that IYM enhances SA among students, thus paving the way for their academic excellence. Additional well-designed studies are needed before a strong recommendation can be made.

Acknowledgment

The authors acknowledge the authorities of Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA) University for granting permission to carry out this work.

References

1. Rangan R, Nagendra HR, Bhatt R. Effect of yogic education system and modern education system on sustained attention. Int J Yoga 2009;2:35-8.
2. Posner MI. In: Hillsdale NJ, editor. Chronometric Explorations of Mind. Oxford University Press, USA: Lawrence Erlbaum Associates; 1978. p. 269.
3. Rueckert L, Grafman J. Sustained attention deficits in patients with right frontal lesions. Neuropsychologia 1996;34:953-63.
4. Pardo JV, Fox PT, Raichle ME. Localization of a human system for sustained attention by positron emission tomography. Nature 1991;349:61-4.
5. Saltz E. Manifest anxiety: Have we missed the data? Psychol Rev 1970;77:568-73.
6. Wallace RK, Benson H, Wilson AF. A wakeful hypometabolic physiologic state. Am J Physiol 1971;221:795-9.
7. Telles S, Hanumanthaiah B, Nagarathna R, Nagendra HR. Improvement in static motor performance following yogic training of school children. Percept Mot Skills 1993;76:1264-6.
8. Sarang SP, Telles S. Immediate effect of two yoga-based relaxation techniques on performance in a letter-cancellation task. Percept Mot Skills 2007;105:379-85.
9. Telles S, Raghuraj P, Maharana S, Nagendra HR. Immediate effect of three yoga breathing techniques on performance on a letter-cancellation task. Percept Mot Skills 2007;104:1289-96.
10. Kelland DZ, Lewis RF. The digit vigilance test: Reliability, validity, and sensitivity to diazepam. Arch Clin Neuropsychol 1996;11:339-44.
11. Dixit A, Thawani R, Goyal A, Vaney N. Psychomotor performance of medical students: Effect of 24 hours of sleep deprivation. Indian J Psychol Med 2012;34:129-32.
12. Tikhe SG, Nagendra HR, Tripathi N. Ancient science of yogic life for academic excellence in university students. Anc Sci Life 2012;31:80-3.
13. Bangalore NG, Varambally S. Yoga therapy for Schizophrenia. Int J Yoga 2012;5:85-91.
14. Balaji PA, Varne SR, Ali SS. Physiological effects of yogic practices and transcendental meditation in health and disease. N Am J Med Sci 2012;4:442-8.
15. Telles S, Raghuraj P, Arankalle D, Naveen KV. Immediate effect of high-frequency yoga breathing on attention. Indian J Med Sci 2008;62:20-2.
16. Fredrikson M, Engel BT. Cardiovascular and electrodermal adjustments during a vigilance task in patients with borderline and established hypertension. J Psychosom Res 1985;29:235-46.

हिन्दी सारांश

विश्वविद्यालय के छात्रों में निरंतर ध्यान बढ़ाने में योग की उपयोगिता

शीला, होन्गासन्द्र रामाराव नागेन्द्र, टिखे शाम गनपत

निरंतर ध्यान (SA) right frontal – parietal cortex का एक महत्वपूर्ण कार्य है । डिजिट विजिलेंस टेस्ट (DVT) SA आकलन करता है । शैक्षिक उत्कृष्टता के लिए छात्र में SA का आकलन एक neuropsychological मूल्यांकन का एक अनिवार्य हिस्सा माना जाता है । इस अध्ययन का उद्देश्य एकीकृत योग मॉड्यूल (IYM) का प्रशिक्षण के दौर से गुजरने वाल छात्रों में SA का आकलन था । १८–३७ साल की उम्र के ६६ विश्वविद्यालय के छात्रों की कुल एक ही समूह के पूर्व पोस्ट डिजाइन के साथ इस अध्ययन में भाग लिया । DVT के डेटा IYM के पहले और बाद में किया गया था । SPSS डेटा विश्लेषण के लिए सांख्यिकीय पैकेज SPSS 19 इस्तेमाल किया गया था ।