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Effect of meditation on cognitive performance of auditory and visual reaction time in medical students

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ABSTRACT

Introduction: Stress and unhealthy lifestyle are the major and important risk factors for the development of comorbidities and impairment in the cognitive as well as sensory- motor performance.
Aims and Objectives: To study the effect of meditation on Visual Reaction Time in undergraduate medical students.
Materials and Methods: Total 100 first MBBS students of Medical College in age group 18-25 years were included. Written informed consent was taken from all the participants before the study. Visual Reaction Time of all students for Green and Red colour stimuli was recorded before and after the mediation training program. The meditation training program was conducted by expert yoga trainer for consecutive 5 months, preferably on empty stomach, without disturbing their teaching schedule.
Results: There was a significant difference between VRT recorded before and after the meditation training with P<0.0001**. It indicates that meditation has very positive effect on improving the individuals sensory motor co-ordination.
Conclusion: Yoga training with particular emphasis on meditation and deep breathing techniques, can be used as an important and cost-effective tool for improving and increasing the level of alertness.

1. Introduction

Mental stress refers to changes in the psycho-physiological state that people experience during the course of prolonged periods of demanding cognitive activity that require sustained mental efficiency.[1] In modern age, Stress is constant companion of people. Their effects especially in student's life are detrimental on wellbeing of the person. Its impact on future habits and coping mechanism can have far-reaching consequences on health and career.

As a result of unhealthy lifestyle, competitive, stressful environment, excess use of electronic gadgets, there is drastic impairment in the cognitive as well as the sensory motor performance. In addition to increase in the incidence of development of the comorbidities like obesity, diabetes, hypertension etc.at an early age of life, it has also been found to be associated with increase in psychiatric illnesses like depression, anxiety and increase in the suicidal tendency among youngsters.

Reaction Time is one of the important Physiological parameters for the assessment of sensory motor coordination of an individual which reflects the level of alertness. It is the time interval between the presentation of a stimulus of any modalities of sensory input (visual, auditory, pain, touch or temperature) and subsequent behavioural response measured typically by a button press, an eye moment, a vocal response, or some other observable behaviour.[2] RT provides an indirect index of the processing capability of central nervous system, concentration and cognitive skills with well proven diagnostic validity.[3] Hence, this is being used in mental chronometry, psychometric psychology and also in training mentally challenged children.[4,5] This test has a physiological as well as a clinical significance, as a shorter RT means a better performance, which is a prerequisite for sports personnel, surgeons and similarly for other professionals too.[6]

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Yoga is an ancient science which deals with asanas, breathing techniques and meditation. Many research studies have reported beneficial effects of yoga on physiological and psychological wellbeing.[7]

Few studies observed that, practicing yoga can reduce stress level and reaction time (auditory/visual), reflecting the sensory motor performance of an individual.[8]

Thus, this study was specifically planned to observe the effect of meditation on the visual reaction time in young individuals.

2. Materials and Methods

The present study was conducted on young students (age group18-25 years), in the Yoga lab, Department of Physiology, D.Y. Patil Medical College, Kolhapur after getting an approval from Institutional Ethics Committee (IEC).

2.1. Study population

All 1st year MBBS students were considered as study population

2.2. Selection of subjects

A total of 100, students were selected randomly by systematic random sampling.

2.3. Methodology

Prior to the onset of the study, history taking and clinical examination of all volunteer students was done. Students were selected according to following pre-set inclusion and exclusion criteria, written informed consent was taken from all the partcipants before the start of study. All the participants were briefed in detail regarding the nature of study.

2.4. Inclusion criteria

1. Both Male and female students
2. Healthy students without any Systemic complications
3. Students who promised to be regular in meditation practice were included.

2.5. Exclusion criteria

1. Students with physical/psychological illness
2. Individuals under any kind of medications

In this study, a choice reaction time in the form of visual signals (Green & Red Light) were used. The examiner sits with master (primary) control keys and subject sits on other side with (secondary) control keys. The two were separated with the help of opaque partition so, that the subject does not see which switch the examiner presses.

Once the unit is switched on, the examiner presents red & green light of visual signal to the subject. Now, the subject immediately has to respond by pressing the corresponding switch on his/her side.

The time duration between the application of stimulus by examiner and the response from the subject is the reaction time, which is recorded on reaction time apparatus in 0.5 milliseconds. such test recordings were done after two to three practice sessions. The average of these recordings was taken as final record for each subject. One set of recordings was taken before meditation practice and the second set of recordings was taken after 5 months of meditation practice.

Meditation training program was conducted by expert yoga trainer, for about30 minutes on 4 days a week for consecutive 5 months, preferably on empty stomach, without disturbing their teaching schedule. It was comprised of:

1. Warmup Exercise
2. Small prayer (Gayatri mantra) in sukhasana or Padmasana
3. Nadishodhan Pranayama (deep breathing technique) with Chinmudra

   Students have to use their fingers as per the instructions given by the yoga trainer. Thumb was kept on right nostril for opening and closing of the nostril, index and middle finger were used for Agnya Chakra (between two eyebrows), ring and little finger were kept on left nostril for opening and closing of the nostril. It involves slow and deep breathing within the comfort zone. The left hand was kept on the lap with chinmudra.
4. Omkar Chanting where, students were requested to close their eyes, interlock their fingers. They were asked to perform 14 cycles of chanting, in that first two cycles were open mouth chanting, remaining 12 cycles along with Bhramari Pranayama.
5. It was followed by guided meditation by Yoga trainer, where they were instructed to close their eyes and to focus on their breathing, deep and slow inhalation as well as exhalation for next 15 minutes in chinmudra, which was further followed by deep relaxation.
6. Deep relaxation: It was also guided by trainer which allowed the students to absorb all the benefits of breathing exercises and meditation. It helped to release all physical and mental stress.

2.6. Statistical analysis

VRT Data recorded before and after the meditation Training Program was analysed by using SPSS software version 24. The results were presented in the form of tables. Since the data was non parametric, Wilcoxon Rank Sum Test was applied. P value <0.0001 was considered as statistically

Table 1:

Reaction Time (0.5 milliseconds)		Before Meditation MEAN ± SD	After Meditation MEAN ± SD	P Value Wilcoxon Rank Sum Test
Visual (Green)	Rt. Eye	0.265±0.105	0.248±0.071	P< 0.0001**
	Lt. Eye	0.21±0.1	0.218±0.078	P< 0.0001**
Visual (Red)	Rt. Eye	0.21 ±0.07	0.19±0.066	P< 0.0001**
	Lt. Eye	0.23±0.1	0.2±0.09	P< 0.0001**

It was observed that there was significant (p<0.0001**) decrease in VRT (Green light) for rt. Eye (from 0.265±0.105 to 0.248±0.071) as well as for Lt. eye (from 0.21±0.1 to 0.218±0.078) which is statistically significant (p<0.0001**) after the meditation training.

significant.

3. Results

Similarly, it was observed that mean VRT (Red Colour) at 0.5 sec time interval for Rt. Eye before meditation training was 0.21±0.07 sec and after the training was 0.19±0.066 sec and the difference is statistically significant (P Value <0.0001**). It is also evident from the table that mean VRT (Red Colour) for Lt. Eye before meditation session was 0.23±0.1sec. and after the meditation session was 0.2±0.09 sec and the difference is statistically significant (P Value <0.0001**).

4. Discussion

In the recent years, stress and unhealthy lifestyle are the major and important risk factors for the development of comorbidities and impairment in the cognitive as well as sensory- motor performance. Against this background the present study was conducted to evaluate the effect of meditation on visual reaction time which is one of the easy and cost-effective tests to assess the individuals sensory motor performance.

The reaction time, the interval between the presentation of a stimulus to a subject and the subject's response, is often used as an indicator of the enhanced motor skills and for the better overall fitness in sports-specific training and competitive situations.[9]

In the present study we observed that there was a significant reduction in the VRT, recorded after the meditation session. It indicates that meditation has very positive effect on improving the individuals sensory motor co-ordination.

Results of our study are parallel with the study of Malathi A et al., in which they observed that Yoga enhances physical and emotional health and improves the performance of an individual by reducing the audio- visual reaction time after meditation & pranayama training.[10]

Madanmohan et al in their study reported that yoga training produces significant reduction in reaction time.[11]

A similar study conducted by Vivek Kumar Sharma et al. demonstrated that Meditation increases the alpha waves in the brain which are observed during relaxed state, suggesting calming effect of meditation. It could have possibly contributed to the reduction in reaction time (auditory/ visual) and thereby, improving the sensory motor performance.[7,12–14]

A study conducted by Norris et al showed that even a small "dose" of Mindfulness meditation practice can have beneficial effects, affecting various psychological outcomes, including cognitive performance, attention and improvement in RTs in individuals with very little or no practice.[15]

Study conducted by Streeter CC et al. states that Yoga is involved in restoring the under activities of the Parasympathetic Nervous System (PNS) and the Gamma Amino-Butyric Acid (GABA) systems. This restoration may be partly through the stimulation of the vagal nerve.[16]

Cohen DL et al in their study named "The cerebral blood flow effects of yoga training: a preliminary evaluation of 4 cases", demonstrated that the yoga training program increased the Cerebral Blood Flow (CBF) and that the changes in particular, appeared to have a greater impact on the right hemispheric function, particularly in the frontal lobes.[17]

During active meditation state, many changes linked with the frontal lobe were noted. This area is specifically involved with the focus of attention.[18]

Age-related thinning of the frontal cortex may be brought down by regular meditation process. Changes in cortical thickness could be owing to greater arborization per neuron, raised regional vasculature or increased glial volume.[19–21]

Bodily attention and visceral awareness are associated with right anterior insula. Increased capacity for awareness is directly associated with increased the thickness of this region[22]The right hemisphere is important for sustaining attention and it is a centre insight meditation[17,23]Meditation reflects on cognitive brain functions, such as stimulus discrimination, sequential information processing and short-term memory.[24]

Thus, it can be emphasized that improvement in the Reaction Time may be related to the above facts.

5. Conclusion

This study concludes that Yoga training with particular emphasis on meditation and deep breathing techniques, can be used as an important and cost-effective tool for

improving and increasing the level of alertness (which can be observed as reduction in the reaction time), especially for medical professionals and sports persons for the betterment of their performance.

6. Limitations

This study was limited by the duration of yoga training and the age group of the participants which needs to be extended for the longer period of training session as well as for the various age group people.

7. Source of Funding

None.

8. Conflicts of Interest

Authors do not have any conflicts of interest to disclose.

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