

**Original Article****Effect of Pranayama on audio visual reaction time in the medical and paramedical students**

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Abstract

Yoga is an ancient science & an art of exercise. Its components include Asanas (postures), pranayama (voluntary breath regulation) & dhyana (meditation). Shortening of audio-visual reaction time after pranayam training signifies greater arousal, improved concentration & faster responsiveness and determines the alertness of a person to a given stimulus. This study was taken to study the effect of pranayama on audio visual reaction time. The study was carried on 100 healthy medical and paramedical students. Pre and post Audio visual reaction was recorded after pranayama training. There is a decline in the reaction time values (both the audio and visual) after the pranayama training. Regular practice of pranayama has vast potential and health benefits. It is complementary to overall stress management (physical, instinctual, emotional, intellectual and spiritual). Inculcating the habit of regular pranayama early in life, will definitely have favorable effect.

Keywords: Pranayama. Audio reaction time, Visual reaction time, medical students, paramedical students.

Introduction

Yoga is an ancient science & an art of exercise which is associated with a set of principles & practices which are designed to promote the health & the wellbeing through the integration of the body, breath & the mind. Its components include Asanas (postures), pranayama (voluntary breath regulation) & dhyana (meditation). Pranayama

involves the use of abdominal, upper and lower thoracic muscles in a rhythmic and co-ordinated manner.¹ Breath control techniques are said to affect the higher functions of CNS like perception, planning, learning and memory. Yoga is a mind-body therapy which can enhance one's ability to focus the attention, improve the cognitive abilities, and decrease the stress which includes the CNS

processing.² Human body responses to a number of external environmental stimuli of different modalities and gives a desired, purposeful voluntary response to different types of stimuli.

Human reaction time (RT) is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by a subject.³ The study of reaction time spans more than a century and provides an indirect index of the processing capability of the central nervous system and also a simple means of determining sensor motor performance.⁴

Shortening of audio-visual reaction time after pranayam training signifies greater arousal, improved concentration & faster responsiveness⁵ and determines the alertness of a person to a given stimulus. It is an index of cortical arousal⁵ and decrease in audiovisual reaction time indicates an improved sensory-motor performance and an enhanced processing ability of the central nervous system. These effects of pranayama training on the central nervous system could be due to greater concentration power and ability to ignore or inhibit extraneous stimuli.

Medical students undergo tremendous stress during various stages of the MBBS course. The vast syllabus of 1st MBBS and the time they get for reading, understanding & analyzing the subjects is very less. Time is also required for adjustment in new environment of college. To cope with these situations and still excel in their curriculum further adds on to the stress which may lead to the decrease in the concentration power and memory of the individual. Yoga and pranayama acts as an adjuvant and are useful for the disciplining of the mind for concentration.

Pranayamic practitioners are known to have better attention and less distractibility. It has been reported that this form of yoga practice results in decreased mental fatigability and an increase in performance quotient. Many factors have been shown to affect reaction time including age, gender, physical fitness, fatigue, fasting, distraction, alcohol, breathing cycle, personality type, exercise, intelligence of the subject

irrespective of whether the stimulus is auditory or visual. Hence this study was taken to study the effect of pranayama on audio visual reaction time in the medical and paramedical students of Mahatma Gandhi Medical College & Hospital, Jaipur.

Material and Methods

This prospective observational study was carried out in the Neurophysiology Research Laboratory in Department of Physiology, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan from April 2017 to March 2018. Institutional ethical clearance was taken prior to the commencement of the study. The study was carried on 100 healthy medical and paramedical students of Mahatma Gandhi Medical College and hospital, Jaipur, aged between 18-25 years and those willing to participate, were included in the study. Informed consent was also taken from all the participants before the onset of pranayama training

Students with history of any neurologic, psychiatric, cardiovascular, respiratory or systemic illness, smokers and alcoholic, on antipsychotic drugs, on antihistaminic and antiepileptics were excluded from study. Those students already practicing Pranayama or exercise were also excluded from this study.

All the participants were explained the standard operating procedure in preparation for the pranayama training. Subjects were asked to come with empty stomach and empty bladder. The timing for pranayama practice was fixed in early morning at the yoga centre of Mahatma Gandhi Medical College. The pranayama training was imparted by a qualified yoga teacher, to all the subjects six days a week for one month for a duration of 40 minutes per session.⁶

Pranayama training schedule

The subjects were asked to take a proper sitting position either in Padmasana (the lotus posture) or Sukhasana (the comfortable posture) or Vajrasana (the thunder bolt posture). After the subjects had

assumed the proper posture, they were instructed to close their eyes and concentrate on the sound of breathing, they were then asked to inhale slowly and deeply followed by pronunciation of 'OM' (A-----U-----M) during slow and gentle exhalation. Three such pronunciation of 'OM' was performed before starting of the pranayama. The following pranayamas were included:

1. Kapalbhati Pranayama: Kapalbhati pranayama involves a vigorous expiration with a slow, passive inspiration.
2. Deerghswas Pranayama: 5 minute (Slow and deep inspiration through nostrils and slowly expiration through mouth. The ratio of inspiration: expiration time is 1:2.) (1 minute interval).
3. Anulom-Vilom Pranayama: Alternate nostril breathing, where in nostril is changed with each inspiration.
 - i) The right nostril was closed with the right thumb and inhalation was done slowly and deeply through the left nostril by the subjects.
 - ii) The left nostril was closed with the ring and little finger and the right nostril was released, exhalation was done slowly and completely through the right nostril.
 - iii) Inhalation was done slowly and deeply through the same (right) nostril, keeping the left nostril closed and then the right nostril was closed and exhalation was done slowly and completely through the left nostril.

The above completed one cycle of anulom-vilom pranayama.

4. Bhramari Pranayama: 'Bhramar' means a large black bumble bee and this pranayama is so called because during exhalation a soft humming sound like that of a bumble bee is made.
 - A) The subjects, after a deep inhalation, exhaled very slowly with a humming sound.

- B) Bhramari pranayama was done while performing Sunmukhi Mudra. (1minute interval)

Sunmukhi Mudra

- A) The subjects were asked to raise the hands to the face and the elbows to the level of the shoulders.
 - B) They were instructed to place the thumbtips in the external auditory meatus to keep out external sounds.
 - C) They were asked to close the eyes and cover the eyelids with the fore and middle fingers. The upper eyelids were drawn down with the pad of the middle fingertips and the fore fingertips to keep out the light. The eye balls were kept gently pressed with the fingers.
 - D) The nostrils were kept pressed with the ring fingertips to narrow the nasal passage for slow, steady, rhythmic and subtle breathing. The little fingers were kept on the upper lip to feel the flow of breath.
5. Omkar Chanting: After completing the pranayama practice, three pronunciations of 'OM' were performed 3 times in 3 minutes at one minute interval.
 6. Meditation: 15 minutes (Concentration on own breathing and chest movements). One minute interval was compulsory before next step performance pranayama. The participants were subjected to the audio-visual reaction time recording before and after the pranayama training. The reaction time test was done in the Neurophysiology Research Laboratory, Department of Physiology, Mahatma Gandhi Medical College & Hospital. It was performed between 9:00 a.m to 11:00a.m. at a comfortable room temperature in noise free room.

Reaction Time

The apparatus used to measure reaction time was the 'Research reaction time apparatus' (Yantrashilp) manufactured by Anand agencies,

Pune-2. It is a portable device within built four digit chronoscope with least count of 1/1000 sec. i.e. 1 millisecond. Green light stimulus and high frequency beep stimulus was selected for recording visual reaction time and auditory reaction time respectively. Once the subject got familiarized with the instrument, the final reading was taken.⁷

For auditory reaction time three reading of the high frequency beep stimuli was recorded.⁸ For visual reaction time three readings of the green light stimulus was recorded in milliseconds from auto display. The average of three readings was taken.⁹ As soon as the stimulus is perceived by the subjects, he/she were asked to respond by pressing the response switch by index finger of the dominant and for each subject the lowest reading was taken as the value for the reaction time task.

The data was entered in Microsoft Office Excel Worksheet. Mean and standard deviation was calculated. Unpaired t test was applied to find significant association. p value <0.05 was considered statistically significant.

Results and Observation

The table 1 shows the mean value of audio reaction time in prepranayama training as

0.1842±0.01646 and post pranayama training as 0.1282±0.01642, the difference was found to be statistically highly significant (P<0.0001***).

The table 2 shows the mean value of visual reaction time in pre pranayama training as 0.2090±0.01685 and post pranayama training, the value was 0.1445±0.01520, difference was found to be statistically highly significant (P<0.0001***).

The mean value of audio reaction time in males and females. In males, the pre pranayama value was 0.1832±0.01734 and post pranayama was 0.1300±0.01732, which is statistically significant (P<0.0001***). In females, the pre pranayama value was 0.1844±0.01636 and post pranayama value was 0.1278±0.01628, which is statistically highly significant (P<0.0001***). [Table 3]

The Table 4 shows the mean value of visual reaction time in males and females. Inmales, pre pranayama value was 0.2074±0.01558 and in post pranayama was 0.1458±0.01502 which is statistically highly significant (P<0.0001***). In females, pre pranayama the value was 0.2094±0.01720 and post pranayama was 0.1442±0.01532, which is statistically highly significant (P<0.0001***).

Table 1: Effect of Pranayama on Audio Reaction Time (ART) in medical and paramedical students [before the training (Prepranayama) and after completion of training (Post pranayama)]

Group	n=no of subjects	Mean (Sec.)	±SD	P-value
PrePranayama	100	0.1842	0.01646	<0.0001***
Post Pranayama	100	0.1282	0.01642	

Table 2: Effect of Pranayama on visual reaction time in medical and paramedical students [before the training (Pre pranayama) and after completion of training (Post pranayama)]

Group	n=no of subjects	Mean (Sec.)	±SD	P-value
Pre pranayama	100	0.2090	0.01685	<0.0001***
Post pranayama	100	0.1445	0.01520	

Table 3: Effect of Pranayam on audio reaction time in males and female students

Gender	n	Pre pranayama (Audio Reaction Time)		Post pranayama (Audio Reaction Time)		p-value
		Mean (sec.)	±SD	Mean (sec.)	±SD	
Male	19	0.1832	0.01734	0.1300	0.01732	<0.0001***
Female	81	0.1844	0.01636	0.1278	0.01628	<0.0001***

Table 4: Effect of Pranayam of visual reaction time based in male and female student

Gender	N	Pre pranayama (Visual Reaction Time)		Post pranayama (Visual Reaction Time)		P-value
		Mean (sec.)	±SD	Mean (sec.)	±SD	
Male	19	0.2074	0.01558	0.1458	0.01502	<0.0001***
Female	81	0.2094	0.01720	0.1442	0.01532	<0.0001***

Discussion

In the present study, it was observed, that there is a decline in the reaction time values (both the audio and visual) after the pranayama training in the 100 students of the medical and paramedical colleges of Mahatma Gandhi medical college where the study was conducted.

The table no 1 shows the difference in the mean ART values in the subjects pre and post pranayamic training sessions. The findings of this study were consistent with the studies done by **Madanmohan et al**¹⁰, where a significant reduction in auditory reaction time was observed. Another study done by **A.S. Borkar**¹¹, had similar findings, where the reduced changes on audio reaction time, from 0.188 to 0.139 sec, was observed after imparting 4 weeks of pranayamic breathing exercises. Another similar finding was reported in the study done by **S.B. Jore**¹², where the students underwent pranayama training daily for 45 minutes for 6 days in a week for 12 weeks, on a volunteer basis from 1st year M.B.B.S. students. They found that after Pranayama training there was statistically significant decline in auditory reaction time. **Manish Dhadse**¹³ observed that pranayama in general and Anulom Vilom pranayama in particular can reduce auditory reaction time and have health promoting, toning effects on central neural structures; quantity, pattern of release of neurotransmitters and mental interaction involved in information processing.

The table no. 2, shows the difference between the mean value of visual reaction time in the medical and para- medical students before pranayama training & after pranayama training, and was found to be statistically highly significant.

Similar results were found in the studies done by **A.S. Borkar**¹¹ where a reduction in VRT from

0.196 sec. to 0.141 sec. after 4 weeks of pranayamic breathing exercise was found. Another study done by **Madanmohan**¹⁰ observed that there is a significant decrease in visual reaction time after 12 weeks of yoga practice. In the study done by **Dr. S.B. Jore et al**¹² the pranayama training was given daily for 45 minutes duration 6 days in a week for 12 weeks and there was statistically significant decline in visual reaction time.

Table no.3 and table no. 4 shows the mean value of audio reaction time and visual reaction time in males & females before pranayama training and after pranayama training which was found to be statistically highly significant. There is significant reduction in values of ART and VRT in both males and females after pranayama training. The findings of this table are consistent with the studies done by **Madanmohan**¹⁰, by **Chandrashekar V Hanji**¹⁴, **Dr. S.B Jore**¹² where they all had observed that after pranayama training there was statistically significant decline in ART and VRT both male and female subjects.

Effect of pranayama on reaction time could be due to greater cortical arousal & faster rate of information processing, improved concentration power, ability to ignore external stimuli i.e. less distractibility and improved memory.¹⁵ During pranayama practitioner not only tries to breathe but also tries to keep attention on breathing, leading to better concentration. This act of breathing removes attention from worries & distress. Practitioner can better handle day to day emotional, physical & mental stress.¹⁶ Nowadays there is noted high stress in medical students with changing relation approach with teaching faculties.¹⁷ The stress can cause affecting loco motor activity and altered behavioural changes (emotions and anxiety)¹⁸.

Conclusion

The medical and paramedical students are often not able to cope with the vastness of the syllabus and show lack of concentration and attention deficit which affects their results. The effect of pranayama on reaction time is seen as an increase in the attention ability of the individual and also the concentration becomes better. It was observed that the ART and the VRT values showed improvement in post pranayama training values when compared with pre pranayama training observations. The post pranayama ART values and the VRT values in males and females also showed a marked improvement when compared to their pre pranayama values. Practice of pranayama improves reaction time and higher brain functions which implies that pranayama leads to a greater cortical arousal and faster rate of information processing, improved concentration power, ability to ignore external stimuli, less distractibility and improved memory.

Therefore, regular practice of pranayama has vast potential and health benefits. It is complementary to overall stress management (physical, instinctual, emotional, intellectual and spiritual). Inculcating the habit of regular pranayama early in life, will definitely have favorable effect.

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