

Original Research Article

Effect of yogic relaxation technique on auditory and visual reaction times

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ABSTRACT

Background: Human beings receive various types of stimuli in day to day life and respond to them accordingly. The time taken to receive a stimulus, its processing and giving a response is different for every individual at minute level, in milliseconds. This time interval is called reaction time. Various yogic practices are found to influence the Reaction Time of individuals. Aim of the work was to evaluate the immediate effect of deep relaxation technique on auditory and visual reaction time.

Methods: Auditory and visual reaction times have been measured using simple reaction time tasks in Inquisit software (version 4.0.10.0). 115 healthy yoga students from SVYASA Yoga university, between the age group of 20 to 50 years were taken for the study. Pre and post measurements of auditory reaction time and visual reaction time was done. 10 minutes of pre-recorded DRT was given as intervention and immediately after that reaction times were measured.

Results: There was a significant decline in the ART and VRT observed in the Post DRT condition. Statistical analysis was carried out using JASP software.

Conclusions: The significant decrease in Auditory and Visual Reaction Time shows that DRT helps to increase the awareness and attention of individuals.

Keywords: Auditory reaction time, Attention, Deep relaxation technique, Visual reaction time, Yoga

INTRODUCTION

Time is an integral part of every event occurring on this earth. The measure of time has always been an essential part of life since several thousand years ago. Human beings have been gifted by God with five sense organs eyes, nose, ears, tongue, and skin. Out of these two of the senses are for vision and auditory. In our day to day life we come across many situations, we see objects, hear the sounds, our senses witness various events happening in our surroundings and act or react accordingly. This is the innate tendency of humans to perceive a stimuli and show a reaction accordingly. But in every individual the time taken between receiving a stimuli or information, it's

processing, decision making and giving a response or reacting is different at the minute level, in some milliseconds. This time interval between the application of a stimuli and appearance of an appropriate response is called Reaction Time (RT).

In scientific researches Human reaction time is considered as an indirect index of central nervous system processing capability and a simple means of determining sensory motor association and individual performance.¹ RT measurement has been often used in the study of cognitive processes.² Some research papers state that alertness of a person can also be determined by measuring his RT as how quickly one responds to a

stimulus depends on his reaction time.³ Factors which have been studied to have an effect on RT are gender, age, personality type, fatigue, fasting, physical fitness, breathing cycle, distractions, alcohol, exercise, intelligence of the subject and whether the stimulus is auditory or visual.^{4,5} Reaction time has been measured since the first half of the 19th century on the emergence of the problem of "personal equation" and after that also many psychologists have made significant contributions in the area of RT and variety of scientific and applied uses of RT has been found in due course of time.^{2,6,7}

From various researches conducted in the past it has been evident that different yogic techniques tend to have an effect on RT. Repeated practice of Yoga is supposed to help in reaching a state of perfect self-awareness.⁸ When an individual will be aware his RT will be lower. Various researches have been done to study the effect of yoga techniques like Asanas, Surya Namaskara, Pranayamas and meditation on reaction time but the effect of yogic relaxation techniques on RT has not been much explored.^{3,9-16} We conducted this study to find whether short duration yogic relaxation technique impacts the audio-visual reaction time of a healthy individual. These studies gave us impetus to conduct and study the effect of a Yoga-based relaxation technique "Deep Relaxation Technique" (DRT) on reaction time.

METHODS

Participants

The study was conducted at SVYASA Yoga University, Bengaluru, India from January to February 2020. The study included healthy students aged between 20 to 50 years. Both male and female subjects residing in hostel having similar eating and sleeping patterns, practicing yoga regularly were included for the study.

Inclusion criteria

Healthy subjects, without any hearing or visual disorder, student who don't have any neurological illness, any acute illness, having normal hearing ability, non-smokers and subjects with uniform pattern of diet and activity were included in the study.

Exclusion criteria

Hearing impairment, any organic disease of ear and nose, chronically ill, students taking any kind of drugs, students involved in any athletic training program were excluded from the study.

Study design

Design of the study was two groups pre-post design as shown in Figure 1. 115 subjects were assessed for visual and auditory reaction time pre and post of DRT practice.

Intervention

Deep relaxation technique (DRT) developed at Swami Vivekananda Yoga Anusandhana Samstha, Bengaluru was performed by subjects for 10 minutes after collecting the Pre ART and VRT data. They were instructed to lie down comfortably on their back in supine posture on their respective Yoga mats and were asked to relax by following the instructions of the audio of DRT by Dr H. R. Nagendra in the psychology laboratory, Anveshana at SVYASA. DRT is performed lying down on the floor with closed eyes. It involves relaxing lower part of the body from the tip of the toes to the waist followed by chanting 'A'kara. Then relaxing body parts from the waist to the neck, followed by chanting 'U'kara. Next relaxing head and neck, followed by chanting 'M' kara, the last part of 'A-U-M'. Then let the whole-body collapse on the ground with a feeling of 'letting go', chanting the whole word, 'AUM'. Let oneself feel apart from the physical body, aware of expansion, and merging with a limitless space like the sky.¹⁷

Assessment

Simple ART and simple VRT tests were conducted using Inquisit software with version 4.0.10.0. Inquisit software supports more than 500 types of cognitive and psychological tasks. We have conducted simple auditory reaction time task and simple visual reaction time task. All the computers in the lab were with same hardware specification and all the computers were installed with the same version of the Inquisit software. Participants needed to press SART task to measure the auditory reaction time. After variable time intervals, a sound was played to the participant. The task was to press the spacebar as soon as the sound is presented. Mean and median latency, latency standard deviation as well as minimum latency and maximum latency were recorded in a summary data file. The set-up of the script took approximately 2 minutes to complete. The script ran 2 blocks of 20 trials each. The time intervals were random from 2000 ms, 3000 ms, 4000 ms, 5000 ms, 6000 ms, 7000 ms, 8000 ms intervals. The sound was panned from the system and was heard by the participants through headphones. The colour of the screen background was white. To measure the visual reaction time participants needed to press SVRT task. The participant used to get presented a fixation cross that was followed after variable time intervals by a visual target stimulus (a circle). The participant's task was to press the spacebar as soon as the target stimulus circle appeared on the screen. Latency, mean latency, and latency standard deviation were recorded in a data file. The set-up of the script took approx 4 minutes to complete. The script ran 2 blocks of 20 trials each. The fixation cross as well as the target stimuli circle appeared in the center of the screen. The time intervals are randomly from 2000 ms, 3000 ms, 4000 ms, 5000 ms, 6000 ms, 7000 ms, 8000 ms. The colour of the fixation circle was red. The colour of the screen background was white.

Statistical analysis

The data generated in visual and auditory summary files of Inquisit software (iqdat file extension) was transformed to Microsoft Excel (xlsx file extension) document. The transformed data contained the Pre and Post values for the variables mean, median, minimum latency, maximum latency, and standard deviation for auditory and visual reaction times. Excel document was converted to CSV format and used in JASP software for performing statistical analysis. The mean value of all 40 attempts of each participant of ART and VRT were considered for further analysis. ART and VRT data were collected in Pre DRT condition and immediately in Post DRT condition of 115 participant. After doing descriptive statistics 9 outliers were detected and removed in ART group and 7 outliers were removed in VRT group.

According to the Central Limit Theorem, our data was considered to be normally distributed. Pre-Post comparison of all the participants for both ART and VRT was done by paired sample t-test. A median split was performed for both ART and VRT data and Pre-Post comparison were done by paired sample t-test. Comparison across male and female gender of Pre value was done using independent sample t-test. Pre-Post comparison of ART and VRT for each gender was performed using paired sample t-test.

RESULTS

The demographic details of the participants are given in Table 1. A paired sample t-test was conducted to compare ART and VRT in Pre-DRT and Post-DRT condition for 106 participants in ART group and 108 participants in VRT group. The comparison results are depicted in Table 2. There was a significant difference in the score for Pre-DRT (M=356.75, SD=139.35) and Post-DRT (M=319.55, SD=92.26) condition; $p=0.002$, $t=3.135$, $d=0.304$ in ART group. In VRT group also there was a significant difference in the score for Pre-DRT (M=382.85, SD=113.12) and Post-DRT (M=337.98, SD=106.29); $p=3.509e-5$, $t=4.32$, $d=0.416$. These results

suggest that DRT does have an effect on ART and VRT. Specifically, our results suggest that after doing DRT the reaction time decreases (becomes faster). In both ART and VRT groups after data collection and removing the outlier, we divided the subjects into two groups based on the median score during analysis. Subjects having mean-pre value less than median score were segregated as Group 1 (above median) and subjects having mean-pre value more than median score were segregated as Group 2 (below median). In ART group 53 subjects having mean-pre value less than median score (Median ART=315.76) were put in Group 1 and 53 subjects having mean-pre value more than median score were put in Group 2. Similarly, in VRT group 54 subjects having mean-pre value less than median score (Median VRT=339.73) were put in Group 1 and 54 subjects having mean-pre value more than median score were put in Group 2. A paired sample t-test was conducted for both Group 1 and Group 2 in ART and VRT. Group 1 results are depicted in Table 3.

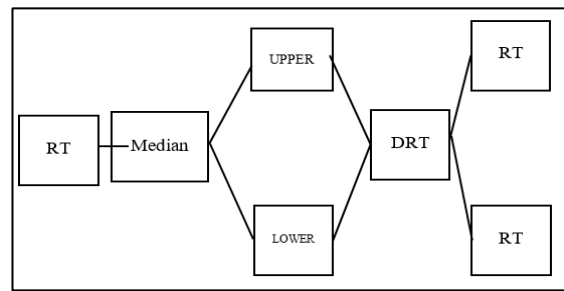


Figure 1: Design of the study.

Table 1: Demographic data of participants.

Variable	Category	Frequency (f)	Percentage
Gender	Male	51	44.3
	Female	64	55.6
Age (in years)	20-30	74	64.3
	31-40	29	25.2
	41-50	12	10.4

n=115

Table 2: Statistical values for DRT (All).

DRT (All)												
	N	Pre			Post			Δ%		T	P	Cohen's d
		Mean	S.D	S.E	Mean	S.D	S.E	Mean	S.D			
ART	106	356.75	139.35	13.54	319.55	92.26	8.96	10.43	33.79	3.135	0.002	0.304
VRT	108	382.85	133.12	12.81	337.98	106.29	10.23	11.72	20.16	4.32	3.509e ⁻⁵	0.416

Table 3: Statistical values for group1 (above median).

Group 1 (above median)												
		Pre			Post			Δ%		T	P	Cohen's d
		Mean	S.D	S.E	Mean	S.D	S.E	Mean	S.D			
ART		271.39	24.37	3.35	275.04	39.87	5.48	-1.34	-63.61	-0.776	0.441	-0.107
VRT		289.98	29.17	3.97	291.12	50.10	6.82	-0.39	-71.77	-0.178	0.859	-0.024

Table 4: Statistical values for group2 (below median).

Group 2 (below median)												
	Pre			Post			Δ%		T	P	Cohen's d	
	Mean	S.D	S.E	Mean	S.D	S.E	Mean	S.D				
ART	442.10	154.17	21.18	364.07	107.52	14.77	17.65	30.26	3.553	8.190E ⁻⁴	0.488	
VRT	475.73	131.71	17.92	384.85	125.78	17.12	19.10	4.50	5.124	4.284E ⁻⁶	0.697	

Table 5: Statistical values for female group.

Female												
	N	Pre			Post			Δ%		T	P	Cohen's D
		Mean	S.D	S.E	Mean	S.D	S.E	Mean	S.D			
ART	58	360.10	153.54	20.16	322.73	108.01	14.18	10.38	29.65	2.021	0.048	0.265
VRT	61	380.15	125.88	16.12	342.30	119.81	15.34	9.95	4.83	2.635	0.011	0.337

Table 6: Statistical values for male group.

Male												
	N	Pre			Post			Δ%		T	P	Cohen's D
		Mean	S.D	S.E	Mean	S.D	S.E	Mean	S.D			
ART	48	352.70	121.51	17.54	315.71	69.58	10.04	10.49	42.74	2.659	0.011	0.384
VRT	47	386.37	143.28	20.90	332.38	86.59	12.63	13.97	39.56	3.605	7.650E ⁻⁴	0.526

There was no significant difference in the score for Pre-DRT (M=271.39, SD=24.37) and Post-DRT (M=275.04, SD=39.87) condition in Group 1 of ART (p=0.441, t=-0.776, d=-0.107). In Group 1 of VRT also there was no significant difference in the score for Pre-DRT (M=289.98, SD=29.17) and Post-DRT (M=291.12, SD=50.10); p=0.859, t=-0.178, d=-0.024. These results suggest that DRT does not have a significant influence on ART and VRT of subjects who already have comparatively faster reaction time.

Paired sample t-test showed a significant difference in the scores for Pre-DRT (M=442.10, SD=154.17) and Post-DRT (M=364.07, SD=107.52); p=8.190e-4, t=3.553, d=0.488 in Group 2 of ART. In Group 2 of VRT also there was a significant difference in the scores for Pre-DRT (M=475.73, SD=131.71) and Post-DRT (M=384.85, SD=125.78); p=4.284e-6, t=5.124, d=0.697. These results suggest that DRT significantly improved both ART and VRT of subjects having comparatively slower reaction time. Group 2 results are depicted in Table 4.

In both ART and VRT groups we segregated the sample gender wise. In ART group there were 58 female and 48 male participants whereas in VRT group there were 61 female and 47 male participants. A paired sample t-test was conducted to compare ART and VRT in Pre-DRT and Post-DRT conditions for both male and female participants. Results depicted for female participants in Table 5.

Table 6 depicts the results for male participants. There was a significant difference in the score for Pre-DRT (M=360.10, SD=153.54) and Post-DRT (M=322.73,

SD=108.01) condition; p=0.048, t=2.021, d=0.265 in ART group. In VRT group also there was a significant difference in the score for Pre-DRT (M=380.15, SD=125.88) and Post-DRT (M=342.30, SD=119.81); p=0.011, t=2.635, d=0.337.

There was a significant difference in the score for Pre-DRT (M=352.70, SD=121.51) and Post-DRT (M=315.71, SD=69.58) condition; p=0.011, t=2.659, d=0.384 in ART group. In VRT group also there was a significant difference in the score for Pre-DRT (M=386.37, SD=143.28) and Post-DRT (M=332.38, SD=86.59); p=7.650e-4, t=3.605, d=0.526.

These results suggest that DRT improves the ART and VRT in both the genders. Specifically, immediately after doing DRT there is significant improvement of VRT in male participants.

DISCUSSION

Reaction time is controlled by an individual's central nervous system.¹⁸ The CNS comprises of billions of neurons that receives sensory inputs or stimulus through signals from an individual's sense organs. From the sense organs the neurons carry these signals to the brain.¹⁹ The brain receives, interprets, and sends physical and mental responses corresponding to these signals. All these processes happen within milliseconds but differs in each individual and one can be trained to give faster response.

Yogic relaxation technique induces deep rest to the senses along with guided awareness.¹⁷ It reduces tiredness and fatigue. It makes the mind calm as a result of which an individual quickly perceives and process a

stimuli. Along with mental relaxation it also provides deep rest to the physical body. It helps in strengthening the connection between the body and the brain.²⁰ Through guided relaxation when an individual moves their awareness to each body part one also gets alert and energized and quickly responds to a stimulus physically as well. This quicker processing ability of both the brain and the body helps in quicker decision making and voluntary movements in response to a stimuli thus leading to a quicker response and a faster reaction time.⁹

The current study conducted on 115 healthy individuals between the age group 20-50 years showed that there is significant improvement in VRT ($p=3.508e-5$) and ART ($p=0.002$) immediately after the practice of Deep Relaxation Technique (DRT). After conducting the median split there was no significant improvement in RT observed for individuals who already had shorter RT. Whereas, those who had slower RT they showed a significant improvement in both ART ($p=8.190e-4$) and VRT ($p=4.284e-6$) after DRT. Male participants showed more improvement in VRT than female after the practice of DRT. This study also showed that there was no significant difference of RT after the practice of DRT between males and females.

This study is in line with the study conducted on Visual and Auditory RT (VRT, ART) by Bhavanani et al, in 2013, a randomized control trial taking 21 healthy female subjects in yoga group and 19 subjects in control group. In yoga group significant improvement in ART and VRT of the subjects was observed immediately after the practice of three rounds of Surya Namaskar.¹²

Even in this study there was significant improvement in VRT and ART of all female subjects immediately after the practice of DRT. Similar results were observed in a study conducted in 2010 by Biswas et al, to observe the effect of short-term yoga training on pulmonary and reaction time in rural medical students.¹⁵ They classified the subjects into three groups like pranayama group (Kapalabhati) having 12 participants, asana group 13 participants and Rajayoga meditation group 17 participants. At the end of 4 weeks they observed that both visual and auditory reaction time improved in all the three groups in accordance with the present study. It was also found that progressive muscle relaxation intervention which is also a form of relaxation technique helps to improve motor response by reducing anxiety and by relaxing muscle tension and improves RT.²¹

As stated in the above studies, it has been found that various yogic techniques have been found to have an impact on reaction time and specifically relaxation technique is also found effective in reducing Reaction time by having an impact on the higher functions of the central nervous system. Following the practice of deep relaxation technique there is a reduction in sympathetic activity. Along with relaxation it makes one more steadier and distractions of the mind get reduced making

an individual quickly responding to a stimuli leading to decreased RT.³

Limitations

This study was limited to subjects who were having the prior exposure to yoga. Duration of intervention was limited for 10 minutes only and there was lack of control group for comparison. A diverse sample with no prior experience in Yoga can be taken for further studies.

CONCLUSION

DRT provides deeper rest to the system improving awareness and alertness. It can influence the central nervous system and enhances the motor responses. This can be extended to the field of sports, race driving where having a fast or short reaction time is required. Furthermore, studies are needed with longer time of intervention. The study design can be improved incorporating different age groups. This study can also be extended to clinical setups to determine the effectiveness of relaxation technique on RT of individuals with different ailments.

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