

Effects of Yogasana Practice and Gymnastics on Reaction Times

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Abstract

Early man's ability to survive depended primarily on physical fitness. It is known that a number of indices of physical fitness are influenced by yogasana and gymnastics. Aim of the study is to find out, effects of these short term exercises on Auditory reaction time, visual reaction time and cutaneous reaction time in healthy young volunteers.

The protocol of the study involved measurement of ART, VRT and CRT in both hands separately; before and after one month of yoga and gymnastics training in two groups. Each consisting of 25 healthy male volunteers, in the age group of 18- 23 years. Response – analyzer [YSRT – 0101] instrument was used for the measurements of ART, VRT and CRT.

The results of study showed that, the random and alert RTs, were decreased after both yoga and gymnastics training ($p < 0.001$). Right hand RTs were significantly shorter than the left hand RTs before and after yoga as well as gymnastics training (random and alert, $p < 0.001$). There was a greater reduction in random RTs after gymnastics training whereas, a greater reduction in alert RTs was found after yoga training but the p value was not significant.

To conclude, yogasana and gymnastics training, both have showed the improvement in the RTs.

Keywords: ART; CRT; VRT; Gymnastics; Yogasana.

Introduction

Yoga is not just about bending or twisting the body in different shapes. It is giving care, to our body, mind and the breath. It includes postures (asanas), breathing techniques (pranayama), and meditation. Through these the body, mind and the breath come in harmony with each other; the very moment yoga happens.[1]

Gymnastics is a sport involving the performance of exercises requiring physical strength, flexibility, power, agility, coordination, grace and balance.[2]

It is known that a number of indices of physical fitness are influenced by yogasana

and gymnastics. These exercises improve the sensory motor performance, and hence reaction time (RT) also called response time, provides a quantitative measurement of these beneficial effects.[3] Reaction time is an interval of time between the signal to begin and the response by the subject.[4]

Only limited studies are available on the physiological effects of short term yogic practice[5] and gymnastics.

Aim of the study is to find out the effects of these short term exercises on Auditory reaction time (ART), visual reaction time (VRT) and cutaneous reaction time (CRT) in healthy young volunteers.

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Materials and Methods

The present study was conducted on volunteers comprising 50 apparently healthy male of age group 18-23 years, according to their preferences, they were divided into two groups, a yoga group (Y), and a gymnastics group (G). They had clinically normal hearing, vision and cutaneous (touch) sensations and were absolutely sound physically and mentally. Their history and thorough clinical examination did not reveal any abnormality of any system. Past and family history of subjects did not suggest any neurological abnormality or any diseases which tend to affect CNS or any other system directly or indirectly, e.g.: diabetes mellitus, hypertension or mental apathies.

All subjects were right handed, non smokers, non alcoholics, non-tobacco product chewers, took no drugs, and had a uniform pattern of diet and activity. They were not exposed to any long term exercises, sports, or yogic postures previously. The yoga and gymnastics trainings were given to them for about 60 minutes between 5 to 7 am, except on Sundays for one month, under the supervision of two qualified persons, and the subjects were asked not to change their lifestyle over the one month duration of the study.

This being a self control study, no control group was kept. Subjects were explained about the study protocol and, informed consent was obtained from them before taking part.

Two groups of subjects, Y and G, each consists of 25 subjects, their physical parameters such as height, weight, BSA, were recorded. Their reaction times ART, VRT and CRT were measured before and after the training in both the hands separately; in both the groups with instrument Response-Analyser.

“Response- Analyser” manufactured by “Yantrashilpa” Electronics- 0101/Pune [YSRT-0101]. This instrument works with a

working supply of 10v.DC and equipped with a very sensitive quartz clock which can measure up to $1/10^{\text{th}}$ of a millisecond. Display accuracy of the instrument is + 0.001 sec and display range is 9.999 seconds maximum. It is a micro-processor based system that can be programmed to measure the response times of the subject to various sensory stimuli, eg: vision, sound, electrical etc.

Different programmes are used for producing auditory, light and cutaneous stimuli; subjects are instructed to press a response microswitch (thumb switch) as quickly as possible after the presentation of the stimuli but never before. The intensity of stimuli was kept constant for all the subjects.

Results

The results are expressed as mean + SD [n=25].

Right hand RTs were shorter than the left hand RTs before and after yoga training, the differences were statistically significant ($p < 0.001$ in both random and alert).

Right hand RTs were shorter than the left hand RTs before and after gymnastics training (in both random and alert). The differences were statistically significant ($P < 0.001$).

The reaction times were found to be shorter after yoga training (random and alert) which was significant ($p < 0.001$).

The reaction times were found to be shorter after gymnastics training (random and alert) which was again significant ($p < 0.001$).

The degree of reduction in RTs in the yoga training group was compared with that of gymnastics training group for the random RTs as well as alert RTs by using t- test and z-test. On analyzing this, it is found that there is a greater reduction in random RTs after gymnastics training whereas there is a greater reduction in alert RTs after yoga training.

Table I: Random Reaction Time [RRT] for Right Hand

Measurements	Before yoga training [Y ₁] Mean +SD [in msec]	After yoga training of one month [Y ₂] Mean +SD [msec]
ART RA	206.52 ± 28.21	192 ± 29.31
VRT RA	229 ± 31.19	212.39 ± 30.26
CRT RA	255.40 ± 39.28	234.42 ± 33.58

ART Y₁ -Y₂ P< 0.001[HS]
 VRT Y₁ -Y₂ P<0.001[HS]
 CRT Y₁ -Y₂ P< 0.001[HS]

Table II: Random Reaction Time [RRT] for Left Hand

Measurements	Before yoga training [Y ₁] Mean +SD [in msec]	After yoga training of one month [Y ₂] Mean +SD [msec]
ART LA	216.79 ± 29.89	200.9 ± 30.81
VRT LA	242.16 ± 35.53	224.14 ± 29.61
CRT LA	264.79 ± 40.63	245.08 ± 38.20

ART Y₁ -Y₂ P< 0.001[HS]
 VRT Y₁ -Y₂ P<0.001[HS]
 CRT Y₁ -Y₂ P< 0.001[HS]

Table III: Alert Reaction Time [ALRT] for Right Hand

Measurements	Before yoga training [Y ₁] Mean +SD [in msec]	After yoga training of one month [Y ₂] Mean +SD [msec]
ART RA	180.26 ± 16.79	168.66 ± 15.91
VRT RA	184.96 ± 16.49	173.62 ± 16.64
CRT RA	190.34 ± 16.00	179.11 ± 16.75

ART Y₁ -Y₂ P< 0.001[HS]
 VRT Y₁ -Y₂ P<0.001[HS]
 CRT Y₁ -Y₂ P< 0.001[HS]

Table IV: Alert Reaction Time [ALRT] for Left Hand

Measurements	Before yoga training [Y ₁] Mean ±SD [in msec]	After yoga training of one month [Y ₂] Mean ± SD [msec]
ART LA	181.27 ± 16.71	169.58 ± 15.76
VRT LA	186.26 ± 16.33	174.42 ± 16.48
CRT LA	191.50 ± 15.74	180.13 ± 16.47

ART Y₁ -Y₂ P< 0.001[HS]
 VRT Y₁ -Y₂ P<0.001[HS]
 CRT Y₁ -Y₂ P< 0.001[HS]

Table V: Random Reaction Time [RRT] for Right Hand

Measurements	Before gymnastics training [G ₁] Mean +SD [in msec]	After Gymnastics training of one month [G ₂] Mean + SD [msec]
ART RA	210.68 ± 39.33	189.34 ± 29.10
VRT RA	233.92 ± 43.37	204.27 ± 31.15
CRT RA	259.60 ± 47.77	223.68 ± 36.72

ART G₁ -G₂ P< 0.001[HS]
 VRT G₁ -G₂ P<0.001[HS]
 CRT G₁ -G₂ P< 0.001[HS]

Table VI: Random Reaction Time [RRT] for Left Hand

Measurements	Before gymnastics training [G ₁] Mean \pm SD [in msec]	After Gymnastics training of one month [G ₂] Mean \pm SD [msec]
ART LA	221.77 \pm 39.32	197.51 \pm 30.03
VRT LA	242.2 \pm 47.24	211.82 \pm 34.86
CRT LA	273.24 \pm 55.83	230.70 \pm 42.14

ART G₁-G₂ P<0.001[HS]VRT G₁-G₂ P<0.001[HS]CRT G₁-G₂ P<0.001[HS]**Table VII: Alert Reaction Time [ALRT] for Right Hand**

Measurements	Before gymnastics training [G ₁] Mean \pm SD [in msec]	After Gymnastics training of one month [G ₂] Mean \pm SD [msec]
ART RA	174.41 \pm 23.10	165.53 \pm 22.41
VRT RA	181.97 \pm 22.55	173.33 \pm 22.22
CRT RA	190.90 \pm 24.27	182.15 \pm 24.42

ART G₁-G₂ P<0.001[HS]VRT G₁-G₂ P<0.001[HS]CRT G₁-G₂ P<0.001[HS]**Table VIII: Alert Reaction Time [ALRT] for Left Hand**

Measurements	Before gymnastics training [G ₁] Mean \pm SD [in msec]	After Gymnastics training of one month [G ₂] Mean \pm SD [msec]
ART LA	175.38 \pm 20.45	166.61 \pm 22.41
VRT LA	183.39 \pm 22.17	174.54 \pm 22.13
CRT LA	192.23 \pm 24.37	183.49 \pm 23.91

ART G₁-G₂ P<0.001[HS]VRT G₁-G₂ P<0.001[HS]CRT G₁-G₂ P<0.001[HS]**Abbreviations:**

ART – auditory reaction time
 CRT – cutaneous reaction time
 G – gymnastics group
 LA – left arm
 RA – right arm
 RT – reaction time
 VRT – visual reaction time
 Y – yoga group

Discussion

Right hand RTs were significantly shorter than the left hand RTs both before and after yoga and gymnastics training (in both random and alert).[6] This may be due to the fact that, the right handers possess a right shift factor which predisposes them to performance of skilled movements by right hand.[7]

The reaction times were found to be shorter after yoga training (random and alert) which was significant (p<0.001). A decrease in RTs indicates an improved

sensory-motor performance and could be due to an enhanced processing ability of the CNS.[8] This could be due to 1) greater arousal and faster rate of information processing and 2) improved concentration power and ability to ignore and / or inhibit extraneous stimuli. Yoga practitioners are known to have better attention and less distractibility due to a decrease in mental fatigability and an increase in performance quotient.[9]

The reaction times were shorter after gymnastics training (random and alert) which was again significant (p<0.001).[10] It is believed that neuromuscular speed may

be maintained by high levels physical fitness. The improved psychomotor performance of the aerobically trained subjects was related to enhanced cerebral metabolic activity such as an increased turnover of neuromuscular transmitters. Exercise induced increase in aerobic efficiency facilitate the transport of oxygen from the environment to the consumer cells in the brain which in turn may improve psychomotor aspects of brain function. Exercise may have beneficial effects on sensory motor factors which contribute to the improvement in the RTs.

Alert RT depends upon the ability to focusing, and a reduction in alert RT means better or improved ability to focus attention. [11,12]

Random RT depends on general level of preparedness or alertness, so reduction in random RT means a general increase in the level of readiness to respond or a general increase in the alertness.

In yoga training a silent zone is maintained; as it is done in isolation, it will improve the concentration power. This may be the reason for greater reduction in alert RTs and less reduction in random RTs. Whereas gymnastics is done in a noisy zone which is more conductive than silent zone. Hence it causes a greater reduction in the random RTs and less reduction in alert RTs.

Conclusions

Right hand RTs were shorter than left hand RTs, this may be due to the right handers possess a right shift factor which predisposes them to performance of skilled movements by right hand.

Yoga practice have reduced the RTs, which may be due to one of the followings:

- 1) Decreased mental fatigability
- 2) Better or improved ability to focus attention.

Gymnastics exercises have reduced the RTs which may be due to one of the following:

- 1) Increased transport of oxygen to the brain cells
- 2) Enhanced metabolic activity.

There is a greater reduction in numerical values of alert RTs after yoga training, which may be due to better or improved ability to focus attention. While there is a greater reduction in random RTs after gymnastics training, which may be due to a general increase in the level of readiness to respond. Further studies are needed to throw more light in this regard.

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