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Evaluation of the Effect of Gym Workout on the Cognitive Abilities; Assessment by Simple Reaction Times

Sendil Kumaran D¹, Venkatesh G¹, and Ayasha juhi¹

¹Department of physiology, Sri Siddhartha Medical College, Tumkur

ABSTRACT

The Gym workouts are having shown various benefits which are regardless of age, gender and physical ability. Clinical conditions like diabetes mellitus, hypothyroidism and depression are affected with cognitive abilities of the individual and hence have prolonged reaction time for various sensory stimuli. Methods to improve the reaction time are the need of the hour. In this context, this study was taken up to evaluate effect of gym workout on Auditory reaction time (ART), Visual reaction time (VRT) and Cutaneous reaction time (CRT). Right handed 25 male healthy volunteers who were aged between 18-25 years were selected. ART, VRT and CRT were tested after training on the instrument. A gym workout protocol was instituted and reaction times were again treated. Among the Alert responses ART was quicker than the VRT and CRT irrespective of before or after the gym workout. Also, there was significant decrease in the values of all the reaction times after the six months of gym workout. Random responses also showed the similar pattern. Pearson correlation showed that no correlation between the anthropometric measurements and the reaction times. Gym can be of a useful tool to improve on the reaction times. Also, this may be extended to the patients with diabetes mellitus, hypothyroidism and depression.

Keywords: Gym, Auditory reaction time, Visual reaction time, Cutaneous reaction time

**Corresponding author*



INTRODUCTION

Reaction time tests are the simple and non invasive technique for the assessment of cognitive abilities. It is the measurement of the time taken by an individual to respond to a stimulus which may be in the form of auditory, visual or touch. Faster reaction time means the better sensory-motor performance and better processing ability of the central nervous system. Hence this technique is employed in the fields of mental chronometry, psychometric psychology and in training mentally challenged children.[1] There are several clinical conditions like diabetes mellitus, hypothyroidism and depression which can affect the cognitive abilities of the individual. [2,3] Neuropathy is one of the micro vascular complication of diabetes is a condition affecting nerve fiber subtypes. Reaction time tests are ideal to identify the neuropathic changes in diabetics. Hypothyroid patients are associated with low basal metabolic rate and may require more time to respond. Individuals with decreased cognitive abilities are prone for injuries. Falls in the old aged people is attributed to the decreased cognitive abilities due to aging process. Therefore, there is a need for the various methods to improve the cognitive abilities of the patients. Various forms of exercises like cycling and type of practices like yoga are studied with respect to its effect on reaction times. [4,5] The effect of gym workout is less addressed in the literature. Therefore, this study intended to evaluate the effect of gym workout on various reaction times.

Gym workouts are a set of strenuous exercises associated with weights which may be free weights or machine weights. The Gym workouts are associated with several advantages. The benefits are regardless of age, gender and physical ability. Gym helps to burn calories and prevents excess weight gain. It helps in preventing the non communicable diseases like hypertension, hypercholesteremia, cardiovascular diseases, metabolic syndrome and Type 2 diabetes mellitus. They have shown to improve the psychological disorders like depression. They also promote better sleep and make feel better. [6,7] These facts gave this study an impetus to investigate the auditory reaction time (ART), visual reaction time (VRT) and cutaneous reaction time (CRT) before and after the six months of gym workout.

MATERIALS AND METHODS

The present follow up study was conducted on 25 male healthy volunteers who were right handed and aged between 18-25 years. They had clinically normal hearing and vision. The subjects were not practicing any form of exercises or sports for the past one year. Smokers, alcoholics and subjects with any chronic illness like hypertension or diabetes were excluded. Selected subjects were briefed about the study protocol and written informed consent was obtained. The subject's anthropometric parameters were recorded. ART, VRT and CRT were measured, a gym workout module was instituted for six months, after which ART, VRT and CRT were again measured, compared with the previous values and analysed statistically using two tailed paired 't' test. Relation between the anthropometric parameters and reaction times were correlated using Pearson's correlation test. In order to avoid the familiarity bias, a session was organized to familiarize the participants to instrument and to train them on the test process. Only later the actual values were obtained.

Reaction times were measured in a quiet secluded room with an ambient temperature of 27°C, between 10 AM and 12.30 PM. RT was assessed by making use of an instrument, RESPONSE –ANALYSER (Model YSRT-0101, Yantrashilpa electronics, Pune). It has an audio mode, visual mode and cutaneous mode for ART, VRT and CRT respectively. The instrument has 2 buttons, first one is a start button, handled by the examiner to deliver the stimulus and the second button is the stop button (response switch), which is to be pressed by the participant when he perceives the stimulus. Thumbs of right and left hands of each subject were being used alternatively to press response switch to get reading for that particular hand. For ART, stimulus was delivered through a head phone of capacity 1000 Hz tone and for VRT; visual stimulus was through a glowing bulb. Start and stop buttons are connected to a computer which records the reaction time in milliseconds. CRT test measures the response to a cutaneous (touch) stimulus. Cutaneous mode was selected. Here the stimulus was contact between the plunger and the skin. Subjects were asked to press the response switch as soon as the touch with the plunger was felt by the other hand. The reading on the display indicated response time to the cutaneous stimulus in milliseconds. The 'alert' values were obtained by keeping the participants mentally alert by a word of caution to avoid possible distraction. After few seconds, stimulus was made to arrive by pressing the start switch. 'Random' values were obtained by changing the time of occurrence of stimuli without cautioning the participant. Gym workout was instituted by a qualified instructor for six days a week between 5-7 AM for six months duration. The gym workout components included contraction of the various muscles of abdomen, back, shoulders, chest and thighs against the weights. Initially a beginner's module with fewer loads was instituted for acclimatization but later loads were increased depending on the individual capacity.

RESULTS

Results obtained were tabulated and the values before and after the gym were compared using two tailed paired 't' test. The Pearson correlation was used to correlate basal reaction time values with anthropometric values. The results are shown in Table 1, 2, and 3. Table 1 shows the anthropometric measurements and blood pressures of the study group. Table 2 shows the Alert responses before and after gym workout. It shows that ART was quicker than the VRT and CRT irrespective of before or after the gym workout. Also, there is significant ($p < 0.01$) decrease in the values of all the reaction times after the six months of gym workout. Table 3 shows the random responses before and after gym workout. It also shows the significant ($p < 0.01$) decrease in the values of all the reaction times after the six months of gym workout. And here also ART is less than both CRT and VRT on both the occasions of before and after gym workout.

Table1: Show the anthropometric measurements of the participants

	Range	Mean \pm SD
Age (years)	18 – 24	20.72 \pm 1.88
Height (cms)	158-195	168.60 \pm 8.12
Weight (kgs)	48-79	62 \pm 8
Surface Area (sq mts)	1.48-2.20	1.72 \pm 0.15
Pulse rate (per minute)	68-92	80 \pm 4
Systolic blood pressure (mm of Hg)	110-130	115 \pm 6
Diastolic blood pressure(mm of Hg)	70-82	74 \pm 5

Table 2: Show the Alert responses before and after Gym exercise

		Before Gym exercise	After Gym exercise	p-value*
ART (msec)	Right	180 \pm 22	171 \pm 24	<0.001
	Left	180 \pm 23	174 \pm 20	<0.001
VRT (msec)	Right	184 \pm 18	178 \pm 22	<0.001
	Left	183 \pm 22	173 \pm 22	<0.001
CRT (msec)	Right	190 \pm 24	181 \pm 24	<0.001
	Left	192 \pm 24	183 \pm 24	<0.001

two tailed paired 't' test

Table 3: Show the Random responses before and after Gym exercise

		Before Gym exercise	After Gym exercise	p value*
ART (msec)	Right	210 \pm 39	189 \pm 29	<0.001
	Left	221 \pm 39	197 \pm 30	<0.001
VRT (msec)	Right	232 \pm 45	204 \pm 31	<0.001
	Left	239 \pm 45	210 \pm 34	<0.001
CRT (msec)	Right	258 \pm 51	223 \pm 36	<0.001
	Left	272 \pm 55	229 \pm 40	<0.001

*two tailed paired 't' test

Pearson correlation between the basal reaction times and the anthropometric measurements and it is shown that there is no correlation between the anthropometric measurements and the reaction time.

DISCUSSION

Gym workouts are the exercises grouped under strenuous exercises. Usually, gym members take up personal trainers who will help and guide them to achieve their own personal goals like general fitness, weight reduction, weight gain, body building etc. Gym consists of many forms of equipments, from cardio equipment such as treadmills, cross-trainers, exercise bikes, rowing machine to weights such as free weights and machine weights. Gym offers something for everybody irrespective of their age and fitness. The beneficial effects of Gym on

the body include improvement in muscle strength, decrease in the percent body fat while increasing the lean tissue mass which helps in combating disorders like dyslipidemia. [1] It also increases the neuromuscular activity, [2] Considering these aspects this study intended to evaluate its effects on reaction times which are an indicator of cognitive abilities.

In this study, reaction time values showed a significant decrease in the values in both the alert and random states. Various factors are identified for the beneficial effects of the strenuous exercises in the literature. First, a study revealed a significant rise in cerebral oxygenation following an exercise and suggested that this may be a responsible factor for improved visual reaction time. [8] Second, it is hypothesized that an increase in arousal level related to physical exertion may be responsible for improvement in cognitive function. Third, it is suggested that greater energy is allocated and used to control movements during the exercise and hence may explain the improvement in cognitive performance during exercise. [9] This study also revealed that there is no correlation between the anthropometric measurements and the reaction time. Hence, height and weight has little effect on the reaction times.

To conclude gym workouts may be considered for improving on the reaction times. Also, these exercises may be extended to the patients with diabetes mellitus, hypothyroidism and depression who are usually associated with decreased reaction times.

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