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Short Communication

# A comparative study of visual reaction time in table tennis players and healthy controls

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## Abstract

Visual reaction time is time required to response to visual stimuli. The present study was conducted to measure visual reaction time in 209 subjects, 50 table tennis (TT) players and 159 healthy controls. Methods: The visual reaction time was measured by the direct RT computerized software in healthy controls and table tennis players. Simple visual reaction time was measured. During the reaction time testing, visual stimuli were given for eighteen times and average reaction time was taken as the final reaction time. Results: The study shows that table tennis players had faster reaction time than healthy controls. On multivariate analysis, it was found that TT players had 74.121 sec (95% CI 98.8 and 49.4 sec) faster reaction time compared to non-TT players of same age and BMI. Also playing TT has a profound influence on visual reaction time than BMI. Conclusion: Our study concluded that persons involved in sports are having good reaction time as compared to controls. These results support the view that playing of table tennis is beneficial to eye-hand reaction time, improve the concentration and alertness.

## Introduction

At the present time children are more involved in videogames, watching TV, movies and exploring internet. Sports like table tennis, volleyball, badminton, cricket, football, etc are preferred less with modernisation. These sports not only make them physically healthy but would also improve their alertness, concentration. Reaction time is duration between applications of a stimulus to onset of response. Visual reaction time is time required to response to visual stimuli. Reaction time acts as a reliable indicator of rate of processing of sensory stimuli by central nervous system and its execution in the form of motor response (1). Reaction time can be broken down into three parts. The first is perception time, which is time for the application and perception of the stimulus and giving the necessary reaction to it. The second is decision time, which signifies the time for giving an appropriate response to the stimulus. The third is motor time, which is the time for compliance to the order received (2, 3). Reaction time can be described into three types (1) Simple reaction time: – here there is one stimulus and one response (2). Recognition reaction time: – here there are some stimulus that should be responded to and other that should not get response (3). Choice reaction time: – here there are multiple stimulus and multiple responses (4, 5). Sports such

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as table tennis, badminton, tennis and squash have been classified as reaction sports (6). In table tennis specifically, the incredible speed of the ball and the short distance it travels between opponents allows a very minimal amount of time to react and execute shots. Table Tennis player has to give proper and quick response during the game. They have to strike the ball in proper direction. A study by Ghuntla T et al found that basketball players had faster reaction time than healthy controls (7). Another study done by Hasçelik et al found decreases in the visual reaction time of male volleyball players (8). Thus we devised the present study to see the effect of table tennis playing, which involves decision making during game, on speed of cognitive processes (reaction time) and to compare with control group which is not involved in regular sports activity.

## Materials and Methods

The present observational study was conducted in 159 healthy controls and 50 Table Tennis (TT) players of age group of 14 to 40 years of male in Jamnagar district. The research protocol was approved by Institutional ethical committee and informed consent obtained from each subject prior to inclusion in the study. Personal history and medical history of both groups was collected in pre-designed proforma. Medical history was taken to rule out any medical or surgical disease, which would affect reaction time of individual. Table tennis players were selected based on following inclusion criteria

- In age group of 14 to 40 years.
- Should have BMI less than 25 kg/m$^2$.
- Should be playing TT for at least 5 hours per week.
- Should be playing TT for at least 1 year regularly (with a break of less than one month).
- Non-smoker and non-alcoholic.
- Free from any medical or surgical illness.
- Not involved in any other sports or activities, which may improve VRT (like video games).

After taking informed consent, Reaction time was measured with Direct RT computerized software (9). It was carried out with adequate light and in silent atmosphere. Visual reaction time was measured where subject has to respond to different colour stimulus appearing on computer screen by pressing spacebar key on keyboard. In present study only simple visual reaction time was measured. Subjects were given practice session before measuring the actual reaction time. Reaction time was reported as mean±SD. The level of significance between Table Tennis players and controls was tested by T-test (Unpaired) by SPSS version 20 software. The difference was taken as significant if P value was less than 0.05. Multivariate analysis was carried out using SPSS to rule out the effects of other confounding factors like age and BMI.

## Results

Simple visual reaction time in healthy controls was significantly (P<0.01) slower (359.18±80.725 ms) than table tennis players (273.96±18.017 ms). Anthropometric parameters age, height, weight and BMI were significantly different in 2 groups as shown in Table I. Univariate analysis showed a significant negative correlation of age and BMI with visual reaction time (Table II). Multivariate analysis was carried out with reaction time as dependent variable

TABLE I: General characteristics of healthy controls and table tennis players.

| | *Age (years)* | *Height (cm)* | *Weight (kg)* | *BMI (kg/m$^2$)* |
|---|---|---|---|---|
| Healthy control(N=159) | 16.66±3.34 | 160.01±9.76 | 45.80±11.27 | 17.75±3.30 |
| TableTennis players(N=50) | 21.82±5.57 | 167.70±10.21 | 59.68±11.61 | 21.08±3.15 |
| P value | 0.0001 | 0.0001 | 0.003 | 0.012 |

Data expressed are Mean±SD.

TABLE II : Correlation of visual reaction time (VRT) with age and BMI in the whole study population (n=209).

| | *r* | *P* |
|---|---|---|
| | *VRT* | |
| Age | –0.273 | 0.001 |
| BMI | –0.305 | 0.001 |

and age, BMI and playing TT as independent variables. Multiple linear regression analysis with forward stepwise regression model was selected to explore the effect of age, BMI and playing TT. It was found that playing TT significantly affected visual reaction time. This correlation existed significantly even after taking in account age and BMI.

TT players had 74.121 sec (95% CI 98.8 and 49.4 sec, P=0.00) faster reaction time compared to non-TT players of same age and BMI. It was also found that BMI had a significant negative correlation with reaction time independent of age and playing TT, for each unit increase in BMI the VRT decreased by 3.35 sec (95% CI 6.31 and 0.39 sec, P=0.27). While age (Beta=0.07, P=0.30) no longer correlated with reaction time after taking in account age, BMI and playing TT together. Also playing TT (Beta =–0.395, P=0.00) has a more profound influence on visual reaction time than BMI (Beta=–0.149, P=0.027).

## Discussion

In present study there are difference of visual reaction time between table tennis players and healthy controls. Visual reaction time is faster in table tennis players than healthy controls, which is statistically significant. Results from present study are in tune with finding of studies on different sport players. A study by Hascelik et al showed decrease in the visual reaction time of male volleyball players from 214.55 ms to 191.3 ms (8), while Ghuntla T et al found the visual reaction time of basket ball players faster than controls (7), which was significant. Mamog¢lu et al found the visual reaction times of professional soccer players to be 175.0±14.0 ms and of part-time soccer players to be 177.0±18.0 ms (10) and Nougier et al also demonstrated that athletes has better reaction time as compared to control subjects (11).

We found that visual reaction time negatively correlated with age and BMI. Deepmala Nagorao Deore et al found visual reaction time to be longer in person with higher BMI (12). Dominika demonstrated that inter individual variability was larger in older adults than young and increase in reaction time is not limited to old age but to mid adulthood too (13). On multivariate analysis it was found that playing table tennis was the most significant factor affecting visual reaction time after controlling for age and BMI. Correlation of age with reaction time was found not significant when considering together with BMI and playing TT while BMI was significantly correlating with VRT. Playing TT was stronger factor affecting VRT than BMI. Table tennis is a sport that depends on finely crafted movements that occur very quickly and a precise execution of shots. Table tennis player has to give a good attention to the stimuli and has to be alert to give a proper motor response. Motor response execution is a physical task, so it is logical that people trained in physically reactive sports like table tennis may have superior ability to select a correct motor response (5).

Although the mechanism behind exercise and human information processing have not been exactly identified. There are several possible mechanisms, which provide primary support for different hypothesis. Different direct and indirect mechanisms could explain relationship between exercise and mental processing. Perhaps the most popular mechanism is the idea that those individuals who exercise at moderate to intense levels have higher rates of cerebral blood flow. This increased amount of blood flow in the brain results in improvements in cognitive functioning due to increased supply of necessary nutrients, such as oxygen and glucose (14). Other mechanism is that exercise induces arousal that supports alertness to external environment stimuli in higher trained persons (15). The quicker reaction time in table tennis players compared to controls is due to improved concentration, alertness, better muscular co-ordination and improved performance in speed and accuracy task. Exercise increased activation of central nervous system and could facilitate cognitive processes. The effect of exercise on arousal could be linked to neurophysiological changes such as level of plasma catecholamines with exercise duration

or intensity. Sports requiring high level of motor reactivity contribute to superior reaction time compared to healthy controls.

To conclude persons involved in sports like table tennis are having good visual reaction time as compared to controls. Table Tennis players had less reaction time compared to non-TT players of same age and BMI. Also playing TT has a stronger influence on visual reaction time than BMI. These results support the view that playing of table tennis is beneficial to eye-hand reaction time and coordination. It can be stated that table tennis is beneficial for the enhancement of cognitive function, concentration and alertness.

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