 DOI: 10.5958/2394-2126.2016.00093.1

A comparative study of auditory & visual reaction time in table tennis players and age matched healthy controls

Deepa HS[1,*], Nivedita Sirdesai[2]

[1]Senior Tutor, Dept. of Physiology, Vydehi Institute of Medical Sciences & Research Centre, Bangalore, [2]Assistant Professor, DY Patil Dental School, Pune

***Corresponding Author:**
Deepa HS
Senior Tutor, Dept. of Physiology, Vydehi Institute of Medical Sciences & Research Centre, Bangalore
Email: dr.deepa.sh@gmail.com

Abstract

Objectives: Evaluation of the effect of playing Table Tennis(TT) on auditory reaction time (ART) & visual reaction time (VRT) and comparison with age matched healthy control group who are not involved in regular sports activity.

Materials and Methods: 30 male table tennis players in age group of 18-30 years and 30 age matched healthy males as controls were included. VRT & ART measurement was done by PC 1000 reaction timer.

VRT Measurement: Examiner pressed the START button in first component & subject was instructed to press the STOP button in second component as soon as he saw the light in the instrument. Reaction Time(RT) was recorded for red, green & blue light in msec using Audacity software.

ART Measurement: Head phones were connected to second component. Subject was instructed to press the STOP button as soon as he heard the sound (1000 Hz). Data was analysed statistically using students unpaired 't' test.

Results: Mean values of VRT in table tennis players was less than controls for red, green & blue colours & the difference was statistically significant ($p<0.05$). Mean value of ART was significantly ($p<0.05$) less r in Table Tennis players than controls.

Conclusion: Mild enhancement of cognitive function is observed in exercise and sports. Playing Table Tennis is useful to improve eye-hand reaction time, for the improvement of concentration, alertness & cognitive processing.

Keywords: Table Tennis, Visual Reaction Time, Auditory Reaction Time, Sports & stimulus.

Introduction

The time between the application of stimulus and the response is called reaction time.[1] Visual Reaction Time and Auditory Reaction Time are considered as ideal tool for measuring sensory motor association and also performance of an individual. Reaction time has physiological significance and is considered as a simple and non-invasive test for peripheral as well as central neural structures.[2] Reaction time is broken down into three parts. 1st: Perception time – i.e. time for the application and perception of the stimulus including giving the necessary reaction to it. 2nd: Decision time - signifies the time for giving an appropriate response to the stimulus. 3rd: Motor time - time for compliance to the order received.[3,4] Reaction time depends on several factors i.e. arrival of the stimulus at the sensory organ, conversion of stimulus to a neural signal by sensory organ, transmission & processing of neural signal, muscular activation, soft tissue compliance, and the selection of an external measurement parameter.[5]

Pioneer reaction time study was done by Donders. He proved that a simple reaction time is shorter compared to recognition reaction time, and choice reaction time is longest of all.[6]

Previous studies have confirmed that reaction to sound is faster than reaction to light, with mean ART being 140-160 ms and VRT being 180-200ms.[7,8,9,10] Sports such as badminton, squash, table tennis & tennis have been classified as reaction sports.[11] Table tennis is a sport that depends on finely crafted movements that occur very quickly and a precise execution of shots. It is one of the reaction sports that should be appreciated for the mental and physical prowess necessary to compete at a high level. Time is a luxury not available to elite table tennis competitors. Table tennis players should rely on accurate anticipation of opponent's stroke, being attentive, reacting to the sound of the ball, use precise stroke biomechanics that allow them to select and execute the motor pattern that provides the best opportunity to win the rally.

Previously researchers have confirmed that sports & exercise are beneficial to mental health. However not many studies have been performed on the RT of Table Tennis players. Present study evaluated the effect of playing Table tennis on ART & VRT and to compare with age matched healthy control group.

Materials and Methods

This comparative study included 30 male table tennis players in the age group of 18-30 years and 30 age matched male healthy controls. Ethical clearance for the study protocol was obtained from Institutional Ethics Committee. Informed consent was 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 & surgical history was taken to exclude any medical or surgical disease which

affects reaction time of individual. VRT & ART measurement was done by PC 1000 reaction timer.[12]
Table tennis players were selected based on following inclusion criteria:

- In age group of 18 to 30 years.
- BMI less than 25 kg/m^2.
- Players practicing TT for minimum of 5 hours per week.
- Playing TT for minimum 1 year regularly (with less than one month break).
- Non-smoker and non-alcoholic.
- No significant medical or surgical illness & not practicing in any other sports activities, which may improve RT

Method of Collection of Data

The subjects were explained about the importance and procedure of the study. An informed consent was obtained from all the participants. The subjects who satisfied inclusion and exclusion criteria were selected after taking a detailed clinical history as in the proforma. The health of the subject was assessed by noting the present, family and personal history and also by general and systemic examination.The study involved non-invasive procedures with no financial burden on the subjects. Sufficient time was given (15 min) for the subjects to mentally & physically relax before recording the parameters.

Height (Ht in cms) measured with subject, standing without shoes, nearest to 0.1 cm error by using a Standard Height measuring Scale. Weight (Wt in kg) measured with subject, wearing minimum clothing, nearest to 0.1 kg error by using a standard weighing machine. The Body Mass Index (BMI) was calculated by: BMI = Weight in Kg/ Height in sqm.[13]

VRT Measurement: Before measuring VRT, participants were made familiar with the Instrument. Examiner pressed the START button in 1st component & subject was instructed to press the STOP button in 2nd component as soon as he saw the light in the instrument. RT was recorded for red, green & blue light in msec using Audacity software. 5 trials for different colours were given and after repeated practice readings were taken for each colour. Lowest of 5 readings of VRT was considered as the final value of VRT for that colour.

ART Measurement: Head phone was connected to second component. Subject was instructed to press the STOP button as soon as he heard the sound (1000 Hz). ART was recorded in ms using Audacity software.

Statistical Analysis: The Statistical software namely SPSS 20th version was used for data analysis and Microsoft word & Microsoft Excel were used to generate graphs, tables etc. Reaction time was reported as mean ± Standard Deviation (SD). Results were analysed statistically using student's unpaired 't' test with a two tail p value. Minimum level of significance was fixed at $p<0.05$.

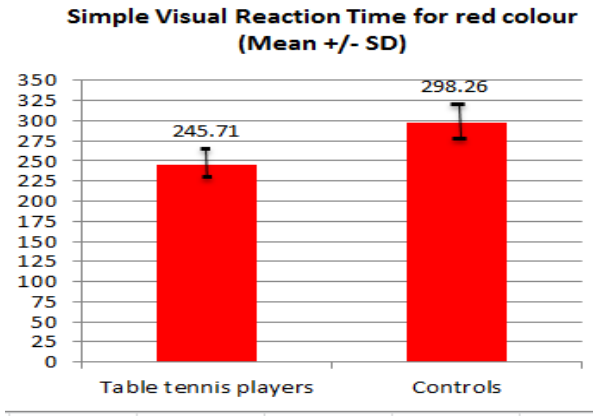
Results

Table 1: General characteristics of Table tennis players & healthy controls (values are in Mean ± SD)

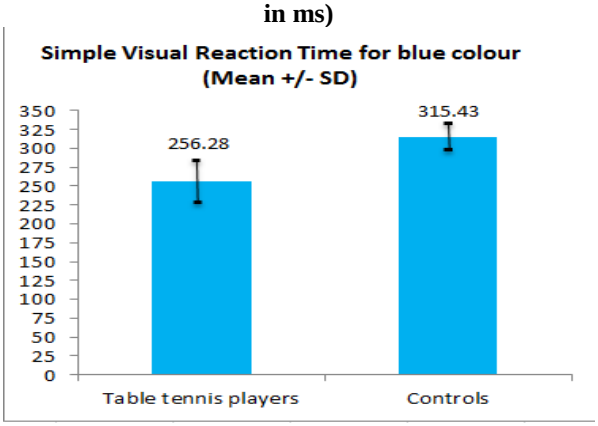
Study group	Age (Years)	Height (cm)	Weight (kg)	BMI (kg/sq m)
Table tennis players (n=30)	22.82±3.06	167.57±4.46	56.49±8.02	20.12
Healthy Controls (n=30)	21.21±2.12	166.06±5.34	59.77±6.49	21.67

Both the groups were age matched without any significant variation in height, weight & BMI.
Graph 1 shows simple VRT for red colour in Table Tennis players (245.71±22.03ms) & healthy controls (298.26±25.91ms). Visual reaction time was significantly faster in Table Tennis players than in healthy controls($p<0.05$). The mean VRT for Blue colour (ms) was 315.43±19.46 ms in healthy controls (**Graph 2**). It was significantly faster in Table Tennis players (256.28 ± 26.56 ms $p<0.05$).
Graph 3 shows Mean values of VRT in Table Tennis players was lesser than controls for green & the différence was statistically significant ($p<0.05$).

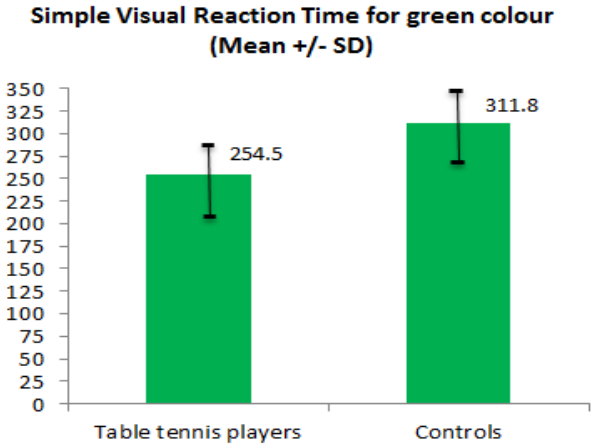
Graph 1: VRT for red colour in Table Tennis players and controls (values in mean ± SD expressed in ms)



Graph 2: VRT for blue colour in Table Tennis players and controls (values in mean±SD expressed in ms)

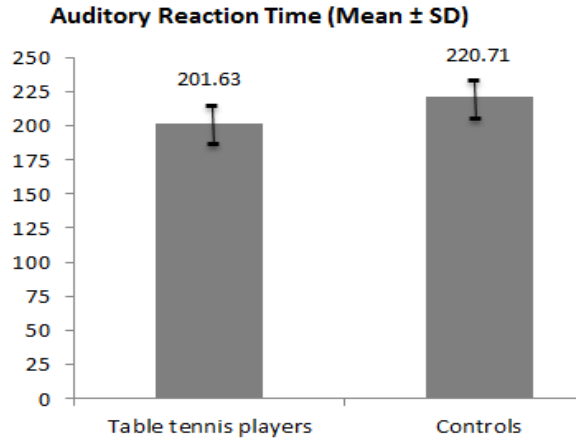


Graph 3: Visual reaction time for green colour (mean ± SD) in ms in Table Tennis players and healthy controls



Mean value of ART was significantly ($p<0.05$) faster in Table Tennis players (201.63±14.09 ms) than healthy controls (220.71±16.72 ms) (Graph 4).

Graph 4: ART in Table Tennis players and healthy controls (values in mean ± SD expressed in ms)



Discussion

Our study compared VRT for all 3 primary colours i.e. red, green & blue. There were differences in the VRT & ART between Table Tennis players and healthy controls. VRT & ART were shorter in Table Tennis players than controls & result was statistically significant. Results of our study matches with Davranche et al[14]; Van Biesen et al[15]. Sema Can et al[16] & Bhabhor M et[17] al who also found faster ART in table tennis players. The faster reaction time in TT players when compared to controls could be due to better concentration, alertness, improved muscle co-ordination and also improved performance in tasks requiring speed and accuracy .[17] Study done by Akhani PN et al[18] showed that TT players have better reaction times than football players. This difference could be possibly due to the differing requirements of the sports. TT requires acute attention to the ball sound and movement that travels at high speed. But football is more of a visual game.[19] Nougier et al showed that athletes have better reaction times.[20]

Mild enhancement of cognitive function is observed in exercise and sports.[21] Exercise training increases mitochondrial content and respiratory capacity of the skeletal muscles which were used during activity leading to sparing of glycogen & in turn delays the onset offatigue[22] Physical Exercise improves neurological functioning by increasing cerebral blood flow.[23] When blood flow increases, more nutrients are delivered to structures that influence an individual's cognitive functioning.[24] Also, Physical exercise may protect central nervous system from oxidant stress by increasing the oxidant enzyme activity & improving the defence ability against the damages caused due to reactive oxygen species.[25]

In table tennis, players position themselves closer to each other for a smaller, lighter ball than any other sport such as lawn tennis, football, basketball & volley ball. Accordingly, table tennis ball, hit by one side reaches to the other side relatively sooner & the player barely has time to react to the visual stimulus of the ball before the ball has arrived to be hit. So the player has to be alert to give a proper motor response. The faster reaction time in table tennis players is due to improved concentration, alertness, better muscular co-ordination and improved performance in tasks requiring speed and accuracy. Exercise improves neurological functioning by increasing the cerebral blood flow & could facilitate cognitive processes.

Conclusion

Study results indicated that ART & VRT for red, green & blue colour were faster in Table tennis players when compared to age matched healthy controls. Results support the view that playing Table Tennis is beneficial to eye-hand reaction time, improvement of concentration, alertness & for the improvement of cognitive processing.

Limitations of our study

Completely automated instruments for reaction time measurement may produce different results. Gender related differences in VRT & ART measurement was not done.

Acknowledgment

The authors are thankful to the Table Tennis players of Davangere officers club for voluntarily participating in the study.

References

1. Ganong WF: Functions of the nervous system-reflexes. Review of medical physiology. 20th edition. A Lange. Medical book publication, California; 20th Edn; 2001;pp.124.
2. Madanmohan, Thombre DP, Das AK et al. Reaction time in clinical diabetes mellitus. Indian J Physiol Pharmacol 1984;28(4):311-14.
3. Teichner WH. Recent studies of simple reaction time. Psychol Bull 1954;51:128.
4. Tripo RS. How fast can you react? Sci Dig 1965;57:50.
5. T. G. Matthew pain, Hibbs A. Sprint starts and the minimum auditory reaction time. Journal of Sports Sciences. 2007;25(1):79-86.
6. Donders FC. 1868. On the speed of mental processes. Translated by Koster WG. Acta Psychologica 1969;30:412-431.
7. Galton F. On instruments for 1. Testing perception of differences of tint & 2. Determing reaction time. Journal of Anthropological Institute. 1899;19:27-29.
8. Woodworth RS, Schlosberg H. Experimental Psychology. Henry Holt, New York. 1954.
9. Fieandt KV, Huhtala A, Kullberg P et al. Personal tempo & phenomenal time at different at different age levels. Reports from the Psychological Institute. 1956. No 2. Univrsity of Helsinki.
10. Brebner JT, Welford AT. Introduction: An historical Background sketch. In A. T. Welford (Ed.) Reaction Times. Academic press, New York. 1980;1-23.
11. Yoshida K, Hiruta S, Shimaoka M et al. A study on spin control techniques for chop and float services in Table tennis. Paper presented at FISU/CESU conference held in Fukuoka, Japan. 1995.
12. Niruba, Maruthy. Glycosylated Haemoglobinvrsus reaction time in diabetics – A cross sectional study. National journal of basic medical sciences. 2011;1(4):198-201.
13. Garrow J.S., Webster J.D. Quetelet's index (W/H2) as a measure of fatness. Int J Obes Relat Metab Disord. 1985;9:147-53.
14. Davranche K, Burle B, Audiffren et al. Physical exercise facilitates motor processes in simple reaction time performance. An electromyography analysis .Neuroscience letters. 2006;396(1):54-56.
15. Van BD, Verellen J, Meyer C et al. The ability of elite table tennis players with intellectual disabilities to adapt their service/ return. Adapt Phys Activ Q. 2010;27(3):242-57.
16. Can S, Kilit B, Arslan E, Suveren S. The Comparison of Reaction Time of Male Tennis Players, Table Tennis Players And The Ones Who Don't Exercise At All. Niğde University Journal of Physical Education and Sport Sciences. 2014;8(2):195-201.
17. Bhabhor M et al. A comparative study of Visual reaction time in Table tennis players & healthy controls. Indian J Physiol Pharmacol. 2013;57(44):439–442.
18. Akhani PN, Gosai H, Mendpara S et al. Mental chronometry in table tennis players and football players: Who have faster reaction time? International journal of basic & applied physiology. 2015;4(1):53-57.
19. Ruschel C, Haupenthal A, Hubert M et al. Simple reaction time in soccer players from differing categories & field positions. Motoricidade. 2011;7(4):73-82.
20. Nougier V, Ripoll H, Stein JF. Orienting of attention with highly skilled athletes. International Journal of Sport Psychology. 1989;20:205-223.
21. Masley S, Roetzheim R, Gualtieri T. Aerobic exercise enhances cognitive flexibility. J Clin Psychol Med Settings 2009;16:186-193.
22. Joki E, Lexington KY, Anand RL. Advances in exercise Physiology: New Delhi: S Karger;1974:18–22.
23. McAuley E, Kramer AF, Colcombe SJ. Cardiovascular fitness & neurocognitive function in older adults. A brief review. Brain Behav Immun 2004;18:214-20.
24. Antunes HKM, Santos RF, Cassilhas R et al. Reviewing on physical exercise & cognitive function. Rev Bras Med Esporte 2006;12:97-103.
25. Radak Z, Kaneko T, Tahara S et al. Regular exercise improves cognitive function & decreases oxidative damage in rat brain. Neurochem Int 2001;38:17-23.