International Journal of Physical Education, Sports and Health 2016; 3(5): 79-83

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2016; 3(5): 79-83

www.kheljournal.com
Received: 17-07-2016
Accepted: 18-08-2016

Neha Chavan
Research Scholar, Department of Physical Education, Savitribai Phule Pune University, Pune, India

Dr. Deepak Shendkar
Director, Physical Education and Sports, Modern College of Arts, Science and Commerce, Pune, India

Correspondence
Neha Chavan
Research Scholar, Department of Physical Education, Savitribai Phule Pune University, Pune, India

A study of variations in an athlete's reaction time performance based on the types of stimulus

Neha Chavan and Dr. Deepak Shendkar

Abstract
The purpose of this study was to investigate the difference in the reaction time responses of an athlete based on various types of stimuli. Reaction time is duration between applications of a stimulus to onset of response. The present study was measured reaction time in 197 athletes, for the comparison in groups which were into 3 categories 1. Gender wise (Female and Male), 2. Game wise (Individual and Team), 3. Standard wise (5^{th}, 6^{th}, 7^{th}, 8^{th}, 9^{th}, 10^{th}) and correlation was done between the group based on the 3 tests. The VRT, SRT and ViRT was measured by the Jerry (Version: 0.6.4) software. During the reaction time testing visual, sound and tactile stimuli were given for five times and average reaction time after omitting highest and lowest reaction time, was taken as the final reaction time. Results suggest that a comparison was done between the performance of male and female athletes and no significant difference was seen in their performance in all the three test. Similarly a comparison was also done based on athletes playing a team and individual game and a significant difference was seen in all the three test (VRT: F = 11.538, p = 0.001); (SRT: F = 8.546, p = 0.004); (ViRT: F = 27.240, p = 0.001). Further a comparison was also done based on the standard in which the athletes study and it was seen that there is significant difference in two of test (VRT: F = 4.287, p = 0.001); (ViRT: F = 5.434, p = 0.001). Co-relational analysis was also done based on gender, and a significant negative correlation was found in females VRT and SRT (r = -.285, p = .001) and the males showed a significantly positive correlation in VRT and ViRT (r = .243, p = .001) and a significant negative correlation in SRT and ViRT (r = -.353, p = .001). Further, the correlation done based on individual and team game. A significant negative correlation was found in individual game athletes VRT and SRT (r = -.532, p = .001) and a positive correlation between SRT and ViRT (r = .104, p = .001). The team game athletes showed a significant negative correlation in SRT and ViRT (r = -.462, p = .001). The correlation was done based on standards athletes. It was seen that in 5^{th} standard a significant negative correlation was found between SRT and ViRT (r = -.764, p = .001), in 6^{th} standard a significant negative correlation was found in VRT and SRT (r = -.554, p = .001), in 7^{th} standard a significant negative correlation was found between VRS and SRS (r = -.396, p = .001), and SRT and ViRT (r = -.381, p = .001). There was no correlation found in 8^{th} standard. In 9^{th} standard a significant negative correlation was found in SRT and ViRT (r = -.446, p = .001). In 10^{th} standard a significant negative correlation was found in VRT and SRT (r = -.554, p = .001).

Keywords: Reaction time, VRT, SRT, ViRT, athletes

1. Introduction
Sport is referred to the ability of demonstrating athletic performance in a constant way. Experts in sports have significantly higher skill, ability or performance than novices (Cote, *et al*, 2003). They are usually more skilled at extracting and utilizing environmental information and adopting it to existing knowledge so that they can select and execute appropriate responses. The ability of expert performers to exploit perceptual cues can lessen the temporal constraints required in a reaction time task (Buckolz, *et al*, 1988).
Reaction time is duration between application of a stimulus to onset of response. VRT is time required to response to visual stimuli. SRT is time required to response to sound stimuli. ViRT is time required to response to tactile 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 (Jayesh. Solanki. *et al*, 2012) [6]. Reaction time can be divided 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 third is motor time which is the for compliance to the order received (Teichner, W. H. 2012; Tripo, R.D., 2010). Reaction time can be described

in to three types, 1. Simple reaction time:- here there is one stimulus and one responded. 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 (Luce, R.D. 1965; Welford, A.T. 2011). In dynamic externally paced activities like those encountered when driving, crossing a road and playing sport, the more acute temporal demands imposed by these tasks mean that key objects must be recognized quickly and accurately to support optimal performance. Skilled athletes in fast ball sports like soccer, field hockey and basket ball are able to make better and earlier decisions, in large part because of their ability to search for and recognize meaningful patterns of play and learning the information that provide the earliest possible indication of the outcome of a movement (Ando, S., Kida, N., & Oda, S. 2003). In sport which allows a very minimal amount of time to react, so player has to give proper and quick response during the game. A study done by Hascelik (Hascelik, *et al*, 1989) [5]. Found decrease in the VRT of male volleyball players. Another study done by Nougier (Nougier *et al*, 1989) [11]. Suggest that an athlete has better reaction time as compared to control subjects.

The present study was conducted to investigate the difference in the reaction time responses of athletes based on various types of stimuli. Comparison and correlation with different reaction time of athletes was also done in this study.

2. Material and Method

The present study was conducted in Pune District 197 athletes of age group of 11 to 16 years. The research informed consent obtained from each subject to inclusion in the study. Personal history was collected in pre-designed program. After taking consent, reaction time was measured with Jerry (Version: 0.6.4) software (Jose, S., Gideon, P.K., 2010) [7]. It was carried out with adequate light and in silent atmosphere. VRT was measured where subject had to respond to different color stimulus appearing on screen by pressing key on screen. SRT was measured where subject had to respond to sound/bip whenever stimulus appearing pressing key on screen. ViRT was measured where subject had to respond to tactile stimulus appearing pressing key on screen. During the reaction time testing visual, sound and tactile stimuli were given for five times and average reaction time after omitting highest and lowest reaction time, was taken as the final reaction time. Subjects were given practice session before measuring the actual reaction time. Data collected and was statistically analyzed. Reaction time was reported as mean, standard deviation. The level of significance between athletes (Gender, Game and Standard wise) was tested by using Independent T-test for comparing the data and Pearson test used for finding correlation between the group based on the 3 tests by SPSS software.

3. Result

Table 1: Gender wise comparison. N= (Female-86, Male-111)

Test	Female	Male	F	Sig
VRT	313.62, (±52.62)	305.67, (±38.27)	1.508	.221
SRT	271.14, (±59.33)	265.77, (±57.60)	0.411	.522
ViRT	302.95, (±58.67)	297.05, (±57.25)	0.504	.479

*p<0.05, **p<0.001.

As per table no 1. Gender wise mean of VRT for female 313.62, (±52.62), and male 305.67, (±38.27). This is not significant at 0.05 significant level (F= 1.508, p=.221). Mean of SRT for female 271.14, (±59.33), and male 265.77, (±57.60). This is not significant at 0.05 significant level (F= 0.411, p= .522). Mean of ViRT for female 302.95, (±58.67), and male 297.05, (±57.25). This is not significant at 0.05 significant level (F= 0.504, p= .479).

Table 2: Femal and Male correlation of the group based on the 3 tests. N = (Female – 86, Male - 111)

Gender	Test	SRT	ViRT
Female	VRT	-.285**	.145
	SRT		-.211
Male	VRT	-.319	.243*
	SRT		-.353**

*p<0.05, **p<0.001.

As per table no 2. In gender wise female group correlation between VRT and SRT of 86 subject was -.285 which was statistically significant at 0.05 significant leave (p<.001). These indicate that there is negative correlation between VRT and SRT. Correlation between VRT and ViRT was .145 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.211 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between SRT and ViRT.

As per table no 2. In gender wise male group correlation between VRT and SRT of 111 subject was -.319 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and SRT. Correlation between VRT and ViRT was .243 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is positive correlation between VRT and ViRT. Correlation between SRT and ViRT was -.353 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between SRT and ViRT.

Table 3: Game wise comparison. N = (Individual- 84, Team - 113)

Test	Individual	Team	F	Sig
VRT	321.48, (±45.50)	299.96, (±42.82)	11.538	.001**
SRT	254.30, (±57.52)	278.38, (±56.93)	8.546	.004**
ViRT	323.04, (±50.94)	282.23, (±56.63)	27.240	.001**

*p<0.05, **p<0.001.

As per table no 3. Game wise mean of VRT for Individual 321.48, (±45.50), and Team 299.96, (±42.82). This is significant at 0.05 significant level (F= 11.538, p= .001). Mean of SRT for Individual 254.30, (±57.52), and Team 278.38, (±56.93). This is significant at 0.05 significant level (F= 8.546, p=.004). Mean of ViRT for Individual 323.04, (±50.94), and Team 282.23, (±56.63). This is significant at 0.05 significant level (F= 27.240, p=.001).

As per table no 4. In game wise individual group correlation between VRT and SRT of 84 subject was -.532 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between VRT and SRT. Correlation between VRT and ViRT was .135 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was .104 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is positive correlation between SRT and ViRT.

Table 4: Individual and Team Game correlation of the group based on the 3 tests. N = (Individual Game – 84, Team Game – 113)

Game	Test	SRT	ViRT
Individual	VRT	-.532**	.135
	SRT		.104**
Team	VRT	-.038	.113
	SRT		-.462**

*p<0.05, **p<0.001.

As per table no 4. In game wise team group correlation between VRT and SRT of 113 subject was -.038 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and SRT. Correlation between VRT and ViRT was .113 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.462 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between SRT and ViRT.

Table 5: Stander wise comparison. N = (5^{th} -20, 6^{th} -22, 7^{th} -40, 8^{th} -39, 9^{th} -35, 10^{th} - 41)

Test	5^{th}	6^{th}	7^{th}	8^{th}	9^{th}	10^{th}	F	Sig
VRT	343.93, (±59.28)	317.15, (±36.54)	312.43, (±41.08)	292.46, (±36.35)	299.27, (±43.60)	308.95, (±45.77)	4.287	.001**
SRT	263.18, (±58.38)	264.58, (±54.64)	269.79, (±61.19)	274.78, (±65.36)	248.67, (±49.19)	281.03, (±55.88)	1.348	.246
ViRT	277.32, (±52.40)	278.32, (±50.64)	307.91, (±56.03)	289.3, (±55.06)	287.21, (±53.80)	334.30, (±57.26)	5.434	.001**

*p<0.05, **p<0.001.

As per table no 5. Standard wise mean of VRT for 5^{th} stander 343.93,(±59.28), 6^{th} stander 317.15,(±36.54), 7^{th} stander 312.43,(±41.08), 8^{th} stander 292.46,(±36.35), 9^{th} stander 299.27, (±43.60), 10^{th} stander 308.95,(±45.77). This is significant at 0.05 significant level (F= 4.287, p= .001). Mean of SRT for 5^{th} stander 263.18, (±58.38), 6^{th} stander 264.58,(±54.64), 7^{th} stander 269.79,(±61.19), 8^{th} stander 274.78,(±65.36), 9^{th} stander 248.67,(±49.19), 10^{th} stander 281.03, (±55.88). This is not significant at 0.05 significant level (F= 1.348, p= .246). Mean of ViRT for 5^{th} stander 277.32,(±52.40), 6^{th} stander 278.32,(±50.64), 7^{th} stander 307.91,(±56.03), 8^{th} stander 289.3,(±55.06), 9^{th} stander 287.21,(±53.80), 10^{th} stander 334.30,(±57.26). This is significant at 0.05 significant level (F= 5.434, p= .001).

Table 6: Standard wise correlation of the group based on the 3 tests. N = (5^{th} – 20, 6^{th} – 22, 7^{th} – 40, 8^{th} – 39, 9^{th} – 35, 10^{th} – 41)

Stander	Test	SRT	ViRT
5^{th}	VRT	-.243	.166
	SRT		-.764**
6^{th}	VRT	-.554**	.184
	SRT		.011
7^{th}	VRT	-.396*	.210
	SRT		-.381*
8^{th}	VRT	-.118	.228
	SRT		-.285
9^{th}	VRT	-.299	.273
	SRT		-.446**
10^{th}	VRT	-.554**	.184
	SRT		.111

*p<0.05, **p<0.001.

As per table no 6. In standard wise 5^{th} stander group correlation between VRT and SRT of 20 subject was -.243 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and SRT. Correlation between VRT and ViRT was .166 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.764 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between SRT and ViRT.

As per table no 6. In standard wise 6^{th} stander group correlation between VRT and SRT of 22 subject was -.554 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between VRT and SRT. Correlation between VRT and ViRT was .184 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was .011 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between SRT and ViRT.

As per table no 6. In standard wise 7^{th} stander group correlation between VRT and SRT of 40 subject was -.396 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between VRT and SRT. Correlation between VRT and ViRT was .210 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.381 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between SRT and ViRT.

As per table no 6. In standard wise 8^{th} stander group correlation between VRT and SRT of 39 subject was -.118 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and SRT. Correlation between VRT and ViRT was .228 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.285 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between SRT and ViRT.

As per table no 6. In standard wise 9^{th} stander group correlation between VRT and SRT of 35, subject was -.299 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and SRT. Correlation between VRT and ViRT was .273 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was -.446 which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between SRT and ViRT.

As per table no 6. In standard wise 10^{th} stander group correlation between VRT and SRT of 41 subject was -.554

which was statistically significant at 0.05 significant leave (p<.001). This indicate that there is negative correlation between VRT and SRT. Correlation between VRT and ViRT was .184 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between VRT and ViRT. Correlation between SRT and ViRT was .111 which was not statistically significant at 0.05 significant leave (p<.001). This indicate that there is no correlation between SRT and ViRT.

4. Discussion

The aim of this study was to determine the differences and correlation of reaction time in athlete. Basically groups are divided in to 3 category for comparison 1.Gender wise (Female and Male), 2.Game wise (Individual and Team), 3.Standard wise (5^{th}, 6^{th}, 7^{th}, 8^{th}, 9^{th}, 10^{th}). Correlation was done in to groups based on the 3 tests. Reaction time is an important component of motor movement. It is one of the important methods to study a person's central information processing speed (Ando, S., *et al*. 2002) [1]. Reaction time is an accurate indicator of speed and effectiveness of decision making. VRT can be of crucial value in activities like driving and is an important quality of a sports persons (Glenister, D., 1996; Scully, D. *et al*. 1998) [3, 13]. Patrick J. Smith, *et al*, (Patrick, J. Smith. *et al*. 2000) [12] found in his study that participants who completed a six month aerobic exercise program exhibited improvements in reaction time. Researchers have also established that exercise and sports results in a mild enhancement of cognitive function (Colcombe, S. K., 2003; Naresh, K. *et al*, 2012) [2, 10]. Many previous researches indicate a superior response on behalf of the elite athletes (Lahtele, *et al*, 1985). These data show that members of the elite group in both sexes possessed significantly higher speed in responding to a reaction time task. This is line with many studies concluding that athletes performing at higher levels show a faster reaction time and also no significant difference in reaction time between males and females. Generally expert performers benefit from more experience gained from practice and professional competition which is correlated to higher knowledge and skill (Thomas, & Thomas, 1994; However, Landauer, Armstrong & Dogwood, 1980). In previous findings that reaction time performance improves as a result of the time spent on practice (Buckolz, *et al*, 1988). Also find visual skill and reaction time in rugby players from different age group. The authors expected that age, along with accompanying motor development in this research showed statistically significant (p<0.05) superiority of the older group in reaction time (Venter & Ferreirn, 2004).

Based on the findings of the present study, gender wise significance difference was not found. Significant difference found in VRTl, SRT and ViRT. Game wise there was significant difference found in VRT, SRT and ViRT. The team game athletes have better in VRT and ViRT in comparison with the individual game athletes. Individual game athletes were better than team game athletes in case of SRT. Standard wise there was significant difference found in VRT and ViRT. Correlation results showed that, female athletes exhibited strong negative correlation between SRT and VRT, and in male athletes there was a strong negative correlation found in VRT and SRT, SRT and ViRT. Individual game athletes showed strong negative correlation in VRT and SRT, and in the team game athletes, there was strong negative correlation found in ViRT and SRT.

5. Conclusion

After comparing 3 categories it was concluded that;

1. Males have a better reaction time than the female.
2. Individual game athletes respond better to sound stimulus where team game athletes respond better to visual and tactile stimulus.
3. 8^{th} standard athletes respond better to visual stimulus, 9^{th} standard athletes respond better to sound stimulus and 5^{th} standard athletes respond better to tactile stimulus.

After co-relational analysis of the group based on the 3 tests, it was concluded that,

1. In females there was negative correlation found in responses to visual and sound stimulus.
2. In males positive correlation was found between responses to visual and tactile stimulus and negative correlation was found between responses to sound and tactile stimulus.
3. There was negative correlation found between responses to visual and sound stimulus and positive correlation was found between responses to sound and tactile stimulus of individual game athletes.
4. In athletes playing a team game negative correlation was found only in sound and tactile stimulus.
5. In 5^{th} standard athletes there was negative correlation found in responses to sound and tactile stimulus.
6. In 6^{th} standard athletes there was negative correlation found in responses to visual and sound stimulus.
7. In 7^{th} standard athletes there was negative correlation found in responses to sound and both visual and tactile stimulus.
8. In 8^{th} standard athletes there was no correlation found in the responses to the reaction time tests.
9. In 9^{th} standard athletes there was negative correlation found in responses to sound and tactile stimulus.
10. In 10^{th} standard athletes there was negative correlation found in responses to visual and sound stimulus.

6. References

1. Ando S, Kida N, Oda S. Central and peripheral visual reaction time of soccer player and non athletes. Perceptual and Motor Skills, 2002; 95(3):747-752. Retrived, 15/09/2015, from http://www.ncbi. nlm.nih.gov/pubmed/3493922.
2. Colcombe S, Kramer AF. Fitness effects on the cognitive function of older adults: A meta-analytical study. Psychol Sci. 2003; 14:125-130.
3. Glenister D. Exercise and mental health: A review. J R Soc Health 1996; 116:7-13.
4. Hanna KM, Antunes Ruth F *et al.* Reviewing on physical exercise and the cognitive function, Rev Bras Med Esporte. 2006, 12(2).
5. Hascelik *et al.* The effects of physical training on physical fitness tests and auditory and visual reaction times of volleyball players. Journal of Sports Medicine and Physical Fitness. 1989; 29(3):234-239.
6. Jayesh Solanki *et al*. A Study of Correlation between Auditory and visual reaction time in Healthy Adults, International Journal of Medicine and Public health [Int. J. Med. Public health], 2012, 2(2). Retrived, 15/09/2015, from http://www.t.sportsci. org/ news/ferret/ visionreview/visionreview.html.
7. Jose Shelton, Gideon Praveen Kumar. Comparison between Auditory and Visual Simple Reaction Times, Neuroscience & Medicine. 2010; 1:30-32.

8. Luce RD. Information Theory of Choice-Reaction Times. London: Academic Press, 1968. Available fromhttp://biology.clemson.edu/bpc/bp/Lab/110/reaction.htm.on 08/08/2011).
9. Mamoglu O, Agaoglu SA, Agaoglu YS. Comparison of Sprint and Reaction Times of Professional and Amateur Football Players. I. Gazi Physical Education and Sport Sciences Congress. Ankara, Turkey: Sim Publishing, 2000, 101-8.
10. Naresh Kumar, Manjeet Singh, Sushma Sood *et al*. Effect of acute moderate exercise on cognitive P300 in persons having sedentary lifestyles, international journal of applied basic medical research. 2012; 2(1):67-69.
11. Nougier V, Ripoll H, Stein JF. Orienting of attention with highly skilled athletes. International Journal of Sport Psychology. 1989; 20(3):205-223. Retrived, 15/09/2015, from http://www.t.sportsci.org/news/ferret/visionreview/visionreview.html.
12. Patrick J. Smith *et al*. Influence of aerobic fitness on the neurocognitive function of older adults. J Aging Phys Act 2000; 8: 379-385.
13. Scully D, Kremer J, Meade MM, Graham R, Dudgeon K. Physical exercise and psychological well being: A critical review.Br J Sports Med. 1998; 32:111-120. Retrived, 15/09/2015, from http:// www.sciences 360.com / index.php/ factors-that-affect-human -reaction-time-7284/.
14. Teichner WH. Recent studies of simple reaction time. Psychol Bull. 1954; 51:128.
15. Tripo RS. How fast can you react? Sci. Dig, 1965; 57:50. Retrieved, 15/09/2015, from http://www.academia.edu/4394833/The_role_of_central_and_peripheral_vision_in_expert_decision_making.
16. Welford AT. Choice reaction time: Basic concepts. In A. T. Welford (Ed.), Reaction Times, Academic Press, New York, 1980, 73-128.
17. Yoshida *et al.* A study on spin control techniques for chop and float services in table tennis. 1995. Paper presented at the FISU/CESU Conference, Fukuoka, Japan.