

Whole body reaction time among cricket, hockey and baseball players and its comparison with their age and sex matched controls

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Abstract

Background: Reaction time relates to, but is different from, reflex time, movement time, and response time. Reflex time is a shortened reaction time wherein the thought or decision making phase is eliminated. In a reflex the impulses travel through the sensory nerves, across the reflex arc, and through motor nerves to the muscles. (The reflex arc relays messages directly from sensory to motor nerves.) **Aims and objective:** To study the Whole Body Reaction Time among Cricket, Hockey and Baseball Players and its comparison with their age and sex matched controls. **Materials and Methods:** The present included 180 Players (60 hockey, 60 cricket and 60 baseball players) aged between 15 to 25 years playing at university or district level and still practicing for their respective game. The control group consisted of 60 age and sex matched male students which included college students, interns and residents from the same area. Subjects were informed about the procedure to find reaction time. Each subject's detailed history was taken, along with it clinical examination was done. Reaction time was recorded preferably after warm-up exercise in the morning session. The whole body reaction time apparatus was used for determining the time taken by the subject to move his body in various directions in response to visual stimuli. After giving a demonstration of reaction time recording by a healthy volunteer, the subject was asked for response. **Results:** Whole Body Reaction Time (msec) for right side among Hockey players was 0.548 ± 0.111 msec, while among Cricket players, Baseball players and Controls was 0.546 ± 0.109 msec, 0.533 ± 0.062 msec and 0.676 ± 0.135 msec. Similarly, the recordings of whole body reaction time (sec) for left side among Hockey players was 0.566 ± 0.124 msec, among Cricket players was 0.550 ± 0.087 msec, among Baseball players was 0.575 ± 0.072 msec and among Controls was 0.671 ± 0.120 msec. Also, the recordings of whole body reaction time (sec) for front side were, 0.580 ± 0.141 msec in Hockey players, 0.588 ± 0.116 msec in Cricket players, 0.591 ± 0.056 msec in Baseball players and 0.723 ± 0.151 msec in Controls. And, the recordings of whole body reaction time (sec) for back side among Hockey players was 0.650 ± 0.120 msec, among Cricket players was 0.673 ± 0.089 msec, among Baseball players was 0.675 ± 0.072 msec and among Controls was 0.821 ± 0.130 msec. **Conclusion:** Thus we conclude that Whole Body Reaction Time (Response Time) was not found to be statistically significant when compared between, Hockey and Cricket players, Hockey and Baseball players, and Cricket and Baseball players. Whole Body Reaction Time (Response Time) was found to be statistically significant when all the players i.e. Hockey, Cricket and Baseball were compared with the controls. Thus sport players were having better reaction time as compared to the control group.

Key words: Whole Body Reaction Time, Players, Response time.

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INTRODUCTION

Reaction time relates to, but is different from, reflex time, movement time, and response time. Reflex time is a shortened reaction time wherein the thought or decision making phase is eliminated. In a reflex the impulses travel through the sensory nerves, across the reflex arc, and through motor nerves to the muscles. (The reflex arc relays messages directly from sensory to motor nerves.) One of the important basic properties of a living organism is to

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respond to stimulus. A stimulus is a sudden physiochemical change in the internal or external environment which is of sufficient intensity so as to evoke response in an organism. Response is the way of reacting to the stimulus by the organism either as a whole body or by part of the body. One of the simple ways by which this can be examined is by noting the reaction time. Reaction time is the time interval elapsed between the presentation of the stimulus and the initiation of the response.¹ Reaction time involves conduction time from periphery towards central nervous system, and also central processing. Movement time starts where reaction time ends. It is the time that elapses between the beginning of a movement and its completion. Response time is a combination of reaction time and movement time. It is the total time that elapses from the onset of the stimulus until the act is completed. Reaction time is used widely in the study of most of the psychological processes. It has a tremendous use in the applied field where there is a demand on the part of the individual to respond surely and quickly (i.e. in players, in the selection of airplane pilots, car drivers etc.)² Reaction time has physiological significance and is simple and non-invasive test to see the functions of peripheral as well as central neural structures. The reaction time can be measured in the form of whole body reaction time, auditory reaction time and visual reaction time. Reaction time is considered as a combination of reaction time proper and movement time which is also called response time. The reaction time using hand, leg or total body reaction time can be measured. The most commonly measured reaction time is that of hand. In whole body reaction time the subject is presented with a visual stimulus for a particular direction, and as the subject perceives the stimulus he/she takes a step in appropriate direction which opens the switch thus records whole body reaction time. Baseball is one of the oldest and most popular spectacular sports today. It values all around ability for performing essential skills of the game which are throwing and hitting the ball. Both these skills are extremely complex activities that use multiple abilities and faculties.³ Many sports rely on speed to gain advantage over opponents. Taking all this into consideration we decided to undertake this study regarding reaction time in different sports using a scientific approach so as to understand the game and identify lacunae's in technical skills. The study of reaction time to assess performance in sports is not new, but in past not much attention has been given to inter sport variations in reaction time. Thus, here emerges a need to determine the variations in reaction time in various athletic activities or to study the variations in reaction time in different sports. Hence in the view of above, this study of Auditory Reaction Time Visual Reaction Time and Whole body

Reaction Time is undertaken which will contribute to the emerging field of sports.

MATERIALS AND METHODS

The present study was conducted in the sports physiology laboratory of department of physiology of the tertiary care institute. The study included 180 Players (60 hockey, 60 cricket and 60 baseball players) aged between 15 to 25 years playing at university or district level and still practicing for their respective game. This constituted the study group. The control group consisted of 60 age and sex matched male students which included college students, interns and residents from the same area. The subjects and controls were divided in different groups,

- **Group I**-Hockey players
- **Group II**-Cricket players
- **Group III**-Baseball players
- **Group IV**- Control.

The subjects and controls were informed about the nature of the study and written consent was obtained. The clearance of ethical committee was obtained.

Following inclusion and exclusion criteria was used to select the study subject and controls.

Inclusion criteria for group I, II and III

- Those who have represented at university or district level in their respective games.
- Those still practicing regularly at least 5 days a week, for last three years.

Exclusion criteria for group I, II and III

- Those players who were not practicing regularly.
- Those players who were injured during practice or during matches were excluded from the study. Minor injuries included sprains and strains and major injuries included recurrent shoulder dislocation, fracture ankle joint, fracture patella, ligament injuries etc.
- Players with major respiratory illness or cardiovascular illness in past.
- Those players having problems with hearing or vision.
- Those players having problems regarding CNS (Central Nervous System).
- Those players having history of smoking or alcoholism.

Exclusion criteria for group IV

- Those undertaking any game regularly.
- Those doing regular exercise.
- Those performing regular yogic practices.
- Those having history of smoking and alcoholism.
- Those having diminished hearing or vision.
- Those players having problems regarding CNS (Central Nervous System).

METHODOLOGY

Subjects were informed about the procedure to find reaction time. Each subject’s detailed history was taken, along with clinical examination was done. Reaction time was recorded preferably after warm-up exercise in the morning session.

The whole body reaction time apparatus was used for determining the time taken by the subject to move his body in various directions in response to visual stimuli. After giving a demonstration of reaction time recording by a healthy volunteer, the subject was asked to move a step immediately in response to blinking of the arrow on the

display box in appropriate direction from the central stepping box on which the subject was standing. The time taken to lift the leg in response to stimulus and the time taken to keep the leg in appropriate direction was measured with the help of digital chronoscopes. Thus time taken by the subject to initiate an action and to complete the action was found out. The time between the onset of stimulus and to initiate the action was reaction time proper and the total time from the onset of the stimulus to completion of the action was the response time. The difference between the reaction time proper and response time was the movement time. In this way reaction time proper, movement time and response time for all four directions were found out.

RESULTS

Table 1: Whole body reaction time-right side

Parameter	Group	Mean±SD	Comparison	T value	P value	S/NS*		
Reaction time proper	I-Hockey players	0.333±0.077	I and II	1.64	>0.05	NS		
			I and III	1.58	>0.05	NS		
			I and IV	3.20	<0.05	S		
			II and III	0.241	>0.05	NS		
	II-Cricket players	0.310±0.075	II and III	0.241	>0.05	NS		
			II and IV	4.53	<0.05	S		
			III-Baseball players	0.313±0.059	III and IV	4.63	<0.05	S
					IV-Control	0.390±0.113		
Movement time	I-Hockey players	0.213±0.091	I and II	1.62	>0.05	NS		
			I and III	0.493	>0.05	NS		
			I and IV	4.27	<0.05	S		
			II and III	1.44	>0.05	NS		
	II-Cricket players	0.236±0.060	II and III	1.44	>0.05	NS		
			II and IV	3.40	<0.05	S		
			III-Baseball players	0.220±0.060	III and IV	4.64	<0.05	S
					IV-Control	0.280±0.079		
Response time	I-Hockey players	0.548±0.111	I and II	0.098	>0.05	NS		
			I and III	0.906	>0.05	NS		
			I and IV	5.62	<0.05	S		
			II and III	0.796	>0.05	NS		
	II-Cricket players	0.546±0.109	II and III	0.796	>0.05	NS		
			II and IV	5.754	<0.05	S		
			III-Baseball players	0.533±0.062	III and IV	7.393	<0.05	S
					IV-Control	0.676±0.135		

* S=significant NS=non- significant

Whole body reaction time on right side was studied and it was observed that Reaction time proper, Movement time and Response time was not statistically significant when compared between, Hockey and Cricket players, Hockey and Baseball players, Cricket and Baseball players. Whole body reaction time on right side was found to be statistically significant when all the players i.e. Hockey, Cricket and Baseball were compared with the controls.

Table 2: Whole body reaction time-left side

Parameter	Group	Mean±SD	Comparison	T value	P value	S/NS*		
Reaction time proper	I-Hockey players	0.350±0.083	I and II	1.440	>0.05	NS		
			I and III	0.377	>0.05	NS		
			I and IV	2.99	<0.05	S		
			II and III	2.150	>0.05	NS		
	II-Cricket players	0.330±0.067	II and III	2.150	>0.05	NS		
			II and IV	4.329	<0.05	S		
			III-Baseball players	0.355±0.059	III and IV	2.98	<0.05	S

	IV-Control	0.406±0.117				
Movement time	I-Hockey players	0.216±0.092	I and II	0.00	>0.05	NS
			I and III	0.318	>0.05	NS
			I and IV	3.099	<0.05	S
	II-Cricket players	0.216±0.055	II and III	0.402	>0.05	NS
			II and IV	3.857	<0.05	S
	III-Baseball players	0.221±0.078	III and IV	3.034	<0.05	S
	IV-Control	0.266±0.083				
Response time	I-Hockey players	0.566±0.124	I and II	0.811	>0.05	NS
			I and III	0.482	>0.05	NS
			I and IV	4.673	<0.05	S
	II-Cricket players	0.550±0.087	II and III	1.700	>0.05	NS
			II and IV	6.27	<0.05	S
	III-Baseball players	0.575±0.072	III and IV	5.269	<0.05	S
	IV-Control	0.671±0.120				

* S=significant NS=non- significant

Table 3: Whole body reaction time-front side

Parameter	Group	Mean±SD	Comparison	T value	P value	S/NS*
Reaction time	I-Hockey players	0.360±0.090	I and II	0.859	>0.05	NS
			I and III	0.371	>0.05	NS
			I and IV	3.179	<0.05	S
	II-Cricket players	0.346±0.087	II and III	1.447	>0.05	NS
			II and IV	4.033	<0.05	S
	III-Baseball players	0.365±0.051	III and IV	3.462	<0.05	S
	IV-Control	0.416±0.101				
Movement time	I-Hockey players	0.220±0.097	I and II	1.161	>0.05	NS
			I and III	0.404	>0.05	NS
			I and IV	4.608	<0.05	S
	II-Cricket players	0.238±0.069	II and III	1.008	>0.05	NS
			II and IV	4.140	<0.05	S
	III-Baseball players	0.226±0.060	III and IV	5.026	<0.05	S
	IV-Control	0.308±0.110				
Response time	I-Hockey players	0.580±0.141	I and II	0.336	>0.05	NS
			I and III	0.556	>0.05	NS
			I and IV	5.316	<0.05	S
	II-Cricket players	0.588±0.116	II and III	0.178	>0.05	NS
			II and IV	5.445	<0.05	S
	III-Baseball players	0.591±0.056	III and IV	6.295	<0.05	S
	IV-Control	0.723±0.151				

* S=significant NS=non- significant

Table 4: Whole body reaction time-back side

Parameter	Group	Mean±SD	Comparison	T value	P value	S/NS*
Reaction time	I-Hockey players	0.403±0.071	I and II	0.212	>0.05	NS
			I and III	1.434	>0.05	NS
			I and IV	4.139	<0.05	S
	II-Cricket players	0.406±0.082	II and III	1.076	>0.05	NS
			II and IV	3.823	<0.05	S
	III-Baseball players	0.420±0.057	III and IV	3.376	<0.05	S
	IV-Control	0.480±0.124				
Movement	I-Hockey	0.246±0.091	I and II	1.302	>0.05	NS

Time	players		I and III	0.589	>0.05	NS	
			I and IV	5.280	<0.05	S	
	II-Cricket players	0.266±0.075	II and III	0.801	>0.05	NS	
			II and IV	4.492	<0.05	S	
	III-Baseball players	0.255±0.074	III and IV	5.175	<0.05	S	
							IV-Control
	I-Hockey players	0.650±0.120	I and II	1.182	>0.05	NS	
			I and III	1.372	>0.05	NS	
	I and IV		I and IV	7.424	<0.05	S	
			II and III	0.134	>0.05	NS	
	Response time	II-Cricket players	0.673±0.089	II and IV	7.215	<0.05	S
				III-Baseball players	0.675±0.072	III and IV	7.546
IV-Control	0.821±0.130						

* S=significant NS=non-significant

Similarly Whole body reaction time on left side, front side and back side was also studied and compared. And it was not found to be statistically significant when compared between, Hockey and Cricket players, Hockey and Baseball players, Cricket and Baseball players. Whole body reaction time (Response time) was found to be statistically significant when all the players i.e. Hockey, Cricket and Baseball were compared with the controls.

Discussion:

The present study was undertaken to study the Whole Body Reaction Time among Cricket, Hockey and Baseball Players and its comparison with their age and sex matched controls. Whole Body Reaction Time (msec) for right side among Hockey players was 0.548 ± 0.111 msec, while among Cricket players, Baseball players and Controls was 0.546 ± 0.109 msec, 0.533 ± 0.062 msec and 0.676 ± 0.135 msec. Similarly, the recordings of whole body reaction time (sec) for left side among Hockey players was 0.566 ± 0.124 msec, among Cricket players was 0.550 ± 0.087 msec, among Baseball players was 0.575 ± 0.072 msec and among Controls was 0.671 ± 0.120 msec. Also, the recordings of whole body reaction time (sec) for front side were, 0.580 ± 0.141 msec in Hockey players, 0.588 ± 0.116 msec in Cricket players, 0.591 ± 0.056 msec in Baseball players and 0.723 ± 0.151 msec in Controls. And, the recordings of whole body reaction time (sec) for back side among Hockey players was 0.650 ± 0.120 msec, among Cricket players was 0.673 ± 0.089 msec, among Baseball players was 0.675 ± 0.072 msec and among Controls was 0.821 ± 0.130 msec. When these results were analyzed, it was found that when players of any of sport were compared with controls players were having statistically significant and better whole body reaction time than the control group in all directions i.e. Right side, left side, front side and back side. However when any of the two sports were compared with respect to whole body reaction time there was not statistically significant difference found. Tate Balasaheb *et*

*al*⁴ Studied the batting performance in thirty club level male cricket batsmen. Reaction time on the right side shows that the experimental group ($t=4.307$, $p<0.01$) was significantly quicker as compared to the other. Similar results were observed on the left side as the experimental group ($t=3.782$, $p<0.01$) was better than the others. Anil R Waghmare *et al*⁵ Studied reaction time in 30 male handball players and their age and sex matched controls. They found highly significant decrease in reaction time for right, left and back direction between the subjects and controls. Whole body reaction time in front direction was also decreased significantly in the subjects than the control group. Vandana S Daulatabad *et al*⁶ revealed that athletes reacted and responded quickly than controls. Whole body reaction time for front and back were highly significant (p value < 0.01), whereas whole body reaction time did not differ on left side in these two groups. Dr. S Vijay⁷ Conducted a study to determine the psychomotor ability of cricket players. The study concluded that there was significant improvement on speed, balance, accuracy and reaction time due to cricket fielding drill. Ajay M. Gavkare *et al*⁸ Conducted a study to find the relation of reaction time to motor skill performance in sports. The values of auditory reaction time, visual reaction time, and whole body reaction time were found to be significantly less in athletes as compared to healthy controls. Reaction time and speed have been used in evaluation of the motor skills of humans for a considerable time. Action time can be improved by appropriate training. It is known that regular training also has a positive effect on reaction time. Although these two factors are independent of each other, they can be improved by common strategies such as suitable physical training (Lemmink and Visscher 2005; Montes-Mico *et al.* 2000).^{9,10} Linford *et al.*¹¹ reported that a 6 week training program significantly reduced reaction time of the peroneus longus muscle in healthy subjects. The result obtained by Tate Balasaheb *et al*⁴ indicates that regular motor practice could improve players reactivity. It

also supports the view that depending on particular sport a specialization of visual system is possible. It can be concluded that the visual skills training program improves the basic visual skills such as reaction time, depth perception, saccadic eye movements and accommodation facility of the cricketers, which demonstrates transference in batting performance. Practice reduces decision time by eliminating incorrect decisions and enables correct decision to be made more efficiently. Enough practice of the act causes formation of conditioned reflex. Hence in selection criteria, reaction time should be assessed. The training programs should include different means to improve reaction time in hockey, cricket and baseball players.⁵ Another study reported that the fastest reaction times were observed when the subjects were exercising sufficiently to produce a heart rate of 115 beats per minute.¹² Various mechanisms have been proposed for faster reaction times in aerobic exercisers. This may be due to improved concentration, alertness, better muscular co-ordination and improved performance in the speed and accuracy.^{13,14}

CONCLUSION

Thus we conclude that Whole Body Reaction Time (Response Time) was not found to be statistically significant when compared between, Hockey and Cricket players, Hockey and Baseball players, and Cricket and Baseball players. Whole Body Reaction Time (Response Time) was found to be statistically significant when all the players i.e. Hockey, Cricket and Baseball were compared with the controls. Thus sport players were having better reaction time as compared to the control group.

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