



A Comparative Study of Visual Choice Reaction Time of University Soccer and Basketball Players

Mohammad Nasim Reza, Shaybal Chanda, Mohammad Hamidur Rahman

Department of Physical Education and Sports Science, Jessore University of Science and Technology, Jessore, Bangladesh

Email address:

Shaybalchanda@yahoo.com (S. Chanda)

To cite this article:

Mohammad Nasim Reza, Shaybal Chanda, Mohammad Hamidur Rahman. A Comparative Study of Visual Choice Reaction Time of University Soccer and Basketball Players. *American Journal of Sports Science*. Vol. 6, No. 4, 2018, pp. 130-136.

doi: 10.11648/j.ajss.20180604.11

Received: August 1, 2018; **Accepted:** August 29, 2018; **Published:** October 9, 2018

Abstract: Reaction time is a measure of how quickly an organism can respond to a particular stimulus. In sports, the reaction time is the ability to respond quickly with proper posture and control to a stimulus such as sound or light. Choice reaction time has multiple stimuli and multiple responses and reaction must correspond to the correct stimulus. Purpose of this study is to compare visual two-choice reaction time and scientifically understand the importance of visual choice reaction time, and the strongest and weakest limb between Soccer and Basketball players of the Universities of Bangladesh. Ten (10) subjects were selected randomly from each of the 4 teams qualified for the semifinal from the “Bangladesh Inter-University Football and Basketball Competition-2018” held from 30 March 2018 to 07 April 2018. Two-Choice Audio-Visual Reaction (AVR) time Machines used to collect data. Data collected from both the hands using subjects’ preferred figure and from both the legs using the thumbs. Average of all the 5 trials given by each limb was recorded as the final reaction time of the test and first 2 digits of millisecond considered for the study. Mean, Standard Deviation, t-test and one-way analysis of variance (ANOVA) were used in the study and level of significance was $p > 0.05$. A significant difference in two-choice reaction time found between Soccer and Basketball players’ strong hand, weak hand and strong leg and no significant difference observed in the weak leg. Soccer players’ total (four limbs) reaction time was better in compared to the Basketball players and there was a significant difference between them. Soccer players’ limbs mean visual choice reaction times of strong and weak hands were 24 ms and the strong and weak legs were 29 ms and 28 ms respectively. Basketball players mean two-choice visual reaction time of weak leg was best (Mean 27 ms), strong hand was poorest (Mean 34 ms), and weak hand and strong leg were similar (Mean 32 ms) and stood in-between. A significant difference observed among the limbs’ visual two-choice reaction time of the Basketball and Soccer players and found no similarities between the sports.

Keywords: Choice Reaction Time, Soccer Players, Basketball Players, Limbs

1. Introduction

The reaction is a purposeful voluntary response to different stimuli such as auditory, visual or tactile stimuli [1]. Earlier scientists believed that the human mental process is too fast to measure. In the year 1865 Dutch physiologist F. C. Donders started to think regarding human reaction time and whether it is measurable or not [2]. His hypothesis had proven by an English scientist named Charles Wheatstone in the year 1840. He invented a device similar to his early invention of telegraph system that recorded the velocity of artillery shells. Donders selected the device to assess the time it takes between a shock occurred on a patient’s foot until

that patient pressed a button. That button had to press with the hand of same side hand of that side’s foot on which a shock is given. He experimented in two different conditions, first informing the patient on which foot he is going to give shock and secondly without giving any prior instruction, and recorded 1/5 of a second delay while the time had taken without prior instruction on which foot shock is going to give. This was the first time in history to measure human mind processing time or reaction time.

Human response time may be divided into reaction time and movement time [3]. Reaction time means the duration

from the start of a signal inviting for a response until the beginning of the response and movement time indicates the duration from the starting of the response to its accomplishment. Reaction time task can be differentiated by the diversities of the stimuli in performing a particular task, which should respond with a specific motor reaction. In the simple reaction time task, the response always requires against only one particular stimulus. On the contrary, in the choice reaction time task, there can be a number of different stimuli requiring a particular response for each of the stimulus.

Quick reaction is the most important component of the speed of movement and the inherent prized quality of an athlete [4]. Most of the time importance of reaction time is over-looked in the athlete selection process. In sports and games, the reaction time is of great importance where signal condition the movement of a player, by rival's movements, or by the motion of the implement in the play.

Reaction time is a measure of how quickly an organism can respond to a particular stimulus. Its practical implication in day-to-day life and in sports has great consequence e.g. driving a car fast or try to hit a pace ball lower than the required normal reaction time. Several factors affect reaction time such as age, sex, physical fitness, fatigue, distraction, drugs, alcohol, type of personality, and according to auditory, visual and tactile stimuli. A model of information flow within an organism may be represented as Stimulus > Receptor > Integrator > Effectors > Response, and vertebrates information flow can be presented as Stimulus > Sensory Neuron > Spinal Cord or Brain > Motor Neuron > Response [5]. A stimulus converted into an electrochemical signal by the sensory neurons that go by the length of the sensory neuron (s) then goes all the way through neuron or neuron (s) of the central nervous system and finally passes through the length of the motor neuron (s). Consequentially, motor neurons will cause a muscle to contract or a gland to secrete a hormone (s). On the other hand, Reaction time that only involves the receptor, the spinal cord, and the effectors are quicker than those involve the brain for processing that commonly known as Spinal Reflex. Spinal reflexes or cord-mediated reflexes are the reactions that merely travel to, though, and from the spinal cord, e.g. when someone withdraws one's hand from a hot object. Simple reaction time consisted of only one stimulus and one response, e.g. pushing a button when a light illuminates or catching a dropped stick. Recognition reaction time, there are symbols to respond to and symbols not to respond, it consists of one correct stimulus and one response, e.g. catching a dropped stick with a cue word while having to ignore other spoken words which are not cues. Choice reaction time has multiple stimuli and multiple responses and reaction must correspond to the correct stimulus, e.g. in reaction time machine reacting with pushing an illuminated button from more than one buttons.

Yet today outcome of reaction time remained an equivocal factor though it has been considered as a training monitoring means in sports training over a long period. In relation to choice reaction time and changes in physical performance

during and after 8 days of extensive cycling training found no differences in choice reaction time between acutely fatigued (AF) and functionally overreached (FOR), and deduced early detection of overreaching choice reaction time is not a valid tool [6]. Sprinting athletes reaction time reduced systematically in both the groups of men and women between 2004 and 2016 Olympics and female athletes eliminated this difference of reaction time in the 2012 Olympics. This decrease in reaction time was possible not because of specific training but for precise force thresholds used to measure the reaction time based on force sensors fixed with the starting blocks [7]. In visual reaction measurements, handball players performed better in compared to volleyball and basketball players and no relationship was established between visual reaction and sprint reaction time of the players among the groups [8]. Children's reaction time improve through sports staking activity for 8 weeks [9]. Instructions for sports staking positively effect on the children's reaction time [10].

In sports, the reaction time is the ability to respond quickly with proper posture and control to a stimulus such as sound or light. In most of the sports, quick reaction is more important than to achieve straight ahead speed especially in team games. In Football and Basketball, maximum speed hardly reached or needed in the game but the explosive reaction is an essential requisite. Reaction time can be improved through training [11]. Reaction time differs from player to player even they are of the same age and play the same game [12]. In the sports competitions, a very small difference in the reaction time of the players plays a significant role to distinguish between winner and loser. The relaxed attitude, less challenge toward the opponent, inattention, overload, highly fatigued and overexcitation etc. have a negative impact on the players' reaction time [13]. According to Gavkare, Nanaware, and Surdi, in a team game, reaction time determines how successful a player in defense [4]. When an attacking player makes a move or faint, in this situation little difference between a slow and a fast reaction by the defensive player determines his success or failure. Defensive and attacking both the groups of players cannot perform quickness required to outmaneuver their rivals because they often suffered from slower reaction time. A similar phenomenon also observed in other sports and games like athletics, tennis, badminton, court and field games, and combative sports. Since both Soccer and Basketball are the team games and visual choice reaction plays a vital role in the performance of both the games. The study of reaction time is not new, but in the past, not much attention has been given on comparing choice reaction time of team games where used dominant limbs are different and comparing limbs choice reaction time within the groups. Purpose of this study is to compare and scientifically understand the importance of visual choice reaction time, and the strongest and weakest limb between Soccer and Basketball players of the Universities of Bangladesh.

2. Methods

2.1. Selection of Subjects

Subjects were selected from the “Bangladesh Inter-University Football and Basketball Competition-2018” organized during 30 March 2018 to 07 April 2018 by the Islamic University, Kustia, Bangladesh. 10 (ten) subjects were selected randomly from each of the 4 teams qualified for the semifinals. In soccer, semifinalist teams were Islamic University, Rajshahi University, Chittagong University and Dhaka University; and in Basketball, semifinalist teams were Islamic University, Jahangirnagar University, Jessore Science and Technology University and Chittagong University.

Table 1. Mean Age of the Subjects.

Age of the Subjects (Years)	
Mean Age	21.80
Std. Deviation	2.190

Table 2. Highest Level Played by the Subjects.

Subjects Played at Highest Level	
Inter-University	83.8%
National Team	12.5%
Premier League, B-League and Champions League	3.8%

Table 3. Subjects belonging to the Academic Year.

Subjects belonging to the Academic Year	
1st Year Bachelor	16.3%
2nd Year Bachelor	21.3%
3rd Year Bachelor	25.0%
4th Year Bachelor	17.5%
Masters	20.0%

2.2. Equipment

Two-Choice Audio-Visual Reaction (AVR) time Machine, MEDI System ISO 9001:2015 (QMS).

2.3. Procedure

During hands’ or legs’ data collection, subjects were not been instructed or given chance to see, which light is going to illuminate by the researcher.

Hands’ visual choice reaction data collected from the subjects asking them to sit on a chair and to keep a respective hand on AVR machine button comfortably to press by any preferred figure, which rested on the table.



Figure 1. Hand's Choice Reaction Time.



Figure 2. Leg's Choice Reaction Time.

Legs’ visual choice reaction data collected from the subjects by asking them to sit on a chair and to keep respective leg close and over the AVR machine button comfortably to press by the thumb that placed on the ground.

Before collection of data, researchers had given an oral and practical demonstration of the machine and then subjects were given chance to practice, two trials consisted of 5 attempts for each hand and leg similar to real test.

2.4. Data Collection Procedure

To collect data from the hand AVR machine was rested on the table and the subject was in table chair sitting condition at his convenient. For the collection of data from the leg subject set in chair sitting position comfortably resting his hill of the data providing leg on the ground close to the AVR machine at his convenient and AVR machine on the ground.

Data collected from both the hands using subjects’ preferred figure and from both the legs using the thumb.

It was ensured before data collection that subjects either were not under overload condition or stressed. Investigators with the verbal question confirmed it. In addition, it was confirmed by the researches that they well understood about the process of data providing and familiar with the AVR machine by the previous practices.

2.5. Trials

5 trials for each hand and leg were given to each of the subjects.

2.6. Scoring

Average of all the five (5) trials given by each limb had recorded as the final reaction time of the test. First two (2) digits of millisecond considered for the study.

2.7. Statistical Procedure

The scholars used SPSS 22.00 statistical software packages for the analysis of the data. Groups were heterogeneous in nature from which data was collected by the researchers. Mean, Standard Deviation, t-test and one-way analysis of variance (ANOVA) were used in this study. The significance level was at $p > 0.05$.

3. Used Terms

3.1. Strong Hand & Leg

It is the hand or the leg that a player unintentionally moves first to accomplish any task.

3.2. Weak Hand & Leg

It is the hand or the leg that a player unintentionally does not move first to accomplish any task.

4. Analysis of Data

Table 4. Independent Samples t-Test (2-tailed) of 4 limbs of Soccer and Basketball Players.

Limbs	Sports	Mean (ms)	Std. Deviation	df	t-test	Sig. (2-tailed)
Strong Hand	Soccer	24	± 5	78	7.481	.000
	Basketball	34	± 7			
Weak Hand	Soccer	25	± 5	78	5.045	.000
	Basketball	32	± 8			
Strong Leg	Soccer	29	± 7	78	2.243	.028
	Basketball	32	± 7			
Weak Leg	Soccer	28	± 5	78	.986	.327
	Basketball	27	± 6			

Table 5. Independent Samples t-test of the total reaction of Limbs between Soccer and Basketball Players.

Limbs	Sports	Mean (ms)	Std. Deviation	df	t-test	Sig. (2-tailed)
Total Body Reaction	Soccer	26	±6	318	7.050	.000
	Basketball	31	±7			

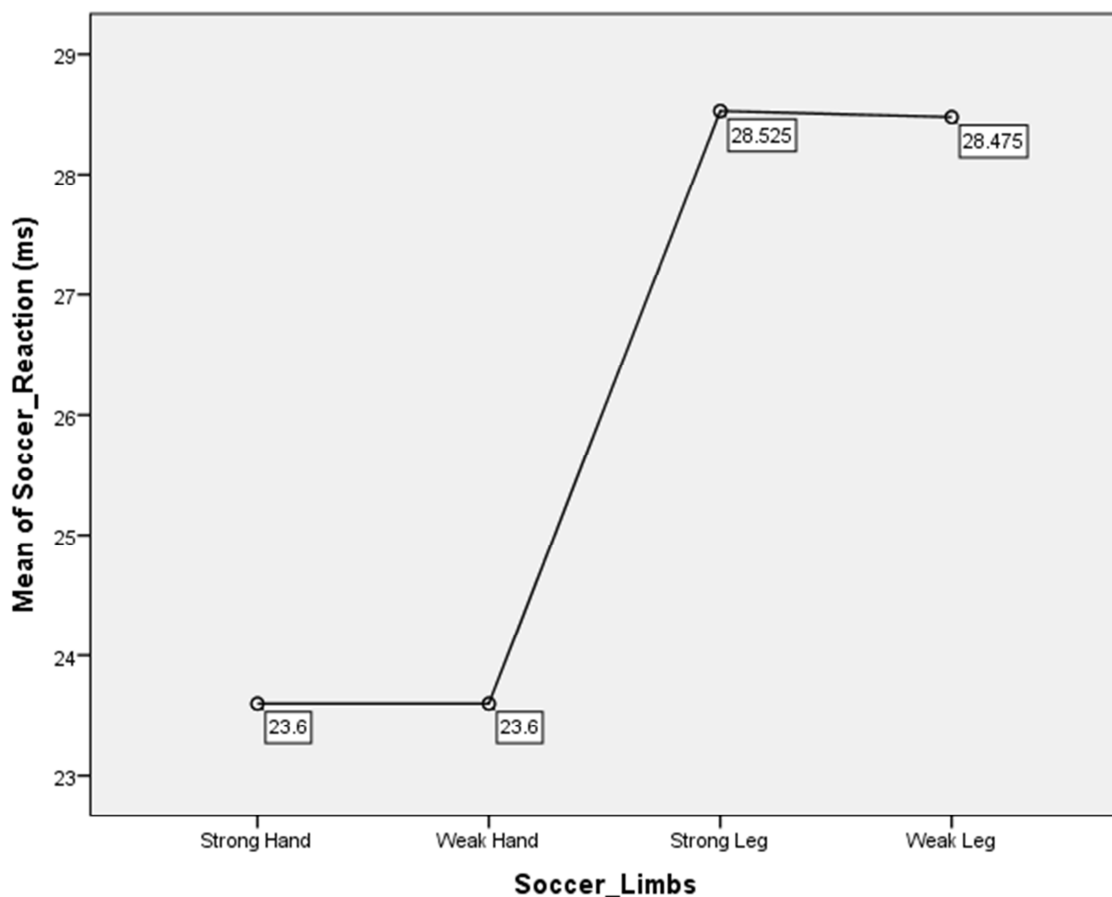


Figure 3. Soccer Players Limbs' Reaction time Mean Plot.

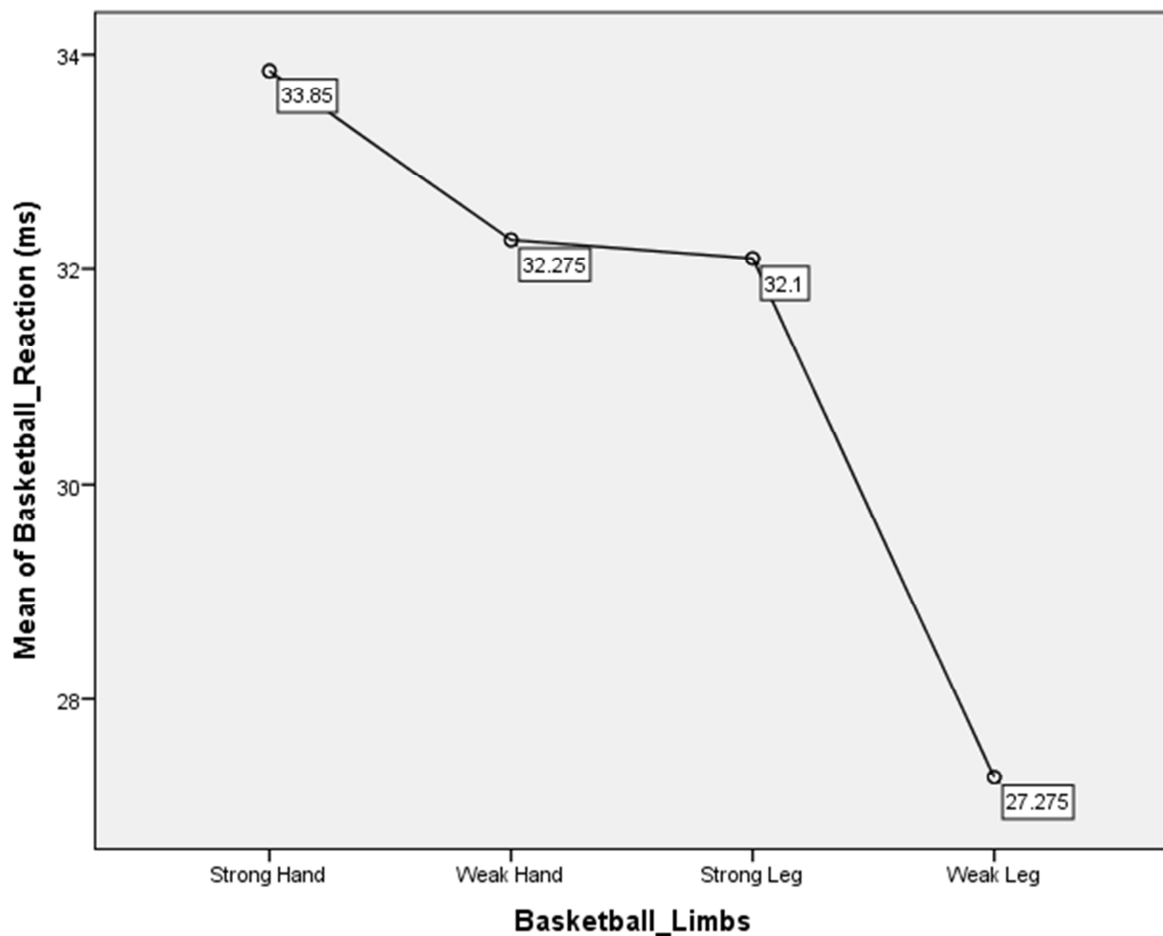
Table 6. ANOVA of Soccer Players Limbs' Reaction Time.

	df	F	Sig.
Between Groups	3	10.660	.000
Within Groups	156		

Table 7. Post Hock (Tukey) Test of Soccer Players' Limbs.

Soccer Limbs	Soccer Limbs	Std. Error	Sig.
Strong Hand	Weak Hand	1.225	1.000
	Strong Leg	1.225	.001
	Weak Leg	1.225	.001
Weak Hand	Strong Hand	1.225	1.000
	Strong Leg	1.225	.001
	Weak Leg	1.225	.001
Strong Leg	Strong Hand	1.225	.001
	Weak Hand	1.225	.001
	Weak Leg	1.225	1.000
Weak Leg	Strong Hand	1.225	.001
	Weak Hand	1.225	.001
	Strong Leg	1.225	1.000

* The mean difference is significant at the 0.05 level.

**Figure 4.** Basketball Players' Reaction time Mean Plot of Limbs.**Table 8.** ANOVA of Basketball Players' Reaction Time of Limbs.

	df	F	Sig.
Between Groups	3	6.393	0.00
Within Groups	156		

Table 9. Post Hock (Tukey) Test of Basketball Players' Limbs.

Basketball Limbs	Basketball Limbs	Std. Error	Sig.
Strong Hand	Weak Hand	1.591	.755
	Strong Leg	1.591	.690
	Weak Leg	1.591	.000

Basketball Limbs	Basketball Limbs	Std. Error	Sig.
Weak Hand	Strong Hand	1.591	.755
	Strong Leg	1.591	1.000
	Weak Leg	1.591	.011
Strong Leg	Strong Hand	1.591	.690
	Weak Hand	1.591	1.000
	Weak Leg	1.591	.015
Weak Leg	Strong Hand	1.591	.000
	Weak Hand	1.591	.011
	Strong Leg	1.591	.015

* The mean difference is significant at the 0.05 level.

5. Results

An independent sample t-test (table: 4) shows the relationships between the Soccer and Basketball players' reaction time of four different limbs; Strong Hand $t(78) = 7.48$, $\text{sig.} = 0.00$, $p < 0.05$ (Mean of Soccer = 25ms and Basketball = 34ms, and $SD \pm 5$ and ± 7 respectively); Weak Hand $t(78) = 5.04$, $\text{sig.} = 0.00$, $p < 0.05$, (Mean of Soccer = 25 ms and Basketball = 32ms and $SD \pm 5$ and ± 8 respectively); Strong Leg $t(78) = 2.24$, $\text{sig.} = 0.03$, $p < 0.05$, (Mean of Soccer = 29 ms and Basketball = 32 ms, and $SD \pm 7$ and ± 7 respectively); and Weak Leg $t(78) = 0.99$, $\text{sig.} = 0.33$, $p < 0.05$, (Mean of Soccer = 28 ms and Basketball = 27ms, and $SD \pm 5$ and ± 6 respectively).

Mean of total choice reaction time (Table: 5) of Soccer and Basketball Players were successively 26ms and 31ms and (SD of Soccer Players was ± 6 and Basketball was ± 7) poorer than soccer players. An independent samples t-test was used to check the relationship between soccer and basketball players total reaction time $t(318) = 7.05$, $\text{sig.} = 0.00$, $p < 0.05$, and significant difference was established (Soccer $M = 26$ ms; Basketball $M = 31$ ms).

Figure 3 depicts the Soccer players' limbs mean visual two-choice reaction times found strong hand and weak hand were equal 24ms, strong leg 29 ms and weak leg 28 ms. The Table: 3, an ANOVA of soccer players limbs' reaction time revealed $F(3,156) = 10.66$, $\text{sig.} = 0.00$, $p > 0.05$ and set up a significant difference between the reaction time of the limbs. The Post Hoc (Tukey) Test of Soccer Players' Limbs (Table:7) yielded that significant difference between strong hand and strong leg, strong hand and weak leg, weak hand and strong leg, weak hand and weak leg all were a $\text{sig.} = 0.001$, $p > 0.05$. On the other hand, no significant difference was found in post hoc test between strong hand and weak hand, strong leg and weak leg both were a $\text{sig.} = 1.00$, $p > 0.05$.

Figure 4, Basketball Players' Reaction time Mean Plot of Limbs states that the reaction time of the Basketball players' weak leg was lowest 27 ms, weak hand and strong leg reaction times were 32 ms and poorest time was found in strong hand 34 ms. The table: 8 of ANOVA of Basketball players limbs' reaction time revealed $F(3,156) = 6.393$, $\text{sig.} = 0.00$ and establish a significant difference between the reaction time among the limbs. Table: 9, the Post Hoc (Tukey) Test of Basketball Players' limbs suggested that significant difference between strong hand and weak leg, weak hand and weak leg, and strong leg and weak leg were a $\text{sig.} = 0.00$, 0.011 and 0.015 respectively at $p > 0.05$. On the other hand, no significant difference was found in post hoc test between strong hand and weak hand, strong hand and strong leg, and weak hand and strong leg were a $\text{sig.} = 0.755$, 0.690 and 1.00 respectively at $p > 0.05$.

6. Discussion

There were significant differences between Soccer and Basketball players' reaction time of strong hand, weak hand

and strong leg but no statically significant difference was visualized in weak leg. A significant difference was observe between Soccer (Mean 26 ms) and Basketball (Mean 31 ms) players in total limbs visual two-choice reaction time, where Soccer players were in better condition than the Basketball players. Visual reaction time in two-choice reaction time task basketball players performed a mean of 30 ms [14]. Chavan and Dr. Shendkar stated that there was a significant difference in correlation in the time required to respond to visual stimuli (VRT) when it was compared between the team and individual games' players [15]. Soccer players both hands reaction times were the same ($M = 24$ ms) and both the legs reaction times were also almost the same (Mean of Strong hand 29 ms and weak hand 28 ms) but hand visual two-choice reaction times were better than the legs. According to Ng and Chan, 21-30 years men two-choice reaction time was found 44 ms of left hand and 40 ms of the right hand [16]. A significant difference was identified in the Soccer players' limbs visual choice reaction time. Soccer players simple reaction time of the different limbs were established a significant difference between strong hand and strong leg, strong hand and weak leg, weak hand and strong leg, and weak hand and weak leg but no significant differences were found between hands and legs. Basketball players mean two-choice reaction time of weak leg was best, strong hand was poorest, weak hand and strong leg were similar and lied in between. There was a significant difference between the limbs' visual choice reaction time of the Basketball Players. A significant difference in two-choice reaction time observed between strong hand and weak leg, weak hand and weak leg, and strong leg and weak leg. On the contrary, no significant difference in two-choice reaction time found when compared between strong hand and weak hand, strong hand and strong leg, and weak hand and strong leg.

7. Conclusion

A significant difference in two-choice reaction time found between Soccer and Basketball players' strong hand, weak hand and strong leg and no significant difference observed in the weak leg when compared among the limbs of the players. Soccer players' total (four limbs) two-choice visual reaction time was better in compared to the Basketball players and there was a statistically significant difference between them. Soccer players' limbs mean visual two-choice reaction times of strong and weak hands were 24 ms and strong and weak legs were 29 ms and 28 ms respectively. Soccer players' limbs visual two-choice reaction time was significantly different. Basketball players mean two-choice reaction time of weak leg was best (Mean 27 ms), strong hand was poorest (Mean 34 ms), and weak hand and strong leg were similar (Mean 32 ms) and stood in-between. A significant difference observed among the limbs' visual two-choice reaction time of the Basketball and Soccer players and found no similarities between the games.

References

- [1] Ghuntla TP, Mehta HB, Gokhale PA, et al. A comparison and importance of auditory and visual reaction time in basketball players. *Saudi J. Sports Med.* [Internet]. 2014; Available from: <http://www.sjosm.org>.
- [2] G Norris D. THE AGE OF PRECISION: F. C. DONDER'S AND THE MEASUREMENT OF MIND [Internet]. Nijmegen; 2018. Available from: www.ru.nl/donders.
- [3] Health & Safety Executive. Review of Wrong Helideck Landings, Status Lights and Signalling Lamps. Offshore Technol. Rep. 2000067 [Internet]. 2001; Available from: <http://www.hse.gov.uk/research/otopdf/2000/oto00067.pdf>.
- [4] Gavkare AM, Nanaware NL, Surdi AD. Auditory Reaction Time, Visual Reaction Time and Whole Body Reaction Time in Athletes. *Indian Med. Gaz.* [Internet]. 2013; Available from: <http://medind.nic.in/ice/t13/i6/icet13i6p214.pdf>.
- [5] Reaction Times.pdf - Biology 104 Reaction Times Objectives 1 Formulate and test hypotheses regarding reaction times Introduction Reaction time is a [Internet]. [cited 2018 Aug 1]. Available from: <https://www.coursehero.com/file/29086837/Reaction-Timespdf/>.
- [6] ten Haaf T, van Staveren S, Iannetta D, et al. Changes in Choice Reaction Time During and After 8 Days Exhaustive Cycling Are Not Related to Changes in Physical Performance. *Int. J. Sports Physiol. Perform.* 2018; 13:428–433.
- [7] Mirshams Shahshahani P, Lipps DB, Galecki AT, et al. On the apparent decrease in Olympic sprinter reaction times. *PLoS ONE.* 2018; 13:1–7.
- [8] Akyüz M, Uzaldi BB, Akyüz Ö, et al. Comparison of Sprint Reaction and Visual Reaction Times of Athletes in Different Branches. *J. Educ. Train. Stud.* 2017; 5:94–100.
- [9] Wang T-C, Wang Dejia. Effect of 8 Weeks Sport Stacking on the Attention and Reaction Time of the 2nd Grade Elementary School Students. The influence of eight-week competitive folding cup exercise on the attention and reaction time of second-grade schoolchildren. 2016.
- [10] Yu-Ting Weng, Weng and Ting. The Effect of Sport Stacking Instruction on Hand-Eye Coordination Ability and Reaction Time of Elementary School Students in Special Education Class. Competitive Stack Cup Teaching Improves the Hand-eye Coordination Ability and Response Time of Students in Special Education Classes. 2014.
- [11] Dilworth M. The Importance Of Reaction Time In Sports Performance | Sports Fitness Hut: Sports Speed, Sports Strength, Sports Nutrition and Supplementation [Internet]. Importance React. Time Sports Perform. Sports Fit. Hut. 2008. Available from: <https://sportsfitnesshut.blogspot.com/2008/01/importance-of-reaction-time-in-sports.html>.
- [12] Saitoh Y. Recovery from vecuronium is delayed in patients with hypercholesterolemia. *Can. J. Anesth.* 2006; 53:556.
- [13] Sahin R. Erkek hentbolde kalecilerle saha oyuncularının reaksiyon zamanlarının karşılaştırılması. *Uksek Lisans Tezi Gazi Univ. Sağlık Bilim. Enst.* 1995.
- [14] Ghuntla TP, Mehta HB, Gokhale PA, et al. A comparison and importance of auditory and visual reaction time in basketball players. *Saudi J. Sports Med.* 2014; 14:35–38.
- [15] Chavan N, Shendkar DD. A study of variations in an athlete's reaction time performance based on the types of stimulus. *Int. J. Phys. Educ. Health.* 2011; 3:79–83.
- [16] Ng AWY, Chan AHS. Finger Response Times to Visual, Auditory and Tactile Modality Stimuli. *Proc. Int. MultiConference Eng. Comput. Sci.* 2012 [Internet]. Hong Kong: IMECS 2012; 2012. Available from: https://www.researchgate.net/publication/288110743_Finger_Response_Times_to_Visual_Auditory_and_Tactile_Modality_Stimuli.