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Original Research Article

Investigation of Audio-Visual Simple Reaction Time of University Athletes and Non-Athletes

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Abstract

Reaction time (RT) is a true pointer of eye-hand coordination, response, and alertness of a person. In sports and daily life, the majority of work is done by the use of auditory and visual information. RT is a measurement of how quickly the particular tasks are done. The purpose of this study was to investigate auditory and visual simple reaction time of university male team branch athletes (basketball, handball, volleyball, football, and cricket) and non-athletes. Totally forty (40) subjects randomly participated in this study; among them (n=20) were team branch athletes and the rest (n=20) non-athletes. Audio-Visual Reaction Timer (AVRT) was used to collect auditory reaction time (ART) and visual reaction time (VRT) data. Ten values of ART and VRT of dominant and non-dominant hands were recorded. Excluding the two fastest and slowest values, and the average for the middle six values saved as two digits of milliseconds were RT data. Descriptive statistics- mean, SD, and Inferential statistics- dependent and independent t-test was applied to check the level of significance ($p<0.05$ and $p<0.01$). Paired sample t-test of university athletes and non-athletes ART was statistically significant than that of VRT ($p<0.01$). A significant difference was found of ART and VRT between dominant and non-dominant hands of both groups together ($p<0.01$). Independent t-test of ART and VRT of dominant and non-dominant hands between athletes and non-athletes was statistically significant ($p<0.05$). In summary, it can be said that in athletes and non-athletes groups auditory reaction time (ART) was faster than the visual reaction time (VRT) and considering both the groups together, the dominant hand was superior to the non-dominant hand in quickness. However, ART and VRT of dominant and non-dominant hands of university athletes took the upper hand over the non-athletes group.

Keywords: Audio-Visual Reaction Time, Athletes and Non-Athletes, Handedness, Hemisphere.

INTRODUCTION

The deliberate voluntary response to many stimuli such as auditory, visual, and tactile stimuli is the reaction [1]. Reaction time (RT) describes the time interval between an external signal and response to it. RT measures how faster an organ can reply to a special stimulus [2]. RT can be described into three types; simple reaction time (SRT), recognition reaction time (RRT), and choice reaction time (CRT) [3]. In the year 1865 Franciscus C. Donders, was the first scientist to measure reaction time in the laboratory and noticed that simple reaction time is faster than the recognition reaction time and that the choice reaction time is the longest to simple and recognition reaction time [4]. RT is composed of the start of eye movements, eye movement time, decision time, and muscle contraction time [5]. SRT refers to reacting to a single stimulus and is usually very fast [6].

Physiological and pharmacological factors affected reaction time [7, 8]. In simple RT, stimuli considering the fastest reaction time to the lower one are- tactile (90-180 ms), auditory (120-180 ms), and visual (150-200 ms) stimuli respectively [9]. Youth sedentary perform faster visual and auditory reaction time with growing age between 11-18 years [10]. According to gender, visual and auditory RT was significantly different in males and females, and males have faster reaction times than females for both auditory as well as visual stimuli [11]. Physical exercises [12, 13] affect the visual and auditory reaction

time of volleyball players when it is measured at the beginning and the end of the training schedule and it is concluded that VRT and ART decrease by exercise [14]. The right and left hemispheres of the brain function are based on the contralateral theory. The left finger of visual and auditory response time was significantly longer than the right finger in simple and choice reaction time tasks [15].

Many studies have been undertaken to investigate and compare RT and its significance in sport. RT is the key factor of success in many sporting competitions. Quick RT is important for daily activities, alertness, and overall wellness as well. For this reason, RT is a meaningful part of an athlete's daily life and sports performance. An athlete who has better reaction time is more significant than another athlete; has equal neuromuscular mechanisms, cognitive ability, and tactical capacity [16, 17]. Researchers [18] show that physically fit athletes are to have better reaction time than others. Further study demonstrated that athletes have better reaction times compared to non-athletes [19]. Elite athletes had shorter reaction time than non-athletes and also participation in sports reduced reaction time [20].

In games and sports, the visual and auditory stimulus is the use of vision (seeing signals and thinking in images) and audition (using sounds and voices) [21]. Auditory stimuli use sound to send and receive information such as vocal (spoken speech) for verbal and tone of voice, talk speed, volume of speech, and intonation for nonverbal communication. Visual involves signal language that can be seen [22]. It may include body gestures, postures, facial expressions, physical appearance, and movement with change of direction [22-24]. Quick reaction time in team branches athletes communicates their teammate during competition by effective way of sounds and signals.

In daily life majority of work is done by the use of auditory and visual information. In many situations, students experience simple reaction time and become able to quickly adjust to suddenly changing situations. In the Bangladesh context, participation in sports, the concept of physical fitness, and a healthy lifestyle among university students are rapidly increasing [25]. Mental and physical relaxation increase if stretching and flexibility exercises are performed regularly [26].

In the context of the Bangladeshi athlete and non-athlete, present researchers found a research gap to investigate the simple reaction time of auditory and visual reaction time. The purpose of the present study was to examine the simple reaction time of auditory and visual reaction time and to compare athletes and non-athletes of this behavior-based on dominant (preferred) and non-dominant (non-preferred) hand.

MATERIALS AND METHODS

Forty (40) university male students were randomly selected as subjects (Here 'subject' refers to the persons participating in the research); among them twenty (20) athletes in different sports branches (basketball, handball, volleyball, football, and cricket) and the rest twenty (20) were non-athletes. All athletes were competing at junior national and inter-university levels in their respected sport. The age of the subjects ranging from 17 to 24 years of age (athletes and non-athletes mean age 22.10±1.65, 21.15±1.39 years respectively) and data were collected in Jashore University of Science and Technology, Jashore, Bangladesh. All subjects were right-handed and they voluntarily participated in this present study.

Audio-Visual Reaction Timer (AVRT) [27] QMS is certified with ISO 9001:2015 standards was used to collect auditory reaction time (ART) and visual reaction time (VRT) data. AVRT was kept on the table, and the test administrator sat on the operator side and the subjects are trainer side. From a sitting position, the subjects kept both hands on the table and their preferred finger in contact with the AVR timer switch. VRT was recorded by illuminating bulbs, and ART was listening to the sound which served as individual stimuli. VRT and ART were tested for both the dominant and non-dominant hands. In both tests, the researchers gave light and sound stimulus 1-3 seconds after the ready call. The subjects were instructed to respond the action and turn off the switch immediately in the shortest time. All subjects repeatedly performed the same tasks 10 times excluding the two fastest and the two slowest values. The average score was considered as the experimented reaction time data. First, two digits of milliseconds (ms) were considered for the study. The test sequence was VRT, then ART of dominant and non-dominant hands. ART and VRT were measured in a quiet and noise-free gymnasium.

The scholar scanned data with the Shapiro-Wilk test and a normal distribution was found. The data were analyzed using descriptive statistics, mean and standard deviation (SD). An inferential statistics-paired and independent t-test was applied to check the level of significance. The significance level was set at $p<0.05$ and $p<0.01$.

RESULTS

Table-1: Comparison between ART and VRT of athletes and non-athletes

Group	Parameter	Descriptive		Inferential: Paired sample t-test		
		Mean (ms)	**SD** (ms)	**t**	**df**	**Sig. (2-tailed)**
Athletes	ART	15.25	1.80	5.85**	19	0.000
	VRT	18.05	1.64			
Non-athletes	ART	16.65	1.69	4.54**	19	0.000
	VRT	19.25	1.71			

Significance level at 19 df at *0.05 level = 2.093 and at ** 0.01 level = 2.861

Table: 1 of comparison between ART and VRT of university athletes and non-athletes shows that athletes group ART mean = 15.25 ms and SD = 1.80 ms, on the other hand VRT mean = 18.05 ms and SD = 1.64 ms, $t_{(19)}$= 5.85 and p= 0.000, (2-tailed); whereas, in the non-athletes ART mean =16.65 ms and SD = 1.69 ms, other side VRT mean = 19.25 ms and SD = 1.71 ms; $t_{(19)}$= 4.54 and p= 0.000, (2-tailed). Both are statistically significant as tabulated value of t(0.01)(19) = 2.861 & p<0.01. The result shows that athletes and non-athletes groups ART was significantly lower than that of VRT and in both groups ART was faster than the VRT.

Table-2: Paired t-test of ART and VRT between hands of athletes and non-athletes

Parameter		Descriptive		Inferential: Paired sample t-test		
		Mean (ms)	**SD** (ms)	**t**	**df**	**Sig. (2-tailed)**
ART	Dominant hand – Non-dominant hand	15.95	1.87	6.55**	39	0.000
		17.60	2.02			
VRT	Dominant hand – Non-dominant hand	18.65	1.76	7.05**	39	0.000
		20.43	1.88			

Significance level at 39 df at *0.05 level = 2.023 and at **0.01 level = 2.708

Table: 2 of paired t-test of ART and VRT between dominant and non-dominant hand of university athletes and non-athletes together shows that ART dominant hand mean = 15.95 ms and SD = 1.87 ms, and non-dominant hand mean = 17.60 ms and SD = 2.02 ms, $t_{(39)}$= 6.55 and p= 0.000, (2-tailed); whereas VRT dominant hand mean = 18.65 ms and SD = 1.76 ms, and non-dominant hand mean = 20.43 ms and SD = 1.88 ms, $t_{(39)}$= 7.05 and p= 0.000, (2-tailed); both are statistically significant as tabulated value of t(0.01)(39) = 2.708 & p<0.01. It has been observed that the result dominant hand of ART and VRT was significantly lower than that of non-dominant hand university athletes and non-athletes together. This confirms that, in terms of ART and VRT, both groups of dominant hands are faster.

Table-3: Independent t-test of ART and VRT of hands between athletes and non-athletes

Parameter		Athletes		Non-Athletes		Independent t-test		
		Mean(ms)	**SD**(ms)	**Mean**(ms)	**SD**(ms)	**t**	**df**	**Sig. (2-tailed)**
ART	Dominant hand	15.25	1.80	16.65	1.69	2.53*	38	0.015
	Non-dominant hand	16.90	1.86	18.30	1.98	2.31*	38	0.026
VRT	Dominant hand	18.05	1.64	19.25	1.71	2.26*	38	0.029
	Non-dominant hand	19.80	1.82	21.05	1.76	2.20*	38	0.033

Significance level at 38 df at *0.05 level = 2.024 and at **0.01 level = 2.721

Table: 3 of independent sample t-test of ART and VRT of dominant and non-dominant hands between university athletes and non-athletes shows that ART of dominant hand athletes mean = 15.25 ms and SD = 1.80 ms, and non-athletes mean = 16.65 ms and SD = 1.69 ms, $t_{(38)}$= 2.53 and p= 0.015, (2-tailed); and non-dominant hand athletes mean = 16.90 ms and SD = 1.86 ms, and non-athletes mean = 18.30 ms and SD = 1.98 ms, $t_{(38)}$= 2.31 and p= 0.026, (2-tailed); Here ART of dominant and non-dominant hands is statistically significant as tabulated value of t(0.05)(38) = 2.024 & p<0.05. According to VRT of dominant hand athletes mean = 18.05 ms and SD = 1.64 ms, and non-athletes mean = 19.25 ms and SD = 1.71 ms, $t_{(38)}$= 2.26 and p= 0.029, (2-tailed); and non-dominant hand athletes mean = 19.80 ms and SD = 1.82 ms, and non-athletes mean =

21.05 ms and SD = 1.76 ms, $t_{(38)}$= 2.20 and p= 0.033, (2-tailed). VRT is also statistically significant as tabulated value of t(0.05)(38) = 2.024 & p<0.05. Finally, table 3 result shows that ART and VRT, in respect of dominant and non-dominant hands, athletes took the upper hand over the non-athletes.

DISCUSSION

In the present study, the table 1 result shows that athletes and non-athletes groups ART was significantly lower than that of VRT, so both groups in ART was faster than the VRT. This finding is similar to the studies done by [28] they confirmed that in a simple reaction time task auditory reaction time is faster as compared to the visual reaction time. An auditory stimulus to reach the brain only takes 8-10 milliseconds [29], but a visual stimulus takes 20-40 milliseconds [30]. For this reason, auditory stimulus reaches the cortex faster than the visual stimulus. Another study has confirmed that visual stimuli are longer than auditory stimuli [31]. Researchers [32] studied 104 elite male soccer players and they determined there were significant differences between the audio and visual reaction times and ART were better than the VRT. In similar studies done by [1], they noticed that ART was superior as compared to VRT of male basketball players. A study was carried out by [33] has concluded that the ART is faster than the VRT in medical students. Our findings acknowledge the early studies and suggest that the earlier the stimulus enters the motor cortex, the quicker the response time to the stimulus would be.

Table 2 observed that the dominant hand of ART and VRT was significantly lower than non-dominant hand athletes and non-athletes together. This confirms that the dominant hand was found faster than the non-dominant hand in terms of ART and VRT. The present study related to literature highlights that control of the hands is contralateral, such that left hemisphere controls the right hand and the right hemisphere controls the left hand [34]. However, right-handedness is the most common form, and it is estimated that around 90% of the human population is right-handed [35]. Further studies done by [36] used student t-test between hands of football and tennis players and the result shows that between the two groups, the difference between right- and left-hand reaction time. Researchers [37] show that reaction time of the dominant hand is faster as compared to the non-dominant hand. Other studies of light and sound between athletes and sedentary group and finally the result shows that significant difference in right and left-hand reaction time and also result goes to meaningful favor of athletes [38]. Among university women athletes and sedentary women, strong hand is faster than that of their weak hand in respect of simple choice visual reaction time [39]. All findings are similar to that of the present study. On the contrary, the reaction time of the dominant and non-dominant hands was not consistent with hemisphere processing theory. On simple reaction time task of university students they do not find any consistent difference between the dominant and non-dominant hands [40]. These statements confirm and extend neither of the findings and they recommending that none of the hemifield effects between the dominant and non-dominant hands on both simple and choice reaction time tasks [41].

In our study table 1 found that an auditory stimulus was faster than the visual stimulus consequently the table 2 proved that the dominant hand of ART and VRT performed better than that of the non-dominant hand. Now, these results have found a new literature lacuna, if and when the non-dominant hand in games and sports is faster than that of the dominant hand.

According to table 3, the ART and VRT result shows that there was a statistically significant difference between university athletes and non-athletes both in dominant and non-dominant hands. ART and VRT in both hands of university athletes took the upper hand over the non-athletes group. Results supporting our study were also observed by [42] they concluded that auditory and visual reaction time was significantly less in both dominant hand and non-dominant hands of basketball players than the healthy controls. For about 130 years, researchers accepted for mean auditory reaction times being 140-160 milliseconds (160ms) and visual reaction times being 180-200 milliseconds (190ms) [43-45]. Previous studies suggested that non-athletes auditory, visual and multiple reaction times were found worse than the different sport branches athletes [46]. A further study conducted by [47] found that non-sport sedentary had higher average milliseconds in auditory and visual reaction time than racket athletes. The visual reaction time of dominant and non-dominant hands of badminton players was shorter than the healthy males who lived a sedentary lifestyle [48]. A study done on the simple reaction time of 94 right-handed healthy males and results shows that significant difference between right hand and left-hand values, and right hand is faster than left hand for auditory and visual reaction time [49].

CONCLUSIONS

Based on the findings of this investigation, researchers conclude that the athletes and non-athletes groups' auditory reaction time (ART) is faster as compared to the visual reaction time (VRT). Athletes and non-athletes, both groups together, the dominant hand was superior in quickness than the non-dominant hand. However, auditory reaction time (ART) and visual reaction time (VRT) of dominant and non-dominant hands of university athletes took the upper hand over the non-athletes group.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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