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A Study on The Visual Reaction Times of Hearing-Impaired Adolescents

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ABSTRACT

The aim of this study was to examine visual reaction time values of adolescents according to gender, hearing impairment and dealing with sports situation. The 78-hearing impaired and 78 normal hearing students joined to study voluntarily. The visual reaction time values of dominant and non-dominant hands were measured by reaction measurement device in laboratory. According to statistical analyze results, it was determined that there was significantly difference between visual reaction time values of students in terms of gender and hearing impairment situation and male and hearing impaired students had faster visual reaction time values compared to female and normal hearing students ($p<0.05$). It was found that the visual reaction time values of students were not differentiated according to situation of dealing with sports of students and sedentary and athlete students had similar visual reaction time values. As conclusion, it might be said that the reason of faster visual reaction time values of hearing-impaired students compared to normal hearing students was to be used of visual signs frequently by hearing impaired students for facilitating their daily life activities and eliminating disadvantages of hearing impairment.

1. Introduction

The disability is an important reality deteriorating life of many people in world. It was stated that hearing impairment have effects on language and communication ability [1]. The subjects of most studies about hearing impairment in children population are speaking and language improvement and reason of this situation are that there are hearing impairment individuals in world which sound is an important component of communication [2]. In the other hand, mental and behavioral improvements of hearing-impaired children are very important. The problems occurring in communication with peers relate with language sufficiency [3]. In this context, the language sufficiency is an important factor in versatile improvement of children.

The physical activity has a positive effect on physical and mental health. The children joining to regular physical activity maintain sporty lifestyle throughout life [4]. The immobility is an important problem among children living together with technology and it threatens their health. The physical activity and joining to sports and exercise has positive effects on psychological states of disabled subjects [5]. Similarly, the participation in sports of disabled children plays an important role on decrease of their disadvantages originating from disability. However, the disabled children are shy for participation in sports due to various factors affecting their communication. In this context, the physical activity and exercise is an important tool increasing communication ability and integration to society.

The hearing impairment is known impairment in hearing mechanisms due to various factors [6]. The hearing sense is one of the most important tools for perceiving external environment and reaction to external stimuli. The hearing-impaired individuals have various hardships in realizing environment and this situation creates a big handicap in their lives. When sensory systems were examined, it was said that impairment of one sensory system could have adverse effects on other sensorial systems [7]. Reynolds [8] asserted that hearing impairment could have an influence on sensorial visual attention in apprehension of external stimuli. The visual sensation feature is too important for hearing impaired individuals and they use this feature for eliminating disadvantage of hearing lack in process of perception environment. The visual reaction to external stimuli in hearing impaired individuals is effective on simplifying life.

Some studies were performed about reaction to visual stimuli in hearing impaired and normal hearing individuals. Lore and Song [9] revealed that hearing-impaired individuals had better visual reaction times than normal hearing individuals in study used visual stimuli sent with 25 degree from foveal point. The different findings on various studies performed on hearing impaired and normal hearing individuals were found in literature and there is no consistency among these findings.

The effects on visual reaction times of gender, situation of dealing with sports and hearing impairment status was not indicated in literature. The investigation of visual reaction times of individuals in the light of these factors can contribute to literature. The purpose of this study was to compare visual reaction times of individuals according to gender, situation of dealing with sports and hearing impairment status.

2. Method

2.1. Research Model

The model of study was determined as experimental method.

2.2. Research Sample

The hearing impaired students attending to special education institution (n=40 female, age: 21.32 ±2.0 years, body mass index: 20.07 ±1.78; n=38 male , age: 21.97 ±2.17 years, body mass index: 22.96 ±2.50) and normal hearing students attending to normal education institution (n=40 female, age 21.32 ±2.0 years, body mass index: 20.07 ±1.78; n=38 male, age: 21.97 ±2.17 years, body mass index: 22.96 ±2.50) in Ordu county joined to study voluntaries. The acknowledgement form was taken from education institution for investigation before study.

2.3. Data Collection

The visual reaction times of students participating in study were measured by reaction measurement device (MOART, Lafayette Instrument, USA). The visual reaction times were measured in a silent room. The students placed their hands same point on table and reacted to light stimulus given with random duration intervals from reaction measurement device. The dominant and non-dominant hand reaction times of students were measured five times and the best and worst values were excluded and mean values of three values remained were determined as visual reaction times of students in millisecond unit.

2.4. Analysis of Data

The SPSS statistic package program was used for all statistical analyzes (SPSS 22.0, USA). The suitability to normal distribution of data were examined and it was seen that data showed suitability to normal

distribution. The study data were presented with descriptive statistics as mean, standard deviation. The independent sample T-test was used for determination intergroups differences according to gender, situation of dealing with sports and hearing impairment status determined as independent variables of study. The statistical results were evaluated in 0.05 significance level.

3. Results

According to Table 1, it was seen that there was significantly difference between hearing impaired and normal hearing individuals about visual reaction time values ($p<0.05$). In other words, it was seen that hearing-impaired individuals had faster dominant and non-dominant hand visual reaction time values compared to values of normal hearing individuals.

Table 1. *The dominant and non-dominant hand visual reaction time values of hearing impaired and normal hearing individuals.*

Variable	Group	n	$\bar{X}$ (msec.)	SD	t	p
Dominant	Hearing impaired	60	513.60	84.50	-6.344	0.000**
	Normal hearing	60	638.77	127.34		
Non-dominant	Hearing impaired	60	514.15	11,30	-6.152	0.000**
	Normal hearing	60	632.63	126.95		

**p<0.001

The visual reaction time values of girl and boy individuals were analyzed, and it was found that there was significantly difference between girls and boys ($p<0.05$). It was determined that the male students had faster dominant and non-dominant visual reaction time values in comparison with girls.

Table 2. *The dominant and non-dominant hand visual reaction time values of male and female individuals.*

Variable	Group	n	$\bar{X}$ (msec.)	SD	t	p
Dominant	Girl	80	602.02	132.96	3.346	0.001**
	Boy	40	524.52	86.41		
Non-dominant	Girl	80	601.16	129.88	3.754	0.000**
	Boy	40	517.85	74.53		

**p<0.001

According to analyze results in Table 3, there was no significant difference between athletes and sedentary individuals in terms of visual reaction time values. It was said that dominant and non-dominant hand visual reaction time values of individuals were not differentiated according to situation of dealing with sports.

Table 3. *The dominant and non-dominant hand visual reaction time values of athlete and sedentary individuals.*

Variable	Group	n	$\bar{X}$ (msec.)	SD	t	p
Dominant	Athlete	32	559.85	99.44	-0.865	0.389
	Sedentary	88	582.12	132.61		

Non-dominant	Athlete	32	556.98	91.25	-0.897	0.372
	Sedentary	88	579.35	129.74		

4. Discussion and Conclusion

In terms of situation of dealing with sports in our study, there is no significant difference between athletes and sedentary individuals. It was said that dealing with sports could be effective on integration to society of hearing-impaired individuals but there was no consensus about effects on reaction time values of situation dealing with sports. Soto-Rey et al. [10] revealed that visual reaction time values of hearing-impaired individuals were faster than visual reaction time values of normal hearing individuals. These findings were like findings of our study. In study of Vujkov et al. [6], it was determined that maximum oxygen uptake values and running speed of hearing-impaired handball players were lower than values of normal hearing handball players. The maximum oxygen uptake was parameter of endurance and it could be said that endurance levels of hearing-impaired handball players were lower than normal hearing handball players and this result could be arisen from not to focus to trainings due to their hearing impairment compared to normal hearing players. Therefore, trainings specialized to hearing impaired athletes could be useful for development of their physical performances.

It was determined that the balance values of visual impaired judokas were better than values of hearing-impaired judokas, but the flexibility values of hearing-impaired judokas were better than flexibility values of visual impaired judokas [11]. Similarly, Al-Rahamneh et al. [12] found that hearing impaired students had higher sit and reach test flexibility values than normal hearing students whereas push-up, sit-up, 4x10 m. shuttle run and 1 mile run test values of normal hearing students were better than test values of hearing impaired students. The balance performances of hearing-impaired judokas could be worse than balance performances of visual impaired judokas due to hearing impairment. The hearing impairment could affect balance mechanisms in ear, and this could deteriorate balance performance in hearing impaired judokas. The better visual reaction performances of hearing-impaired individuals compared to normal hearing individuals in our study showed similarity to studies of Karakoç [11] and Al-Rahamneh et al [12] in terms of flexibility performances of hearing-impaired individuals.

Ilkim and Akyol [13] performed 14-week training period on hearing impaired athletics and gymnasts. They found an improvement in Flamingo balance test, low extremity visual reaction time and quadriceps femoris muscle strength values of athletics after 14-week training period. Also, only Flamingo balance test values of gymnasts progressed after training period compared to pre-training test values. It could be said that balance and reaction times values of hearing-impaired athletes were improved with suitable trainings according to this study findings. The development of balance ability of hearing-impaired individuals which may be affected from distortions in functionality of balance mechanisms in ear might be provided with special trainings.

Neuls et al. [14] revealed that maximum oxygen uptake values of normal hearing soccer players were higher than maximum oxygen uptake values of hearing-impaired soccer players. Also, normal hearing soccer players had lower body fat mass than hearing impaired soccer players. The difference in maximum oxygen uptake values might be arisen from body fat mass values in study of Neus et al. [14]. The maximum oxygen uptake parameter was physical performance parameter and related to endurance ability of individuals in prolonged exercises. The visual reaction time was process of carrying to central nervous system from peripheral nervous system of nerve impulses perceived by receptors and reaction production to these

impulses quickly. Therefore, reaction time parameter was mostly related to function of central nervous system in brain. In this regard, findings of our study showed difference in visual reaction ability against peripheral stimulants of central nervous system between hearing impaired and normal hearing individuals. It might be said that physical and visual reaction time mechanisms were different and dissimilarity of findings in two study might be arisen from this situation.

Çebi et al. [15] found that visual reaction time values of hearing-impaired athletes were faster than visual reaction time values of normal hearing, physical disabled athletes and sedentary individuals. The findings of related study were like findings of our study and it might be said that hearing impaired individuals paid attention to visual reaction ability for perceiving peripheral stimulants due to hearing impairment. Also, reaction ability against to sound of visual impaired athletes was better than reaction ability of other groups and these findings showed that visual impaired individuals mostly used auditory signals perceived from external environment instead of vision ability for facilitating their lives. On the other hand, Ercan et al. [16] determined that there is no significant difference between hearing impaired and normal hearing athletes in terms of parameters of exercise stress test as maximum oxygen uptake, blood pressure, rest heart rate and maximum heart rate during test. The similar physical fitness level of hearing impaired and normal hearing athletes in study of Ercan et al. [16] might cause to similarity of study findings.

In study performed by Gkouvatzi et al. [17], it was found that the hearing impaired and hard of hearing pupils differentiated in terms of upper extremity coordination ability and group and age factors had main effect on upper extremity coordination ability. Also, Gkouvatzi et al. [17] found that hearing impaired pupils had better upper limb coordination test values compared to hard of hearing pupils. In our study, the reaction time values of hearing-impaired individuals were higher than values of normal hearing individuals and findings of our study resembled to study of Gkouvatzi et al. [17]. To be needed to reaction exercises in coordination tests might be presented as evidence to this similarity between two studies.

The dominant and non-dominant single leg balance parameters of hearing-impaired karate athletes were better than visually impaired goalball athletes [18]. The karate was a sport branch needing balance ability and balance ability of hearing-impaired karate athletes might be developed by specific karate trainings. The difference between balance values of athletes might be arisen from specific karate trainings aiming development in balance ability of athletes. Therefore, it might normally be accepted that hearing impaired karate athletes had better test values compared to visually impaired goalball athletes. The branches as karate, judo can need features as balance and reaction and these features can be in position determining performance of athletes. In our study, there was no significant difference between sedentary individuals and individuals dealing with sports in terms of visual reaction time values. It might be said that visual reaction time values might not be differentiated between groups due to being non-elite athletes of individuals dealing with sports in our study.

Mickevičienė et al. [19] determined that simple and complex visual reaction time values after 6 minutes walking test of hearing-impaired athletes were significantly higher than values of hearing-impaired non-athletes. The investigation group of study included hearing impaired national basketball players and basketball was a sport branch needing visual reaction ability in play. In this context, it might be said that hearing impaired athletes might develop their simple and complex reaction time values by specific trainings compared to hearing impaired non-athletes. The findings of our study didn't show any differences between sedentary individuals and individuals dealing with sports in terms of visual reaction time values and it might

be said that this difference between findings of two studies might be arisen from characteristics of investigation groups of studies.

Nacaroglu and Karakoç [20] found that balance parameters of hearing-impaired volleyball players showed improvement after 8-week plyometric training period. It might be expressed that balance parameters of hearing-impaired volleyball players might be improved by extra power trainings. Similarly, Chang et al. [21] determined that 8-week table tennis training period developed static balance parameters of hearing-impaired children aged 12-year-old. It was said that the insufficiency in balance and motor ability of hearing-impaired children affected negatively their daily life and sports activities [21]. The most studies emphasized importance of balance ability in sports activities. The balance ability was an important component in most sports branches, and it should be developed with suitable trainings. Also, the balance and reaction abilities were two components of coordination feature. In this context, reaction time parameter might be developed specific trainings and studies including various training period might be designed for determination effects of different training methods on reaction time parameter.

In study of Ibrahim et al. [22], it was determined that agility test values of hearing-impaired netball players were worse than agility test values of normal hearing netball players. The agility ability is quick direction change ability and have an important role in most sports branches. The hearing impairment might cause to impairment in agility ability. Also, the lack of verbal encouragement during agility tests for hearing impaired netball players might cause to decrease in agility performance of players. On the other hand, Żebrowska et al. [23] determined that hearing and visually impaired adolescents had lower maximum oxygen uptake values compared to non-disabled adolescents. The maximum oxygen uptake indicating endurance capacity of subjects may be differentiated according to sports branches, genetic features and physical condition level of athletes. Therefore, it might be expressed that the maximum oxygen uptake values of disabled subjects in study of Żebrowska et al. [23] might be affected from these factors having influence on their performance.

As conclusion, the visual reaction time values of hearing-impaired individuals in our study were faster than values of normal hearing individuals and more using of visual signs by hearing impaired individuals to eliminate the hearing loss might cause to these differences in visual reaction ability. It was found that the visual reaction time values of male adolescents were faster than visual reaction time values of female adolescents and it might be said that this result arose from gender features of male subjects. According to situation of dealing with sports, the visual reaction time values of hearing-impaired subjects was not differentiated in our study. It is recommended that more studies related visual reaction time values in terms of situation of dealing with sports of subjects will be performed. Also, the studies about effects of different training periods on visual reaction ability of hearing-impaired subjects may contribute to scientific literature.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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