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Investigation of Visual and Auditory Reaction Times of Female and Male Students at Different Educational Grades

Farklı Kademelerde Eğitim Gören Kız ve Erkek Öğrencilerin Görsel ve İşitsel Reaksiyon Sürelerinin İncelenmesi

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INVESTIGATION OF VISUAL AND AUDITORY REACTION TIMES OF FEMALE AND MALE STUDENTS AT DIFFERENT EDUCATIONAL GRADES

ABSTRACT

The aim of the study is to examine whether there is a difference in the visual and auditory reaction times of individuals between the ages of 7-15. A total of 162 students voluntarily participated in this study, including 82 female and 80 male students who were educated at different levels in Gaziantep and Kahramanmaraş provinces and who were not trained in any sports. The participants were familiarized with the visual and auditory reaction test, and 10 consecutive measurements were taken after they felt ready. The arithmetic averages of the last five of these measurements were taken and recorded in milliseconds. Measurements were made using special software programs (www.humanbenchmark.com, www.cognitivefun.net). As a result of the data obtained, significant difference was not found between the groups of female and male students of the same age ($p>0.05$). However, significant difference was found in reaction times as age progressed in males and females ($p<0.05$). In this study, in which we compared the visual and auditory reaction times of female and male students, it would be possible to say that age directly affects the reaction time in both female and male groups. As a result, although there is no difference in reaction times when female and male subjects are in the same age group, it can be said that there is a significant decrease in reaction times as a result of development and maturation in muscles and perception with increasing age.

Keywords: Visual Reaction, Auditory Reaction, Reaction, Age.

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FARKLI KADEMELERDE EĞİTİM GÖREN KIZ VE ERKEK ÖĞRENCİLERİN GÖRSEL VE İŞİTSEL REAKSİYON SÜRELERİNİN İNCELENMESİ

ÖZ

Araştırmanın amacı 7-15 yaş arası bireylerin görsel ve işitsel tepki sürelerinde anlamlı bir farklılık olup olmadığını incelemektir. Bu çalışmaya, Gaziantep ve Kahramanmaraş illerinde farklı kademelerde eğitim gören ve herhangi bir spor dalında eğitim almamış 82 kız, 80 erkek olmak üzere toplam 162 öğrenci gönüllü olarak katılmıştır. Katılımcılara görsel ve işitsel reaksiyon testi hakkında bilgi verildi ve kendilerini hazır hissettikten sonra ardı ardına 10 ölçüm yapıldı. Bu

ölçümlerin son beşinin aritmetik ortalamaları milisaniye cinsinden alınarak kaydedildi. Ölçümler özel yazılım programları (www.humanbenchmark.com, www.cognitivefun.net) kullanılarak yapıldı. Elde edilen veriler sonucunda aynı yaştaki kız ve erkek grupları arasında anlamlı bir fark bulunamadı (p>0,05). Ancak kız ve erkeklerde yaş ilerledikçe tepki sürelerinde anlamlı farklılık olduğu belirlendi (p>0,05). Kadın ve erkeklerin görsel ve işitsel reaksiyon sürelerini karşılaştırdığımız bu çalışmada, hem kadın hem de erkek gruplarında yaşın reaksiyon süresini doğrudan etkilediğini söylemek mümkün olacaktır. Sonuç olarak kadın ve erkeklerin aynı yaş grubunda olması durumunda tepki sürelerinde farklılık olmamasına rağmen yaş ilerledikçe kaslarda ve algılamada gelişme ve olgunlaşma sonucunda tepki sürelerinde ciddi bir gelişim olduğu söylenebilir.

Anahtar Kelimeler: Görsel Reaksiyon, İşitsel Reaksiyon, Reaksiyon, Yaş.

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INTRODUCTION

It is a fact that in the current century, countries attach special importance to sports and conduct more scientific studies for success in order to gain superiority over other countries in international platforms. The way to be successful in sports is possible with training programs prepared with long-term and scientific methods. Recently, rapidly developing technology and scientific studies help athletes to maximize their physical and psychological performance. Scientific studies carried out in order to maximize the performance of athletes have revealed that reaction time is as important as some other parameters (Avcı, 2021).

Reaction time can be defined as the neuromuscular coordination level at which our body resolves the auditory and visual stimuli that reach the brain as sensory stimuli after going through some chemical, physical and mechanical processes (Jose & Gideon, 2010). Reaction time determines the time it takes for people to react or act first to a stimulus (Bayar & Koruç 1992). In a study on reaction time, it was found that the response to the audible stimulus was 140-160 milliseconds on average, and the response to the visual stimulus was 180 to 200 milliseconds (Thompson, 1992). Several factors can affect the reaction time, including age, gender, education level, type of stimulus, habit, alertness, fatigue, alcohol, nicotine, altitude and training level (Cerrah, 2010). It has been found in studies that the auditory reaction time (ART) of young adults is faster than the visual reaction time (VRT), the auditory and visual reaction times of male young adults are faster than female young adults, and the auditory and VRTs of young adults who exercise regularly are faster than young adults who do not exercise (Wadoo, 2019). Although there are many factors affecting the reaction time, it has been demonstrated by many scientific studies that the reaction time is faster in individuals who do sports

than those who do not. Reaction time, which is one of the most important parameters required for superior performance in team sports and individual sports, is a feature that can be improved with training. Many studies conducted in the same age group have shown that individuals who do sports are faster than those who do not. It is known that the reaction time differs in different sports branches and athletes have a better reaction time than non-athletes (Hascelik, 1989; Moka, 1992). In a study examining the visual and auditory reaction times of university students who play team sports (Basketball, Football, Volleyball, Handball, Cricket) and university students who do not do sports, it was observed that the visual and auditory reaction times of students who are athletes are faster than students who are not athletes (Hamidur & Muhammad, 2021). It has been determined that reaction time, which is an important parameter in determining performance in many sports branches, can be improved with training as a result of studies (Cerrah et al. 2010). In a study conducted on pre-school students, it was determined that in addition to simple VRTs and simple auditory reaction times, hand-eye coordination of females and males in the 6/7 age group who received movement training was more developed (Kayapınar, 2002). In a study examining the effects of swimming training on the physical and motor characteristics of 7-12 age group female and male swimmers, a statistically difference was found in the visual and auditory reaction times of the athletes in the training program in the measurements made before and after the training program (Odabaş, 2003). In a study conducted on students in the 12-18 age group, it was determined that there was a statistically difference in favor of those who did sports in terms of attention level and visual/auditory reaction rates when the status of students doing sports was evaluated ($P<0.05$). When the visual and auditory reaction rates of the males were compared with the females, it was determined that there was a significant difference in favor of males ($P<0.05$). In addition, a significant difference was found between the students' attention level and their visual and auditory reaction rates ($P<0.05$) (Aydın, 2017).

In the light of this information, our study is important because no study has been conducted to determine whether there is a difference in the visual and auditory reaction times of females and males between the ages of 7-15 who have not received training in any sports branch.

METHOD

Research Model

Experimental-comparative design was used in the study. Age, auditory and visual reaction time measurements were performed on the groups.

Research Group

The study group of the research consists of a total of 162 students (Table 1) who did not receive training in any sports branch, studying in 4 different schools in the primary and secondary schools affiliated to the Ministry of National Education in Gaziantep and Kahramanmaraş provinces of Turkey. 20 of these students are in the 1st grade of primary school, 22 of them are in the 2nd grade of primary school, 20 of them are in the 3rd grade of primary school, 20 of them are in the 4th grade of primary school, 20 of them are in the 5th grade of secondary school, 20 of them are in the 6th grade of secondary school, 20 of them are in the 7th grade of secondary school and 20 of them are in the 8th grade of secondary school. Since all the participants included in the study were under the age of 18, the study started after the parents filled out the informed consent form.

Table 1. Descriptive features of the participants

	n		Min.	Max.	Mean	Std.
	82	**Age**	7.00	15.00	10.52	2.45
Female		**Visual RT**	266.00	807.00	454.84	138.16
		Auditory RT	278.00	912.00	481.85	138.19
	80	**Age**	7.00	15.00	10.66	2.44
Male		**Visual RT**	262.00	923.00	423.30	108.66
		Auditory RT	299.00	1086.00	473.26	154.66

Data Collection Tool

In the laboratory, where stimuli from the environment are minimized and suitable environment and environmental conditions are provided; Two points, auditory reaction test and visual reaction test were created. Students were taken inside one by one, and they were allowed to take the auditory reaction test first and then the visual reaction test. Participants were accustomed to the test and after they felt ready, 10 consecutive measurements were taken. The arithmetic averages of the last five of these measurements were taken and recorded in milliseconds. Measurements were taken using special software (www.humanbenchmark.com, www.cognitivefun.net) (Pancar et al., 2016).

Data Collection Process

The measurements were made outside of the course hours so that the students included in the study would not experience any disruption during the course hours.

Research Ethics

This research started with the permission of Kahramanmaraş Sütçü İmam University Medical Research Ethics Committee, session number 2022/34, decision number 05.

Analysis of Data

SPSS 22.0 was used for statistical analysis of obtained data which were presented as mean and standard deviation. After Shapiro-Wilk test, ANOVA and LSD post-hoc tests were performed for multiple groups, independent samples t test was used for paired groups at 0.05.

FINDINGS

The obtained data are presented in this section. The data are explained with minimum value, maximum value, mean, and standard deviation.

Table 2. Comparison of the participants' visual and auditory reaction times between genders

	Gender	Mean	sd	t	p
Visual RT (ms)	Female	454.84	138.16	1.617	0.108
	Male	423.30	108.66		
Auditory RT(ms)	Female	481.85	138.19	0.373	0.710
	Male	473.26	154.66		

Table 2 shows comparision of the visual and auditory reaction time between genders. According to table 2, there is no significant difference between visual and auditory reaction times of males and females ($p>0.05$).

Table 3. Comparison of participants' visual and auditory reaction times between educational grades

	Grade	n	Mean	sd	F	p	Significant Difference
Visual RT (ms)	**1st**	21	569.29	162.56	23.60	**<0.001**	5-1, 5-2, 5-3, 5-4 6-1, 6-2, 6-3, 6-4 7-1, 7-2, 7-3, 7-4 8-1, 8-2, 8-3, 8-4
	2nd	21	530.10	103.03			
	3rd	20	453.45	122.57			
	4th	20	534.45	45.02			
	5th	20	360.05	48.76			
	6th	20	348.30	45.10			
	7th	20	366.50	33.62			
	8th	20	340.95	48.92			
Auditory RT (ms)	**1st**	21	602.14	130.80	19.46	**<0.001**	5-1, 5-2, 5-3, 5-4 6-1, 6-2, 6-3, 6-4 7-1, 7-2, 7-3, 7-4 8-1, 8-2, 8-3, 8-4
	2nd	21	533.52	99.04			
	3rd	20	545.35	167.10			
	4th	20	606.95	142.38			
	5th	20	381.40	45.20			
	6th	20	402.25	74.02			
	7th	20	400.05	101.96			
	8th	20	340.20	36.22			

Table 3 shows the comparison of the visual and auditory reaction times of the participants between grades. As a result of the analysis, a significant difference was found in the average of both visual and auditory reaction times between grades ($p<0.05$). There was a significant difference in visual and auditory reaction times between the 5th, 6th, 7th and 8th grades and the other grades in favor of the 5th, 6th, 7th and 8th grades. There was a significant improvement in average reaction times as grade levels increased.

Table 4. Comparison of visual and auditory reaction times by gender between educational grades

		Grade	Mean	sd	F	P	Significant Difference
Female	**Visual Reaction Time (ms)**	**1st**	618.82	151.29	15.660	**<0.001**	5-1, 5-2, 5-3, 5-4 6-1, 6-2, 6-3, 6-4 7-1, 7-2, 7-3, 7-4 8-1, 8-2, 8-3, 8-4
		2nd	534.00	121.82			
		3rd	519.30	120.06			
		4th	541.90	50.84			
		5th	344.80	59.83			
		6th	348.90	49.99			
		7th	362.50	35.02			
		8th	344.20	54.85			
	Auditory Reaction Time (ms)	**1st**	576.27	99.90	11.268	**<0.001**	5-1, 5-2, 5-3, 5-4 6-1, 6-2, 6-3 7-1, 7-2, 7-3 8-1, 8-2, 8-3, 8-4
		2nd	548.45	134.15			
		3rd	622.90	180.83			
		4th	537.80	54.05			
		5th	363.20	33.12			
		6th	436.00	83.48			
		7th	421.50	84.80			
		8th	332.60	35.12			
Male	**Visual Reaction Time (ms)**	**1st**	514.80	164.31	11.402	**<0.001**	5-1, 5-2, 5-4 6-1, 6-2, 6-4 7-1, 7-2, 7-4 8-1, 8-2, 8-4
		2nd	525.80	84.03			
		3rd	387.60	87.57			
		4th	527.00	39.64			
		5th	375.30	30.39			
		6th	347.70	42.34			
		7th	370.50	33.53			
		8th	337.70	44.93			
	Auditory Reaction Time (ms)	**1st**	630.60	158.79	14.007	**<0.001**	5-1, 5-2, 5-4 6-1, 6-2, 6-3, 6-4 7-1, 7-2, 7-3, 7-4 8-1, 8-2, 8-3, 8-4
		2nd	517.10	35.04			
		3rd	467.80	116.27			
		4th	676.10	171.03			
		5th	399.60	49.80			
		6th	368.50	45.45			
		7th	378.60	117.18			
		8th	347.80	37.51			

Significant differences were found in the mean of both visual and auditory reaction times between grades of female students ($p<0.05$). It was determined that as the educational grade of female students increased, their reaction times significantly decreased compared to other grades (1, 2, 3, and 4th). Significant differences were found in the mean reaction times of male students between grades ($p<0.05$). It was determined that as the educational grade level increased in VRTs, there were significant decreases in reaction times compared to other educational grades (1, 2, 3, and 4th).

DISCUSSION

Athletes, whether individual or team athletes, need to develop some parameters such as strength, speed, balance, endurance, agility, flexibility in order to improve their performance. One of the important parameters for performance is reaction time. Reaction time can be improved by 0.12s as a result of regular training. This change can be achieved not by the improvement in the speed of the stimulus going to the brain and coming from the brain to the organs, but by preserving the current reaction speed, making the movement more economical with the developed technical skill level (Sevim, 2002). In addition to regular exercise and training in a sport for the development of reaction time, mental studies will contribute to the development of visual and auditory reaction time (Çolakoğlu, et al. 1993). It is essential to develop reaction time in order to be successful in many team sports such as football, basketball, volleyball and handball, and in many individual sports such as athletics, taekwondo, karate, tennis, badminton. In order to achieve this development, it can be said that there are exercises to be done between the ages of 9-15, when fine and gross motor skills begin to develop.

It has been determined that the visual and auditory reaction of individuals who exercise regularly from the age of 12-14 approach the values of adults (Şahin, 1995). Studies comparing the genders and reaction times of the athletes show that men have a faster reaction time than women in almost all age groups (Adam, et al. 1999). This difference in reaction times between male and female athletes disappears between men and women who exercise regularly, and female athletes reach the level of male athletes in almost all branches (Jin, et al. 2015). In our study, no significant difference was found in the visual and auditory reaction times of male and female subjects when the same age groups were evaluated.

It has been observed that there is no difference in visual and auditory reaction times when females and males do not receive any sports training, especially during childhood, and when the studies in this field are examined, it has been determined that the factor that reveals the difference is sports training. In the study conducted by Aslan et al., the visual and auditory reaction times of females aged 8-11 who

did not receive sports training were compared. In this study, it was revealed that visual and auditory reaction abilities are affected even by small age differences. In addition, it has been stated that if intergroup comparisons are to be made in studies on reaction time with children, paying attention to the absence of age differences between the groups to be formed will be effective in increasing the reliability of the studies (Aslan, et al. 2016).

In a study examining the visual and auditory reaction times of professional football players according to the positions they play, there was a significant difference in favor of the goalkeepers between the visual and auditory reaction times of the goalkeepers and the players playing in other positions. It can be said that in addition to technical and tactical studies, activities to improve reaction time should be frequently included in the training of football players playing in all positions, especially goalkeepers (Göral, et al. 2012).

In a study conducted on subjects from different age groups, including men and women, it was stated that the visual and auditory reaction times of men, especially during childhood and late maturity, were always shorter than women, and that the best reaction times were measured in individuals between the ages of 21-30 (Bellis, 1933). In a study examining the visual and auditory reaction times of female handball players, no significant difference was found in the visual and auditory reaction times of middle playmaker, center and wing players in the same age group (Hasdemir, et al. 2003).

In this study, in which we compared the visual and auditory reaction times of female and male groups, it would be possible to say that age directly affects the reaction time in both female and male groups. In the analysis of females and males on the basis of age, it was determined that the visual and ART decreased as the age progressed. Although many previous studies have revealed that males have a faster reaction time than females in all age groups, in our study, it was determined that there was no significant difference in visual and auditory reaction times of females and males in the same age group, especially from individuals between the ages of 7-15 who did not receive any sports training. It is thought that the biggest factor in the emergence of this situation is the development and maturation of fine and gross motor skills in the transition from childhood to youth, as well as the level of perception that develops in individuals. In particular, the time to perceive and take action against visual and auditory stimuli develops as they pass from childhood to youth, and the reaction time accelerates accordingly. In this transition period, we think that especially females and males who receive sports training will improve their reaction time and make a positive contribution to their sportive performance.

CONCLUSION AND RECOMMENDATIONS

The following is recommended for the results of the study and the studies that can be conducted by different researchers;

1. This study can be applied to students living in different provinces and regions.

2. This study was carried out with male and female students who did not start sports training, and it can be applied to females and males in the same age group who receive sports training in the same sports branch.

3. This study can be applied to males and females in the same age group who have and have not received sports training.

4. This study can be applied to females and males in the same age group who are trained in different sports branches.

5. This study revealed that age is an important factor in the development of auditory and visual reaction, especially for girls and boys of primary school age. Researchers can make similar applications among young people, adults and the elderly to see whether the age factor is a factor that can affect the visual and auditory reaction.

6. There was a significant difference in visual and auditory reaction times between the 5th, 6th, 7th and 8th grades and the other grades in favor of the 5th, 6th, 7th and 8th grades. Researchers should take this difference into consideration in studies conducted on males and females in this age group.

Conflict of Interest Declaration

There is no personal or financial conflict of interest within the scope of the study.

Statement of Contribution of Researchers

Design of Study: ÖFY (%100)

Data Acquisition: AK (%50), MBC (%50)

Data Analysis: NA (%100)

Writing Up: ÖFY (%50), NA (%50)

Submission and Revision: ÖFY (%50), NA (%50)

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