


Investigation of reaction time and hand-eye coordination in early adolescent female basketball and wrestlers

 Kurtuluş Aslan¹

To cite this article: Aslan, K. (2023). Investigation of reaction time and hand-eye coordination in early adolescent female basketball and wrestlers. *Journal of Theory and Practice in Sport*, 2(2), 1-10.

Received: 16.11.2023

Accepted: 21.12.2023

Published: 30.12.2023

¹ Afyonkarahisar Gençlik ve Spor İl Müdürlüğü, Afyonkarahisar, Türkiye, kurtulusaslan2@gmail.com

Investigation of Reaction Time and Hand-Eye Coordination in Early Adolescent Female Basketball and Wrestlers

Abstract

This study was conducted to investigate hand-eye coordination and reaction time (visual and auditory) in early adolescence (10-14 years old) female basketball and wrestling players. A total of 18 athletes (9 females from each branch, 9 females from each branch without any health problem or sportive injury) participated in the study in basketball and wrestling branches between the ages of 10-14 years in early adolescence. In the study, The Minnesota Dexterity Test was used for hand-eye coordination performance measurement and Newtest 1000 Instrument was used for visual and auditory reaction time measurements. As a result of statistical analysis, a significant difference was found between the visual reaction times of basketball and wrestling athletes. No significant difference was found between hand-eye coordination and auditory reaction. Hand-eye coordination, visual reaction time and auditory reaction time values of basketball athletes were better than wrestling athletes. In conclusion; physiological and psychological changes in the body are experienced very rapidly during adolescence. In order to be successful in sports, it is important to plan training according to the characteristics of this period and sports branch.

Keywords: Reaction Time, Hand Eye Coordination, Early Adolescence

Erken Ergenlik Dönemi Kadın Basketbol ve Güreşçilerde Reaksiyon Zamanı ve El-Göz Koordinasyonunun İncelenmesi

Özet

Bu çalışma erken ergenlik dönemi (10-14 yaş arası) kadın basketbol ve güreşçilerde el göz koordinasyonu ve reaksiyon zamanını (görsel ve işitsel) incelemek amacıyla yapılmıştır. Araştırmaya erken ergenlik döneminde 10-14 yaş arasındaki basketbol ve güreş branşlarında yer alan ve herhangi bir sağlık sorunu veya sportif yaralanması olmayan her branştan 9 kadın sporcu olmak üzere toplam 18 sporcu katılmıştır. Araştırmada el göz koordinasyonu performans ölçümü için The Minnesota Dexterity Test ölçüm aracı, görsel ve işitsel reaksiyon zamanı ölçümlerinde ise Newtest 1000 Aleti kullanılmıştır. İstatistiksel analiz sonucunda; basketbol ve güreş branşı yapan sporcuların Görsel Reaksiyon süreleri arasında anlamlı farklılık tespit edilmiştir. El-göz koordinasyonu ve işitsel reaksiyon arasında anlamlı farklılık tespit edilmemiştir. Basketbol branşında yer alan sporcuların el göz koordinasyonu görsel reaksiyon zamanı ve işitsel reaksiyon zamanı değerleri güreş yapanlara göre daha iyi çıkmıştır. Sonuç olarak; ergenlik döneminde vücutta fizyolojik ve psikolojik değişimler çok hızlı yaşanmaktadır. Sporda başarılı olmak için bu dönemin ve spor branşının özelliklerine göre antrenman planlaması yapılması önemlidir.

Anahtar Kelimeler: Reaksiyon Zamanı, El Göz Koordinasyonu, Erken Ergenlik Dönemi

Introduction

Adolescence is a period in which the body's structure develops biologically and physically, power generation capacity develops, sexual and psychosocial development and the person gains independence and gains productivity by opening wider horizons than the family in the social relationship dimension. Adolescence covers the period between the ages of 10-19 and is divided into three different periods: early, middle and late adolescence. The period between the ages of 10-14 is early adolescence. In this period, individuals try to adapt to the biological changes that occur rapidly with puberty (Civelek, 2019; Şahan, 2009).

Adolescence is a very important period of life as dramatic physiological, psychological and cognitive changes occur. Cognitive changes as well as perceptual development can affect motor coordination abilities (Nayak, 2015). In order to achieve successful performance in sports, perceptual, cognitive and visual skills are needed in addition to physical and motor skills (Schwab & Memmert 2012; Mankowska et al., 2015). Hand-eye coordination is a perceptual-motor skill process that involves the harmonious processing of visual and tactile inputs in the central nervous system in order to perform a purposeful motor movement. Hand-eye coordination is the ability to perform a physical task with one's eyes and hands simultaneously (Haningsih, 2023; Nayak, 2015). Good hand-eye coordination enhances the player's ability in ongoing movement fluency in the case of successfully responding to external stimuli while performing complex movements (Paul et al., 2011).

Reaction time, like hand-eye coordination, is a measure of the speed at which the organism voluntarily responds to an incoming stimulus. It is the time period between when the stimulus is first received and the emergence of one's own voluntary response (Jain et al., 2015). Visual reaction is the process associated with movement control and regulation processes, influenced by the muscular effects of the central nervous system. There are also studies indicating that vision is important in sports practices and visual training should be an important part of athletes' exercise training (Theofilou et al., 2022). Studies have shown that early adolescents who regularly participate in sports have significantly lower reaction time values and that chronic physical activity has many positive effects such as increasing concentration and alertness, providing better muscle coordination, improving speed and task accuracy performance, reducing psychological tension and developing better mind contact (Klasnja et al., 2022). While coordination exercises are included in the planning, they should support cognitive development and be at an appropriate level according to the characteristics of the period in which the individual is in (Yılmaz, 2019).

Method

Research Model

The research was designed according to the descriptive model. Descriptive research is the process of collecting quantitative or qualitative numerical values of an existing variable or group and presenting the results of the analyzes (Büyüköztürk et al., 2018).

Study Group

Eighteen athletes, including 9 female athletes from each branch, who were between the ages of 10 and 14 in basketball and wrestling branches in early adolescence, who had been practicing the relevant branch for at least 2 years and who did not have any health problems or sportive injuries, participated in the study.

Measurement Collection Instruments

Hand-eye Coordination: Hand-eye coordination was measured with The Minnesota Dexterity Test. The test measures skills that require quickness in using simple tools, especially gross motor skills. The test was applied to the athletes as a rotation test. The test was explained to the athletes, the test devices were introduced and the athletes were allowed to make trials. Athletes' performances were recorded in seconds with a stopwatch. After the athletes performed the test 3 times, the best time was recorded (Lafayette Instrument, 1998).

Reaction Time Measurement: Reaction time was measured with the Newtest 1000 Instrument. The device measures with a precision of 0.001 of a second. Reaction times were measured in 2 different ways, first visual reaction and auditory reaction times, respectively, using the dominant fingers of the participants. For visual reaction, a red light is illuminated on the control panel. For auditory reaction time, a constant beep sound is emitted from the control panel. When the stimulus arrives, the subject presses the button to turn off the light or sound stimulus. Ten measurements are taken by making sure that the measurement area is quiet and has normal light. The 2 lowest and 2 highest values are not included in the calculation. The reaction time of the person is calculated by calculating the average of the remaining scores (Tamer, 2000).

Data Analysis

The data were saved in the SPSS (version 26.0) program for statistical calculations, and it was seen that the variables had a normal distribution since their kurtosis and skewness values were between +1.5 and -1.5 (Tabachnick & Fidell, 2013). Independent Sample t-Test was used to determine the differences between the branches. The significance level was accepted as $p < 0.05$.

Results

Table 1: Data means, standard deviation and independent samples t-test results

	Sport	X \pm s.d.	t	p
Hand-Eye Coordination	Wrestle	01.15 \pm 00.10	-1,13	.27
	Basketboll	01.10 \pm 00.10		
Visual Reaction Time	Wrestle	484,74 \pm 88,72	-3,35	.00*
	Basketball	379,03 \pm 32,35		
Auditory Reaction Time	Wrestle	487,92 \pm 147,07	-,59	.56
	Basketboll	446,70 \pm 147,94		

When Table 1 was examined, it was found that there was a significant difference ($t(16) = -3,35$; $p < 0,05$) between the Visual Reaction times of the athletes engaged in basketball and wrestling branches, while no significant difference was found between hand-eye coordination ($t(16) = -1,13$; $p > 0,05$) and auditory reaction ($t(16) = -,59$; $p > 0,05$).

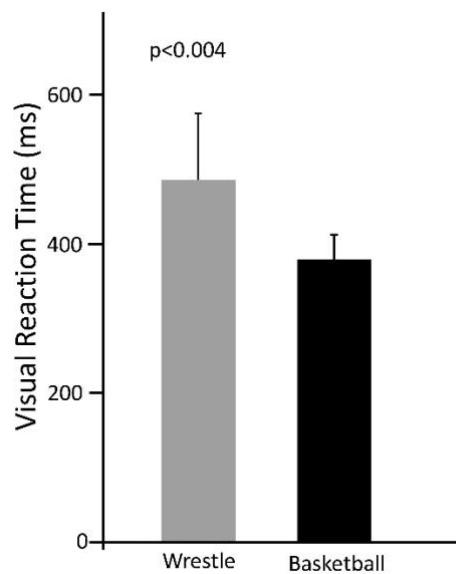


Figure 1. Visual reaction time of wrestlers and basketball players

Looking at the averages in Figure 1, the mean value of visual reaction time of basketball players (379.03 \pm 32.35) is better than the mean value of wrestlers (484.74 \pm 88.72).

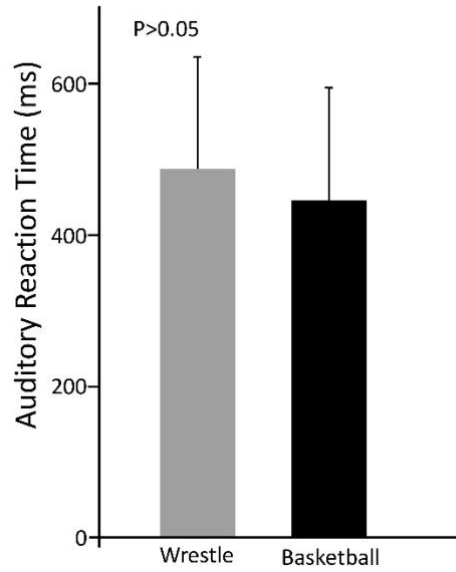


Figure 2. Auditory reaction time of wrestlers and basketball players

Looking at the averages in Figure 2, the mean value of auditory reaction time of basketball players (446.70 ± 147.94) is better than the mean value of wrestlers (487.92 ± 147.07).

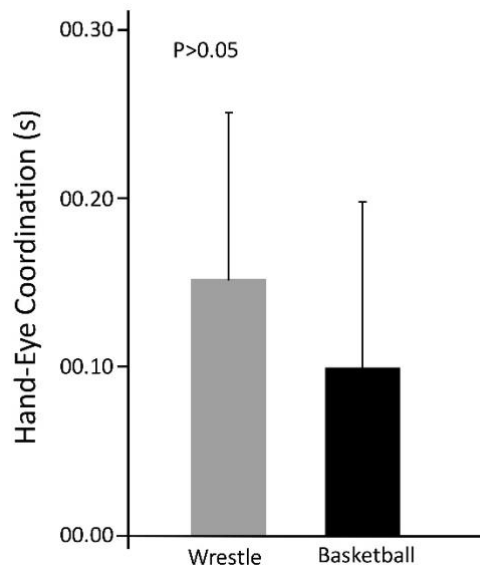


Figure 3. Hand-eye coordination of wrestlers and basketball players

Looking at the averages in Figure 3, the mean value of Hand-eye coordination of basketball players (0.10 ± 0.10) is better than the mean value of wrestlers (0.15 ± 0.10).

Discussion and Conclusion

This study was conducted to investigate reaction time (visual and auditory) and hand-eye coordination in early adolescence (10-14 years) female basketball and wrestling players.

Adolescence is the transition stage of physical and mental development between childhood and adulthood. During adolescence, physical development accelerates due to perceptual-cognitive changes and developments in the body. Cognitive features such as hand-eye coordination also develop and as the age of the person increases, hand-eye coordination also increases (Nayak, 2015; Szabo et al., 2021). When the studies were examined, it was found that male adolescent children had better hand-eye coordination than female adolescent children (Ojeda et al., 2022; Szabo et al., 2020). In contrast to these studies, Brito et al. (2011) found that female athletes had better hand-eye coordination than male athletes (Szabo et al., 2021). Our study, on the other hand, was limited only to girls and hand-eye coordination values with different averages were determined according to the branch. When Figure 3 was examined, it was determined that the hand-eye coordination values of basketball players (01.10 ± 00.10) were better than those of wrestling athletes (01.15 ± 00.10). Aslan et al. (2021) found that hand-eye coordination performances were better in the evening hours in a study conducted in badminton and tennis players aged 8-12 years. When the studies are examined, hand-eye coordination varies according to time of day, age ranges, branch and gender (Canto et al., 2015; Garmanjani et al., 2023).

When the studies on reaction time were examined, it was found that male athletes had better reaction time than females (Ojeda et al., 2022). As in hand-eye coordination, in some studies, on the contrary, female athletes have better reaction time than males (Vences et al., 2012). Studies have shown that reaction time improves with adolescence and reaches better levels with sports activity. It is also known that this situation differs according to the level of physical activity and the type of sport practiced. Reigal et al. (2019), in their study in children aged 10-12 years, found that children who participated in more physical activity had a positive effect on cognitive processes such as reaction time and attention capacity at a significant level compared to others. Günay et al. (2011) found that there was a similarity in the audiovisual reaction times of tennis and volleyball athletes aged 14-16 years. The reason for this similarity may be due to the need to respond quickly and quickly to fast stimuli in the basic game logic of the branches. Reaction time may differ even in the positions formed within the sports branches (Hasdemir et al., 2003). By using physical exercises, cognitive skills such as general and special coordination, visual and auditory reaction can be developed according to the periods in which children are in

(Yılmaz, 2019). When we examined the results of our study, as in hand-eye coordination, the visual reaction time (379.03 ± 32.35) and auditory reaction time (446.70 ± 147.94) values of basketball athletes were better than those of wrestling athletes. The reason for this may be due to the fact that the ball, which is a factor other than the opponent, is also present during the game due to the structural characteristics of basketball. Because when we look at the characteristics of the branch, it is a sports branch in which teammates and rival players are involved in a certain narrow area and in contact with rival players to ensure that the ball passes through the target (hoop). In this way, playing fast, continuously and in a narrow area requires motor skills such as reaction time and hand-eye coordination.

As a result, in order to be successful in sports during the rapid changes in our body during adolescence, it is important to plan training according to the characteristics of the athletes, taking into account the characteristics of this period.

Author Contribution

Aslan, K (Conceptual framework, Data Collection, Data Analysis, Writing)

Ethical Statement

Board Name: Afyon Kocatepe University Health Sciences Scientific Research and Publication Ethics Committee

Toplantı Sayısı/Karar: 11/2023-23

References

- Aslan, K., Gelen N. K., Saygın, Ö., & Aslan, H. G. (2021). Gün zamanının raket sporcularında algısal-bilişsel özellikler üzerine etkisi, *Atatürk Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi*, 23(2), 229-244. <https://dergipark.org.tr/en/pub/ataunibesyo/issue/63280/947802>
- Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2018). *Eğitimde bilimsel araştırma yöntemleri*. (25. Baskı) S:24, Pegem Akademi.
- Civelek, E. (2019). Adolesan dönemi ve özkıyım girişimi. *Türkiye Çocuk Hastalıkları Dergisi*, 1. <https://doi.org/10.12956/tchd.542211>
- García Canto, E., Pérez Soto, J. J., Rodríguez García, P. L., Guillamón, A. R., López Miñarro, P. Á., & López Villalba, F. J. (2015). The relationship between segmental coordination, agility and physical activity in adolescents. *Motriz: Revista de Educação Física*, 21, 200-206. <https://doi.org/10.1590/S1980-65742015000200011>
- Garmanjani, U., Rostami, R., & Nazemzadegan, G. (2023). Comparison of hand-eye coordination in high school and conservatory students. *International Journal of Motor Control and Learning*, 5(1), 10-15. <https://doi.org/10.52547/ijmcl.5.1.10>
- Haningsih, W. O., Ihsan, N., Gusril, R. B., & Zarya, F. (2023). Object control abilities of kindergarten students: impact of eye-hand coordination, nutritional status, gender. *International journal of Multidisciplinary Research and Analysis*, 2318-2324. <https://doi.org/10.47191/ijmra/v6-i6-22>

- Hasdemir, S., Gündüz, N., & Müniroğlu, S. (2003). Bayan hentbolcuların görsel ve işitsel reaksiyon zaman farklılıklarının incelenmesi. *Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi*, 1(1), 49-52. https://doi.org/10.1501/Sporm_0000000004
- Huerta Ojeda, Á., Lizama Tapia, P., Pulgar Álvarez, J., González-Cruz, C., Yeomans-Cabrera, M. M., & Contreras Vera, J. (2022). Relationship between attention capacity and hand–eye reaction time in adolescents between 15 and 18 years of age. *International Journal of Environmental Research and Public Health*, 19(17), 10888. <https://doi.org/10.3390/ijerph191710888>
- Jain, A., Bansal, R., Kumar, A., & Singh, K. D. (2015). A comparative study of visual and auditory reaction times on the basis of gender and physical activity levels of medical first year students. *International Journal of Applied and Basic Medical Research*, 5(2), 124. <https://doi.org/10.4103/2229-516X.157168>
- Klasnja, A., Milenovic, N., Lukac, S., Knezevic, A., Klasnja, J., & Karan Rakic, V. (2022). The Effects of Regular Physical Activity and Playing Video Games on Reaction Time in Adolescents. *International Journal of Environmental Research and Public Health*, 19(15), 9278. <https://doi.org/10.3390/ijerph19159278>
- Lafayette Instruments; Examiners Manual (1998). Minnesota manual dexterity testMODEL# 32023. https://www.rehabmart.com/pdfs/141_2_n.pdf (Erişim: 25.10.2023)
- Mankowska, M., Poliszczuk, T., Poliszczuk, D., & Johne, M. (2015). Visual perception and its effect on reaction time and time-movement anticipation in elite female basketball players. *Polish Journal of Sport and Tourism*, 22(1), 3-8. <https://doi.org/10.1515/pjst-2015-0008>
- Nayak, A. K. (2015). Effect of hand-eye coordination on motor coordinative ability of tribal adolescents. *International Journal of Physical Education, Sports and Health*, 2(2), 328-330.
- Paul, M., Biswas, S. K., & Sandhu, J. S. (2011). Role of sports vision and eye hand coordination training in performance of table tennis players. *Brazilian Journal of Biomotricity*, 5(2), 106-116. www.redalyc.org/pdf/930/93018957006.pdf
- Reigal, R. E., Barrero, S., Martín, I., Morales-Sánchez, V., Juárez-Ruiz de Mier, R., & Hernández-Mendo, A. (2019). Relationships between reaction time, selective attention, physical activity and physical fitness in children. *Frontiers in Psychology*, 10, 2278. <https://doi.org/10.3389/fpsyg.2019.02278>
- Schwab, S., & Memmert, D. (2012). The impact of a sports vision training program in youth field hockey players. *Journal of Sports Science and Medicine*, 11(4), 624-631. www.ncbi.nlm.nih.gov/pmc/articles/PMC3763307/
- Szabo, D. A., Neagu, N., Teodorescu, S., & Sopa, I. S. (2020). Eye-hand relationship of proprioceptive motor control and coordination in children 10–11 years old. *Health, Sports & Rehabilitation Medicine*, 21(3), 185-191. <https://doi.org/10.26659/10.26659/pm3.2020.21.3.185>
- Szabo, D., Ujică, A., & Ursu, O. (2021). Testing the eye-hand coordination and reaction speed in children aged between 10–14 years old. *Geosport Soc*, 15, 110-121. <https://doi.org/10.30892/gss.1505-077>
- Şahan, A. (2009). *Erkek çocuklarda puberte ve prepuberte dönemlerinde yapılan kuvvet antrenmanlarının koordinasyon gelişimi üzerine etkisinin incelenmesi*. (Unpublished master's thesis). Akdeniz Üniversitesi, Antalya, Türkiye.
- Tabachnick, B.G., & Fidell, L. S. (2013). *Fidell Using Multivariate Statistics (sixth ed.)* Pearson, Boston. p481-498.

- Tamer, K. (2000). *Sporda fiziksel ve fizyolojik performansın ölçülmesi ve değerlendirilmesi*. Bağırğan Yayımevi.
- Theofilou, G., Ladakis, I., Mavroidi, C., Kilintzis, V., Mirachtsis, T., Chouvarda, I., & Kouidi, E. (2022). The effects of a visual stimuli training program on reaction time, cognitive function, and fitness in young soccer players. *Sensors*, 22(17), 6680. <https://doi.org/10.3390/s22176680>
- Vences Brito, A., Silva, C., Cid, L., Ferreira, D., & Marques, A. (2012). Attention and reaction time in shotokan athletes. *Revista De Artes Marciales Asiáticas*, 6(1), 141–156. <https://doi.org/10.18002/rama.v6i1.88>
- Yılmaz, E. (2019). *Çocuklarda koordinasyon ve hareketlilik gelişimi*. Çocuklar İçin Spor Eğitimi, 147-166.