DIFFERENCES IN COORDINATION ABILITIES BETWEEN MALE AND FEMALE 10-11-YEAR-OLD ATHLETES

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ABSTRACT
Our research focuses on coordination abilities as a key factor in developing motor skills and techniques in sports. Often, researchers observe differences in development between men and women, which emerge with human growth. Basketball is known as a sport with high coordination demands for athletes. In our study, we will compare the coordination abilities of youth basketball players from both genders.
We tested 93 male and female basketball players, divided into two age groups: 10 and 11 years old. We assessed them in four key coordination skills – accuracy, balance, rhythm, and spatial orientation – and made comparisons.
According to the results, we found that female athletes perform better than male athletes at the studied age, but this changes with growth. We identified 10-11 years as a sensitive period for balance in female athletes and 12 years for male athletes; after 12 years, rhythmic abilities and spatial orientation improve in both genders.

Keywords: *coordination abilities, youth, male and female athletes, basketball*

INTRODUCTION

Coordination abilities are essential for practicing most sports and are especially important in team sports. These abilities, which include the physical and mental skills needed for effective body movement management and problem-solving, are vital for both physical and cognitive development (De Smul et al., 2018). According to us (Brestnichki, 2008), coordination abilities encompass accuracy, balance, rhythm, and spatial orientation—skills necessary not only in sports but also in everyday life. P. Hirtz (1986) states that all coordination abilities are interconnected, though some directly influence athlete training. The study by Opstoel et al. (2015) showed that, generally, young children do not display sport-specific traits unless they have high training volumes. Today, sports are practiced by both genders, but differences in development and performance are observed. Research indicates that significant differences between boys and girls usually do not appear until ages 9-10 (Rachev, 1998). However, many educational studies suggest that children between 8–9 and 11–12 years old have strong potential for developing their motivity and coordination, with a notable increase in sensitivity during this period (Momchilova, 1998). Based on this, we chose participants aged 10–11 years for our study.

Our study aims to identify any differences in the coordination abilities of boys and girls aged 10-11 who practice basketball. This age is a sensitive period for coordination development, and we will explore any developmental differences.

METHODOLOGY

For this purpose, we studied 93 children aged 10-11 years (Table 1), including 44 boys and 49 girls.

Table 1. *Participants in the study*

Gender \ Age	10 years	11 years
Male	24	20
Female	33	16

All participants were evaluated with four coordination tests – Table 2, after they were introduced to the procedures and their consent, along with their parents', was obtained.

The tests used were developed to assess the key components of coordination—rhythm, balance, accuracy, and spatial coordination. They help us determine the level of coordination abilities in the

studied athletes and compare them based on gender. These tests are validated and described by Al. Naumovski et al. (2004). They are considered reliable and consistent. The tests are divided into four categories, as shown in Table 2.

Test 1: Aiming at a target with a short bar using one hand. The examinee holds the aluminum bar with one hand, 1.20 m from the target at the marked spot, and, raising their arm, directs it toward the center of the target, which has a radius of 16 cm divided into 10 circles. The target height is set individually. The center of the target should be at the shoulder height of the person being tested. One cycle consists of 7 attempts. Each aim is performed every 3 seconds, and the test is repeated 7 times. After each set of 7 hits, there is about a 20-second rest. The result is obtained by averaging all 49 attempts, and if a puncture lands on the line between two results, the smaller value is used.

Test 2: Standing on one leg on the apparatus (balance device) with eyes open. The individual being tested is barefoot and stands on one leg (chosen leg), with the forefoot placed on the perpendicular board of the balance device, while the other leg remains on the floor. The arms are extended along the sides of the body, and the palms rest against the hips. The time is measured from when the person lifts the leg from the floor to when balance is lost. The result, in tenths of a second, is recorded. Six attempts are made, and the average is calculated.

Test 3: Moving both hands in a specific order without a set rhythm (rhythmic movement). The person being tested sits in a chair next to a table with adhesive tape across its middle. Their palms are placed on the table, one on each side of the tape line. The right hand is on the right side of the line, and the left hand on the left side, at shoulder width. When the "now" signal is given, the subject must perform as many cycles as possible in the following manner:

– Using the left palm, strike the left side of the table twice.
– With the right palm through the left hand, strike the left side of the table twice.
– With his right palm, he touches his forehead once.
– Use the right palm to strike the right side of the table once.

The second and later cycles proceed as described. The test is performed for 20 s. The cycles performed correctly are counted. The average results of the four attempts are recorded.

Test 4: Running in a figure-eight pattern with bending. The person being tested starts from a high position behind a line where one stand is placed. Another stand is positioned 4 meters away from it. An elastic band connects the stands, stretched to a horizontal position and raised to the height of the person's highest hips. At the signal "now," the person passes under the stand, runs around the second stand, then passes under the elastic band again and runs around the starting stand, completing one figure-eight. This is repeated four times, meaning one task ends after four figure-eights are completed. The task is repeated three times with a rest period between attempts. Time is measured in hundredths of a second from the signal "now" to when the task is finished. Timing stops after the person completes four figure-eights and passes the start-finish line at chest height. The average of the three attempts is recorded.

Table 2. *Test battery is used to determine the coordination abilities of the athletes*

#	Name of the test	Values	Polarity
1	Aiming at a target with a short bar using one hand (aiming at a target)	Points	+
2	Standing across the apparatus with one leg and open eyes. (standing on one leg)	Seconds	+
3	Moving with both hands without a specific rhythm but in a specific order (rhythmic move)	Points (cycles)	+
4	Running in a figure eight with bending of the body. (figure eight)	Seconds	-

All test results were analyzed with appropriate descriptive statistical methods. The main method for comparing the two groups was the Student's *t*-test, with a significance of at least $p < .005$. All data analyses were conducted using SPSS software.

RESULTS

Table 3 and Figure 1 present the results of our research on coordination abilities. In the figure, we can identify the differences between the average values of 10- to 11-year-old boys and girls basketball players. What we observe in the figure is that

male basketball players generally perform worse in most of the tested coordination abilities compared to female basketball players.

Ten-year-old boys perform worse than girls in all four tests of coordination skills. For 11-year-old basketball players, boys have an edge in two of the tests, while girls excel in the other two.

In the accuracy with one hand (Test #1), 10-year-old boys have a disadvantage of 2.15 points compared to girls. This result is guaranteed with the required probability ($p < .001$). In the same test, 11-year-old boys (Test #1) still perform worse than girls, with a difference of 0.19 points. The Student *t*-test does not confirm this difference in results. Regarding the percentage, we could not confirm that girls have better accuracy at this age.

Table 3. *Data from the coordination tests of male and female basketball players aged 10-11 years showed a significant difference.*

Tests	Age	Male			Female			*d*	*t*	*p*
		n	*Mean*	*SD*	*n*	*Mean*	*SD*			
Accuracy	10 y.	24	5.74	0.93	33	7.89	0.81	2.15	9.30	.001
	11 y.	20	8.02	0.69	16	8.21	0.66	0.19	0.84	.405
Balance	10 y.	24	0.56	0.09	33	0.94	0.32	0.37	5.56	.001
	11 y.	20	1.48	0.45	16	1.07	0.40	0.41	2.82	.008
Rhythm	10 y.	24	8.46	1.67	33	10.20	2.59	1.74	2.88	.006
	11 y.	20	9.88	2.77	16	10.53	2.38	0.65	0.74	.463
Coordination	10 y.	24	22.84	2.33	33	21.65	1.55	1.19	2.32	.240
	11 y.	20	19.57	2.33	16	20.96	1.92	1.39	1.92	.630

About the balance abilities (Test #2), ten-year-old male basketball players have a worse result than female basketball players, with 0.37 seconds. The Student *t*-test also guarantees this result with $p < .001$. According to the balance ability, 11-year-old boys' basketball players show results 0.41 seconds better than those of the girls. This difference in the results of the tested basketball players is confirmed with $p = .008$ by Student's *t*-test. That shows us that boys at 11 years old improve their balance abilities, which is crucial for good shooting.

The next test assesses the rhythmic abilities of 10-year-old boys and girls playing basketball, showing that boys have weaker rhythmic skills than girls. The difference of 1.74 cycles is not due to chance. This result is confirmed by a high confidence level of $p = .006$. This indicates that 10-year-old girls' basketball players have a higher level of rhythmic ability than the boys.

The rhythmic abilities of 11-year-old boys' basketball players are still worse than those of girls' basketball players, with 0,65 cycles. This difference is not statistically significant with the required confidence level ($p = .463$). Therefore, we cannot conclude that 11-year-old girls practicing basketball have better rhythmic abilities than boys.

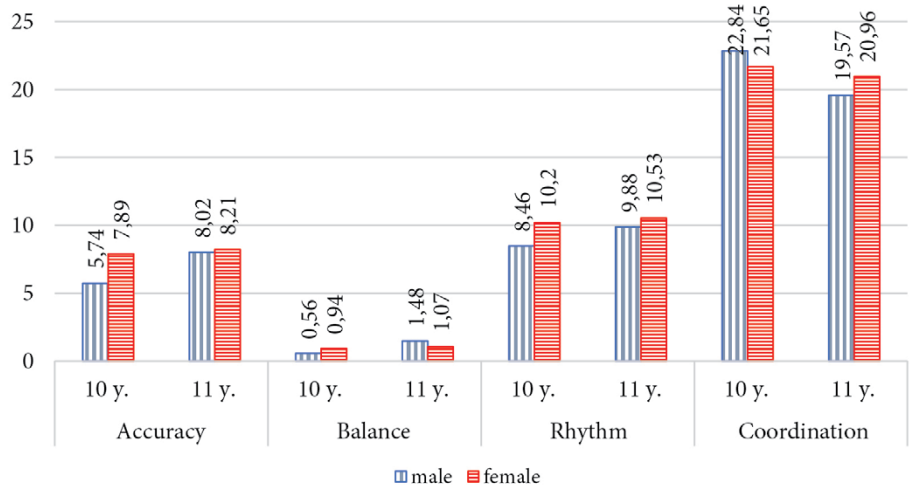

Figure 1. *Comparing the coordination abilities of 10 and 11-year-old boys and girls basketball players*

The final coordination test for 10-year-old boys and girls' basketball players focuses on spatial coordination during running (Test #4). It shows that girls outperform boys. The girls' results are 1.19 seconds faster than the boys'. The calculated significance *(p = .240) indicates that 10-year-old girls who play* basketball have better coordination during running. The spatial coordination during running among 11-year-old boys' basketball players surpasses that of the girls. They achieved a time of 1.39 seconds, which is better than that of girls' basketball players. However, this result is not guaranteed by the required significance (p = .630), which could improve due to the accident.

DISCUSSION

Coordination skills during physical activities are crucial for self-directed learning (De Smul et al., 2018). Motor skills and movement are directly linked to learning (Araujo et al., 2018). The girls typically reach maturity earlier than the boys, which is a factor for better learning and improved coordination abilities. Our results show that at age 10, the girls outperformed the boys in all four examined coordination skills.

Gochev (2002) indicates that success in developing and improving human motor activity is closely linked to enhancing movement coordination, including the ability to perform motor actions accurately in space, time, and muscular effort. We can confirm this with the boys' results, which improve at a later stage. At the age of 11, boys perform better than girls in two of the assessed coordination abilities and show improvement in the other two.

The study by Mardiansyah (2023) showed a less stable increase in motor performance between 7 and 9-year-olds but an average improvement in 10- to 12-year-olds. We can easily confirm the results of the tested athletes at both younger and older ages. In Figure 1, the differences between the examined ages are clear, and we can say that during this sensitive period, older athletes tend to perform better than younger ones. Almeida (2021) confirmed that the age range of 10 to 11 years is a critical period for developing coordination skills. Understanding when motor skills become stable or consistent throughout the developmental stages of both boys and girls is essential.

Brestnichki (2021) has identified that children's coordination skills develop at different rates between the ages of 8 and 16. The sensitive periods are 12-14 years for rhythm, 14-15 years for balance, 12-15 years for spatial coordination, 8-10 years for aiming accuracy, and again at 16 years. Knowing these time frames allows the methodist to optimize training results and athlete performance. Some of these sensitive periods are confirmed in our study.

Niet et al. (2022) showed that boys and girls develop similarly during school age (6 to 12 years old). However, a more detailed analysis of each variable reveals that girls excel in balance and sideways movement (Platvoet et al., 2018; Niet et al., 2022; Li et al., 2023), while boys outperform in the eye-hand coordination test (Faber et al., 2017; Platvoet et al., 2018). In our study, we confirm better balance and spatial orientation at age 10 for girls and at age 11 for boys. Additionally, girls perform better in rhythm and accuracy.

In another study (Brestnichki, 2017), we found that rhythmic abilities are best demonstrated in 12-year-old boys. We believe that this age is sensitive to the development of this coordination ability. In the current study, we found superiority of 10-11-year-old girls, and therefore, we can define this period as sensitive for improving rhythm in girls.

Balance is a coordination skill that affects basketball players' shooting and court movement, and the study conducted in 2017 (Brestnichki, 2017) found that it improves with age in adolescents, as shown by the results of the current study. It is impressive that 12-year-old boys demonstrate significant improvement in their balance skills.

A study by Brestnichki (2017) shows that spatial-temporal orientation is most evident in 10-year-old basketball players. The current study also confirms this: 10-year-old boys and girls have better orientation skills than 11-year-olds. Therefore, it should develop more in this age group, which will help children who experience significant growth during puberty and tend to lose this specific coordination ability.

CONCLUSION

In summary of our research, we found that 10-year-old girls' basketball players have better-developed coordination skills than boys' at the same age. However, by age 11, boys improve their coordination and reach levels similar to those of girls at that age.

This study concludes that the age range of 10-11 years is a critical period for balance in female athletes, while 12 years old is critical for male athletes; after age 12 in both genders, rhythmic abilities and spatial orientation improve.

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