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TESTING AGILITY WITH AND WITHOUT THE BALL IN FOOTBALL PLAYERS IN THE AGE OF 10-13

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Abstract
The study aimed to examine the agility of 10-13-year-old athletes through ball and non-ball tests conducted over two measurement sessions. The agility tests focused on evaluating the players' ability to change direction, accelerate, decelerate, and perform technical tasks under sport-specific conditions. The results revealed significant improvements in agility performance during the second measurement for both test types. Non-ball tests produced faster completion times, indicating that sport-specific technical skills, such as ball handling, influenced execution speed. Strong correlations between the first and second measurements demonstrated performance stability and the reliability of the testing method.
These findings highlight the effectiveness of agility training programs and underscore the importance of integrating technical and coordination skill development into training regimens. The study provides practical insights for coaches aiming to optimize athlete performance and underscores the value of a comprehensive approach to agility training that incorporates both physical and technical components. The results contribute to the advancement of youth sports training methodologies and the enhancement of competition readiness.

1 Introduction

In today's modern football, explosive starts, acceleration, changes of direction, and turns with or without the ball, are essential for a fast and efficient game. In addition to the amount and intensity of running, changes of direction and turns are also important in football. The dynamics and changing circumstances of the game require the player to be able to react quickly to events around him, so that he is able to change direction and make sudden turns. [1,2,3]. A player makes an average of 727±203 changes of direction and/or turns during a match [4]. This justifies the significant role of these technical abilities (quick changes of direction and turns while running and dribbling) in the preparation of players.

During a match, a player must find an optimal balance position from which he can accelerate suddenly, reach maximum speed, then decelerate, and make sudden stops, turns, and quick changes of direction. This complex coordination ability (trait) is called agility. [5]. In football, agility is one of the most important selection factors. [6]. In football, agility is one of the most important selection factors [6]. This ability is a combination of the player's balancing, spatial orientation, reaction, rhythmic and kinesthetic differentiation abilities, as well as his speed, explosive and reactive power. [4,5]. This ability is increasingly becoming the focus of research, as the sport is becoming more dynamic [7] and agility is a performance trait that is positively correlated with the intensity of the game [8,4]. Agility is the ability to quickly respond to stimuli that appear during a match (ball,

opponent, teammate movement, changes in the game situation, etc.). This ability is related to several factors. Decision-making and speed of running with changes of direction being among the most significant factors [9].

One of the focus points of the research is the examination of individual areas (e.g. anthropometry, running technique) and motoric skills from the perspective of agility. Speed, strength, dynamics, balance and flexibility also contribute to agility [10]. All of these are trainable traits, so improving one or all of them with various agility tasks will result improvement in performance [10]. However, research has found mixed results regarding the connection between agility and speed, or agility and dynamic leg strength. The results are also different for agility and training methods. If agility is defined as running with changes of direction, then there will be bigger connection between the abilities (speed, dynamic leg strength, etc.). However, when reactive agility is compared with other abilities (speed, strength, dynamic foot strength), a significant connection is very rare. In this case, the player has to react to a visual stimulus, so decision-making ability and cognitive factors play a greater role than dynamic foot strength or speed.

Agility is one of the most important factors in football performance [6], so it is not surprising that its study is popular among researchers. Agility is studied by many people, using a variety of methods. Matlák et al. [9] point out that this may be the reason for the different results obtained regarding the connection between the two abilities. The most commonly used tests include the Illinois agility test, the T-test, and the Zigzag test. In addition, modifications of these and other tests are also frequently used by researchers. [11,12,13,14]. The number of changes of direction, their angle, the length of the running test, and the time interval required to be different between the tests. In case where the change of direction is small and the length of the running test is similar to the length or duration of the agility test, then a correlation between speed and running with changes of direction occurs more often.

2 Method

2.1 Research objective

The goal of the research is to examine various aspects of agility among 10-13 year old athletes, with particular attention to tests with and without ball. Furthermore to explore the development of players' agility, the connections between measurement results and the role of sport-specific technical skills. Based on the results, recommendations are made to increase the effectiveness of agility training methods.

2.2 Research questions and hypotheses

The questions of the research are the followings. How much improvement do the players' agility results show between the two measurements? What differences are there between the results of the tests with and without the ball? What connections can be observed between the results of the first and second measurements, and how can these be interpreted in terms of the training process? The following hypothesis were formulated. Presumably, the players' training methods and with maturation, the players' agility results will improve after one year. We assume that the players' second measurement results of agility are significantly better than the first measurement, both in the case of tests with and without the ball.

2.3 Method

The agility test was conducted with two tests, T-test with and without ball. The survey was conducted 2 times, one year apart. The test was conducted on an artificial turf field. Each measurement was performed twice by the players, as recommended by the literature. The average time of the measurements was taken into account during the tests.

The design of the track required for the exercises was planned in advance based on the recommendations in the literature, and the necessary equipment was prepared. The test was carried out in two ways, without a ball and with a ball. The measurement area was a 20x20 meter track section, which was marked (see Figure 1) with 3 cones based on the test track of Semenick (1990). [15]. The starting point was determined 80 centimeters before the measurement point. The

measurement point was a photocell gate, which the player passed through and ran to the first cone, which was 5 meters away in a straight line. Here, the athlete changed direction around the cone, and ran to the second cone, which was 5 meters away. After going around the second cone with a full turn, a 10-meter run in a straight line followed to the third cone. After he did a full turn around the third cone, the player ran towards back the first cone, where he changed direction and ran to the finish line. The results were recorded in seconds using the OXA Starter+ infrared gate timing device.

The ball agility test was different in that the athlete performed the same task as in the previous one, but with a ball. Due to the implementation with the ball, the player's agility is also related to the level of his sport-specific technical ability. Thus, in this test, the performed time is influenced by the player's current technical level.

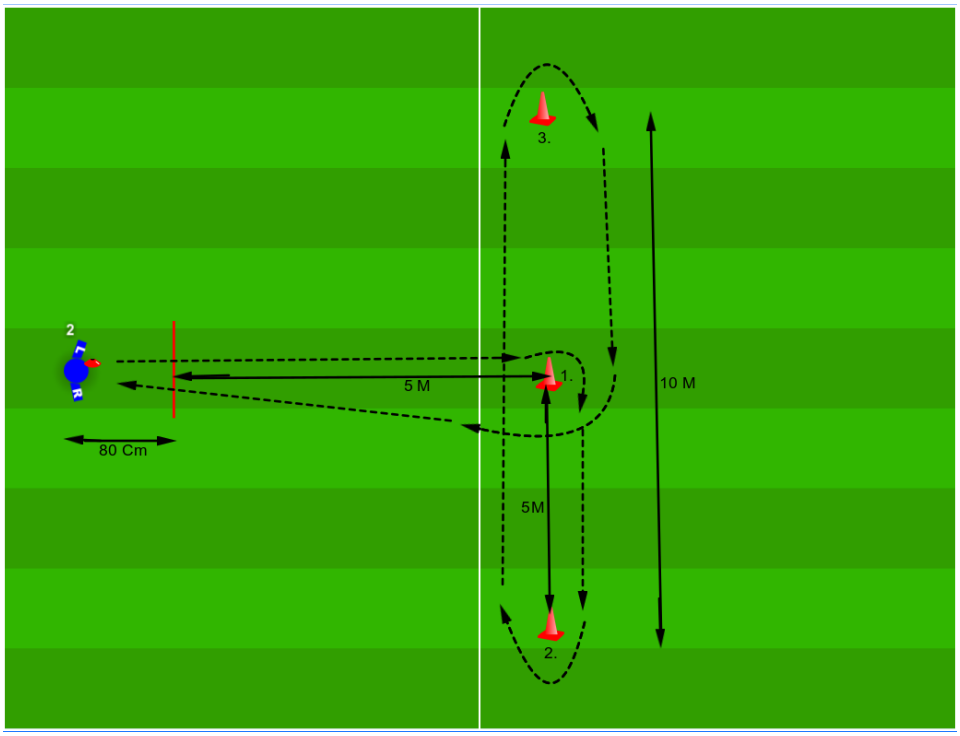

Figure 1. The layout and sizes of the track for measuring agility, and the measurement protocol

2.4 Sample

The study involved 15 participants, all of them were registered players for youth teams. Most of them started playing football at the age of 3-4, so they have been playing football for an average of 5 years. The average age of the participants is 11.67 years (SD = 0.900), which shows a homogeneous sample, as the range between the minimum and maximum ages is narrow (10-13 years). This provides a good basis for comparability of agility tests while minimizing age differences.

2.5 Statistical analysis

We also performed basic statistics and correlation analysis. We calculated the mean and standard deviation for the measured variables. First, we performed a normality test. Since the normality test showed that the sample had a normal distribution, we used a 2-sample t test. In the case of the correlation calculation, we used a significance level of $p \leq 0.05$. In the tables, the significant correlation corresponding to the $p \leq 0.05$ value is marked with an asterisk. When evaluating the results, we used the SPSS-27 program.

3 Results

3.1 Agility without ball

The average implementation time on the right side at the first measurement was 9.78 seconds (SD = 0.717), while at the second measurement this value decreased to 9.20 seconds (SD = 0.534).

The decrease suggests that the players' performance improved, which can be partly attributed to practice and the effect of repetition.

The average time on the left side at the first measurement was 9.98 seconds (SD = 0.812), which also decreased to 9.38 seconds (SD = 0.612) at the second measurement. The results show that there is also an improvement in the implementation on the left side (see Table 1).
In the agility tests, a lower standard deviation is observed for both sides at the second measurement, reflecting to more stable performance of the players.

3.2 Agility with ball

The average time on the right side at the first measurement was 12.40 seconds (SD = 1.39), while at the second measurement this decreased to 11.81 seconds (SD = 1.18). The significant decrease in time suggests that technical skills have improved through repetition of the task.

On the left side at the first measurement the average of the initial measurement was 12.29 seconds (SD = 1.33), which decreased to 11.69 seconds (SD = 1.19) at the second measurement.

In both cases, it can be observed that the implementation with the ball requires longer time than the test without the ball. This is natural, since the ball handling techniques complicate the movement. However, the results of the 2nd measurement show that the players adapted better to the task and the time difference decreased between the tests with and without the ball (see Table 1).

Table 1. Change in the mean and standard deviation results of agility between the two measured times

	Measurement	*mean (sec)*	*SD*
agility right	1. measurement	9,78	0,717
	2. measurement	9,20	0,534
agility left	1. measurement	9,98	0,812
	2. measurement	9,38	0,612
agility with ball (right)	1. measurement	12,40	1,39
	2. measurement	11,81	1,18
agility with ball (left)	1. measurement	12,29	1,33
	2. measurement	11,69	1,19

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3.3 Differences between left and right side

The right-sided measurements were consistently faster in both with and without the ball tests. This may indicate that the majority of participants are right-footed dominant, which affects their agility skills. However, the difference is not significant, indicating the relative development of left-sided skills.

Based on the results, it can be stated that during the second measurement, an improvement is observed in all tests, which is due to the adaptation of the test exercises, the effect of repetition and the development of technical skills. The decrease in the standard deviation indicates a more stable performance, especially in the tests without the ball. In addition to the right-sided dominance, the left-sided skills are also relatively developed, which assumes balanced movement coordination.

The results of the ball agility test showed that technical level has a significant impact on implementation time. This is especially important when planning sport-specific training, as improving

agility is closely related to developing technical skills. In future training programs, it is worth placing more emphasis on left-sided ball implementation to reduce side-to-side differences.

3.4 Paired sampled statistics

The paired samples T-test provides a detailed statistical evaluation to compare the results between the first and second measurements. In the following stages here comes an analysis, which includes the significance of the results, the magnitude of the differences, and the conclusions that can be drawn from them.

Based on the analysis of means and standard deviations, the second measurement always showed a lower average time compared to the first measurement, both for the agility tests with and without the ball. This indicates an improvement that is due to the experience gained during repetitions and adaptation to the test tasks.

In the tests without the ball (right and left), the average difference is 0.58 seconds on the right side and 0.60 seconds on the left side, in both cases the second measurement shows improvement. In the tests with the ball (right and left), the difference is 0.59 seconds on the right side and 0.59 seconds on the left, which also shows significant improvement.

Table 2. Paired samples correlations

	N	*Correlation*	*Asymp. Sig. (2-tailed)*
1. measurement. agility right & 2. measurement. agility right	15	0,765	0,001***
1. measurement. agility left & 2. measurement. agility left	15	0,876	0,000***
1. measurement. agility with ball (right) & 2. measurement. agility with ball (right)	15	0,972	0,000***
1. measurement. agility with ball (left) & 2. measurement. agility with ball (left)	15	0,922	0,000***

Paired T-test *p≤0.05; ** p≤0.01; ***p≤0.001

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The correlations between the results are high and significant ($p < 0.01$), indicating that the first and second measurements are closely related. This means that the players' performance on the first measurement was well predicted on the second measurement, indicating stability and consistency in the testing protocol. The highest correlation was for agility with the ball on the right side ($r = 0.972$), indicating an almost perfect connection. The lowest correlation was for agility without the ball on the right side ($r = 0.765$), which still shows a strong connection (see Table 2).

3.5 Paired sampled T-test

The results show a significant difference between the first and second measurements in all four cases ($p < 0.001$), confirming that the results of the second measurement indicate statistically better performance.

For agility without ball, the average difference on the right side is 0.58 seconds ($t = 4.851$, $p < 0.001$). For the left side, the average difference is 0.60 seconds ($t = 5.730$, $p < 0.001$). For agility with ball, the average difference on the right side is 0.59 seconds ($t = 6.164$, $p < 0.001$). For the left side, the average difference is 0.59 seconds ($t = 4.414$, $p = 0.001$).

This shows there has been significant improvement. During the second measurement, there was a significant improvement in all tests, confirming that the players' performance improved with repetition and practice. Stable correlations. High correlation values indicate that the players' performance was consistent between measurements, which supports the reliability of the test. Better performance without ball. Tests without ball showed lower implementation times, which is normal, because the technical skills of ball handling require more time. The decrease in measurement

differences and lower standard deviations during the second measurement indicate that the players successfully adapted to the tasks, thereby increasing their stability.

Table 3. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
Agility	Measurement	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
right	1 - 2	,57933	,46255	,11943	,32318	,83548	4,851	14	0,000***
left	1 - 2	,59867	,40463	,10448	,37459	,82274	5,730	14	0,000***
with ball (right)	1 - 2	,58800	,36944	,09539	,38341	,79259	6,164	14	0,000***
with ball (left)	1 - 2	,59200	,51948	,13413	,30432	,87968	4,414	14	0,001***

*p≤0.05; ** p≤0.01; ***p≤0.001

source: own editing

Overall, the results showed that there was significant improvement in both with and without ball versions of the agility tests, reflecting the players' learning ability and technical skills. This improvement emphasizes the importance of agility training in improving sport-specific performance.

4 Conclusions

The results of the research clearly show that the players' agility improved significantly in both with and without ball tests at the second measurement. This suggests that agility training programs are effective and contribute to the development of athletes' speed, explosiveness, and directional change abilities. The close correlations between the results of the first and second measurements show that the players' performance is stable, and capable for improvement, which provides a reliable basis for further development.

The faster times achieved in tests without ball support the theoretical assumption that the presence of sport-specific technical skills, such as dribbling, can slow down the performance of agility tests. This is a particularly important finding for training methods aimed at developing technical skills. The extension of improvement also shows that ball agility results can be improved if we emphasize both the athletes' technical and movement coordination skills.

Overall, the research highlights that measuring agility, reflects not only the speed and coordination abilities of players, but also their technical level. Based on the results, the complex development of agility, including the combined practice of speed, direction-changing abilities and sport-specific technical elements, is particularly important in future training planning. This can contribute to increasing the performance and competitiveness of players in a long term basis.

5 Summary

The goal of the research was to examine the agility of 10-13 year old athletes, using tests with and without the ball, on two separate occasions. Based on the results, it can be stated that the players' agility performance improved significantly during the second measurement for both test types. The faster time results in tests without ball support the fact, that sport-specific technical skills – such as ball handling – have a slowing effect on the performance of agility tests. The strong correlations between the first and second measurements indicate the stability of performance and the reliability of the test method.

The results of the research highlight the effectiveness of agility training programs and the key role of technical and coordination skills in optimizing athletic performance. These results provide an important basis for future training planning, in which both agility and sport-specific technical elements

are emphasized. The research contributes to improving the performance of young athletes and provides valuable practical guidance for coaches.

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