

A Comparison of 5, 10, 30 Meters Sprint, Modified T-Test, Arrowhead and Illinois Agility Tests on Football Referees

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Abstract

The ability of change of direction quickly, in other words agility, and short distance sprinting speed are two of the most important performance components for football referees. The tests used by FIFA and UEFA such as Cooper Test, Yo-Yo Intermittent Test, 40 × 75 m tests do not include testing the agility skills of the referees. However, especially the field referees changing their activities constantly. Otherwise, the short distance sprinting is another important factor to well positioning of the football referees. Especially, the assistant referees frequently performs short sprints to follow the offside line. For these reasons, we have compared 5 m, 10 m, 30 m sprint tests, T-Test, Arrowhead Agility Test and Illinois Agility Test scores of the football referees working in Ankara (City referees). All referees performed sprint tests twice and performed the agility tests one time. All tests have shown normal distribution frequencies. Our results showed that all of the six tests have shown positive correlations between ($P < 0,01$). Additively, it could be said that the agility skill has a relationship with short distance sprinting because of the referees who showed better sprint performances were also found to have higher agility scores. Consequently, each of the 5 m, 10 m, 30 m, T-Test, Arrowhead and Illinois Agility Test could be used to assess the performance of the referees.

Keywords: agility, Arrowhead, football referees, Illinois, sprint tests, T-Test

1. Introduction

Speed and agility are two of the most important performance components for success on the football. It has been shown that the players has spent about 22 minutes (2,6% of total time) at high speed running and sprinting ($>19,8$ km.h-1) in the Premier League (Bradley et al., 2009). As well as the footballers, the referees are in physical activity at a significant level during the match. Moreover, Weston et al. showed that the total distance covered by referees (11,280+738 m) were greater than the players (10,794+374 m) in Premier League. The referees covered approximately 869 meters of that total distance at high-speed and by sprinting (Weston, Drust, & Gregson, 2011).

The agility skill is as important as speed for referees' performance. To be close to the positions, the referees must be successfully for various movements during game like changing direction quickly, side stepping and back stepping. Furthermore, 1268 activity changes (1053 for assistant referees) has been reported in Danish elite football referees (Helsen & Bultynck, 2004; Krstrup & Bangsbo, 2001; Krstrup, Mohr, & Bangsbo, 2002).

Some of the tests has been used by FIFA (International Union of Association Football) and UEFA (European Union of Association Football) to the selection of the football referees. Most used tests by FIFA and UEFA are the Cooper Test, 40 × 75 m interval test, 20 × 150 m interval test, 6 × 40 m sprint test, Yo-Yo Intermittent Test and CODA Test (Castagna, Abt, & D'Ottavio, 2005; Castagna, Impellizzeri, Bizzini, Weston, & Manzi, 2011; Weston, Castagna, Helsen, & Impellizzeri, 2009). The Cooper test includes 12 minutes straight running and the test is used calculating maximal oxygen intake (Cooper, 1968). Also, 40 × 75 m and 20 × 150 m interval tests include straight runnings. All of these tests excepting the CODA test are include straight runnings and does not include changing of directions. However, the football referees must have a great skill of changing direction quickly to be the close to the positions and making the true-decisions during a match. Additively, although the CODA test has been used to test performance of assistant referees, Castagna et al. showed that the CODA test has no significant performance differences were found between competitive levels (Castagna et al., 2011).

In this study, we applied 6 performance tests to the referees. Half of these tests were sprint tests and the other half were agility tests. The first three tests were 5 meters, 10 meters and 30 meters sprint tests. Especially, the assistant referees

have a 52,5-60 meters (For a field with FIFA standards) moving line to perform on a football match. Therefore the short distance sprints are notably important for assistant referees. Additively, the explosiveness and the sprint speeds of the assistant referees are very important to follow properly the offside line.

Our last three tests were the T-Test, Arrowhead Test, Illinois Agility Test. Many studies showed the 5, 10 and 30 meters sprint tests were related the sprint ability of the athletes (Duthie, Pyne, Ross, Livingstone, & Hooper, 2006; K kl  Alemdarođlu,  zkan, Koz, & Ers z, 2015; Marques, Gil, Ramos, Costa, & Marinho, 2011; Miller, Herniman, Ricard, Cheatham, & Michael, 2006). And the studies showed the relation of the agility skills of the athletes and the T-Test, Arrowhead Agility Test and Illinois Agility Test (Amiri-Khorasani, Sahebozamani, Tabrizi, & Yusof, 2010; Chan, Lee, Fong, Yung, & Chan, 2011; Jalilvand et al., 2015; Miller et al., 2006; Muniroglu & Subak, 2018). Especially, agility is an essential skill for the field referees. Because, the field referees should perform side steps, back steps, changing of directions quickly, sudden turning backs etc. successfully during the game. In addition, side stepping is an essential skill for the assistant referees and the T-Test has a side stepping part (Muniroglu & Subak, 2018).

The importance of the short sprinting skills and the agility skills of soccer referees is obvious. And the tests have been used by FIFA do not exactly measure these abilities. The aim of this study was finding reliable sprint and agility tests for soccer referees. For this purpose, we have compared the 5 meters sprint, 10 meters sprint, 30 meters sprint, Arrowhead Agility Test, T-Test and Illinois Agility Test scores of the 72 male soccer referees in Ankara (Turkey).

2. Methods

2.1 Participants

72 male football referees (city referees, mean age $23,51 \pm 2,69$) in Ankara (Turkey) participated in this study. All referees signed the approval forms. All referees have regularly participated in trainings and matches. The height (mean $180,50 \pm 5,19$) and weight (mean $73,51 \pm 7,94$) informations of the all referees were recorded.

2.2 Test Protocols

All tests practiced on the synthetic turf, in the Ankara 19 Mayıs Stadium training pitches. At the time of the tests, the temperature was 22°C . All referees performed the 5, 10 and 30 meter sprint tests twice and performed the T-Test, Arrowhead and Illinois Tests one time. Before the tests, all referees participated 20 minutes warm-up workout. At the waiting times of the between tests, all referees were kepted active by jumping rope and stretching exercises to avoid cool down.

2.3 5-10-30 Meters Tests Protocols

5 meters, 10 meters and 30 meters sprint tests has similar protocols. The photocells settled the starting and finishing points of the distance 5 meters, 10 meters and 30 meters. All referees have started from 1 meter behind of the starting photocell. Best scores of the referees were recorded.

2.4 T-Test Protocol

We have used our previous modified T-Test protocol that has been shown in Figure 1 (Muniroglu & Subak, 2018) (Figure 1A). 40 cm height cones have been used. All referees have started 1 meter behind of the starting photocell. The referees must touch the cones with hand when they reached. Firstly, the referee runs 10 meters forward as quickly as possible, then run to the right by side steps, 5 meters along. After, the referee runs by side steps to the left, 10 meters along. Again, the referee runs to the center cone by side steps, 5 meters along. Then he runs by back steps, 5 meters along. Finally, he turns back as much as quickly and sprint to the finishing photocell.

2.5 Arrowhead Agility Test Protocol

We have used the protocol used by Jalilvand et al. for the Arrowhead Agility Test as showed in the figure 1B (Figure 1B) (Jalilvand et al., 2015). All referees have started 1 meter behind of the photocell. In the beginning of the test, the referees sprint to the middle cone and turn from outside of the cone to the left or right what they want. After, referees turn around the left/right cone and around the upper cone. Finally, referees sprint to the finishing photocell.

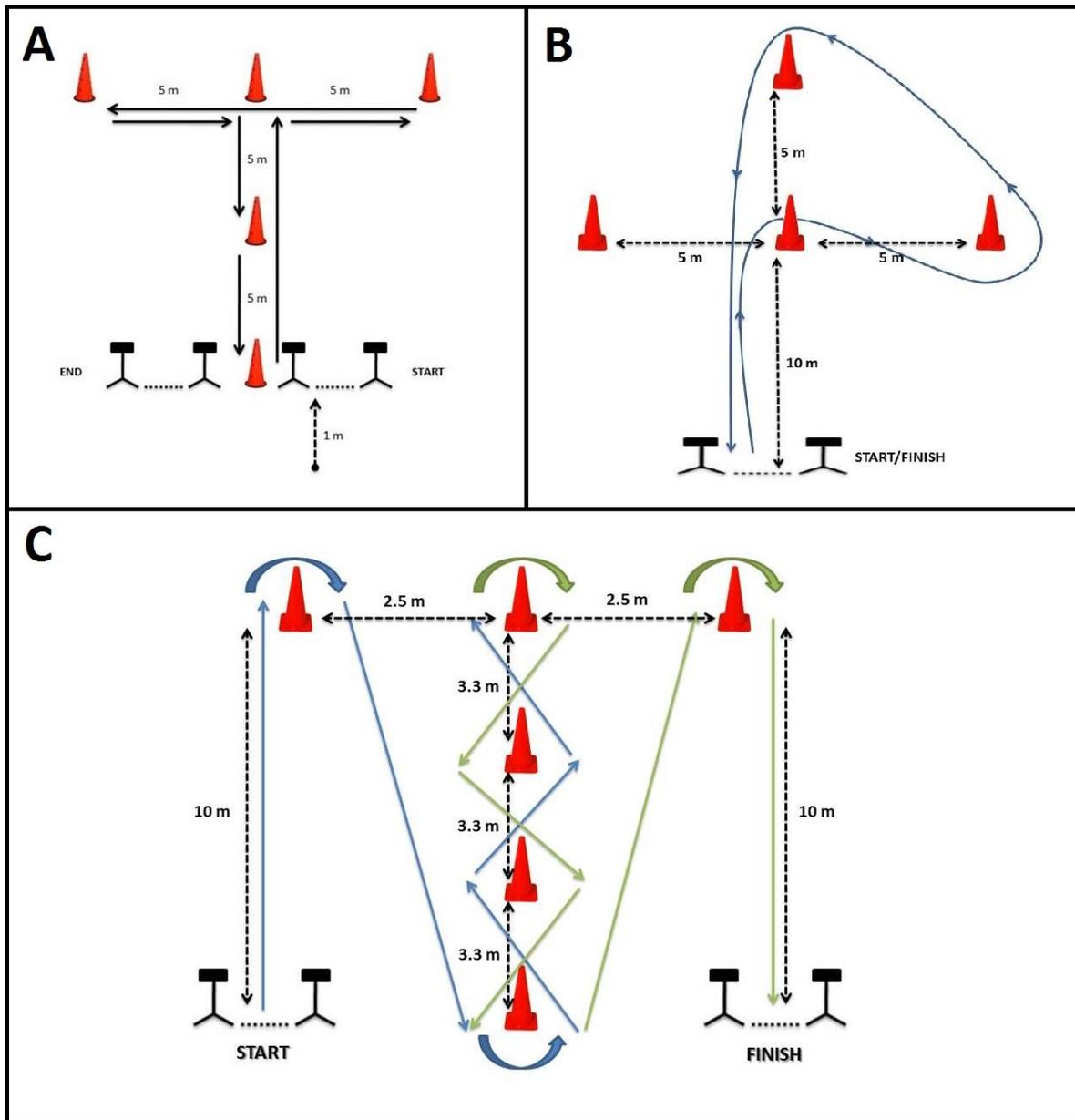


Figure 1. A. T-Test, B. Arrowhead Agility Test, C. Illinois Agility Test

2.6 Illinois Agility Test Protocol

For the Illinois Agility Test, we have used the standard protocol used in many studies (Amiri-Khorasani et al., 2010; Negra et al., 2017; Raya et al., 2013). Firstly, the referees have sprinted to the left cone and turned around it. After, the referees have run to the first middle cone standing in the starting line then turned around it. All referees have passed the cones with zigzag move as shown in Figure 1C (Figure 1C). Lastly, the referees have sprinted to the finishing photocell.

2.7 Statistical Analyses

We have used the IBM SPSS Statistics 24.0 to statistical analyses. The histogram analysis was made and graphed for all tests (Figure 2). Linear regression and Pearson Product Moment Correlation analysis were used to determine the statistical relationship of all tests. The significance level was settled at $P < 0,01$.

3. Results

72 active football referees have participated all of the 6 tests. The mean age, height and weight of the participants were $23,51 \pm 2,69$, $180,50 \pm 5,19$, $73,51 \pm 7,94$. The histogram graphics of the age, height, weight and all tests have shown normal distribution (Figure 2). Mean scores for all tests have shown in Table 1 (Table 1).

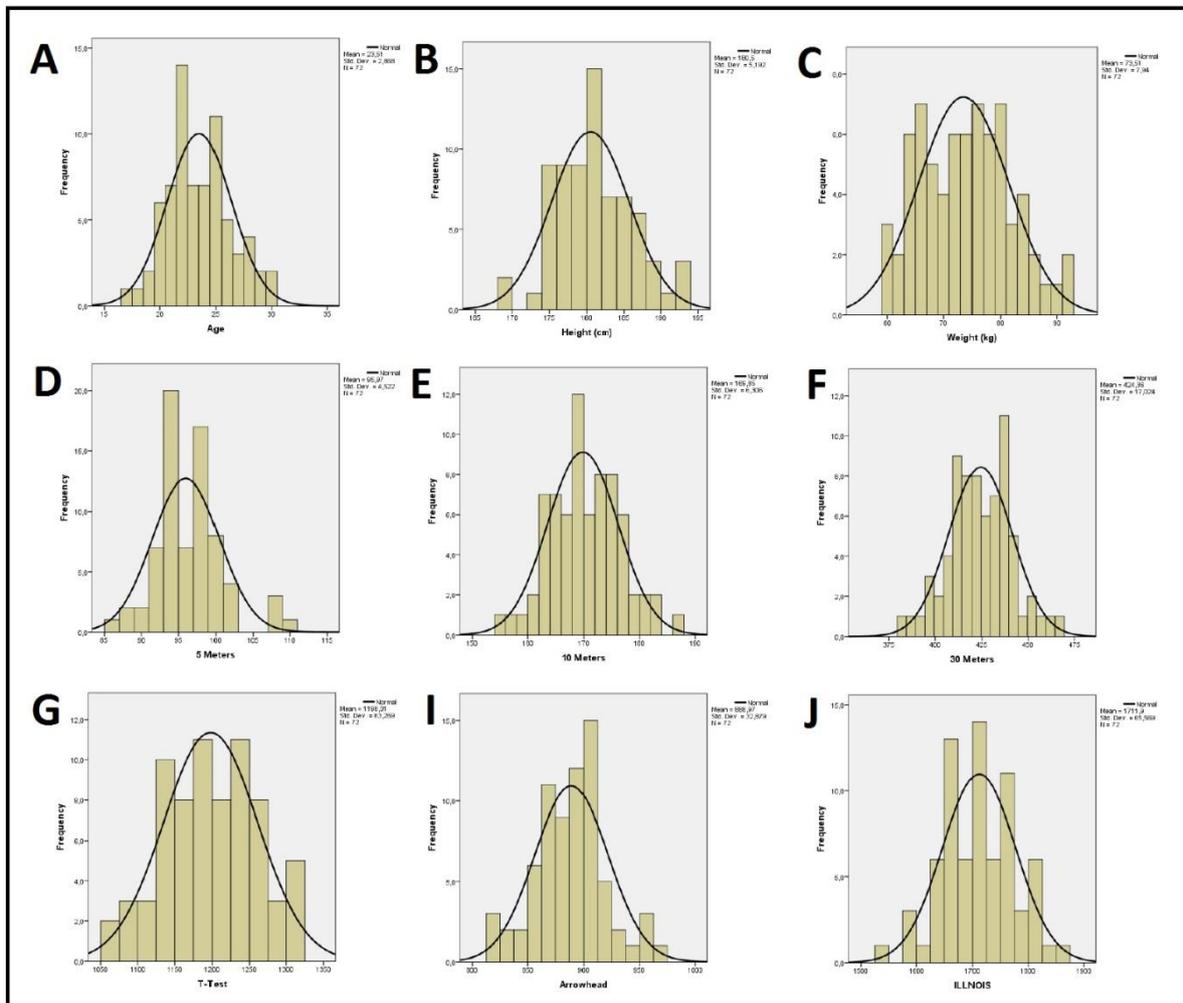


Figure 2. Frequency distributions. A. Age, B. Height, C. Weight, D. 5 m, E. 10 m, F. 30 m, G. T-Test, I. Arrowhead Agility Test, J. Illinois Agility Test

The Pearson Product Moment Correlation analyses showed that all of the tests have had positive correlation between each other. According to the results of correlation analyses; 5 m – 10 m ($r = 0,726, P < 0,01$), 5 m – 30 m ($r = 0,626, P < 0,01$), 10 m – 30 m ($r = 0,847, P < 0,01$), 10 m – T-Test ($r = 0,426, P < 0,01$), 10 m – Arrowhead ($r = 0,576, P < 0,01$), 10 m – Illinois ($r = 0,603, P < 0,01$), 30 m – T-Test ($r = 0,484, P < 0,01$), 30 m – Arrowhead ($r = 0,706, P < 0,01$), 30 m – Illinois ($r = 0,752, P < 0,01$), T-Test – Arrowhead ($r = 0,501, P < 0,01$), T-Test – Illinois ($r = 0,614, P < 0,01$) and Arrowhead – Illinois ($r = 0,792, P = 0,01$) tests have shown very high correlations (Table 2). Besides, the 5 m – T-Test ($r = 0,310, P = 0,01$), 5 m – Arrowhead ($r = 0,389, P = 0,01$) and 5 m – Illinois ($r = 0,399, P = 0,01$) have shown weak positive correlations. Additively, the linear regression analyses have shown significance for all groups ($P < 0,01$).

Table 1. Mean test scores of 72 football referees.

Test	Mean (s)	Sd
5 m	0,95	0,04
10 m	1,7	0,06
30 m	4,24	0,17
T-Test	11,98	0,63
Arrowhead	8,89	0,33
Illinois	17,12	0,66

We have also analysed the correlations between of the age, height, weight values with the all tests. However, the analyses have not shown significant correlations.

Table 2. Results of correlation analysis ($P < 0,01$)

Test	<i>r</i>
5 m - 10 m	0,726
5 m - 30 m	0,626
10 m - 30 m	0,847
5 m - T-Test	0,726
5 m - Arrowhead	0,389
5 m - Illinois	0,399
10 m - T-Test	0,426
10 m - Arrowhead	0,576
10 m - Illinois	0,603
30 m - T-Test	0,484
30 m - Arrowhead	0,706
30 m - Illinois	0,752
T-Test - Arrowhead	0,501
T-Test - Illinois	0,614
Arrowhead - Illinois	0,792

4. Discussion

In this study, we have compared the short distance sprint skills (5, 10 and 30 m) and agility skills of the 72 football referees. According to the histogram analyses, our group has shown normal distribution of all parameters (age, weight, height and all test scores) (Figure 2). And this results have shown that we have a favorable sample to compare test scores meaningfully.

Previously, Little & Williams showed significant correlations between the 10 m, 20 m sprint and zigzag agility test scores in professional football players (Little & Williams, 2005). In parallel, our results showed significant correlations between 5 m, 10 m, 30 m sprint tests with all of the agility tests we practiced on referees. Further, Raya et al. showed a positive higher correlation between T-Test and Illinois Agility Test scores in 97 male U.S. Army (Raya et al., 2013). Correspondingly, our results showed a positive and higher correlations between these agility tests in soccer referees.

In our previous study, we have revealed the relationship between 10 meters, 30 meters sprint skills with our modified T-Test (reliability of the test is 84%) (Muniroglu & Subak, 2018). We have shown once again the correlation between T-Test and 10 m – 30 m sprint test with this study. In addition to this, we have shown that there is a positive correlation between T-Test and 5 meter sprint test. Moreover, the correlation analysis also have shown us our modified T-Test has revealed high correlations with the Arrowhead and the Illinois Agility Tests. Given these results, the modified T-Test could be an appropriate test to gain insights about the agility skills of referees.

Although all tests showed significant positive correlations in this study, 5 m sprint scores showed weaker positive correlations comparing to others. 5 m sprinting performance requires some other special skills such as explosiveness and techniques such as correct starting position (Duthie et al., 2006; Marques et al., 2011; Mendoza & Schöllhorn, 1993). So that, these weaker correlations might be affected by the wrong starting techniques and the difference of the explosiveness skills of the football referees. However, 5 m sprint scores have shown a high correlation with T-Test scores ($r = 0,726$). T-Test is not a continuous running test and includes a number of stopping and re-activation phases. Therefore, this is the main difference of the T-Test from Arrowhead and Illinois tests. Hereby, this could be the reason why the T-Test and the 5-m sprint test has shown a high correlation. Similarly, 5 m has shown weaker correlations with Arrowhead and Illinois Agility Tests (Table 2).

Unlike the tests has been used by FIFA and UEFA; T-Test, Arrowhead Agility Test and Illinois Agility Test includes agility skill more predominantly. T-Test include side steps exactly used by assistant referees. The Arrowhead and Illinois Agility Tests includes quickly change of direction skills predominantly used by field referees. Our study has shown that the T-Test, Arrowhead and Illinois Agility Test able to more specifically measure the referees' performance. Because, these tests include the movements especially that the referees performs in the field.

In addition to these results, this study showed there is a strong relationship between short distance sprint and agility performance. Our previous study has also showed this result (Muniroglu & Subak, 2018). As a result of our studies, the referees who showed better sprint performances were also found to have higher agility scores. And the referees who

scored worse sprint performances had lower agility scores. Although short distance sprint speed and agility performances have relation, Young et al. showed that the training of these two skills should be specific to the skill desired to be improved (Young, McDowell, & Scarlett, 2001).

5. Conclusion

The tests have been used by FIFA and UEFA for referee selection have not included agility performance essentially. However, the change of direction ability is very important especially for the field referees. Also, short distance sprint speed is another critical skill for both of the field and assistant referees. Particularly, 40 × 75 m test used by FIFA and UEFA might not an appropriate test for the assistant referees. Because, assistant referees perform maximum 60 m (half of the 120 m sideline) area during match. Assistant referees do not run 75 m distance during the match. Therefore, the short distance sprinting and the agility tests should also add to the referee selection steps. Our study showed the positive correlations between 5 m, 10 m, 30 m sprint, T-Test, Arrowhead and Illinois Agility Tests and these tests could be used to the referee selection stages.

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