

Validity and reliability of three standardized agility tests for Indonesian soccer players

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ABSTRACT

The aim of this study was to determine the validity and reliability of three standardized agility tests. A total of 36 male soccer players from the Faculty of Sports and Health, Universitas Pendidikan Ganesha, Indonesia, participated (age 19.31 ± 1.22 years; height 168.62 ± 5.13 cm; weight 60.87 ± 8.97 kg; playing experience 8.91 ± 4.67 years). The subjects were given the Illinois Agility Test (IAT), Agility T-Test (ATT) and Boomerang Agility Test (BAT) at different times twice a week to compare their agility levels. The test results showed that the three agility tests had very high and high validity ($r_1 = 0.951$, $r_2 = 0.748$ and $r_3 = 0.889$), and there was a significant difference in the retest results ($p < 0.05$). There was a very high correlation/reliability between the first test and the second retest ($r_1 = 0.943$, $r_2 = 0.809$ and $r_3 = 0.939$) for all types of agility tests. High correlations were found between IAT and ATT ($r = 0.633$), IAT and BAT ($r = 0.725$), and ATT and BAT ($r = 0.698$). The study also showed significant differences in agility among player positions—forward, midfielder, winger, center back, and goalkeeper ($p < 0.05$). The three agility tests were concluded to be valid, reliable, and effective for evaluating the agility and physical abilities of male soccer players in Indonesia.

KEYWORDS

Validity; Reliability; Agility Test; Soccer Player

1. INTRODUCTION

The game of soccer is associated with running, meaning that the ability to run is very important for soccer players. Furthermore, running is associated with agility and speed (Hasan & Clemente, 2021). It is believed that players who do not have agility and speed will find it difficult to develop in the world of soccer. Agility is the ability to change directions into any direction as quickly as possible (Sheppard & Young, 2006; Young et al., 2001). Soccer players almost every time change their direction to chase the ball, both for attack and defense. According to Bangsbo (1992), soccer players change direction every 2-4 seconds and change direction approximately 1,300 times in each game. The importance of agility in the game of soccer has been found in many literatures, especially to improve the ability of soccer players (Rauter et al., 2018; Reyes et al., 2022). In fact, Franca et al. (2022), state that lower body explosive strength is a significant predictor in increasing the capacity of agility and speed of soccer players. Furthermore, according to Sporis et al. (2010), agility is believed to be a very important physical component for the success of soccer players.

The agility tests that exist today are very diverse. From various existing literature, there are more than 30 types of agility tests. The selection of the 3 agility tests in this study was based on the finding that the Illinois Agility Test (IAT), Agility T-Test (ATT) and Boomerang Agility Test (BAT) had almost the same characteristics based on the distance traveled in carrying out the test, the form of the test and the similarity of the pattern change direction. According to Hachana et al. (2013); Paul et al. (2016); Pauole et al. (2000) IAT and ATT were the best at measuring agility. It is also strengthened by tracing various previous studies related to evaluating the validity and reliability (Clemente et al., 2022), of agility tests mostly carried out outside Indonesia, there are still very few evaluations of agility tests conducted in Indonesia.

Evaluation of agility tests is a priority in Indonesia as an Asian country. However, the average body posture of Asians (Indonesians) is shorter than Americans. This means that the structures of bones, joints, and muscle mass are presumably also different (Wang et al., 1999). This condition greatly affects the body's performance in terms of strength, speed, and agility. In the context of the validity and reliability of a test, the accuracy between the measuring instrument and the measuring subject becomes very important. At the present moment, almost the majority of physical ability tests used by Indonesians originate from America, Europe and Australia. This is not a problem, but evaluation research related to validity and reliability is urgent to be conducted, considering the differences in physical abilities that we have with western countries.

Soccer players are closely associated with physical abilities, especially speed and body agility. In order to know the agility of soccer players, coaches need to conduct agility tests on their players. Currently there are standardized agility tests created from the western world. Indonesia as an eastern state that has different structures of muscles, bones and joints as well as physiological conditions often encounters obstacles to the implementation of existing physical tests. Therefore, with this experimental study of agility tests for soccer players in Indonesia, it was hoped that it could provide additional insights and repertoire on the suitability of agility tests and agility exercises, or efforts could be made to develop new and more specific agility tests according to the characteristics of Indonesian (Asian) people.

At the moment, in Indonesia there have not been many in-depth investigations of agility tests for soccer players, especially at the student level. So far, the agility test is only often used as the dependent variable to determine the level of agility alone. However, whether the agility status is valid or reliable there has been no further investigation. This was a strong reason for us in Indonesia to further investigate the validity and reliability of the agility test, which in this study took three of the six agility tests we explored including 1) Illinois Agility Test (IAT), 3) Agility T-Test (ATT).), and 3) Boomerang Agility Test (BAT). This research was funded independently.

Based on the above background, the objectives of this study are: 1) to evaluate through testing the validity and reliability of the agility tests used in soccer, 2) to compare the validity and reliability of different agility tests, and 3) to evaluate the agility of Indonesian college-level soccer players against the difference in position between Forwards, Midfielders, Wingers, Center Backs, and Goal Keepers in 3 agility tests namely IAT, ATT and BAT.

2. METHODS

2.1. Participants

This study involved 36 male college-level soccer players (mean age = 19.31 ± 1.22 years) who were interested in participating. Sixteen of them were soccer players at the provincial level, and twenty were players at the regency level in Bali, Indonesia. All participants provided written consent to take part in the study. The average playing experience of the study participants was 8 years with a practice session of approximately 2.5 hours. The training program, intensity, and technical preparation for those participating in the research were strictly controlled. The research protocol was approved by the Physical Conditions Team of the Faculty of Sports and Health, Universitas Pendidikan Ganesha.

According to Horicka et al. (2014), the IAT is started from 'Start' (in Figure 1), after the sound of the whistle, the participants run 10 meters and turn 10 meters back to do a zigzag run with a distance of 3.3 meters, then turn around to run back 10 meters to reach the cone and 'Finish' as seen in Figure 1.

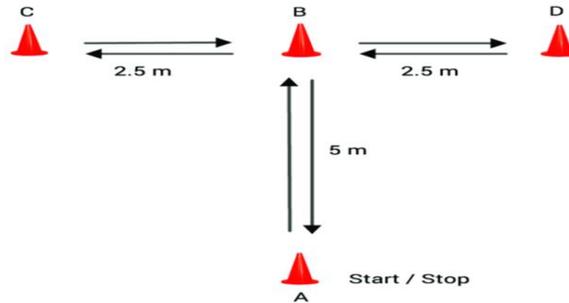


Figure 2. Agility T-Test (ATT)

(Source: Ramirez-Campillo, 2018)

According to Ramirez-Campillo et al. (2018), the implementation of the *ATT* (Figure 2) begins with the players having to touch the top of the cones instead of its base. A-B displacement (5-m): at his own discretion, each subject sprints forward to cone B and touches the top of the cone with the right hand. B-C displacement (2.5-m): facing forward the participants shuffle to the left to cone C and touch the top of the cone with the left hand. C-D displacement (5-m): the soccer players then shuffle to the right to cone D and touch its top. D-B displacement (2.5-m): the participants shuffle back to the left to cone B and touch its top. B-A displacement (5-m): the soccer players move as quickly as possible and return to line A.

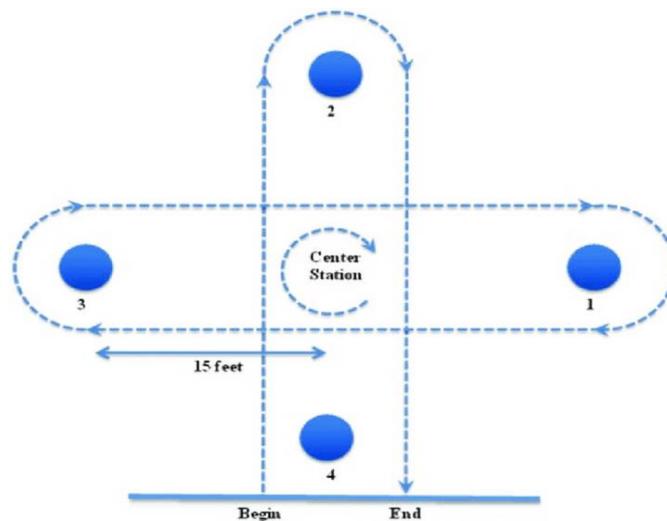


Figure 3. Boomerang Agility Test (BAT)

(Source: Ambegaonkar et al., 2011)

According to Ambegaonkar et al. (2011), the implementation of the *BAT* begins with a whistle signal, upon which the participants run from 'Begin' (Figure 3) to the center station. The participants then make a quarter right turn, run to and around the first outside station, return to the center, make another quarter turn, and continue through the course until 'End'.

2.3. Statistical Analysis

The data were analyzed using IBM SPSS Version 25. The Mean, SD, and Range were measured in the three agility tests performed. Before being tested further, the research data were tested for normality using the Kolmogorov-Smirnov test and the homogeneity test using Levene's test. Then, the validity test utilized Product Moment correlation (Pearson Correlation), by correlating each item score with the total score, then the reliability test utilized the test-retest method and Cronbach Alpha reliability. To find out the difference between the positions of soccer players, a one-way Analysis of Variance (ANOVA) test was used.

3. RESULTS

The general description of the sample data for soccer players at the Faculty of Sports and Health at the time of the study is presented in Table 1.

Table 1. General description of the soccer players' sample data at the time of the study

| | Age | Height (cm) | Weight (kg) | HR (After Agility Test) (bip/minute) | Years of Playing |
|---------|------------|--------------------|--------------------|---|-------------------------|
| Mean±SD | 19.31±1.22 | 168.62±5.13 | 60.87±8.97 | 120.51±9.44 | 8.91±4.67 |

Table 1 showed that the soccer players had an average age of 19.31 ± 1.22 years, an average height of 168.62 ± 5.13 cm, and an average weight of 60.87 ± 8.97 kg. After the agility test, their average heart rate was 120.51 ± 9.44 bpm, and they had an average of 8.91 ± 4.67 years of playing experience.

In the following, Table 2 presents the descriptive statistics results of three agility tests. The prerequisite analysis test showed that all data on the 3 agility tests were normally distributed through the Kolmogorov-Smirnov test ($r = 0.86$), and homogeneous through the Lavene test ($r = 0.90$) (Table 2).

Table 2. Descriptive statistics of three agility tests

| | Mean \pm SD | Range | Variance |
|------------------------------|---------------------------------|--------------|-----------------|
| Illinois Agility Test 1 | 17.63 \pm 0.77 | 3.96 | 0.597 |
| Illinois Agility Test 2 | 17.78 \pm 1.11 | 6.48 | 1.224 |
| Illinois Agility Test (all) | 17.71 \pm 0.95 | 6.48 | 0.904 |
| Agility T-Test 1 | 11.99 \pm 0.65 | 2.91 | 0.418 |
| Agility T-Test 2 | 12.38 \pm 1.00 | 4.22 | 1.019 |
| Agility T-Test (all) | 12.19 \pm 0.86 | 4.22 | 0.747 |
| Boomerang Agility Test 1 | 13.32 \pm 0.71 | 2.70 | 0.498 |
| Boomerang Agility Test 2 | 13.53 \pm 0.78 | 3.18 | 0.606 |
| Boomerang Agility Test (all) | 13.42 \pm 0.75 | 3.20 | 0.556 |

The mean and standard deviation of all experimental agility tests were obtained (Mean \pm SD) = 17.71 \pm 0.95 for the Illinois Agility Test (IAT), 12.19 \pm 0.86 for the Agility T-Test (ATT), and 13.42 \pm 0.75 for the Boomerang Agility Test (BAT) (Table 2).

Based on the results of the validity test using Pearson Correlation, the results for IAT showed a very high validity = 0.951, ATT showed high validity = 0.748 and BAT indicated very high validity = 0.889 (Table 3).

Table 3. Validity and reliability of three agility tests

| | Validity (Pearson Correlation) | Reliability (Cronbach's Alpha) |
|------------------------|---------------------------------------|---------------------------------------|
| Illinois Agility Test | 0.951** | 0.943 |
| Agility T-Test | 0.748** | 0.809 |
| Boomerang Agility Test | 0.889** | 0.939 |

Note. **. Correlation is significant at the 0.05 level (2-tailed)

Meanwhile, the reliability test using Cronbach's Alpha (Table 3) obtained results for very high reliability in IAT = 0.943, very high reliability in ATT = 0.809 and very high reliability in BAT = 0.939.

The highest correlation between the three agility tests was between IAT and BAT $r = 0.725$, and the lowest correlation was between IAT and ATT $r = 0.633$, while the correlation between BAT and ATT was $r = 0.698$, as shown in Table 4.

Table 4. Correlation between the three agility tests

| | Illinois Agility Test | Agility T Test | Boomerang Agility Test |
|------------------------|------------------------------|-----------------------|-------------------------------|
| Illinois Agility Test | 1 | | |
| Agility T-Test | 0.633** | 1 | |
| Boomerang Agility Test | 0.725** | 0.698** | 1 |

Note. **. Correlation is significant at the 0.05 level (2-tailed)

Table 5 shows the differences in performance (expressed as mean ± SD) across different soccer player positions: Forward, Midfielder, Winger, Center Back, and Goalkeeper.

Table 5. Descriptive statistics of differences in performance across soccer player positions

| Variable | Forwards (n = 2) | Midfielders (n = 16) | Wingers (n = 9) | Center Back (n = 9) | Goal Keepers (n = 3) |
|------------------------|-----------------------------|---------------------------------|----------------------------|--------------------------------|-------------------------------------|
| Illinois Agility Test | 17.29 ± 0.43 | 17.61 ± 0.62 | 17.27 ± 0.60 | 18.06 ± 1.12 | 17.86 ± 0.64 |
| Agility T-Test | 11.86 ± 1.19 | 12.04 ± 0.59 | 11.58 ± 0.30 | 12.38 ± 0.82 | 11.99 ± 0.37 |
| Boomerang Agility Test | 13.17 ± 0.39 | 13.31 ± 0.76 | 12.87 ± 0.52 | 13.79 ± 0.70 | 13.26 ± 0.17 |

Data description of agility test results with college-level soccer player positions consisting of Forward, Midfielder, Winger, Center Back, and Goal Keeper positions. From the data obtained, the highest mean for IAT was in the Winger position = 17.27, for ATT the highest was in the Winger position = 11.58 and for the highest BAT was in the Winger position = 12.87 (Table 5). In general, there were differences in the effect of soccer player positions on agility.

Table 6. Differences in the effect of player positions on agility

| Position | p value |
|--------------------------------|----------------|
| Forwards vs Midfielders | 0.000 |
| Forwards vs Wingers | 0.000 |
| Forwards vs Center & Wing Back | 0.000 |
| Forwards vs Goal Keepers | 0.000 |
| Midfielder vs Wingers | 0.000 |
| Midfielder vs Center Back | 0.000 |
| Midfielder vs Goal Keepers | 0.000 |
| Winger vs Center Back | 0.000 |
| Winger vs Goal Keepers | 0.000 |
| Center Back vs Goal Keepers | 0.000 |

From Table 6, it can be seen that all player positions had different effects with a significance value = 0.000 with $p < 0.05$.

4. DISCUSSION

Testing agility tests on college-level soccer players in Indonesia showed low variations in terms of the average score (Table 2). The results of trial 1 were lower than the 2nd trial. This indicates that trial 1 had provided positive motion learning, so that in trial 2 the motion pattern of the agility test to be carried out was well understood. In addition, giving examples of test moves before participants carry out the test did not provide a positive value in the implementation of the test. Thus, in addition to giving examples, it was suggested that one trial to be provided prior to the actual test.

Table 2 showed that the three types of agility tests tested indicated that the average result of trial 1 was lower than that of the 2nd trial or in other words, there was an increase in test results between trial 1 and trial 2. The results of validity and reliability testing on the three agility tests have shown high and very high coefficients. The Illinois Agility Test (IAT) showed a higher coefficient of validity ($r=0.951$) and reliability ($r=0.943$) than the other two tests. The lowest coefficient of validity and reliability was obtained in the Agility T-Test (ATT) ($r=0.748$) (Table 3). This is in accordance with the findings of previous studies using ATT, in which the test showed a reliability coefficient that was lower than other agility tests and research on the validity and reliability of pre-existing agility tests was also in the high category (Altmann et al., 2022; Qowiyyuridho & Fauzi, 2021; Morral-Yepes et al., 2001).

Based on data from the agility test results, the college-level soccer players at the provincial level were on average 2 seconds faster than players at the regency level. This was possible because the training process for soccer players at the provincial level is more varied and has more frequent and complex practice and match experience and is supported by a more stringent selection process for physical elements to be accepted as players at the provincial level, while players at the regency level have relatively lower training experience and fewer matches. From the three agility tests tested, it can be concluded that the tests have relatively the same pattern of variations.

The highest correlation value was shown between the IAT and BAT tests ($r = 0.725$), because they had almost the similar pattern of test execution, the distance traveled, and the concept of changing direction. Meanwhile, the correlation between IAT and ATT was the lowest ($r=0.633$). This was because the test for ATT had different movement patterns such as side steps to complete the test. According to Brown et al. (2000); Brughelli et al. (2008) side step is a sideways movement that

requires coordination, balance, and knee strength to support the movement so that it can move as quickly as possible, and there is an element of running backwards to complete the final stage of the test. Backward running is the opposite of forward running which requires coordination, balance, and flexibility in order to be able to move backwards as fast as running forward. Of the three agility tests tested, all of them had positive correlation values as they were above $r = 0.50$. Therefore, in general each test had a good and positive correlation for measuring agility.

The average result of the agility test based on the player's position is that for the highest average IAT was in the position of Winger $M = 17.27$, for ATT the highest was in the position of Winger $M = 11.58$ and for the highest BAT was in the position of Winger $M = 12, 87$ (Table 5). This indicates that in this study, the position of Winger had better agility than the other positions, although there was not much of a difference (IAT: 0.02-0.79 seconds, ATT: 0.28-0.46 seconds, and BAT: 0.30-0.62 seconds). The findings in this study show that there was a difference with previous findings which state that the midfield position was more agile and changed direction more often than the attacker and defense positions in using the ATT agility test (Sporis et al., 2010). The difference in these findings was presumably because Indonesian Wingers tends to play more aggressively, so that speed, agility and changing direction are carried out with a high frequency. For that reason, Wingers are trained in terms of agility, and besides that it is often seen that Wingers assist in attack slightly to the middle field, so that the task area becomes wider which requires running and quick change in direction (Gultom & Endriani, 2021). The finding of agility ability of the Goal Keepers was a relatively new finding because there has been no previous research that further examines the ability of a Goalkeeper in terms of agility. A goal keeper is tasked with protecting his goal from attacks by opposing attackers. To secure his goal he requires quality footwork to reach, block, fend off opponent's kicks, therefore, speed and foot agility are required (Apriliyanto, 2020).

In general, there are significant differences between all positions of college-level soccer players in Indonesia, namely among Forwards and Midfielders, etc., Midfielders and Wingers, etc., Wingers and Center Backs, etc., and Center Back and Goal Keepers. All positions have significant differences in foot agility. This certainly shows that each position requires almost equal agility skills. According to Altmann et al. (2021); Cahanin et al. (2021); Ciocca et al. (2022) agility is the main key in the performance of soccer players in all positions. Even, positions such as Wingers, Midfielders and Forwards are believed to have super agility compared to other positions. However, in general, all soccer players without exception must have a high level of agility.

5. CONCLUSIONS

Based on the results and discussion above, it can be concluded that of the three agility tests studied in this research, the IAT is the most valid and reliable test for estimating the agility of college-level soccer players in Indonesia. The position of players in soccer deserves attention in creating agility tests and based on these findings the three agility tests are generally suitable for use by soccer players in Indonesia to measure agility. Specifically, it was found that IAT is more suitable for estimating the agility of Wingers, ATT for Midfielders, and BAT for Forwards

6. PRACTICAL APPLICATIONS

In the game of soccer, player agility is highly prioritized, because the ability to run and change direction quickly is the main weapon in creating opportunities for success in matches. Players who are agile will immediately have good balance, coordination, flexibility, and control. Thus, their playing performance will be better. The agility tests that have been tested for validity and reliability are proven to be valid and reliable for soccer players in Indonesia. The results of this study have implications for the agility test on soccer players namely; 1) the three agility tests studied had very high validity and reliability, 2) the Illinois Agility Test (IAT) had the highest level of validity and reliability compared to the Agility T-Test (ATT) and Boomerang Agility Test (BAT), 3). The results of this research also indicates that IAT was more suitable for estimating the agility of Wingers, ATT for Midfielders, and BAT for Forwards.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

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