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# FACTORIAL VALIDITY AND RELIABILITY OF AGILITY TEST OF NON-SPECIFIC AND SPECIFIC PRE-PLANNED FOR THE ATHLETE OF YOGYAKARTA, INDONESIA

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**Abstract:**
Agility is the most important aspect in the tennis court to support the athlete's performance, but there is a study focusing on the performance applying of agility especially for tennis and comparing it with the performance of non-specific agility which is equal. The aim of this research is to evaluate the factorial validity and reliability of the three agility tests which have been planned, conducted in the condition (with a tennis racket) and non-specific (without a tennis racket). The sample consists of 28 tennis players (15 males and 13 females; age 17 ± 1 year and 16 ± 1,2 years; height 160 ± 30 cm and 168 ± 7 cm, bodyweight 50 ± 5 kg and 52 ± 7 kg). The variable consists of three agility tests such as the 20-yard test, T-test and Illinois test, all tests were conducted with and without a racket. The reliability among and in the subjects was found high (Cronbach Alpha: 0,92 to 0,98; variation coefficient: 3 to 8 percent), with the reliability and stability for specific measurement. The correlation of non-specific and specific agility performance was high (≥0,83), meanwhile for factor analysis only one which was significant according to Guttman-Kaiser. The 20-yard test result was better when the test was conducted in certain conditions (T-test = 2,65; p <0,05). For the Illinois test, the good result was in non-specific condition (uji-t = 2,95; p <0,05), which was conducted with the duration 20 seconds and conducted in non-specific. The result of the test showed that the athlete having good agility will make the performance and pattern of playing to be maximal as well as support the athlete's prestige. In this founding, when conducting the agility test of pre-planned especially for tennis, it is suggested to use the test having a short duration which is less than 10 seconds and specific sport kind which is corresponding with the sport to conduct the measurement of agility.

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**Keywords:** educational research, experimental approach, quantitative tradition

## 1. Introduction

Agility can be defined as the ability to move fast and efficient to change the direction of movement speed (Sekulic et al., 2013). In general, agility is an important quality in most sports where the planned and unplanned direction change which is fast and efficient is needed (Sattler dan Sajber, 2015; Sole et al., 2013). To differentiate clearly between the capacity of an athlete: (i) has the rate of knowledge about the direction change that is needed (i.e., the agility that has been planned before); and (ii) have no idea about the information but should react to the stimulus (most of them is visual) that could be predicted (unplanned agility), the term of Change of Direction Speed) and reactive agility is used (Sekulic et al., 2016).

Tennis is a sport where both types of agility (Change of Direction Speed and reactive agility) is important in the specific condition. We also evaluate the important relation in playing situations when the player is between the test observed in the children sample that is positioned on the frontcourt and exchange shots of tennis players. The improvement of knowledge in a relatively close distance possibly makes the test is more meaningful of the agility, the player should react fast in tennis and give the basis for the opponent's shot conditioning and change it efficiently to improve the agility in this sport. Meanwhile, when both players are positioned in the backcourt and deep shot, in this position, the ball needs the time which is relatively long to go to the player. This case possibly makes the player determine the right position to do the shot and, in this case, it needs reactive agility (Sekulic et al., 2014).

The previous study has shown that the performance of different agility cannot be observed as a unique quality (Sekulic et al., 2013). The performance of different agility is found rarely, it really depends on the type of movement involved in each agility. In the direction change that includes in performance indicator (single direction change versus several direction changes) (Sekulic et al., 2013). It is important that the study give proof of the potency of difference which is significant in agility.

In a certain sport such as tennis, squash or rugby, agility almost dominates when the athlete holds sports equipment (racket or ball). The equipment directly affects the technique of movement and generate the specific movement pattern. There are many studies that have observed repeatedly that agility is important in tennis (Bloomfield et al., 2007; Fernandez-Fernandes et al., 2016; Murphy et al., 2015), however, there only a few researchers that conducted the test directly with racket use (Barber- Westin et al., 2010; Filipcic et al., 2010). Moreover, there isn't a case study combining the performance of agility by using a racket and without a racket.

Therefore, the aim of this research is to evaluate the reliability and validity of several agility tests, conducted with and without racker. The researcher also evaluates the relation with the young athlete. The improvement of knowledge in sport will possibly make a good agility test and give the progress in this sport.

## 2. Method

The sample consists of 28 tennis players (15 male and 13 female, age 17 ± 1 year and 16 ± 1.2 years; height 160 ± 30 cm and 168 ± 7 bodyweight 50 ± 5 kg and 52 ± 7 kg). They all attain the age of 15 to 18 years old and have practised tennis for more than 8 years. When the evaluation, regular practice consists of 4 to 5 hours of systematic practice in a day, with one day off in a week. The most practice session is for tennis (80-90 percent) with the additional practice 10-20 percent of strength training. All participants are advanced tennis athletes and have participated in national and international events.

After assessing the normality (Kolmogorov-Smirnov), average and deviation standard for all variables. For all agility tests, reliability used Coefficient Variation (CV), Cronbach Alpha (CA) and Intra-Item Korelasi (Iirs) (Hopkins, 2000; Sattler et al., 2012). CA and Iir were counted to determine the reliability among the subjects, meanwhile, CV was counted to set the reliability of the test in the subject.

ANOVA was for repeated action and Tukey Post Hoc Test was used to detect the systematic bias between the individual trial test of each test (Hopkins, 2000; Sattler et al., 2012). To set the factorial validity of agility test, factor analysis with the criteria extraction of Guttman-Kaiser. Besides that, the relation between tests was determined by Coefficient Correlation Pearson (Sattler et al., 2012; Uljevic et al., 2013). The difference between the performance agility in the specific and non-specific test was evaluated by students T-test for the dependent sample. The statistical significance of $p< 0.05$ was set.

### 2.1 Procedure of test

Regardless of height and body mass (measured by the SECA scale and stadiometer; Seca, Birmingham, UK), the sample variable consists of three-item tests of agility: 20-yard test, T-test and Illinois test. All tests were conducted with and without a racket. All tests were conducted on a tennis court outdoor, wearing sports shoes they choose. When the evaluation, the temperature outside was 20-25° Celsius. All athletes did the test at the same time from 8 to 10 A.M. all tests were conducted in standard form by holding the tennis racket. For all tests, three times trials were conducted in rest time for 3 to 5 minutes between trials. The tests were conducted randomly for every participant, and half of the participants conducted the non-specific test 20-yard test, T-test and Illinois) and the test for tennis used the racket (R-20-yard, R-T-test, R-Illinois), meanwhile the other half of the participants perform the tests in the opposite order. During the test, the timing uses WIB (Western Indonesian Time) which is positioned with a height of 1 meter and a width of 3 meters. Time is measured with a precision of 0.01 seconds.

A warm-up was performed prior to the test and included 10 minutes of light jogging, mobility exercises and dynamic stretching. Before the test, the participants did a simulation with a slow tempo. The Illinois test is shown in Figure 1. The length of the path (distance between 1 and 2) is 10 meters, and the width (distance between 1 and 2) is 5 m. The track consists of cones 1,2,3,4,5,6,7,8 and the procedure where the athlete ran from number 1 to number 2, then 2 to 3, running between (3,4,5,6), then turning around

again through (6,5,4,3) runs between 3 and 7, and last ran between 7 to 8. A cone is used to mark all points (1 to 8). Cone (3,4,5,6) is 3.3 m apart. Participants started in a standing position.

For the 20-yard test (figure 1c), the athlete started with three cones, from point 1 run 5 yards to point 2, 10 yards against to point 3, and then running backwards 5 meters to point 1. This exercise tests lateral changes the direction and speed which is very commonly done in tennis. Timing started at the sound signal and stopped when the subject has crossed the starting line that was crossed earlier.

For the t-test (figure 1b), the four cones were arranged in T-shape, with cone (2) was located in 9.14 m from the cone (1), and two additional cones (3 and 4) located in 4.57 on both sides of the cone (2). The athlete ran forward from (1) to (2), rotated 4.57 to the left of the cone (3), rotated in 9.14 m to the right to cone (4) and ran again 4.67 m to the back left of the cone (2) before the end of the path backwards to the cone (1). Timing started at the sound signal and stops when the subject has crossed the line on their return.

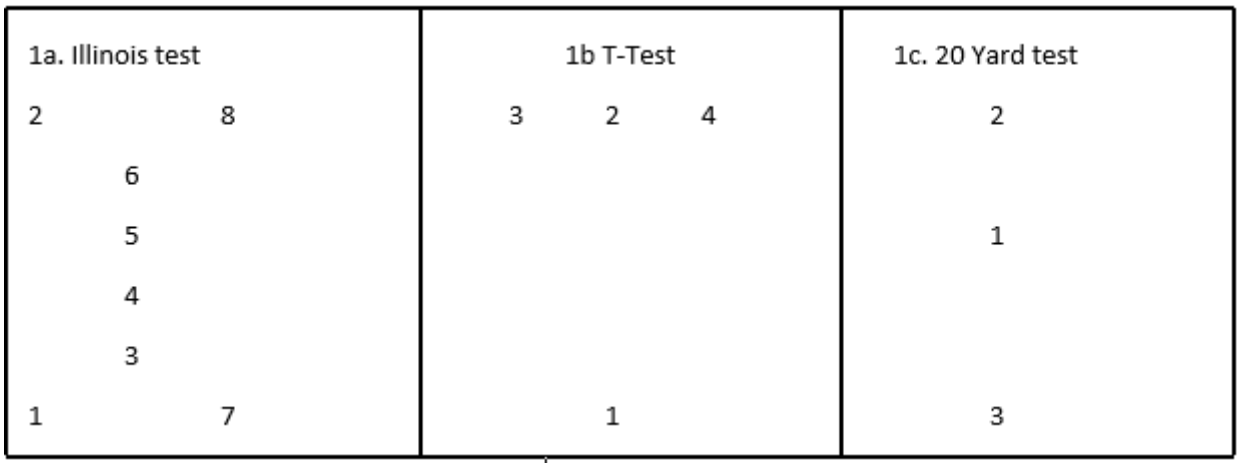


**Figure 1:** Construction of test

## 3. Result

The inter-subject reliability of the test was proved by Cronbach alpha and IIR ranges from 0. Each one from 0.92 to 0.99 and from 0.82 to 0.96. The highest reliability between subjects was found for T-TEST and R_ILLINOIS (IIR 0.88 and 0.88, Cronbach alpha 0.98 and 0.98, for T-TEST and R_ILLINOIS). The reliability in-subject as demonstrated by CV was generally found to be higher for agility tests conducted while holding a tennis racket (CV was 3-4percent) than when conducted under standard conditions, i.e., without racket (CV 5-8%) (Table 1).

When the ANOVA was calculated into the trials, the significance was found for all three types of agility tests performed without the racket. Post hoc analysis showed a significant difference between the first and second trials to be carried out under non-specific conditions, without significant difference between the second and third trials.

ANOVA did not show a significant difference between the test trials conducted with the racket.

The correlation between non-specific and tennis-specific agility performance was high (r 0.82) and statistically significant ($p < 0.05$). The strongest relation was found between the two T-test performances ($r = 0.98$; $p < 0.05$), while lower correlation was observed between the tennis-specific and non-specific Illinois agility tests ($r = 0.84$; $p < 0$ ,05) (Table 2). Factor analysis was calculated for all the extracted tests of one significant latent dimension - the factor, with all tests strongly projected on the extracted components. The latent explained 89 percent of the common variance of the common tests (Table 3). Players achieved much better results at the R_20YARD than at 20YARD (t-value = 2.65; $p<0.05$). At the same time, the performance in ILLINOIS was superior when athletes performed the test under non-specific conditions (without a tennis racket; t-value = -2.95; $p < 0.05$). There was no significant difference found between T-TEST and R_T-TEST (Table 4).

**Table 1:** The reliability analysis of agility test (CA - Cronbach Alpha, IIR – correlation between-item, CV - coefficient of variation)

| | **Value** | **SD** | **CA** | **IIR** | **CV** |
|---|---|---|---|---|---|
| 20 YARD | 5.25 | 0,33 | 0,92 | 0,82 | 0,06 |
| 20 YARDtrial1 | 5.65 | 0,40 | | | |
| 20 YARDtrial2 | 5.56 | 0,38 | | | |
| 20 YARDtrial3 | 5.55 | 0,44 | | | |
| T-TEST | 11,90 | 1.11 | 0,99 | 0,96 | 0,07 |
| T-TESTtrial1 | 12.30 | 1.00 | | | |
| T-TESTtrial2 | 12,45 | 0,98 | | | |
| T-TESTtrial3 | 11.96 | 1.09 | | | |
| ILLINOIS | 19.20 | 1.43 | 0,96 | 0,87 | 0,08 |
| ILLINOIStrial1 | 19.36 | 1.38 | | | |
| ILLINOIStrial2 | 19.55 | 1.37 | | | |
| ILLINOIStrial3 | 19.67 | 1,61 | | | |
| R_20YARD (s) | 5.30 | 0,32 | 0,97 | 0,88 | 0,02 |
| R_20YARDtrial1 | 5.40 | 0,38 | | | |
| R_20YARDtrial2 | 5.75 | 0,41 | | | |
| R_20YARDtrial3 | 5.65 | 0,34 | | | |
| R_T-TEST | 11.70 | 1.00 | 0,98 | 0,92 | 0,05 |
| R_T-TESTtrial1 | 12.30 | 1,11 | | | |
| R_T-TESTtrial2 | 12.20 | 1,14 | | | |
| R_T-TESTtrial3 | 12.35 | 1.12 | | | |
| R_ILLINOIS (s) | 19.30 | 1.20 | 0,98 | 0,94 | 0,04 |
| R_ILLINOIStrial1 | 19.40 | 1,51 | | | |
| R_ILLINOIStrial2 | 19.50 | 1,53 | | | |
| R_ILLINOIStrial3 | 19.69 | 1.42 | | | |

20 YARD - 20 yard agility test; T-TEST - agility test during the t-shaped course;
ILLINOIS - Illinois agility test; R_ - indicates agility tests performed under specific conditions ((athletes perform a tennis racket while performing tests.

Table 5 showed the ranking that those having good agility and were above the average of their friends will support a very significant game pattern, it has been proven that "famous" first rank in the average test has won the match among his peers. In addition, agility significantly affects the performance of playing tennis.

**Table 2:** Coefficient correlation of Pearson between the standard of agility test and tennis-specific (* showed a significant correlation in p<0.05)

| | R_20YARD | R_T-TEST | R_ILLINOIS |
|---|---|---|---|
| 20 YARD | 0,92 * | 0,85 * | 0.88 * |
| T-TEST | 0,92 * | 0,98 * | 0,94 * |
| ILLINOIS | 0,83 * | 0,85 * | 0,95 |

* 20 YARD – 20-yard agility test; T-TEST - agility test during the t-shaped course.
ILLINOIS - Illinois agility test; R_ - indicates agility test performed under certain specific conditions (athlete holding a tennis racket while performing the test)

**Table 3:** Factor analysis of standard agility test and specific tennis

| | |
|---|---|
| 20YARD | -0.91 |
| T-TEST | -0.97 |
| ILLINOIS | -0.954 |
| R_20YARD | -0.94 |
| R_T-TEST | -0.96 |
| R_ILLINOIS | -0.97 |
| Expl.Var | 7.04 |
| Prp.Totl | 0.87 |

* 20 YARD – 20 yard agility test; T-TEST - agility test during t-shaped course.
ILLINOIS - Illinois agility test; R_ - indicates agility test performed under certain specific conditions (athlete holding a tennis racket while performing the test)

**Table 4:** Difference of T-test between the performance agility of specific tennis and non-specific tennis

| | Meaningful | SD | Meaningful | SD | T value | hal |
|---|---|---|---|---|---|---|
| 20 YARD | 5.25 | 0,32 | 5.30 | 0,33 | 2.66 | 0,01 |
| T-TEST (s) | 11,90 | 1.00 | 11.70 | 1.11 | 1,00 | 0,21 |
| ILLINOIS | 19.20 | 1.20 | 19.30 | 1.43 | -2,96 | 0,01 |

20 YARD – 20-yard agility test; T-TEST - agility test during t-shaped course.
ILLINOIS - Illinois agility test

**Table 5:** T-test students For dependent sample (Without racket) specific tennis (With racket)

| No. | Name | Illinois | r Illinois | t test | r t test | 20 yard | r 20 yard | Number | Rank |
|---|---|---|---|---|---|---|---|---|---|
| 1 | KDG | 15,60 | 16,47 | 11,18 | 9,33 | 11,52 | 11,01 | 75,10 | 1 |
| 2 | MFT | 15,07 | 15,40 | 12,23 | 9,59 | 11,57 | 11,28 | 75,14 | 2 |
| 3 | YG | 15,33 | 15,73 | 9,91 | 9,30 | 12,51 | 12,36 | 75,14 | 3 |
| 4 | FBN | 15,73 | 16,37 | 12,89 | 9,53 | 10,69 | 10,41 | 75,62 | 4 |
| 5 | FZL | 15,80 | 16,17 | 11,11 | 9,87 | 11,68 | 11,47 | 76,10 | 5 |
| 6 | AGG | 16,80 | 17,43 | 10,75 | 9,62 | 10,98 | 10,62 | 76,20 | 6 |
| 7 | DF | 16,67 | 17,47 | 10,73 | 9,53 | 11,41 | 11,18 | 76,99 | 7 |
| 8 | FRD | 15,63 | 16,07 | 11,23 | 10,11 | 12,43 | 12,15 | 77,62 | 8 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | DN | 16,37 | 17,20 | 11,22 | 10,16 | 11,73 | 11,51 | 78,19 | 9 |
| 10 | IMN | 17,10 | 17,97 | 11,88 | 10,17 | 10,73 | 10,51 | 78,35 | 10 |
| 11 | KRS | 16,87 | 17,13 | 10,65 | 9,62 | 12,49 | 12,33 | 79,09 | 11 |
| 12 | RL | 16,07 | 16,37 | 12,92 | 10,12 | 11,96 | 11,69 | 79,13 | 12 |
| 13 | TLT | 17,20 | 17,87 | 10,50 | 9,42 | 12,37 | 12,03 | 79,38 | 13 |
| 14 | HFF | 17,10 | 17,60 | 11,46 | 10,20 | 12,22 | 11,97 | 80,55 | 14 |
| 15 | HNF | 17,50 | 18,13 | 12,60 | 9,73 | 11,56 | 11,26 | 80,77 | 15 |
| 16 | IRM | 17,83 | 18,60 | 11,98 | 9,47 | 11,65 | 11,45 | 80,98 | 16 |
| 17 | FTM | 17,60 | 18,37 | 12,64 | 10,03 | 11,48 | 11,29 | 81,39 | 17 |
| 18 | MS | 15,73 | 17,47 | 11,84 | 9,63 | 13,41 | 13,37 | 81,45 | 18 |
| 19 | SF | 16,80 | 17,80 | 12,85 | 10,00 | 12,38 | 11,94 | 81,77 | 19 |
| 20 | ALS | 17,87 | 19,00 | 11,09 | 9,31 | 12,41 | 12,19 | 81,87 | 20 |
| 21 | AML | 17,73 | 18,47 | 11,80 | 9,31 | 12,76 | 12,59 | 82,66 | 21 |
| 22 | SRLT | 17,50 | 18,30 | 12,53 | 9,77 | 12,57 | 12,31 | 82,98 | 22 |
| 23 | RFK | 17,87 | 18,23 | 13,04 | 9,45 | 12,38 | 12,30 | 83,28 | 23 |
| 24 | SYF | 16,47 | 17,63 | 11,71 | 9,66 | 13,94 | 14,10 | 83,50 | 24 |
| 25 | SNT | 17,43 | 19,20 | 11,43 | 9,75 | 13,58 | 13,05 | 84,44 | 25 |
| 26 | NBL | 17,43 | 18,67 | 11,63 | 9,75 | 13,87 | 13,28 | 84,63 | 26 |
| 27 | NF | 18,53 | 19,90 | 13,13 | 9,42 | 12,31 | 12,16 | 85,46 | 27 |
| 28 | LTF | 17,80 | 18,70 | 11,24 | 10,47 | 13,97 | 13,59 | 85,78 | 28 |

## 4. Discussion

There are several important findings in this research. First, the reliability of non-specific and specific agility tests applied with high quality. But non-specific agility test showed stability which is rather low during the trial and the reliability in the subject was still on a low scale from the specific agility test of tennis. The correlation among all tests showed that the test applied should be assumed as a unique quality, which is then checked by the expert. Finally, the young player's performance on the tennis court in the short duration of the agility test was better when the test was performed in a specific tennis test (holding racket during the test). Meanwhile, for the agility with longer duration, the superior performance was in non-specific condition (without racket).

### 4.1 Reliability in Test Application

In general, reliability is the main requirement of the test application due to reliability indicates the error in the test (Bellar et al., 2015; Uljevic et al., 2013; Waldron et al., 2014). It has been accepted widely that both subject and reliability are the important indicators of all the test quality uji (Idrizovic et al., 2015). In the short term of systematic change, the trial testing (systematic reduction in the performance due to the anxiety or systematic increase due to the learning effect) may do not always change the reliability between subjects (the subject maintains their relative achievement compared to another subject test). Meanwhile, the reliability in subject condition (relative change in every subject's performance) may become a question (Hopkins, 2000; Shrout dan Fleiss, 1979; Weir, 2005). Regarding this research both reliability in and between the subject were found

corresponding, the researcher underlined the measurement error from the test applied in evaluating the agility among young tennis players in advanced level.

Both kinds of agility that were evaluated with and without racket have reliability among the similar subjects as shown by the value of Cronbach Alpha and IIR. However, the agility test of specific tennis has better reliability in the subject (shown by CV). The detailed observation about the statistics test makes meaningful analysis of all findings. The finding of the difference between the trial showed a lower difference between the trial of specific tests. For instance, the difference for R_20yard is 1 percent (between trial 1 and trial 2), 1,4 percent (between trial 1 and trial 3) and less than 05 percent (between trial 2 and trial 3). At the same time, the difference between the trial for 20 yards is 3.4 and 1 percent of each. The participants are variative in performance when they were tested in the non-specific agility test. It showed that the reliability of the subject was stronger for specific agility performance.

The result showed that better reliability of specific agility test of tennis was consistent with the previous research researching the specific test of another kind of sport. For instance, Sisic et al. (2016) reported that the reliability of agility from a specific test of basketball that has been planned was better compared to the common procedure test in basketball juniors. A similar result was also proposed by Sattler et al. (2012) that conducted a study about non-specific jump tests in volleyball, and Peric et al. (2012) that compared the reliability of jump tests in the field and in the water for the swimmer. The agility test for tennis has better reliability than a standard agility test (non-specific), though the test for tennis is more complex at least it is more difficult than the standard test. When conducting the test for tennis, the subject should run and make a direction change of movement with the racket, the racket length is 70 cm having a weight 300-350 grams.

The result of the test showed that the ability of agility affects the athlete's performance in doing the tennis court game. The case was proven by the famous first ranked having good agility in his game, he was also agile in making a move. From this case, it can be concluded that agility affects tennis court games.

### 4.2 The Validity Test Applied

In this article, the test observed was found the correlation. Moreover, the analysis factor identified that all tests were designed significantly from a single point of view (component factor analysis). The result is all agility tests used in this research should be assumed as single capacity size. This result is contrary to the result of a previous study observing the athlete from a different kind of sport and it reported a relatively low correlation between various agility of performance. In this study, the researcher observed various agilities corresponding to the several movement patterns in various agility tests (movement rotation, zig-zag, walk back and forth, stop and so on) identified the point of view which was relative and interpreted the agility (Metikos et al., 2003; Sekulic et al., 2013). However, the main explanation of several differences between the finding and the previous result study should be found in the sample from the subject tested. In summary,

the sample in the previous study included athletes from different kinds of sports (basketball, football, handball, tennis), meanwhile, the researcher only examined the tennis player (Metikos et al., 2003; Sekulic et al., 2013).

To apply that different sport, develop specific agility for sport such as running back and forth in basketball, zig-zag agility in football, etc. As indirectly confirmed in a recent investigation where the author developed a specific agility test for handball, that emphasize on movement agility are important in lateral sports. (Spacic et al., 2015). In these studies, including athletes from different sports, the relatively low correlation between different agility tests is a natural development consequence of the development of some specific agility types (Metikos et al., 2003; Sekulic et al., 2013). For example, football players achieve the best result in zig zag agility, while basketball players show good agility for back and forth running and T-Test (Metikos et al., 2003; Sekulic et al., 2016). It naturally results in relatively low correlations between different agility tests and causes differences in agility as an individual quality. Unlike the research mentioned above, the researcher only observed tennis players. During their involvement in tennis, they develop the specific agility of the sport. Therefore, agility performance in one test will almost certainly be related to agility performance in another. Although there are different patterns in agility.

### 4.3 The Performance Difference Between Specific and Non-Specific Test

The subject achieved a good result in the 20-yard test when performing with a racket, compared to doing without a racket. We should note that the 20-yard test includes changes in direction made after the first 5 (first) and 10-yard changes of the maximal semi-lateral sprint. Therefore, it can be hypothesized that holding a racket in one's hands requires concentration, whereas our results point to the opposite conclusion. Although it was surprising, these results are a natural consequence of long-term involvement in tennis.

The players involved in this research have more than 8 years of practice experience. During this period, they participated in thousands of hours of systematic training and tennis matches. In almost all situations and situations when they must make a quick change of direction, they do it while holding the racket in their hands. As a result, agility performance without a tennis racket will affect their hands, as they are used to using rackets with various movement patterns. This is directly in the reliability analysis where we found better in-subject reliability (i.e., good reliability) for the tennis-specific test. As a result, the agility performance of tennis using a racket and without a racket does not affect or be burdened by the racket.

The findings in the Illinois test, where the subject achieved significantly better results than the non-specific (without the racket) were the results of (i) test and (ii) the non-specific movement pattern (i.e., a form of motion) in this test. The Illinois test lasted about 20 seconds, which is four times longer than the 20-yard test. The longer the duration of the test, the worse the burdensome effect of the external load (tennis racket).

With a duration of 20 seconds, the Illinois test requires a significant contribution of lactate metabolism ((McArdle et al., 2006). Therefore, the effect of the racket is clearer.

There is an argument that people play tennis for no more than 20 seconds, and it is unusual, therefore a test of such duration should not be considered problematic for tennis players. Meanwhile, we can agree with such criticism that the patterns contained in tennis have many developments. The Illinois test itself consists of a form of locomotion that can hardly be seen as the standard for tennis. In short, rotational motion doesn't really exist in tennis. While such movements are partly a form of natural locomotion used in daily life.

### 4.4 The Limitation of Study

The main limitation of this study arises from the fact in the field that we learn through tests that require agility. While the performance of agility is an important factor in tennis performance. This study involved young tennis players. Regarding the limited number of studies investigating this issue in tennis and other sports where agility is specifically exercised (using equipment or racket). Hopefully, this article can contribute to the field.

## 5. Conclusion

The test used in this research can be relied on and applied to measure the agility that has been planned before in young tennis players. Our opinion is that the agility performance in tennis should be evaluated with the test on the athlete, bringing in outside room and perform manoeuvres by holding the tennis racket. In testing the agility for tennis, the test is suggested in a short duration (less than 10 seconds). Long test duration will produce the result in higher lactate anaerobic metabolic demands. Advanced lactate resistance effects that should be avoided is if the goal is agility.

The different agility is successful observed in this research, bringing the conclusion that various kinds of movement patterns can be used in agility tests of tennis players. The performance of agility can be effective if the locomotor body movement is corresponding to the movement of the sport. In this research, it was found that the athlete named Kondang had good agility compared with his friends, as evidenced by ranking one. His agility and performance are really good, with good agility carrying capacity, obtained the performance to make transfers and the carrying capacity of playing on the field is maximized so as to support technique and tactics.

### Conflict of Interest Statement

The authors declare no conflicts of interest.

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