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Yo-yo intermittent recovery test level 1 for young soccer player: Test-retest reliability

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Abstract: The data of intermittent endurance for soccer player is very needed by soccer coach to design the next training program. Therefore, a reliable instrument is needed to measure the endurance capacity. This study was aimed at examining the reliability of Yo-Yo Intermittent Recovery Test Level 1 (YYIRT Level 1) for amateur young soccer player aged 19 to 22 years. The players were devided into two groups, namely U-21 and U-23, and were instructed to complish three YYIRT Level 1 in three weeks. The comparison of mileage from the two groups was used to test the reliability of YYIRT Level 1 by using typical error (TE), coefficient of variation (CV), and intra-class correlation (ICC). The results showed that the average distance for YYIRT Level 1 performance in the U-21 and U-23 groups was 2404 ± 337 meters and 2475 ± 347 meters, respectively. Varying results were also reported for TE between 75 and 173 meters, CV between 3.0 and 6.9%, and ICC between 0.87 and 0.95 across age groups. Therefore, the performance of YYIRT Level 1 has proven to be very reliable in a sample of young soccer players, aged between 19 and 22 years. The intermittent endurance capacity shown in all age groups can be applied for measurements on other young players, both for determining prospective players and comparing performance between players.

Keywords: field test, endurance, soccer, young player

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INTRODUCTION

Soccer is a competitive sport that continues to experience an increase in the intensity of game tempo (Bush et al., 2015). As a result, the game has become faster and more demanding, requiring players to maintain a high level of fitness throughout. In other words, soccer belongs to the sport with high-intensity explosive (Rivilla-García et al., 2019). This explosive nature challenges players to constantly adapt, adjusting their pace and intensity depending on the flow of the game. Therefore, each player needs physical condition to be able to implement playing scheme effectively (Syafi'i & Setiawan, 2019). A well-rounded physical preparation enables players to execute complex tactics while maintaining peak performance levels, which is crucial during both offensive and defensive phases of the game. Agility, power, coordination, speed, strength and endurance are the physical components with endurance becomes an essential aspect (Guntoro et al., 2020). Among these components, endurance plays a pivotal role in sustaining overall performance, particularly in the later stages of a match when fatigue sets in. The energy systems used during the game of soccer include the aerobic and anaerobic systems (Suryadi et al., 2023). The balance between these systems is critical, as players must transition between aerobic endurance for longer periods of running and anaerobic bursts for explosive movements like sprinting and shooting.

The use of the aerobic system in soccer can be seen when players are jogging during the game (Purba & Setiowati, 2022). Jogging helps maintain a steady pace, allowing players to recover between

high-intensity efforts and ensuring they remain effective throughout the match. In addition, players are also required to have anaerobic endurance to be able to play more competitively (Aguiar et al., 2013)(Dolci et al., 2018). Anaerobic endurance becomes particularly important in the game's high-intensity moments, such as during sprints, tackles, and goal-scoring opportunities. The anaerobic endurance, also known as special endurance, is a fundamental fitness component needed in the soccer, both in the context of talent identification and the selection system for young players (Deprez et al., 2014). This component helps young players maintain peak performance even during intense, short bursts of activity, which are crucial for their development and success in competitive environments. The anaerobic endurance is also a strong asset for playing with submaximal and maximum intensity (Donie et al., 2021). Players who possess exceptional anaerobic endurance are able to exert themselves in short, intense efforts repeatedly, without a significant drop in performance. Thus, Endurance in soccer must be trained and developed since it has a positive impact on the technical and tactical performance of players (Warni et al., 2017). Endurance allows players to maintain their decision-making abilities, execute precise skills, and adhere to tactical strategies, even as fatigue sets in later in the game.

The development and application of sports science in soccer can be seen from various data findings through the results of individual and team performance analysis (Chandra et al., 2022). This data-driven approach has transformed the way coaches and analysts assess player capabilities, providing deeper insights into strengths and areas for improvement. Monitoring player performance during training or matches using Global Positioning System (GPS) is a form of tracking and analyzing the physical performance of soccer players (Castillo et al., 2020; Dios-Álvarez et al., 2023; Nosek et al., 2021; Núñez et al., 2018). GPS technology has enabled coaches to monitor players in real-time, ensuring that they are performing at their optimal levels throughout the game. It has been reported that young players in a match cover an average running distance of 9.9 km with very high intensity reaching more than 16 km h-1 (Buchheit & Mendez-Villanueva, 2014). This running distance and intensity are key indicators of the physical demands placed on soccer players, highlighting the importance of conditioning to sustain performance over the course of a match. Therefore, coaches are required to have data about the endurance capacity of each player through a measurement process. By tracking endurance metrics, coaches can identify potential areas of improvement and create personalized training regimens tailored to each player's specific needs. Traditionally, there have been many tests used to evaluate the endurance of soccer players. These tests provide valuable baseline data, but with advancements in technology, more precise methods have emerged. In order to meet the specification elements and endurance characteristics specific to the soccer, Yo-Yo intermittent recovery test (YYIRT) was developed and has been used to measure the endurance level of soccer players (Bangsbo et al., 2008; Mohr & Krustrup, 2014; Buchheit & Rabbani, 2014). The YYIRT has become a standard in soccer fitness assessments, as it effectively simulates the stop-and-start nature of the game, providing a reliable measure of players' aerobic and anaerobic capacity.

In the last two decades, YYIRT has been studied intensively in various age groups (Hammouda et al., 2013; Leão et al., 2022; Michailidis, 2024), in female soccer players (Lockie et al., 2016; Lockie et al., 2017), and in both elite and non-elite players (Oberacker et al., 2012), as well as in smokers and non-smokers (Boussetta et al., 2019). YYIRT is known as a type of test to evaluate the endurance capacity of athletes, which is divided into two categories, namely YYIRT Level 1 and YYIRT Level 2. With the character of soccer which has high intensity activities and short rest periods (active), YYIRT becomes more relevant for measuring the endurance capacity of soccer players. YYIRT has also been reported as a valid field test used to describe endurance capacity (Dugdale et al., 2019).

Besides its validity, the reliability of an instrument also needs to be known. The level of reliability of an instrument in sports science is very important to be obtained (Garcia-Ramos & Janicijevic, 2020). The trainer needs to know the causes of the endurance improvement whether it is due to the treatment process or an error during measurement. It has been reported previously that the test-retest reliability of YYIRT on 24 young soccer players (aged 17 years) were good with a typical error of measurement value of 7.3% (Fanchini et al., 2014). Likewise, the results of test-retest reliability in three groups of young male players and males who are not active in sports, which stated that the intraclass correlation coefficient value was very good in both groups, namely in the range of 0.844 – 0.981 (Póvoas et al., 2016). It means that YYIRT performance is reliable for soccer players aged 9 – 16 years and boys who are not active in sports. However, there are still limited reports on the reliability of YYIRT in amateur

young soccer players aged 19-22 years (U-23). Therefore, the aim of this study was to examine the test-retest reliability of YYIRT (mileage) in amateur young soccer players (U-21 dan U-23).

METHODS

Design of this research used test-retest to examine the reliability of YYIRT Level 1. This research involved 40 Undiksha FC players, which is an amateur football club that competes in Indonesian League 3, aged from 19.1 to 22.5 years. Players are divided into two groups based on their age, namely players born in 2004 and 2005 are included in U-21 group (aged 19.9 ± 0.5 years), and players born in 2002 and 2003 are included in U-23 group (aged 22.1 ± 0.4 years).

All participants completed YYIRT Level 1 for 3 times in 3 consecutive weeks in September 2024 according to the protocol (Krustrup et al., 2003). All participants were advised not to exercise at high intensity in 48 hours before the test. However, the participants were still advised to train normally and maintain training habits a week before the first test and during the week between the second and third test sessions. The test was done on the same place, which is in Undiksha football court, at 04:00 p.m. with sunny weather conditions and the environmental temperature around 290C. Before doing the test, the participants warmed up using the RAMP protocol, and used the same soccer shoes in all the test session.

Data from the two age groups were analyzed separately to determine the reliability of YYIRT Level 1 (mileage). Reliability test was done using the comparative data from the three YYIRT sessions. Intra-class correlations (ICC) were used to determine the relative reliability values. According to Fleiss (1986), a value between 0.75 and 1.00 is categorized as excellent category, a value between 0.41 and 0.74 is in the good category, and a value between 0.00 and 0.40 is in the poor category. Then, typical error (TE) dan coefficient of variation (CV) were calculated to determine absolute reliability (Atksinson & Nevill, 1998). All the reliability calculation (ICC, TE, CV) accompanied by 90% confidence intervals (CI).

RESULTS AND DISCUSSION

This The mean score of YYIRT Level 1 performance for U-21 group is 2404 ± 337 meters and for U-23 groups is 2475 ± 347 meters (table 1). The ICC in this group is in the excellent category and varies between 0.87 and 0.95. TE (accompanying CV) for YYIRT Level 1 differences between sessions 1 and 2 were 102 m (6.8%) and 107 m (4.1%); between sessions 2 and 3 were 78 m (3.1%) and 75 m (3.1%); and between sessions 1 and 3 were 127 m (5.4%) and 173 m (6.9%).

This study was aimed at examining the reliability of YYIRT Level 1 on 40 amateur young soccer players, Undiksha FC, aged 19 to 21 years. During 3 sessions in 3 weeks the test was done, the overall results were that YYIRT Level 1 was reliable with CV values are between 3.0 and 6.9% in both age groups. The relative reliability value in each age group also shows the excellent category (ICC is in between 0.87 and 0.95). Based on these results, the use of YYIRT Level 1 was declared reliable to be used in measuring and evaluating intermittent endurance capacity in amateur young soccer players.

Nothing has been found so far regarding the test-retest reliability of YYIRT Level 1 for amateur soccer player aged U-21 and U-23. Thus, this research is the first research, because the previous report was more about examining the reliability of YYIRT Level 1 performance in a group of young players aged 6 – 9 years (Ahler et al., 2012), elite players from one of the Belgian U-15, U-17 and U-19 League clubs (Deprez et al., 2014), student soccer players who have elite and non-elite status in Japan (Ueda et al., 2011), and elite U-17 players (Michailidis et al., 2020). Although it has been previously reported about YYIRT Level 1 reliability results in elite young players, this current performance is almost identical between the amateur U-23 and elite U-19 groups in Belgium.

The reliability results of YYIRT Level 1 in amateur soccer players provide benefits to coaches in evaluating players' intermittent endurance. The character of today's soccer game is classified as high-intensity interval training (Papanikolaou et al., 2021), characterized by repeated speed actions, which are sometimes interspersed with walking or jogging (Kinnerk et al., 2018). The YYIRT Level 1 character is the same as that of a soccer player during a match. So it is important to choose a type of test that reflects the movement needs and energy systems of the player during a match. Although there are various types of endurance tests, both field-based tests such as the Cooper 12-minute run test (Martinez-Lemos & Rodriguez, 2024), multi-stage fitness test (Bok & Foster, 2021), and lab-based tests such as on a

treadmill, of course, coaches must be able to choose the type of test that is closest to the character of their sport. The current findings also confirm that YYIRT Level 1 has proven to be reliable and consistent over time. It is important for researchers or practitioners in the field to use objective and consistent instruments in showing their results in order to be trusted and to be more confident in making decisions based on the test results in question.

Table 1. Mean (SD) for YYIRT Level 1 Distance for Each Test Moment with Pairwise Typical Errors (90% Confidence Interval), Coefficients of Variation (90% Confidence Interval), and Grand Mean Intra-Class Correlation (90% Confidence Interval) Between the Three Test Moments

Variable	Age Category	n	Sesi 1 mean (SD)	Sesi 2 mean (SD)	Sesi 3 mean (SD)	Grand Mean mean (SD)	TE (abs) 1-2 (90% CI)	CV (%) 1-2 (90% CI)	TE (abs) 2-3 (90% CI)	CV (%) 2-3 (90% CI)	TE (abs) 1-3 (90% CI)	CV (%) 1-3 (90% CI)	ICC (90% CI)
YYIRT Level 1 (m)	U-21	22	2280 (357)	2486 (322)	2428 (360)	2404 (337)	102 (75-168)	6.8 (4.1 – 7.0)	78 (57 - 127)	3.1 (2.3 – 4.8)	127 (93 – 208)	5.4 (3.9 – 8.8)	0.95 (0.87 – 0.98)
	U-23	14	2610 (266)	2680 (314)	2380 (415)	2547 (347)	107 (67 – 313)	4.1 (2.5 – 11.8)	75 (47 – 218)	3.0 (1.8 – 8.6)	173 (107 – 500)	6.9 (4.3 – 2.1)	0.87 (0.41 – 0.99)

This finding completes previous findings regarding the examination of YYIRT Level 1 as a reliable instrument in measuring the fitness or endurance of soccer players with different status (recreational-competitive), age and type (Schmitz et al., 2018). The consistency of these results can also be seen from previous findings regardless of participants' experience with the type of test or other variables (Grgic et al., 2019). This finding also confirms previous findings that test selection must be done by considering several features that support the purpose of the test, the validity and reliability of the test, and its sustainability (Póvoas et al., 2016; Póvoas et al., 2019). The limitation of this study is that the response measurement to heart rate has not been reported due to limited of resources. Besides, the participants' familiarity with the test protocol is also a consideration with the hypothesis whether there is an impact of differences in experience joining YYIRT. As stated in (Dobbin et al., 2018) finding which gives participant opportunity to try twice before test.

CONCLUSION

This study focused on the correlation between dietary inflammatory index (DII), body composition, physical activity, and hs-CRP levels. The results showed that there is no correlation between body composition and physical activity with hs-CRP. However, the study found a correlation between DII scores and hs-CRP levels. The male group had the most anti-inflammatory diet compared to females, but there was no significant difference. DII scores can be used to measure the correlation between diet and inflammatory events. Future longitudinal studies using large populations of adolescent athletes are warranted to elucidate the role and mechanism of anti-inflammatory and pro-inflammatory diets on inflammatory events. In addition, examining the relationship between DII scores and athletes' performance is necessary.

CONFLIC OF INTEREST

There are no conflicts of interest related to this research or the publication of this manuscript

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