Turkish Journal of Sport and Exercise /
Türk Spor ve Egzersiz Dergisi
http://dergipark.gov.tr/tsed
Year: 2024 - Volume: 26 – Issue 2- Pages: 230-235
10.15314/tsed.1496858

Turkish Journal of Sport and Exercise
Türk Spor ve Egzersiz Dergisi
ISSN: 2147-5652
https://dergipark.org.tr/tr/pub/tsed

Investigation of the relationship between yo-yo intermitted rest test results and performance in soccer players

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Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

(Date Of Received): 06.06.2024 (Date of Acceptance): 22.08.2024 (Date of Publication): 31.08.2024
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Abstract

The purpose of your study; The aim is to determine the relationship between aerobic endurance and the performance of football players. 30 licensed male football players (age 18,33±0,47 years, height 179,5±10,6 cm, body weight 76,6±11,5 kg) playing in the Turkish Football Federation U-19 Development League voluntarily participated in the research. Football players' Yo-Yo IRT1 test was measured twice at eight-week intervals on an artificial football field. During the test, Heart rate (HR) (beats/min) and afterwards Maximal Aerobic Power (VO_2max) values were measured and calculated. IBM SPSS Statistics v29.0 (IBM Corp., USA) was used for statistical tests. Paried T-test, one of the parametric tests, was used to determine whether there was a difference in terms of Yo-Yo IRT 1 test, VO_2max values and pulse values. All analyzes were processed at the 0.05 significance level. In conclusion; There is no statistically significant difference $p>0.005$ between the first and last values of the distances traveled by the football players who were subjected to the Yo-Yo IR1 test first and last measurement test, their HR and their measured VO2max values.

Keywords: Football, aerobic endurance, performance.

Futbolcularda Yo-Yo Aralıklı Dinlenme Test Sonuçları ile Performansları Arasındaki İlişkinin İncelenmesi

Özet

Çalışmanı amacı; aerobik dayanıklılık ile futbolcuların performansları arasındaki ilişkinin belirlenmesidir. Araştırmaya Türkiye Futbol Federasyonu U-19 Gelişim Liginde oynayan (yaş 18,33±0,47 yıl, boy 179,5±10,6 cm, vücut ağırlığı 76,6±11,5 kg) lisanslı 30 erkek futbolcu gönüllü olarak katılmıştır. Futbolcuların Yo-Yo IRT1 testi suni futbol sahasında sekiz hafta aralıklarıyla iki kez ölçülmüştür. Test sırasında Kalp atım hızı (KAH) (atım/dk) ve sonrasında Maksimal Aerobik Güç (VO_2max) değerleri ölçülüp hesaplanmıştır. İstatistiksel testler için IBM SPSS Statistics v29.0 (IBM Corp., ABD) kullanıldı. Yo-Yo IRT 1 testi, VO_2max değerleri ve nabız değerleri bakımından fark olup olmadığının belirlenmesinde parametrik testlerden Paried T-testi kullanılmıştır. Tüm analizler 0,05 anlamlılık düzeyinde işlenmiştir. Sonuç olarak; Yo-Yo IR1 testi ilk ve son ölçüm testine tabi tutulan futbolcuların test sonucunda kat ettikleri mesafelerin ilk ve son değerleri arasında ayrıca KAH arasında anlamlı fark bulunmuşken $p<0,05$, VO_2max değerleri arasında ilk ve son ölçümler arasında istatistik olarak anlamlı bir fark $p>0,05$ yoktur.

Anahtar Kelimeler: Futbol, aerobik dayanıklılık, performans.

INTRODUCTION

Football is a physically demanding sport characterized by high-intensity activities interspersed with submaximal periods (16). Many laboratory and field test protocols have been developed to assess aerobic capacity and endurance. In recent years, different training methods such as endurance training, high-intensity interval training (HIIT) and strength training have been proposed to improve physical, technical and tactical skills (9). Football matches consist of intermittent and dynamic movements (running, jumping and kicking) interspersed with low-intensity periods with changes in speed and direction from high to maximum intensity (1). Therefore, physical performance in football is largely dependent on intermittent exercise (13).

The Yo-Yo Intermittent Recovery Test Level 1 (YYIR1) is a fitness test that can conveniently and accurately measure intermittent exercise fitness in team athletes (2). Previous studies have shown that the YYIR1 is a reliable and valid field test for the assessment of fitness in field soccer players (13,19). Aerobic endurance is crucial for endurance sports, where oxygen must be supplied at all times to release energy from muscle materials. The Yo-Yo IR1 test offers a novel and potentially practical approach to routinely assess the physical response to intermittent exercise in young soccer players (7). Therefore, a person needs to have a good VO2 max to be able to do activity for a long time. This requires the development of aerobic endurance training first, then anaerobic endurance training (22). Frequently used interval elite football tests. Speed endurance training is an important training that allows elite football players to improve their match performance throughout the year. This type of training is highly recommended for top-level professional players. It is very important to see a very high increase in the number of accelerations per match during the period in question with the implementation of speed endurance training (12).

The purpose of your study; The aim is to determine the relationship between aerobic endurance and the performance of football players.

METHOD

Study Group

The study included 30 volunteers who are licensed Isparta 32 Sports male football players playing in the U-19 Development League.

Procedure

The first measurements were taken at the beginning of the second week of the preparation season, the second measurements were taken at the eighth It was conducted after 1 week. The Yo-Yo IRT1 test was applied to the football players. Wimu Fit (Spain) brand athlete tracking system devices were used to measure their pulses during the tests.

Yo-Yo Intermittent Recovery Tests (YIRT1): The Yo-Yo IRT1 test consisted of 2 x 20 m shuttle runs, repeated at an increasing speed, controlled by audible beeps (13). Between each running competition, the players were given a 10-second active rest period in a 5 m area where they were encouraged to walk or run. The test was terminated when the players could not complete the 2 x 20 m track in the desired time twice and the distance covered was recorded. Heart rate was recorded throughout the entire fitness trial. Maximal Aerobic Power (VO2max) capacity, which determines the capacity of the heart, lungs and blood to carry oxygen to the working muscles and the oxygen use of the working muscles during exercise, was calculated using the formula used by Bangsbo et al. (2). All tests were conducted on the artificial turf where football players train and play official matches.

VO_2max= 24.8+(0.014x Running distance)

Statistical Analysis

SPSS 29 statistical package program was used to evaluate the data. Descriptive statistics method was used to calculate mean and standard deviation values for all variables. Shapiro Wilk test was used to determine whether the data showed normal distribution. Since the data showed normal distribution, Yo-Yo IRT 1 test, Paried T-test from parametric tests were used to determine whether there was a difference in VO2max values

and HB values and correlation test was used to compare the positions. All analyzes were processed at 0.05 significance level.

Ethical approval and institutional permission

The study was conducted with the permission of Süleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee dated 29.12.2023 and numbered 357.

FINDINGS

Table 1. Demographic characteristics of football players

Variables n=30	**Mean SD**	**SS**
Age (years)	18,33	,479
Height (cm)	179,5	10,6
Body Weight (kg)	76,2	11,5

Table 2. Distribution of football players according to their positions

Variables n=30		**n**	**f**
Position	Defender	6	%20
	Forvet	10	%33,3
	Goalkeeper	5	%16,7
	Midfield	9	%30
Total		30	% 100

Of the football players participating in the study, 5 were goalkeepers, 6 were defenders, 9 were midfielders and 10 were forwards.

Table 3. Test data of football players (Paried T-test)

Parameter (n 30)	**Mean ±SS**	**MD**	**t**	**p**
Yo-Yo IR1 test (First Measurement)	2173,3±705,82			
Yo-Yo IR1 testi (Second Measurement)	2559,3±663,3	-386	-4,90	**,001**
HB (beats/min) (First Measurement)	178,3±10,11			
HB (beats/min) (Second Measurement)	172,1±12,05	6,2	4,200	**,023**
VO_2max (First Measurement)	57,64±12,05			
VO_2max (Second Measurement)	58,57±7,8	-0,9	-,688	,770

There is no statistically significant difference between the first and last values of the distance covered by the football players who were subjected to the first and last measurement test of the Yo-Yo IR1 test. Similarly, there is no statistically significant difference between the first and last measurements between the pulse values and the measured VO_2max values. p>0.005.

Table 4. Correlation between pre-test values

Variables	X	SS	1	2	3
Yo-Yo IR1 (m)	2173,3	705,82	1		
HB (min/beat)	178,3	9,73	0,142	1	
VO_2max (ml / kg / min)	57,64	12,05	,888**	0,135 1	57,64

Note: Yo-YO IR1: Intermittent Recovery Test (m), HB: Heart Rate /min/beat), VO_2max; Maximal Aerobic Power (ml/kg/min) **p<0,01, *p<0,05

Table 4 shows the correlation analyses between the variables. A positive relationship was found between the intermittent recovery test variable and maximal aerobic power (r=0.888, p<0.01).

Table 5. Correlation between post-test values

Variables	X	SS	1	2	3
Yo-Yo IR1 (m)	2559,3	663,3	1		
HB (min/beat)	172,1	10,11	0,114	1	
VO2max (ml / kg / min)	58,57	7,82	,822**	-0,044	58,57

Note: Yo-YO IR1: Intermittent Recovery Test (m), HB: Heart Rate /min/beat), VO_2max; Maximal Aerobic Power (ml/kg/min) **p<0,01, *p<0,05

Correlation analyses between variables are shown in Table 5. A positive relationship was found between the intermittent recovery test variable and maximal aerobic power (r=0.822, p<0.01).

Graph 1. First and last test running distances of the positions

In Graph 1, the first and last measurement distance values are given according to the positions of the football players. When the distances covered between the tests are examined, the results seem to be in favor of the last values. When the differences between the positions are considered, we see that the defenders, forwards, midfielders and goalkeepers are ranked respectively. When looked at individually, we see that the midfielders made the best grades, and when looking at the averages, the defenders were in the first place in both tests.

DISCUSSION AND CONCLUSION

As a result of our study; a statistically significant difference p<0.05 was found between the distance covered and the first and last values of HB (beats/min) of the football players who were subjected to the first and last measurement test of the Yo-Yo IR1 test. VO2max values, which are an indicator of athletic performance, increased in favor of the last test between the first and last measurements, but a statistically significant difference p>0.005 was not found. We concluded that the Yo-Yo IR1 test has high discriminant and concurrent validity due to its ability to distinguish between players at different intra-league and inter-league competitive levels and its relation to other leagues. The Yo-Yo IR1 test can be considered an aerobic-anaerobic, football-specific field test (3). When the aerobic endurance of the football players between the two tests is considered, it is seen that some of them improved while some of them regressed. When the averages of all the players participating in the tests are taken and the Yo-Yo IR1 test results are examined, it is seen that the running distances of the football players did not improve and even regressed on average when the 8-week time evaluation is made. It is seen that there is a direct proportion between the ranking of the players of the team that finished the league as the leader and their performance. Our results show that the Yo-Yo IR1 is applicable in the endurance assessment of young and adult football players.

It has been shown that football players who achieve better results in Yo-Yo IR1 (i.e., have a higher level of specific endurance) can cover more total distance, perform more acceleration and deceleration, and cover

more high-intensity distance during exercise (14). Suryadi et al., indicated that endurance is one of the most important aspects of improving performance, that it is needed only for athletes or endurance athletes to maintain the physical and mental health of non-athletes, and that the YIRT1 test will give closer results in assessing only the endurance level in the assessment of VO2max endurance level (23, 8).

In conclusion, the application of Yo-Yo IR tests shows that football players increase both aerobic and anaerobic capacities. Yo-Yo intermittent recovery test level 1 (Yo-Yo IR1) is one of the most commonly used tests to monitor the ability to cope with intermittent exercise in team sports. Many studies in the literature support our result.

It is accepted that it has high discriminant and concurrent validity because it distinguishes between players at different intra- league and inter-league competitive levels and is related to other frequently used intermittent elite football tests (10,17).

The Yo-Yo IR1 test results may vary depending on many parameters. The psychological, physical and mental arousal of the football players is the biggest factor. When the performance of the football players is considered, it is quite variable throughout the season in a football league and is affected by the league ranking, the regularity of the competitive game and the playing position (16).

In our study, when we looked at the correlation between the Yo-Yo IR1 test data and the HR (min/beat) numbers, a negative relationship was observed. In order to follow the performance, the changes in HR should be followed and the presence of a negative relationship is quite sensitive and is recommended for monitoring the training (5).

It provides evidence that the Yo-Yo interval test reference values vary according to the type and level of the sport performed. The results presented can be used by practitioners, coaches, and athletes to rate Yo-Yo interval testing performance levels and monitor training effects (20).

We can use the Yo-Yo IR1 test to observe VO2max results and HB data and evaluate football players. Schmitz et al., 2020, stated that they used the Yo-Yo IR1 test to follow VO2max data in their studies (21,

15).

Several studies have examined the effect of high-intensity training through soccer-specific exercises, showing that it is possible to achieve high exercise intensity using a ball, as indicated by high heart rates, significant blood lactate accumulations, and high rates of perceived exertion (10). High-intensity shuttle running and explosive strength training are recommended to improve the ability of soccer players to move efficiently during matches (3).

Yo-Yo interval tests are simple, inexpensive, and allow multiple participants to be tested on the field simultaneously, and in team sports, performance on these tests is closely related to the amount of high-intensity running performed during matches for adolescents and adults. Yo-Yo interval tests are popular in soccer, and many studies have analyzed the reliability and validity of Yo-Yo interval tests for team sports athletes. Our study suggests that the Yo-Yo IR1 test can be used to determine aerobic and anaerobic endurance in young soccer players. In the literature, we can see that this test is used in many studies in the football branch. In terms of discrimination and match performance validity, the Yo-Yo test can be considered as a relevant field test to evaluate the endurance preparation of experienced football referees and a useful tool in talent selection (4).

Tests need to be done to follow the developments in macro and micro training programs and training practices. The Yo-Yo IR1 test is both reliable and very economical to follow a large number of athletes at the same time.

As a result, the motoric characteristics of football players required for training and matches must be worked on in a program-integrated and scientific manner. Tests are important for us to measure the efficiency of training. In our study, the efficiency of training content is sufficient or not when considering the performance of football players in matches. In this context, we believe that the Yo-Yo IR1 test is a good method to compare training efficiency and performance. The development and goodness of Yo-Yo IR1 test results can be considered as the performance being good in this direction.

REFERENCES

1. Bangsbo, J., & Michalsik, L. (2002). Assessment of the physiological capacity of elite soccer players. Science and football IV, 5362.
2. Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports. Sports medicine, 38, 37-51.
3. Castagna, C., Impellizzeri, F. M., Chamari, K., Carlomagno, D., & Rampinini, E. (2006). Aerobic fitness and yo-yo continuous and intermittent tests performances in soccer players: acorrelation study. The Journal of Strength & Conditioning Research, 20(2), 320-325.
4. Castagna, C., Abt, G., & D'ottavio, S. (2005). Competitive-level differences in YoYo intermittent recovery and twelve minute run test performance in soccer referees. The Journal of Strength & Conditioning Research, 19(4), 805-809.
5. De Freitas, V. H., Pereira, L. A., De Souza, E. A., Leicht, A. S., Bertollo, M., & Nakamura, F. Y. (2015). Sensitivity of the YoYo Intermittent Recovery Test and cardiac autonomic responses to training in futsal players. International journal of sports physiology and performance, 10(5), 553-558.
6. Delahunt, E., Callan, L., Donohoe, J., Melican, R., & Holden, S. (2013). The YoYo intermittent recovery test level 1 as a high intensity training tool: Aerobic and anaerobic responses. Preventive medicine, 56(5), 278-282.
7. Doncaster, G., Scott, M., Iga, J., & Unnithan, V. (2019). Reliability of heart rate responses both during and following a 6 min Yo-Yo IR1 test in highly trained youth soccer players. Science and Medicine in Football, 3(1), 14-20.
8. Gürses, V. V., & Akalan, C. (2018). Determination of Relationships Between Aerobic Performance, 20m Shuttle Run and YoYo Intermittent Recovery Tests in Basketball Players. CBU Journal of Physical Education and Sports Sciences, 13(1), 12-21.
9. Hammami, M., Negra, Y., Shephard, R. J., & Chelly, M. S. (2017). The effect of standard strength vs. contrast strength training on the development of sprint, agility, repeated change of direction, and jump in junior male soccer players. Journal of strength and conditioning research, 31(4), 901-912.
10. Ingebrigtsen, J., Bendiksen, M., Randers, M. B., Castagna, C., Krustrup, P., & Holtermann, A. (2012). Yo-Yo IR2 testing of elite and sub-elite soccer players: performance, heart rate response and correlations to other interval tests. Journal of sports sciences, 30(13), 1337-1345.
11. Izzo, R., & Giovannelli, M. (2018). Session RPE and Speed High Intensity Distance in Meters (D_SHI mt): A valid method to analyze training load in soccer players. Journal of Sports Science, 6(3), 159-164.
12. Izzo, R., Altavilla, G., Cejudo, A., Raiola, G., D'Isanto, T., & Giovannelli, M. (2020). Performance improvement in yo-yo intermittent recovery test Level 2 and during official matches: The role of speed endurance training production in Élite football players. Sport Mont, 18(3), 61-66.
13. Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., ... & Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. Medicine & Science in Sports &Exercise, 35(4), 697-705.
14. Modric, T., Versic, S., & Sekulic, D. (2021). Relations of the weekly external training load indicators and running performances in professional soccer matches. Sport Mont, 19(1), 31-37.
15. Michailidis, Y., Chavlis, S., Mitrotasios, M., Ispirlidis, I., Vardakis, L., Margonis, K., ... & Metaxas, T. (2020). The use of YoYo intermittent recovery test level 1 for the estimation of maximal oxygen uptake in youth elite soccer players.
16. Mohr, M., & Krustrup, P. (2014). Yo-Yo intermittent recovery test performances within an entire football league during a full season. Journal of sports sciences, 32(4),315-327.
17. Owen, C., Jones, P., & Comfort, P. (2017). The reliability of the submaximal version of the Yo-Yo intermittent recovery test in elite youth soccer. Journal of Trainology, 6(1), 31-34.
18. Papadakis, L., Tymvios, C., & Patras, K. (2020). The relationship between training load and fitness indices over a pre-season in professional soccer players. The Journal of Sports Medicine and Physical Fitness, 60(3), 329-337.
19. Rampinini, E., Bishop, D., Marcora, S. M., Bravo, D. F., Sassi, R., & Impellizzeri, F. M. (2006). Validity of simple field tests as indicators of match-related physical performance in top-level professional soccer players. International journal of sports medicine, 228-235.
20. Schmitz, B., Pfeifer, C., Kreitz, K., Borowski, M., Faldum, A., & Brand, S. M. (2018). The Yo-Yo intermittent tests: a systematic review and structured compendium of test results. Frontiers in physiology, 9, 870.
21. Schmitz, B., Pfeifer, C., Thorwesten, L., Krüger, M., Klose, A., & Brand, S. M. (2020). Yo-Yo intermittent recovery level 1 test for estimation of peak oxygen uptake: Use without restriction? Research Quarterly for Exercise and Sport, 91(3), 478-487.
22. Supriatna, E., Suryadi, D., Haetami, M., & Yosika, G. F. (2023). Analysis Endurance Profile (Vo2max) of Women's Volleyball Athletes: Yo-yo intermittent test level 1. Indonesian Journal of Physical Education and Sport Science, 3(1), 12-19.
23. Suryadi, D., Samodra, Y. T. J., & Purnomo, E. (2021). Efektivitas latihan weight training terhadap kebugaran jasmani. Journal Respecs, 3(2), 9-19.