Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVIII, ISSUE 2 Supplement, 2018, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

Science, Movement and Health, Vol. XVIII, ISSUE 2 Supplement, 2018
September 2018, 18 (2 supplement): 270 - 276
Original article

RELATIONSHIP BETWEEN MAXVO$_2$AND ANAEROBIC ENDURANCE

CEMALETTIN BUDAK[1], AHMET SANİOĞLU[2], MINE TAŞKIN[3], NADIDE ASLIHAN PEKTAŞ[4], MAYA BUDAK[1]

Objectives. The aim of this study was to examine of the effect of MaxVO$_2$ level on anaerobic endurance.

*Method of research***.** A total of 26 amateur male soccer players (mean ± SD; age: 22.00 ± 1.414 years; weight: 73.58 ± 7.596 kg; body height: 1.79 ± 0.083 m) volunteered to participate in this study.Anaerobic endurance was measured with three corner run test in FIFA test battery. Aerobic endurance was measured with Yo-Yo intermittent recovery 2 tests. Before measurements, soccer players carry out warm up for fifteen minutes. The pulse rate is measured rest, directly after warm up and anaerobic run finish via a heart rate monitor. Measurements were competition period. We used photocell, meter, slalom bar, cone and polar monitor for measurements. Height (m) was measured with an instrument sensitive to 1 mm. Their body (kg) weight was measured with participants dressed in only shorts (and no shoes) with an electronic weight-bridge sensitive up to 20 g ((Professional Sport Technologies, Sport Expert).

Results. There is a significant relationship between MaxVO$_2$ level and anaerobic endurance (F=5,729; P=0,025). Anaerobic endurance explained by MaxVO$_2$ as 19 %. Also, a unit increase in MaxVO$_2$ level lead to change 40% in anaerobic endurance.

*Conclusion***.** it is considered that anaerobic endurance explained by MaxVO$_2$ as 19 % and other parameters (strength, speed, quickness, agility etc.) 81%.

Key words: Aerobic; anaerobic; amateur; soccer.

Introduction

Anaerobic capacity is identified with the quantity of total energy because of the combination of anaerobic gliosis and phosphagen system (Rodgers,1990). According to other definition, it is quantity of ATP which is synthesized by anaerobic metabolism during the maximal activity that is show in short spans in exercises (Green,Hungson, Orr, Ranney, 1983). Aerobic strength is the ability of producing energy of muscle cell by aerobic in high intensity exercise and it is identified with consumption of maximum oxygen. Aerobic capacity is used as the synonym of durability and an exercise is identified with long time prosecution property in the same intenseness (Aşçı,2008). Aerobic capacity or aerobic strength is the capacity of oxygen usage of muscle tissue and transport of maximal oxygen. Aerobic strength is also important index of capacity of cardiovascular system. In endurance sportsmen, while cardiac outflow rises 5 times higher during doing exercise, in consequence of developing adaptation of cardiovascular system which is conformed with dynamic exercise with workouts, air volume that is ventilated in lungs rises 10-12 times higher (Yıldız, 2012). Development studies of aerobic capacity clarifies that it can be developed in the range of 170-175 atm /min and in the studies that is counterbalance to 80% of MaxVO$_2$ anaerobic metabolism, the most important factor that determines endurance performance, is the aerobic capacity which states to usage of long-time the highest percentage of MaxVO$_2$before beginning to be active. Aerobic capacity is related to relative percentage of maximal oxygen capacity, in other words, relative exercise density. Anaerobic steps, which is indicator of aerobic endurance performance, states the time when it counterbalances to revulsion rate with the production of lactate in the muscle cells during the strength workout attending of big muscle groups (Aşçı, 2008). Bangsbo, (2011) explains that workout development for anaerobic capacity must be planned as an continuousness in speed, overloads must be between 10 or 30 seconds in high intensity and also there must be 2 or 3 minute's relaxation (Delextrat and Cohen, 2008). Studies indicates that in the professional football 90 minutes matches is played with physiological loads corresponding to percentage of MaxVO$_2$ consumption as 75% or 80% and also 85% or 90% percentage of heart rate. This situation shows the energy that is needed for in the large part of matches can be supplied by aerobic energy metabolism. During matches, the periods, which players do high intensity activities in short spans, consist of the parts that determine the performances. On the other hand, it is not possible to

Institute of HealthScience, Dumlupınar University, Kütahya, Turkey.
[2]Faculty of SportSciences, Selçuk University, Konya, Turkey.
[3]School of AppliedScience, Selçuk University, Konya, Turkey.
[4]Institute of HealthScience, Selçuk University, Konya, Turkey
[3]Address correspondence toMine TASKIN: mtaskin@selcuk.edu.tr
[*] the abstract was published in the 18th I.S.C. "Perspectives in Physical Education and Sport" - Ovidius University of Constanta, May 17-19, 2018, Romania
Received 18 march 2018 / Accepted 6 may 2018

extend 90 minutes these kind of high intensity activities due to the increasing of accumulation of lactic acid in the muscle cells.

Throughout the matches, performance of these activities hinges upon players who can remove the capacity of lactic acid from the muscle cell and blood during the low intensity exercise and between high intensity movements. This fact is determined by endurance level and indicators of endurance performance are the notions of capacity and aerobic strength (Aşçı,2008). It is indicated that it is at the rate of probably 55-68 ml/kg/min in the sportsmen except goalkeepers, as well as the highest measured $MaxVO_2$ in the football studies is 80 ml/kg/dk(Aşçı, 2008).

In football player's snapback, anaerobic system plays an important role in the interference of backfield and attack checking out abruptly and also in terms of deflection, shooting the ball suddenly and rising for head goal (Kunter, 1997). Football players, who have a strength aerobic capacity, can remove the lactic acid from their bodies quicker and they can have a chance to pick themselves up earlier. Aerobic capacity of these football players helps them to seem more energetic and quicker during match when we compare with underdeveloped opponents (Sharky, 1986). Therefore, the aim of this study was to examine of the effect of $MaxVO_2$ level on anaerobic endurance.

Method

Experimental Approach to the Problem

This investigation involved sectional design to examine of the effect of $MaxVO_2$ level on anaerobic endurance. A total of 26 amateur soccer players were obtained. These soccer players are playing in third league of Turkey. The F-MARC test battery, which was designed by FIFA, was used for soccer players.

Subjects

A total of 26 soccer players were examined. These soccer players were playing in third league of Turkey. The mean (SD) age was 22.00±1.414 years, height was 1.79±0.083 m, and weight was 73.58±7.596 kg for the 26 soccer players. Before conducting the experiment, all subjects were informed of the risks of the study and gave informed. The study was approved by a local ethics board and met the conditions of the Helsinki Declaration.

Procedures

In this study, the Yo-Yo Intermittent Recovery Test 2 and three corner run test were used. All of the soccer players included the study had the same physical fitness because they attended the preparatory period, which had lasted 6 weeks. The tests were applied in the contest season, and the aims of all tests were explained to the players before the tests were conducted. The tests were started with a 15-minute warm-up session. While the tests were conducted, the same weather conditions were taken into consideration. This was followed by the administration of Yo-Yo Intermittent Recovery Test 2 and three corner run test on two separate days. Soccer balls, dribbling bars, cone, photocell (Professional Sport Technologies, Sport Expert), polar heart rate and tape measure for distance were used. The methodology employed during the tests is summarized in the following paragraphs.

The Yo-Yo Intermittent Recovery Test

The Yo-Yo intermittent recovery test consists of repeated 2 x 20-m runs back and forth between the starting, turning, and finishing line at a progressively increased speed controlled by audio bleeps from a tape recorder (Bangsbo, 1994, Bangsbo, Laila, Kurstrup, 2008). Between each running bout, the subjects have a 10-s active rest period, consisting of 2 x 5 m of jogging. When the subjects twice have failed to reach the finishing line in time, the distance covered is recorded and represents the test result. The test may be performed at two different levels with differing speed profiles (level 1 and 2). In the present study, we used the Yo-Yo intermittent recovery test, level 2,

Three-Corner Run Test for Anaerobic Endurance

This test was used for the purposes of assessment of Speed and anaerobic endurance in athletes (Rösch, Hodgson, Peterson, Baumann, Junge, Chomiak, Dvorak, 2000; Taskin, 2009). The test field was designed. After the starting command, the subject ran to the flag post (1) away 80 meter from the start. He turned to left hand side and ran the flag post (2), away 20 meter from the flag post (1). Then he ran back to the flag post (3), away 82.4 meters from the start. Finally, he turned to right hand, ran to finish line (4) and crossed the finish line. The time between the starting command and crossing the finish line was measured by a stopwatch and was recorded as the score of the subject in units of 0.1 seconds (Rösch, Hodgson, Peterson, Baumann, Junge, Chomiak, Dvorak, 2000).

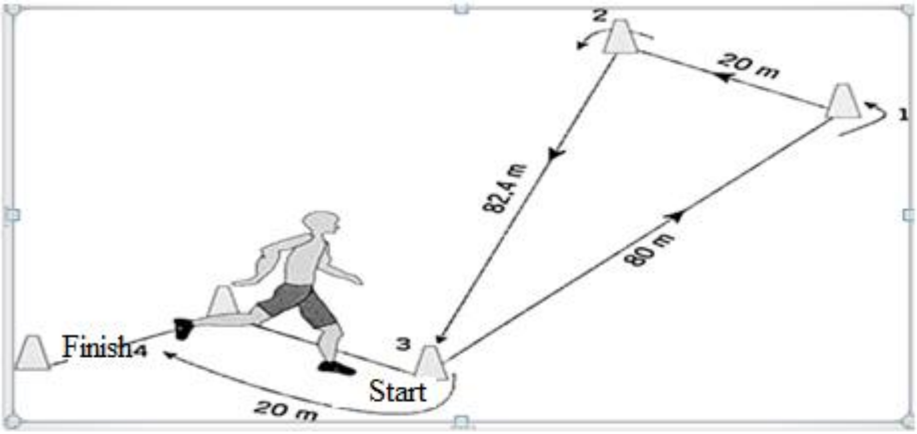


Figure 1.Three Corner Run Test (Rösch, Hodgson, Peterson, Baumann, Junge, Chomiak, Dvorak, 2000; Taskin 2009).

Heart Rate Measurement

Before and after anaerobic endurance, the athletes' Heart Rate was recorded with a heart rate monitor (RS 800, Polar Vantage NV, Polar Electro Oy, Finland) at intervals of 5 seconds.

Statistical Analysis

All analyses were performed using SPSS 16.0 for Windows (SPSS Inc., Chicago, IL). Values were expressed as mean and standard deviation (SD). A ShapiroWilks test was used to examine whether the variables were normally distributed. In case of normality, liner regression analysis was used to determine the effect of $MaxVO_2$ capacity on anaerobic durability. The level of significance chosen was $p < 0.05$.

RESULTS

Table 1. Physical characteristic data for the test subjects.

Variables	N	Mean	S.D
Age (years)	26	22,00	1,414
Height (m)	26	1,79	0,083
Body weight (kg)	26	73,58	7,596
Anaerobic endurance run (s)	26	34,33	3,575
$MaxVO_2$(ml.kg.min^{-1})	26	56,546	3,951
Yo-Yo test distance run	26	826,92	290,541
Pulse rest (b.min^{-1})	26	75,18	7,384
Pulse before anaerobic endurance test(b.min^{-1})	26	111,62	11,832
Pulse after anaerobic endurance test(b.min^{-1})	26	191,92	7,277

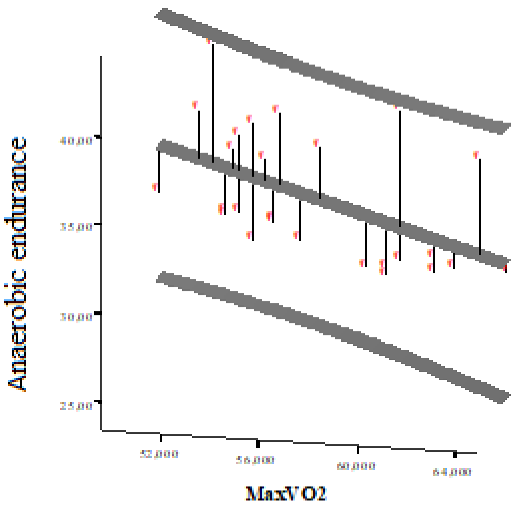
Subject characteristics were as follows: age = 22.00±1.414 years, height = 1.79±0.083 m, body mass = 73.58±7.596 kg, Anaerobic endurance run = 34.33±3.575 s, $MaxVO_2$ = 56.546±3.951 ml.kg.min^{-1}, pulse rest = 75.18±7.384 beats.min^{-1}, pulse before anaerobic endurance test = 11162±11.832 beats.min^{-1}, and pulse before anaerobic endurance test = 191.92 = 7.277 beats.min^{-1}.

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVIII, ISSUE 2 Supplement, 2018, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

Table 2. Regression analysis between anaerobic endurance and $MaxVO_2$ in soccer players

Variables		B	StandardError	Beta	T	P
Depend variable=Anaerobicendurance	$MaxVO_2$	-0,397	0,166	-0,439	-2,394	0,025
		R = 0,439	R^2 = 0,193	F = 5,729	P = 0,025	

Regression model is significant (p<0.05). We found a significant relationship between $MaxVO_2$ and anaerobic endurance in soccer players (F=5,729; P=0,025). Also, explaining 19% of the variance. Anaerobic endurance in a unit change affects $MaxVO_2$ in 0.40 rate (P<0.05).



Graphic 1. Regression analysis between anaerobic endurance and $MaxVO_2$ in soccer players

Regresyon formula;

Anaerobic endurance= 56,79 + (-0.40 x $MaxVO_2$)

$Y=\beta_0+ \beta_1 X$

X: $MaxVO_2$

Y: Anaerobic endurance

β_0: X=0 cut-off point anaerobic endurance (Y)

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVIII, ISSUE 2 Supplement, 2018, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

β_1: regression coefficient

Discussion

The increasing of oxygen usage depending on $MaxVO_2$ usage, leads to increasing of aerobic contribution but decreasing of anaerobic contribution. In the anaerobic studies, like sprint, while aerobic contribution decreases, anaerobic contribution increases (Tomlin and Wenger,2001) While Yo-yo intermittent recovery test level 1 focuses on performing the intermittent exercises that leads to maximal activation of aerobic system, yo-yo intermittent recovery test level 2 states the ability of individual recovery with the help of anaerobic system in repetitive exercises (Bangsbo, Laila, Kurstrup,2008). The aim of this study is to examine the effects of $MaxVO_2$ on the anaerobic endurance and it is determined that there is a significant connection between anaerobic endurance and $MaxVO_2$ level (F=5,729; P=0,025). In amateur players, property of $MaxVO_2$ is explained 19% in the anaerobic endurance and it is determined that increasing of one mile on the $MaxVO_2$ level leads to changing the anaerobic endurance at 40% percent. Rösch et al. (2000), in their studies "Measurement of performance and assessment in football'', used the cone shuttle drill test to evaluate the anaerobic endurance and anaerobic running time of 40 professional football players, 41 football players from 3.league, 25 players from amateur league, 38 players from local team are determined as 31.4±1.8 s; 30.8±1.4 s; 33.6±5.0 s and 31.5±1.4 s, (respectively).In the same study, while averages of anaerobic running time of 137 professional football players who are at 16-18 years are found 31.2±1.6 s, running time of 16 low level players are found 32.1±1.6 s. Anaerobic running time is 31.5±1.4 s for 118 professional football players who are at the 14-16 years and other anaerobic running time is reported 33.9±2.3 s for 93 players at low level. In another study, anaerobic endurance is evaluated by cone shuttle drill test and anaerobic running times of experimental players are found 31.53±0.48 s(Taşkın, 2009). In this study, anaerobic running time is found 34.33±3.5 s for amateur players and this result shows the parallelism with the study of Röschet al., (2000) (Table 1.) In previous study, $MaxVO_2$ values of football players are evaluated with Yo-yo tests (Metaxas, Koutlıanos, Sedelıdes, Kouıdı, 2001). While running distance for Yo-yo intermittent recovery test level 1 is determined is found 2030 – 2420 meters for professional football players, running distance for Yo-yo intermittent recovery test level 2 is found 840-1260 meters (Bangsbo, Laila, Krustrup, 2008).In the study of Rampiniet al. (2010), running time for yo-yo intermittent test level 1 is found 2231±294 meters ($MaxVO_2$=55.14 ml.kg/min) and 1827±292 meters ($MaxVO_2$=51.75 ml.kg/min) for professional and amateur football players, respectively. Again in the same study, running time for yo-yo intermittent test level 2 is found 958±99 meters ($MaxVO_2$=58.33 ml.kg/min) and 613±125 meters ($MaxVO_2$=53.64 ml.kg/min) in the professional and amateur football players, respectively. In the study of Erkmen et al. (2005), they report that the $MaxVO_2$ values of professional football players are 51,73±4,01 ml/kg/min.In this study, it is stated that running time of amateur football players is 826.92±290.541 meters($MaxVO_2$=56.546 ml.kg/min) by yo-yo intermittent test level 1 (Table 1).Castagnaet al., (2006) found the 1331 running distance for Yo-Yo intermittent test level 2. In the study on 24 amateur football players who have an 178.1±4.5 cm average stature, 74.6±8.5 kg average body weight and average age at 26, they found that $MaxVO_2$ values are 63.402 ml.kg/min regarding this study. In the same study, it is stated that there is a positive relationship between the Yo-yo test level 1 and 2 vertical jump. In addition to this, Castagnaet al.states that exercises are impressed by the maximal muscle strength like Yo-yo tests made intermittently in high intensity. In the study on 12 football players who have 176.3±4.2 cm average stature and 68.1±3.6 kg average body weight and average age at 15 years, distance is found 1208.33±89.22 meters for Yo-yo test level 2 regarding to $MaxVO_2$ values that is found 61.73 ml.kg/min. It is stated that there is a negative correlation (r= -0.55) between the Yo-yo test level 2 and maximal anaerobic power evaluated with Wingate test (Karakoç, Akalan, Alemdaroğlu, Arslan, 2012). Krustrupet al. (2006) report that there is not any relationship between Sprint performance and repetitive sprint performance with the results of Yo-yo test level 2. In the study on 25 handball players who are at averagely 17.2±0.7 years old and have 1.87±0.86 meters average stature and 88.7±6.1 kg average body weight, It is examined the correlation between Yo-yo repetitive intermittent test level 1 and anaerobic performance tests and stated that there is a significant correlation (P<0.01) between anaerobic performance tests (Strength and speed tests, jumping tests and sprint tests) and Yo-yo maximum running speed (4.8±0.3 m/s) (Hermassi, Aouadi, Khalifa, Tillaar, Shephard, Chelly, 2015).In the study ''Analyzing of repetitive sprint running in team sports associated with locomotive functions, metabolic control and aerobic capacity'' Buchheit, (2012) states the $MaxVO_2$ values (56.2±3.1 ml/kg/min)of 10 national players who are at 14±0.0 years average age and have 161.4±7.6 cm average stature and 48.9±7.7 average body weight evaluating with the running test which began with 10 km speed per hour and increasing of progressing speed 1 km in a minute. Averages of repetitive sprint values are found 4.83±0.20 s. At the same time, he states that there is a negative correlation at medium level between $MaxVO_2$ values and repetitive sprint values (r= -0.58).In the study on 14 amateur

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVIII, ISSUE 2 Supplement, 2018, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

players (23.2±3.5 average age, 177.8±6.4 cm average stature and average body weight 70.8±6.5 kg), it is stated that there is a significant correlation between Yo-yo test and intermittent running (15 seconds running,15 seconds rest) in high intensity (r=0.72; P<0.01) (Dupont, Defontaine, Bosquet, Blondel, Moalla, Berthoin, 2010). In another study, it is stated that there is a significant correlation between Yo-yo test values and high intensity running of 17 Danish fifa- licenced referees (r=0.57; P<0.05)(KrustrupandBangsb, 2001). In the study for analyzing relationship between aerobic and anaerobic development with the Yo-yo test, in U13 and U17 football players, running distance of Yo-yo 1 is found 2365 meters and Yo-yo 2 running distance is found 843 meters for U17 regarding to $MaxVO_2$ values that is found 56.26 ml.kg/min and 56.76 ml.kg/min, respectively. The results of Yo-yo 1 and 2 is associated to vintage test results and it is stated that there is no significant correlation between them(r=0.53) running distance of Yo-yo 1 is found 1963 meters and Yo-yo 2 running distance is found 550 meters for U13 regarding to $MaxVO_2$ values that is found 52.89 ml/kg/min and 52.78 ml/kg/min, respectively. The results of Yo-yo 1 and 2 is associated to Wintage test results and it is stated that there is a significant correlation between them (r＝0.61) (Chuman, Hoshikawa, Lida, Nishijima, 2011). In the study of 25 football players who are at averagely 26.7±5.1 years, it is found that there is an significant correlation between $MaxVO_2$(r=0.77) and vertical jumping(r= 0.73) with the Yo-yo intermittent recovery test level 1(Gümüşdağ, Ünlü, Çiçek, Kartal, Evli, 2013).While running distance of professional male badminton players is found 1020 meters for Yo-yo intermittent recovery test, running distance is found 720 meters for elite level football players for Yo-yo intermittent recovery test (Young, Newton, Doyle, 2005; Thomas, Dawson, Goodman, 2006).

In a conclusion, it is stated that anaerobic endurance of $MaxVO_2$ capacity is at 19% percent and increasing of $MaxVO_2$ level in amateur football players at 1% percent can lead to changing anaerobic endurance at 40% percent and for this reason, it has a less affect. It can be said that anaerobic endurance is explained by $MaxVO_2$ at 19% percent and other 81% percent can be explained by other parameters (strength,speed,quickness,agility etc.)

Acknowledgments

I thank all soccer players for participating in this study. No funding was used for this study

References

Aşçı, A., 2008, Futbol Eğitimi 14 Yaş ve Altı. 1. Baskı. Neyir Matbaacılık. Tüvaf Yayınları. 2008; 34-37.

Bangsbo,J., 2011, Fitness Testing and Training of the Top-Class Football Player. In: Foootball Science VII,2011; 8: 1, 25

Bangsbo, J., 1994, Fitness Training in Football: A Scientific Approach. Bagsværd, Denmark: HO+Storm, 1994; 1–336.

Bangsbo, J., Laila, F., Kurstrup, P.,2008,Yo-Yo İntermittent Recovery Test Sports Medicen,2008 38(1), 37-61.

Buchheit, M., 2012, Repeated-sprint performance in team sport players: associations with measures of aerobic fitness, metabolic control and locomotor function. International journal of sports medicine,2012; 33(3), 230.

Castagna, C., Impellizzeri, F.M., Chamari,K., Carlomagno, D., Rampinini, E., 2006, Aerobıc Fıtness And Yo-Yo Contınuous And Intermıttent Tests Performances In Soccer Players: Acorrelatıon Study. The Journal of Strength & Conditioning Research, 2006; 20(2), 320-325.

Chuman, K., Hoshikawa, Y., Iida T., Nishijima ,T., 2011, Relationships between Yo-Yo intermittent recovery tests and development of aerobic and anaerobic fitness in U-13 and U-17 soccer players. International Journal of Sport and Health Science, 2011;9, 91-97.

Delextrat, A., Cohen, D., 2008, Physıologıcal Testing of Basketball Players: Toward a Standart Evaluating of Anaerobic Fitness. J. of Stenght and Conditioning Ass,2008;22. (4)/10066-1072.

Dupont, G., Defontaine , M., Bosquet, L., Blondel, N., Moalla, W., Berthoin, S., 2010, Yo-Yo intermittent recovery test versus the Universite de Montreal Track Test: relation with a high-intensity intermittent exercise. Journal of Science and Medicine in Sport, 2010;3(1), 146-150.

Erkmen, N., Kaplan T., Taşkın H., 2005, Profesyonel Futbolcuların Hazırlık Sezonu Fiziksel ve Fizyolojik Parametrelerinin Tespiti ve Karşılaştırılması. Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 2005 ;3 (4) 137-144.

Green, H.J., Hungson, R.L., Orr, G.W., Ranney, D.A., 1983, Anaerobic threshold, blood lactate, and muscle metaholites in progressive excercise. Journal of Applied Physiology, 1983; 54: 1032-1038.

Gümüşdağ, H., Ünlü, C ., Çiçek, G., Kartal, A., Evli, F., 2013, The Yo-Yo Intermıttent Recovery Test As An Assessesment Of Aerobıc-Anaerobıc Fıtness And Game-Related Endurance In Soccer.International Journal of Academic Research, 2013;5(3).

Hermassi, S., Aouadi, R., Khalifa, R., Tillaar, R., V.D., Shephard, R.J., Chelly, M.S., 2015, Relationships Between the Yo-Yo Intermittent Recovery Test and Anaerobic Performance Tests in Adolescent Handball Players.Journal of human kinetics, 2015; 45(1), 197-205.

Karakoç, B., Akalan, C., Alemdaroğlu, U., Arslan, E., 2012, The relationship between the yo-yo tests, anaerobic performance and aerobic performance in young soccer players. Journal of human kinetics, 2012; 35(1), 81-88.

Krustrup, P., Bangsbo, J., 2001, Physiological demands of top-class soccer refereeing in relation to physical capacity: effect of intense intermittent exercise training. Journal of sports sciences, 2001; 19(11), 881-891.

Krustrup, P., Mohr, M., Nybo, L., Jensen, J.M., Nielsen, J.J., Bangsbo, J.,2006, The Yo-Yo IR2 Test: Physiological response, reliability and application to elite soccer. Med Sci Sport Exer, 2006;38: 1666–1673.

Kunter, E., 1997, Futbolda Süratin Teoriği ve Pratiği Bağırkan Yayınevi, 1997; Ankara.

Metaxas, T.N., Koutlıanos, T., Sedelıdes ,E., Kouıdı, 2001, Evaluation of the level of aerobic capacity in pubertal soccer players in the field test. Health Sport Perform, 2001; 4:316–322.

Rampinini, E., Sassi, A., Azzalin, A., Castagna, C., Menaspà, P., Carlomagno, D., Impellizzeri, F.M., 2010, Physiological determinants of Yo-Yo intermittent recovery tests in male soccer players. European Journal of Applied Physiology, 2010 ; 108(2), 401-409.

Rodgers, C., 1990, Excercise Physiology Labarotory Manuel Wm C: Brown Puplishers.

Rösch, D., Hodgson, R., Peterson, L., Baumann , T.G., Junge, A., Chomiak, J., Dvorak, J., 2000, Assessment and Avaluation of Footboll Performance. The American Journal of Sports Medicine, 2000 ; 28(5):29-39.

Sharky, J.B., 1986,Coaches Guide To Sport Physiology, Human Kinetics Publisher, Inc, Champaing, Illınois, 1986; 36-38.75.81.87.100.

Taşkın, H., 2009, Effect of Circuit training on the Sprint-Agility and Anaerobic Endurance. Journal of Strengeth and Conditional Assontion..

Thomas, A., Dawson, B., Goodman, C., 2006, The yo-yo test: reliability and association with a 20-m shuttle run and VO (2max). International Journal of Sports Physiology and Performance,2006; 1(2), 137.

Tomlin, D.L., Wenger, H.A., 2001, The relationship between aerobic fitness and recovery from high intensity intermittent exercise. Sports Medicine, 2001; 31(1), 1-11.

Yıldız, S.,2012, Aerobik ve Anerobik Kapasitenin Anlamı Nedir? İstanbul Üniversitesi İstanbul Tıp Fakültesi Spor Hekimliği Anabilim Dalı.

Young, W.B., Newton, R.U., Doyle, T.L. A., Chapman, D., Cormack, S., Stewart, C., Dawson, B., 2005, Physiological and anthropometric characteristics of starters and non-starters and playing positions in elite Australian Rules football: a case study. Journal of Science and Medicine in Sport, 2005; 8(3), 333-345.