BEDEN EĞİTİMİ SPOR SAĞLIK VE EFOR DERGİSİ

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THE EFFECT OF PLYOMETRIC TRAINING ON ANAEROBIC PERFORMANCE AND AGILITY IN BASKETBALL PLAYERS

Yaşar KÖROĞLU [1]: Sivas Cumhuriyet University Faculty of Sports Sciences,yasarkoroglu@cumhuriyet.edu.tr, Orcid: 000-0003-4662-3353, Sivas/ TURKEY

ABSTRACT

Basketball is an entertaining sport that involves a combination of technical, tactical and physical fitness. The general aim of our study was to investigate the effect of plyometric training on anaerobic performance and agility in high school basketball athletes. A total of 15 students between the ages of 15-17 (male, 8, female, 7) studying at Siirt sports high school participated voluntarily. Height, body weight, 30 m sprint test, 10x5 shuttle run agility test, Flamingo balance test, vertical jump and standing long jump and flexibility tests were taken from the athletes as pre-test and post-test. 8 weeks and 3 days a week plyometric training program was applied. The normality test was used to determine whether there was a difference between the pre-test and post-test data and it was seen that the data were normally distributed. Paired sample t test was also used to compare dependent groups. In the data obtained as a result of the research, it was seen that there was a significant difference in body weight, BMI, balance, vertical jump, agility, 30 m sprint, standing long jump and flexibility values ($p<0.005$). As a result, we can say that regular plyometric training performed for 8 weeks has positive contributions on physical performance in 15-17 age group basketball players, and coaches should include plyometric training in their annual plans for performance development, injury prevention and continuity.

Keywords: Plyometrics, quickness, vertical jump, speed, balance

BASKETBOLCULARA UYGULANAN PLİOMETRİK ANTRENMANININ ANAEROBİK PERFORMANS VE ÇEVİKLİK ÜZERİNE ETKİSİ

ÖZET

Basketbol sporu, teknik olmakla birlikte taktik ve fiziksel uygunluğun kombinasyonunu içeren eğlenceli bir branştır. Çalışmamızın genel amacı lisede öğrenim gören basketbol sporcularına uygulanan pliometrik antrenmanının anaerobik performans ve çeviklik üzerine etkisinin incelenmesidir. Çalışma Siirt spor lisesinde öğrenim gören 15-17 yaş aralığında (Erkek, 8, kız, 7) toplam 15 öğrenci gönüllü olarak katıldı. Sporculardan ön test-son test olarak boy uzunluğu, vücut ağırlığı, 30 m sürat testi, 10x5 mekik koşusu çeviklik testi, Flamingo denge testi, dikey sıçrama ve durarak uzun atlama ve esneklik testleri alınmıştır.8 hafta ve haftada 3 gün pliometrik antrenman programı uygulanmıştır. Ön test-son test verileri arasında fark olup olmadığını belirlemek için normallik testi kullanılmıştır ve verilerin normal dağılım gösterdiği görülmüştür. Bağımlı grupların karşılaştırılmasında da paired sample t test kullanıldı. Araştırma sonucunda elde edilen verilerde vücut ağırlığı, BKİ, denge, dikey sıçrama, çeviklik, 30 m sürat, durarak uzun atlama ve esneklik değerlerinde anlamlı farklılığın olduğu görüldü ($p<0.005$). Sonuç olarak 8 hafta süresince gerçekleştirilen düzenli pliometrik antrenmanın 15-17 yaş grubu basketbolcularda fiziksel performans üzerine olumlu katkılarının olduğunu, Antrenörlerin performans gelişimi, sakatlıkların önlenmesi ve devamlılığının devam etmesi için yıllık planlarında pliometrik antrenmanlara yer vermesi gerektiğini söyleyebiliriz.

Anahtar Kelimeler: Pliometrik, çabukluk, dikey sıçrama, sürat, denge

INTRODUCTION

Basketball sport is an entertaining branch that includes a combination of tactical and physical fitness as well as technique (Ziv & Lidor, 2009). When we examine the game character of basketball, it contains combined activities that include maximum intensity during the game. During the game, it includes many sudden, fast, medium and high intensity movements such as speed, muscular power generation, sudden changes of direction, dribbling and sliding movements, jumping (Narazaki et al., 2009). In order to ensure the development of these characteristics of basketball athletes and to maintain their development for a long time, new and different training programmes should be included in the annual plans prepared according to the development of these characteristics (Spiteri et al., 2014). As the basic requirement of basketball, high-level strength, aerobic and anaerobic capacity, jumping, sudden and fast-slow change of direction are inherent in this sport (Rinaldo et al., 2020). For high-level performance and success in basketball, it is necessary to develop the ability to produce maximum muscle power in the shortest time (Brittenham, 1996). Many coaches use resistance training to develop maximum strength and quick strength training in their training programmes (Mangine et al., 2014). On average, it is stated that a player travels between 6000-7500 m in a basketball match (Abdelkrim et al., 2010). However, it is explained that approximately 20 per cent of the number of movements during the competition are in the high-intensity movements class (Abdelkrim, El Fazaa, & El Ati, 2007). In a study, it was stated that a basketball player can perform approximately 1000 short actions in every 2 seconds (Köklü et al., 2011). One of the training programmes applied for performance improvement is plyometric training. Plyometric training allows the muscles to produce maximum power in a short time (Pancar et al., 2018). It is an endurance training that contributes to producing more power by stimulating muscle contraction in a short time. The effect of plyometric training on muscle contraction is actually to strengthen muscle fibres, connective tissue and flexibility. During the athlete's jump to the ground over a high area, the muscle fibres are affected by the stretching of the agonist muscles and trigger the stretch reflex. The excitation levels of the muscle fibres in the passive state also increase and gradually increase (Yüksel et al., 2016). Plyometric training actually allows athletes to apply a high level of force very quickly in a very short time with eccentric - concentric contraction. Plyometric training is a positive-negative strength training and contributes to the explosive jumping power of athletes. Athletes who will apply plyometric training must have a sufficient level of basic strength. Especially children do not need much strength because they do not have much body weight. When children need strength, it is to prevent injuries that may occur in the

muscles during exercise (Acar, 2016). The aim of our study was to investigate the effect of plyometric training on anaerobic and agility in basketball athletes aged 15-17 years.

Material Method

The study was organised as a single group. Two measurements were taken before and after the study.

Research Group

In the study, 15 (male (n:8), (female (n:7) athletes between the ages of 15-17, who were studying at the sports high school in Siirt province, participated. Necessary measurements were taken before starting the measurements. After the measurements, they participated in plyometric training for three days together with basketball training. Eight weeks plyometric training programme was applied to the athletes. Informed voluntary consent form was filled out from the athletes participating in the study and the necessary permissions were obtained from the families of the athletes participating in the study and the school administration.

Data Collection Tools

Measurement of height

The height measurements of the subjects participating in the study were measured with a height meter.

Body weight measurement

Body weight measurements of the subjects were carried out with an electronic scale with a precision of 0.1. At the time of measurement, the subjects were measured in an upright position with the hands at the side and the weight equally distributed on both feet and the values in kg were recorded.

Bioelectrical Impedance Analysis

The bioelectrical impedance analysis of the students participating in the study was measured by the foot-to-foot method with TANITA Inc, Tokyo, Japan, Model TBF-300 A impedance analyser. Personal information was recorded on the bioelectrical impedance analyser. The subjects stood barefoot on the analyser with the electrodes on the scale touching the soles of the feet, in an upright position and motionlessly waited motionlessly until the results were displayed on the screen. The values (body weight, body mass index, body fat percentage, fat mass, lean body mass, total fluid weight and basal metabolic value) were recorded on a printer.

30 m Speed Test

Athletes ran 30 metres in the designated area and 3 measurements were made with the help of a photocell and the best result was recorded (Rakovic et al., 2018)**.**

10x5 m Shuttle Run Agility Test

It was applied to measure the running speed of the individual. Funnels or lines placed 5 metres apart were prepared. The subject gets ready behind the starting line. With the start command, he/she runs as fast as possible with both feet crossing the two lines, crosses the opposite line and returns back to the starting line. The run was repeated 10 times until a total of 50 metres was reached and the running time was recorded (Özer, 2013).

Vertical Jump Test

While the student was touching the ground with his/her feet stretched, the highest point he/she could reach with his/her dominant arm was determined. The student was asked to touch the highest point by jumping vertically with two feet with knees bent at a ninety-degree angle. The measurement was completed by determining the distance obtained with the jump and the point determined from the jump. The test was performed 3 times and the best result was recorded (Bostancı et al., 2019).

Anaerobik Güç:

√ 4.9. (W) √ D.

W = Body Weight (kg), D = Jump Distance (cm)

Sit and Reach (Flexibility) Test

The test was performed with the legs resting on the floor, the soles of the feet resting on the table and the legs stretched. Without bending the legs, the legs were stretched forward on the table with both hands on top of each other and the score was recorded in cm by waiting for 2 seconds at the last point of extension (Özkan, 2010).

Standing Long Jump Test

The student was asked to jump forward from the determined point with feet together. The test was applied 3 times and the best result was recorded (Bostancı et al., 2019).

Table 1. Plyometric Training Program

Plyometric training method was applied to our study group 3 days a week for 8 weeks together with weekly badminton training. The training programme is given in the table below

Name of the movement	**Repeat / Set / Rest**	**Name of the movement**	**Repeat / Set / Rest**
Vertical jump with knees pulled up	10 / 3 / 1:1	Jump rope	10 / 3 / 1:1
Sideways wrist jump	10 / 3 / 1:2	Jumping forwards by pulling the knees	10 / 3 / 1:2
Forward jump with kangaroo motion	10 / 3 / 1:1	Sideways jump over obstacle	10 / 3 / 1:1
Jumping movement down the staircase	10 / 3 / 1:1	Running movement in different directions by jumping over obstacles	12 / 3 / 1:1
Stair jumping with one foot forward	10 / 3 / 1:2	Squat jumping movement	12 / 3 / 1:1
Squat jump on the stairs	10 / 3 / 1:1	Jumping over the obstacle to the side area	10 / 3 / 1:2
Double foot leap forwards with double foot	10 / 3 / 1:1	Zig zag dril work	10 / 3 / 1:1

Points to Consider During Plyometric Training

- ✓ Training sessions should be carried out on soft ground
- ✓ The athlete should be able to perform plyometric training exercises
- ✓ If he/she is not at a level to perform the training, the movement should be stopped
- ✓ Training should be planned from easy to difficult
- ✓ Before starting plyometric training, perform warm-up exercises and finish the workout with a cool down.
- ✓ Ensure optimal implementation of the work for best performance
- ✓ 1-2 minutes rest break should be given between series
- ✓ Each set should be between 6-8 seconds, not too long
- ✓ Full recovery should be ensured between sets

Care should be taken to apply the correct technique (Blattner ve Noble, 1979).

Statistical Analysis

IBM SPSS 22.0 statistical package programme was used to analyse all data. The normality test was applied to determine whether the data had a normal distribution. As a result of the normality test, it was determined that the data were normally distributed. Dependent sample t-test was used in in-group evaluations.

Results

Table 2. Comparison of physical characteristics of basketball players

Variables	Groups	N	X ± SS	t	p
Age (years)		15	15,87±0,990		
Height Length (cm)		15	171,13±9,141		
Body Weight (kg)	Pre-test End test	15	59,813±7,886 58,993±7,899	2,613	**0,020**
Body Mass Index (BMI))	Pre-test End test	15	20,433±2,284 19,980±2,271	5,042	**0,000**

When Table 2 was examined, it was seen that there was a statistically significant difference between the body weight pre-post test values of the basketball athletes participating in the study ($p<0.005$), and there was a significant difference in the body mass index values as a result of two measurements ($p<0.005$).

Table 3. Statistical comparison of group measurements

Variables		Experiment (n:15)		
		X ± SS	**t**	**p**
Agility	Pre-test End test	6,37±0,41 6,20±0,35	-2,370	**0,025**
Vertical jump (cm)	Pre-test End test	36,53±7,763 39,67±10,140	-2,623	**0,020**
Long jump standing (cm)	Pre-test End test	192,20±36,638 198,53±38,240	-2,513	**0,025**
30 m sprint test	Pre-test End test	5,15±0,644 5,01±0,709	3,230	**0,006**
Flexibility	Pre-test	23,87±9,303	-2,448	**0,028**

	End test	25,80±10,571		

When Table 3 was analysed, it was determined that there were statistically significant differences between pre-test and post-test values in balance, vertical jump, standing long jump, 30 m sprint test and flexibility values ($p<0.005$).

Discussion and Conclusion

Basketball sport is a fun game and includes technical and tactical skills and physical performance elements (Ziv & Lidor, 2009). The general characteristic of the game consists of many combined movements such as speed, sudden change of direction, fast turns, sliding with step, jumping high and accelerating again after stopping and producing muscular power in high-intensity activities (Narazaki, et al., 2009).

In the study, it was determined that there was a statistically significant difference in body mass index values. We think that the reason for the significant difference in BMI values in our study is the regular participation of the athletes in training and the decrease in body weight. Maçaoğlu reported that there was no significant difference in BMI values in a study applied to basketball players aged 10-14 years (Maçaoğlu, 2022). Aydemir and colleagues explained in their study that the plyometric training applied to taekwondo athletes did not have a significant difference in the BMI values of the athletes (Aydemir et al., 2021). It was determined that plyometric training applied to tennis players had a significant difference in BMI values in the experimental and resistance training group (Öner, 2021). It is seen that studies have similar and different results from our study.

In our findings, it was determined that there was a statistically significant difference in 30 m sprint test values. We think that the training programme applied to improve performance in basketball improves the 30 m sprint test. In a study conducted on female athletes, plyometric training was applied together with resistance training and it was reported that there was a significant difference in favour of the experimental group in the speed performance values after the study (Myer et al., 2005). Bavlı, applied plyometric training in addition to basketball training in his study on basketball athletes and when the results of the study were analysed, it was determined that the speed values in the experimental group were more significant than the values in the control group (Bavlı, 2012). Plyometric training programme was applied to female football players for 8 weeks together with normal football training. As a result of the study, it

was determined that there was a difference in the speed values of female athletes (Ozbar, Ates, & Agopian, 2014). It is seen that our study is similar to similar studies in this field.

In the study data we obtained, it was seen that there was a significant difference in the vertical jump values of basketball players after the study. Plyometric training is one of the training methods necessary for the development of speed and explosive power required for many sports branches (Chu, 1998). As a result of plyometric training, we can say that there are increases in vertical jump values of athletes. When the studies conducted in this field are examined, it is seen that there are similar results. In addition to 12-week resistance exercise, plyometric training contributed to a 15% increase in the vertical jump values of the individuals participating in the study (Fatouros et al., 2000). Diallo and colleagues, who applied a ten-week plyometric training programme in addition to the normal exercise programmes of football players aged 12-13 years, stated that there was a positive improvement in the vertical jump performance of the experimental group (Diallo et al., 2001). In another study, Adams et al. divided the participants into three groups, one group participated in plyometric training, one group only in weight training and the last group in combined plyometric training. After the study, they stated that the combined plyometric training data values contributed to the emergence of more significant results than the other two groups (Adams et al., 1992).

As in many sports branches, agility has an important place in basketball. As a game characteristic, fast movement and displacements due to position are very common. In our study, it was observed that there were significant increases in agility values after plyometric training. Uzun and Eriş, reported that plyometric training had a positive contribution to agility values in their study (Uzun & Eriş, 2021). In parallel with our study, they explained that plyometric training applied for 4 months caused an increase in the agility values of athletes (Cengizel, Cengizel, & Öz, 2021). It was reported that there were significant positive increases in agility values in basketball athletes after 6 weeks of training (Wibowo et al., 2020). It is also seen in other studies with similar results to our study.

In the data we obtained, it was seen that plyometric training had a significant positive effect on balance values in basketball players. It is necessary for the success and performance development of athletes, whether individual or team sports. In particular, although the performance of athletes is high, deficiencies in balance values may prevent the athlete's performance from emerging. We can say that the reason why there was no significant difference in our study was the effect of plyometric training on the lower extremity muscles and the

positive effects of the work programme applied in basketball training to improve the performance of the athlete. It was explained that 8-week plyometric training applied to fencing athletes had no significant effect on balance values (Kosova, 2020). Haag et al. similarly stated that plyometric training applied to basketball athletes had no significant effect on the dynamic balance values of athletes (Haag et al., 2010). Similar to our study, in the research on footballers, it was explained that plyometric training had a positive contribution to the balance values of athletes (Hammami et al., 2016).

In our study, there was a significant difference in standing long jump values. Standing long jump is one of the measurement methods used to determine the explosive power of the lower extremity required for many sports branches (Castro et al., 2010). It is explained in many studies that plyometric training has positive effects on the increase of explosive power by strengthening the muscles of the lower region. We think that the most important reason for the difference in our study was that plyometric training applied to basketball players increased leg strength values. Baş stated that 10-week core training applied to football players contributed positively to long jump performance (Baş, 2018). It was stated that 8-week plyometric training applied to handball players significantly increased the standing long jump values of the athletes in favour of the experimental group (Pancar, Biçer, & Özdal, 2018). In their study, Koç et al. stated that there was no statistical difference between basketball and handball players in standing long jump values (Koç, Pulur, & Karabulut, 2011). This study was found to be different from the study we conducted.

In our study, it was determined that there was a significant difference in flexibility values. It was observed that there was no significant difference in the flexibility values of the athletes after the training applied to basketball players (Maçaoğlu, 2022). Öner, in his study on tennis athletes, stated that there were significant differences in the flexibility values of the experimental and resistance group athletes participating in plyometric training after the study (Öner, 2021). In another study conducted on students, it was explained that there was a significant difference in the flexibility values of the group applying plyometric training (Çavdar, 2006). When the studies are analysed, it is seen that the results are similar and different from our study. In our study, we can say that the fact that the athletes performed cooling and flexibility exercises before and after the training, that the athlete group was young in age and regularly participated in training and plyometric training were effective in the significant values.

As a result, plyometric training is an important training practice in improving the performance of athletes and ensuring continuity. Especially the inclusion of plyometric training programme in the annual training programme of young athletes will minimise the risk of injury along with performance and they will be able to continue their studies. We can say that it has important contributions to the development of jumping, agility and speed characteristics, which are important in basketball branch, and the application of plyometric training in certain periods in many sports branches will have positive contributions to the development of athletes' performance.

Limitations of the Study

Students who played basketball for at least 2 years participated in the study.

Students with injuries did not participate in the study.

Students who smoked and had any health problems were not included in the study.

Students who had just started basketball did not participate in the study.

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Conflict of Interest

There is no conflict in the this study.

References

Abdelkrim, NB, Castagna, C, Jabri, I, Battikh, T, El Fazaa, S, El Ati, J. (2010). Activity profile and physiological requirements of junior elite basketball players in relation to aerobic-anaerobic fitness. The Journal of Strength & Conditioning Research, 24(9), 2330-2342

Abdelkrim, NB, El Fazaa, S, El Ati, J. (2007). Time–motion analysis and physiological data of elite under-19-year-old basketball players during competition. British journal of sports medicine, 41(2), 69-75

Acar, N. (2016). The effect of flexibility on motoric characteristics in basketball. Istanbul University Institute of Health Sciences, Master's Thesis. Istanbul.

Adams, K, O'Shea, JP, O'Shea, KL, Climstein, M. (1992) The effects of six weeks of squat, plyometric and squat plyometric training on power production, Journal of Applied Sport Science Research, 6, 36-41

Aydemir, B, Yüksek, S, Ölmez, C, Şar, H. (2021). The Effect of Taekwondo Themed Plyometric Training on the Motoric Characteristics of 12-14 Years Old Taekwondo Athletes. International Journal of Contemporary Educational Studies (IntJCES), June, 7(1): 335-351

Baş, M. (2018). Evaluation of the effect of 10-week core training on selected motor parameters in 11-13 age group football players. Istanbul Gelisim University Institute of Health Sciences

Bavlı, Ö. Investigation of the Effect of Plyometric Training Combined with Basketball Training on Some Biomotoric Characteristics. Pamukkale Journal of Sport Sciences 2012, Vol.3, No.2, Pg:90-100

Bostancı, Ö, Mayda, MH, Tosun, MI, Kabadayı, M. (2019). The effect of high intensity interval training programme on physiological parameters and respiratory muscle strength. SPORMETRE Journal of Physical Education and Sports Sciences, 17(4), 211-219. https://doi.org/10.33689/spormetre.605119

Bostancı, Ö, Mayda, MH, Tosun, MI, & Kabadayı, M. (2019). The effect of high intensity interval training programme on physiological parameters and respiratory muscle strength. Spormetre Journal of Physical Education and Sports Sciences, 17(4), 211-219. https://doi.org/10.33689/spormetre.605119

Brittenham, G. (1996). Complete Conditioning for Basketball. Champaign, III: Human Kinetics

Castro, J, Ortega, FB, Artero, EG, Girela, MJ, Mora, J, Sjöström, M, Ruiz, JR, (2010). Assessing muscular strength in youth: usefulness of standing long jump as a general index of muscular fitness. The Journal of Strength & Conditioning Research, 24(7), 1810-7

Cengizel, E, Cengizel, ÇÖ, Öz, E. (2021). Investıgatıon of The Relatıonshıp Between Calf Cırcumference and Jumpıng, Speed, Agılıty in Young Male Basketball Players. Journal of Sport & Health Research, 13(1)

Chu, DA. (1998) Jumping into Plyometrics, 2nd Edition, Human Kinetics Publishers,llionois,: 1-24

Çavdar, K. Investigation of Jumping Performance of Students Performing Plyometric Training. Institute of Health Sciences, Physical Education and Sports Department. Master Thesis, Istanbul: Marmara University 2006

Diallo, O, Dore, E, Duche, P, Van Praagh, E. (2001). Effects of plyometric training followed by a reduced training programme on physical performance in prepubescent soccer players. Journal of sports medicine and physical fitness, 41(3), 342

Fatouros, IG, Jamurtas, AZ, Leontsini, D, Kyriakos, T, Aggelousis, N, Kostopoulos, N, Buckenmeyer, P. (2000) Evaluation of plyometric exercise training, weight training

Haag SJ, Wright GA, Gillette CM, Greany JF. Effects of acute static stretching of the throwing shoulder on pitching performance of national collegiate athletic association division III baseball players. J Strength Cond Res. 2010, 24(2): 452-7

Hammami R, Granacher U, Makhlouf I, Behm DG, Chaouachi A. Sequencing effects of balance and plyometric training on physical performance in youth soccer athletes. J Strength Cond Res. 2016, 30(12): 3278-89.

Koç, H, Pulur, A, Karabulut, EO. (2011). Comparison of Some Motoric Characteristics of Male Basketball and Handball Players Nigde University Journal of Physical Education And Sport Sciences Vol 5, No 1

Kosova S. The Effects of 8-Week Plyometric and Resistance Training on Static-Dynamic Balance and Changing Direction Performance in Young Fencers. Institute of Health Sciences, Department of Sports Health Sciences. Doctoral Thesis, Izmir: Ege University 2020

Köklü, Y, Alemdaroğlu, U, Koçak, F, Erol, A, Fındıkoğlu, G. (2011). Comparison of chosen physical fitness characteristics of Turkish professional basketball players by division and playing position. Journal of human kinetics, 30(2011), 99-106

Maçaoğlu, Ö. Investigation of the relationship between agility and overhead squat test in 10-14 age group male basketball players. Master Thesis. Istanbul Gelisim University, Istanbul, 2022

Mangine, GT, Fukuda, DH, LaMonica, MB, Gonzalez, AM, Wells, AJ, Townsend, JR, Hoffman, JR. (2014). Influence of gender and muscle architecture asymmetry on jump and sprint performance. Journal of sports science & medicine, 13(4), 90

Myer, G., Ford, K., Palumbo, J., Hewitt, T., (2005) Neuromuscular training improves performance and lower extremity biomechanics in female athletes. Journal of Strength and Conditioning Research, 19, 51-60

Narazaki, K, Berg, K, Stergiou, N, & Chen, B. (2009). Physiological demands of competitive basketball. Scandinavian journal of medicine & science in sports, 19(3), 425-432

Ozbar, N., Ates, S., Agopyan, A. (2014). The Effect of 8-week plyometric training on Leg Power, Jump and Sprint Performance in Female Soccer Players. J. Strength Cond. Res. 28:2888–2894. doi: 10.1519/JSC.00000000000005416

Öner, S. The Effect of Plyometric and Resistance Training on Some Motoric and Performance Parameters in Tennis Players. Doctoral Thesis. Inonu University. Malatya, 2021

Ozer, K. (2013). Physical Fitness (4th Edition). Ankara: Nobel Publishing

Özkan, A. (2010). Anaerobic performance and measurement methods. Ankara: Gazi Bookstore

Pancar, Z, Biçer, M, Özdal, M. (2018).Journal of Sports and Performance Researches Journal of Sports and Performance Researches, 9(1):18-24

Rakovic, E, Paulsen, G, Helland, C., Eriksrud, O, Haugen, T. (2018). The Effect of İndividualised Sprint Training in Elite Female Team Sport Athletes: A Pilot Study. Journal of Sports Sciences. 36(24):2802-2808

Rinaldo, N, Toselli, S, Gualdi-Russo, E, Zedda, N, Zaccagni, L. (2020). Effects of anthropometric growth and basketball experience on physical performance in pre-adolescent male players. International journal of environmental research and public health, 17(7), 2196

Spiteri, T, Nimphius, S, Hart, NH, Specos, C, Sheppard, JM, Newton, RU. (2014). Contribution of strength characteristics to change of direction and agility performance in female basketball athletes. The Journal of Strength & Conditioning Research, 28(9), 2415-2423

Uzun, R, Eriş, F. (2021). Investigation of the Effect of Plyometric Training on Some Motoric Characteristics in Adolescent Male Badminton Players. Atatürk University Journal of Physical Education and Sports Sciences, Volume: 23, Issue: 1

Wibowo, S, Fathir, LW, Hartono, S, Kusnanik, NW, Muhammad, HN. (2020, December). Agility and Balance Development Using Functional Training for Basketball Youth Athlete. In International Joint Conference on Arts and Humanities (IJCAH 2020),pp. 1346-1350

Yüksel, Y, Hekim, M, Tokgöz, M, Zengin, S, Ulukan, H. ve Kaya, E. (2016). Plyometric exercising of athletes at adolescence period Jo.

Ziv ve Lidor, 2009). Ziv, G., & Lidor, R. (2009). Physical attributes, physiological characteristics, on-court performances and nutritional strategies of female and male basketball players. Sports Medicine, 39, 547-568