Essay

The Effects of Core Training on Balance and Some Physical Performance in Tennis Players

Yaşar KOROGLU * , Samet samet Sitti , Kenan kenan Koç , Soner soner Yüce , Mehmet Şerif ÖKMEN , Mustafa mustafa Türkmen , Isa isa Tastan , Feyzullah feyzullah Koca , Erkan KONCA , Mine mine Ucar

Posted Date: 11 February 2025

doi: 10.20944/preprints202502.0734.v1

Keywords: core; training; tennis; agility; balance

 doi:10.20944/preprints202502.0734.v1

Essay

The Effects of Core Training on Balance and Some Physical Performance in Tennis Players

Yaşar Köroğlu [1,*], Samet Sitti [2], Kenan Koç [3], Soner Yüce [4,5], Mehmet Şerif Ökmen [6], Mustafa Türkmen [6], İsa Taştan [4], Feyzullah Koca [3], Erkan Konca [1] and Mine mine Ucar [7]

[1] Sivas Cumhuriyet University Faculty of Sports Sciences,Sivas/ TURKEY
[2] Siirt University Faculty of Sports Sciences,Siirt/TURKEY
[3] Erciyes University Faculty of Sports Sciences, Kayseri, TURKEY
[4] Erciyes University Institute of Health Sciences, Department of Physical Education and Sports, Kayseri, TURKEY
[5] Istanbul Sabahattin Zaim University Faculty of Sports Sciences, Istanbul, TURKEY
[6] Mardin Artuklu University Faculty of Sports Sciences, Mardin, TURKEY
[7] Mardin Artuklu University Physical Education and Sports Yüksekokulu, Mardin/TURKEY
* Correspondence: yasarkoroglu@cumhuriyet.edu.tr

Abstract: Tennis is an entertaining sport that includes a combination of technical, tactical and physical fitness components. The aim of the study was to investigate the effect of core training on anaerobic performance and some physical performance values of tennis players studying at university and training on certain days of the week. 30 students between the ages of 18-23 who were studying at Sivas Cumhuriyet University, participated in the study as experimental group (15 male) and control group (15 male). Height, body weight, flamingo balance test, vertical jump test, balance and pro-agility test were applied to the subjects as pre-test and post-test. The experimental group practiced core training 3 times a week along with the tennis training 3 days a week. The control group participated only in tennis training. The study was conducted for 6 weeks. Since the data were normally distributed, independent sample t test was used to compare independent groups and paired sample t test was used to compare dependent groups. In the data obtained as a result of the research, it was determined that there was a significant difference in crunch, balance, vertical jump and agility values in the experimental group, and there was a significant difference in crunch, vertical jump and agility values in the control group but there was no difference in other variables. As a result, we can say that 6-week core trainings applied to tennis players have positive effects on physical performance, and trainers should include core trainings in their annual plans in order to increase and maintain performance in their studies.

Keywords: core; training; tennis; agility; balance

Introduction

Tennis is an entertaining sport that is popular around the world and played by nearly 75 million people (Pluim et al., 2007). In addition, it is also an enjoyable sport to watch and one of the competitive sport branches attracting many followers (Fernandez et al., 2013). Since there is no time limitation in tennis, the matches can be played for more than 5 hours (Kilit and Arslan, 2017). Tennis is a sport that anaerobic and aerobic capacity, speed, agility, balance and strength abilities are used together (Bashir et al., 2019). Athletes who have good aerobic and anaerobic capacity are able to use technical and tactical capacities longer in prolonged matches, thus making their performances last for a long time. Additionally, they are able to recover in a shorter period of time and perform in other matches or sets more preparedly (Urhausen and Kindermann, 2002). Along with being an entertaining sport, tennis

 doi:10.20944/preprints202502.0734.v1

also brings the risk of injury on the lower and upper extremities because it is played in high intensity with rapid and sudden direction changes (Kermen, 2002). Core training and the strengthening core muscles will be beneficial to prevent athletes from injuries and to ensure them to recover and return to the courts more quickly after injuries. Core muscles serve as a bridge especially between the lower and upper extremities (Sandrey and Mitzel, 2013). Core exercises give an opportunity for the arms and legs to strengthen (Zurar, 2019) as well as developing the balance ability of the athletes (Yüksel et al., 2016). Core training provides increase in the balance and strength of muscles in the core area (Hsu and Ark., 2018). Core area muscles will also decrease the risk of other muscle injuries by ensuring body control and balance (Zurar, 2019). Core muscles contribute to increase body performance as well as strengthening the spine by enhancing the body's ability to move (Bozlak, 2019). Muscles in the core area support the spine due to being in the center of the body. Deterioration in body balance can occur as a result of long term exercises. In turn, this deterioration prevents the body to produce the desired amount of strength (Sato and Mokha, 2009). Core training is a type of training that individuals perform with their own body weight and improves body performance by strengthening the spine through abdominal and spinal muscles (Akuthota et al., 2008). Core training is especially preferred to improve the functions of balance and flexibility and anatomical functions that are important to many sport branches (Sun and Ark., 2016). In the studies conducted in this field, psycho motor movements, muscle strength, respiratory muscle endurance and athletic performance are stated to be improved (He et al., 2019). It is reported that a strong core area had a positive impact on the reaction of hitting the ball and hitting the ball quickly (Bompa, Pasqual and Cornacchia, 2014). It is stated that core training performed by tennis players contributes to physical fitness, body strength and athletic performance (Gür and Ersöz, 2017). In another study, it is observed that core training contributed to 50 m swimming performance (Weston et al., 2015). Similarly, it is stated that core training performed by tennis players contributed to serving accurately (Sever, Kır and Yaman, 2017). The purpose of our study is to search the effects of core training performed by students studying at university on tennis performance.

Method

Research Model

The research was designed as pretest and posttest. The information on what core training was included and how it would be performed was provided in the first interview. 2 measurements were taken from the individuals participating in the study as pretest and posttest. A total of 30 people participated in the study. The study was conducted for 6 weeks. The experimental group (15 males) participated in trainings strengthening their core area in addition to tennis training for 3 days a week. The control group (15 males) only participated in designated tennis training but not the core training. Core training was performed 3 days a week.

Study Group

30 students between the ages of 18-23 and studying in the faculty of sports sciences of Sivas Cumhuriyet University participated in the study. Individuals having a disease were not included in the study. The purpose of the study was explained to the subjects participating in the study voluntarily and they signed a volunteer consent form. The study was designed and conducted in accordance with the rules of Declaration of Helsinki (World Medical Association, 2013).

Data Collection Tools

Crunch

Athletes wait readily lying on supine position with knees bent and hands on the nape. Then they are asked to lift their bodies up and touch the knees with the elbows for 30 seconds. The repetitions

 doi:10.20944/preprints202502.0734.v1

that do not follow the rules are not accounted for. Crunches performed correctly for 30 seconds are recorded (Mackenzie, 2005).

Flamingo Balance Test

Athletes stand on the balancing beam and try to stay balanced for one minute. The foot balanced on is placed on the beam, and the other foot is held by hand and pulled to the hip. Timing is stopped when athletes lose balance or fall down from the beam. Scoring is recorded as total balance achieved in one minute (Jakobsen et al., 2011).

Vertical Jump Test

Subjects are asked to stand with feet aligned with pelvis and hands in both sides, and to achieve a 90 degree angle and squat, then jump quickly and as high as they could. They land on the designated spot. Those landing outside the spot repeat the test. Feet must be strained and knees must not be pulled to the chest when jumping high. The test was performed twice and the highest score was recorded (Wehbe et al., 2015).

Standing Long Jump Test

Athletes are asked to leap forward from a designated spot with adjacent feet. The test was applied 3 times and the highest score was recorded (Bostancı et al., 2019).

Pro-Agility Test

Cones are placed to 4-57 meters on the right and left of the starting line. Athletes wait readily on the starting line. Timing starts when athletes are ready. The test ends when athletes reach the starting line by first touching the cone on the right, then the cone on the left. The best score out of 3 test results was recorded (Bayraktar, 2013).

Training Schedule

The training was applied for 6 weeks and 3 days a week. The experimental group attended core training along with tennis practice. The control group only attended designated tennis practice. The training exercises included 10 separate exercises every week. A training plan including 2 sets and 8 sets of repetitions was performed. While a five second rest time was given between the repetitions, complete rest was given between tests.

Results

Upon reviewing Table 1, the age average of the tennis players was determined to be 20,93±2,282 in the experimental group and 20,00±1,772 in the control group, the average height was 173,86±9,280 in the experimental group and 170,40±10,972 in the control group, and the average body weight was 67,07±9,989 in the experimental group and 61,13±9,970 in the control group.

Table 1. Explanations of the core exercises.

Core Exercises	Explanations
Crunch	Students sit on the floor and place the soles of their feet on the floor. They lie on supine position with bent knees. The hands are next to the head. They lift their bodies until upper shoulder blades lift off the floor. The training continues until number of repetitions is completed.

 doi:10.20944/preprints202502.0734.v1

Reverse Crunch	Students lie on supine position with knees bent. Hands and arms are placed on the chest. Knees are lifted in a 90 degree angle to align with the chest. Legs and hips are slightly lifted from the floor.
Bird Dog	Students stand on hands and knees with their head held straight. Their spine stays in neutral position. Their right leg and the left arm are lifted together being parallel to the floor.
Prone Plank	Students lie on the floor with their feet next to each other, spine in neutral position and palms of their hands touching the floor. Their bodies are lifted by palms and toes. Heads, bodies and legs are kept in a straight position.
Superman	Students lie face down on the floor with their hands in front of their body. They lift their arms and legs at the same time. They wait for approximately a second in this position before slowly leading their arms and legs down.
Leg Lower	The students lie on the floor on supine position placing their hands next to their hips and stretch their legs forward. They move their waist region towards the floor in order to bring their abdominal muscles to contraction. They lift their legs until the legs are at a 45 degree angle, and then slowly lead their legs down.
Sit-Up	Students stand with bent knees and their feet contacting the floor. They sit on the floor and cross their hands on their chest. With the start command, they lift their shoulders off the floor and continue the movement until they come to a sitting position. Then, they return to the position at the beginning.
Slide Board Mountain Climber	Students start the movement with their hands on the edge or just outside of slide board equipment, their arms in full extension, their bodies is push-up or front bridge position, and their feet in dorsiflexion position. One of their knees and hips are in flexion position, while the others are in extension. They wait in the flexion position for a predetermined amount of time (5, 10, 15, 30 seconds), then they return to the beginning position. They repeat the movement with the leg on the other side.
Jackknife	Students lie on the floor on supine position. They stretch their arms and legs. They lift their shoulders and one of their legs off the floor. While doing this, they apply a slight rotation. They join their legs with the opposite arms.

 doi:10.20944/preprints202502.0734.v1

Plate V-Up (In weight use)	Students lie on the floor on supine position and hold a medicine ball in each hand. They flex their hips with their arms and legs stretched. They lift off the floor in order to bring their body and legs together at the midpoint and try to maintain their balance using gluteal muscles. Then, they slowly lower their body and legs to the floor.

(Willardson, 2018).

Upon reviewing Table 2, while statistically significant difference was observed in the crunch, balance, vertical jump and agility values of the tennis players in the experimental group ($p<0.005$), the standing long jump values showed no significant difference ($p>0.05$). Whereas in the control group, while a significant difference occurred in the crunch, vertical jump and agility figures ($p<0.005$), no significant difference was determined in balance and standing long jump values ($p>0.05$).

Table 2. The Comparison of the physical characteristics of the tennis players.

Variables	Groups	N	Mean	Standard Deviation
Age (years)	Experimental	15	20,93	2,282
	Control	15	20,00	1,772
Height (cm)	Experimental	15	173,86	9,280
	Control	15	170,40	10,972
Body Weight (kg)	Experimental	15	67,07	9,989
	Control	15	61,13	9,970

($p<0.005$).

When table 3 was reviewed, while a significant difference was observed in the pre-test measurements of balance and agility values of the tennis players ($p<0.005$), no significant difference was determined in the other variables ($p>0.05$). There was a statistically significant difference in the agility values in the post-test measurements ($p<0.005$), but no significant difference was found in the other variables ($p>0.05$).

Table 3. The statistical comparisons of in-group measurements.

Variable		Experimental (n:15)			Control (n:15)		
		X ± SS	t	p	X ± SS	t	p
Crunch (number)	Pre-test	15,07±3,19	-4,620	**0,000**	15,53±3,68	-4,620	**0,000**
	Post-test	18,40±4,38			16,40±3,20		
Balance (number)	Pre-test	4,93±2,89	2,591	**0,021**	2,13±0,35	-1,852	0,085

 doi:10.20944/preprints202502.0734.v1

	Post-test	3,00±1,73			4,07±4,16		
Vertical jump (cm)	Pre-test	41,53±8,89	-3,780	**0,002**	44,00±9,05	-3,780	**0,002**
	Post-test	44,87±7,68			45,47 ±9,10		
Standing long jump (cm)	Pre-test	2,24±0,29	-1,589	0,134	2,19±,0,23	-0,824	0,424
	Post-test	2,29±0,29			28,15±68,39		
Agility test (sec)	Pre-test	6,37±0,41	3,879	**0,002**	6,98±0,59	4,003	**0,001**
	Post-test	6,20±0,35			6,64±0,61		

(p<0.005).

Table 4. The statistical comparison of the intergroup measurements.

Variable		Pre-test (n:15)			Post-test (n:15)		
		X ± SS	t	p	X ± SS	t	p
Crunch (number)	Experimental	15,07±3,19	-0,371	0,714	18,40±4,38	1,426	0,165
	Control	15,53±3,68			16,40±3,20		
Balance (number)	Experimental	4,93±2,89	3,725	**0,002**	3,00±1,73	-0,916	0,371
	Control	2,13±0,35			4,07±4,16		
Vertical jump (cm)	Experimental	41,53±8,89	-0,753	0,458	44,87±7,68	-0,195	0,847
	Control	44,00±9,05			45,47 ±9,10		
Standing long jump (cm)	Experimental	2,24±0,29	0,559	0,581	2,29±0,29	0,622	0,539
	Control	2,19±,0,23			2,23±0,26		
Agility test (sec)	Experimental	6,37±0,41	3,296	**0,003**	6,20±0,35	-2,370	**0,025**
	Control	6,98±0,59			6,64±0,61		

(p<0.005).

Discussion and Conclusion

Core training decreases the risk of injury by helping individuals gain strength and contributes the increase of performance by decreasing the period of recovery after injury (Türksoylu and İşlegen, 2013). Core training also contributes to the vestibular sense operating efficiently (Rajendran, Roy and Jeevanantham, 2013) and the improvement of the arm and leg muscles (Willardson, 2014).

 doi:10.20944/preprints202502.0734.v1

A significant difference was discovered in vertical jump values in the results we obtained. It was revealed in a study on football players that there was a significant difference in the vertical jump values (Doğan et al., 2016). Savaş and Uğraş stated that a significant difference was found in vertical jump figures in the research they conducted (Savaş and Uğraş, 2004). Furthermore, in another study, core training was performed for 25-30 minutes three days a week in a time span of 10 weeks. After the study, a significant difference was revealed in the vertical jump values of the football players (Boyacı and Bıyıklı, 2013). Göktepe et al. stated that although there was an increase in the vertical jump values after 2 days a week core training for 8 weeks, this increase was not statistically significant (Göktepe et al., 2019). Core training can cause an increase in muscle strength and vertical jump values due to strengthening the body and lower extremity muscle groups. We believe that the significant difference revealed in vertical jump values in our study was because of the core training the experimental group performed and the participation of the control group actively in other sport branches along with tennis.

In the data obtained, a significant difference was observed in the balance values of tennis players. The improvement of balance ability is necessary for succeeding in sports. The decrease of balance performance can also reduce the performance of athletes by increasing the risk of injury (Ateş, Çetin and Yarım, 2017). The improvement of balance performance also contributes in other performances (Okudur and Sanioğlu, 2012). No statistically significant difference was revealed in the pretest and posttest results after 12 weeks of core training performed by female badminton athletes (Eriş, 2018). Lengkana et al. declared that the core training performed by the students in the age group of 10-11 resulted in a significant difference in their static balance (Lengkana and Tangkudung, 2019). A 12 week core training performed by tennis players showed no significant difference in their balance performance (Gür and Ersöz, 2017). We can claim that the training we applied had a positive contribution to the balance performances of the athletes. Our study is observed to have similarities to and differences from the other studies conducted in this field.

In our study, a significant difference was observed in crunch values in favor of both groups. The areas core area affects in our body are listed as abdominal muscles, paraspinal muscles, gluteal muscles, oblique muscles, pelvic hip muscles and the diaphragm muscle (Shinkle et al., 2012). Study results parallel to our study can be observed in other studies conducted in this field. In their study on tennis players, Arı and Çolakoğlu stated that the group that performed core training had a significant increase in their crunch figures (Arı and Çolakoğlu, 2021). Similarly, it was expressed that core training performed with the help of swissball resulted in a significant increase in the strength and the activation rate of m. rectus abdominis and m. obliques internus/externus muscles (Escamilla et al., 2010). Cosio-Lima et al. reported increases in the abdominal muscle stability and strength levels of athletes after core training (Cosio et al., 2003). It is explained that core training results in a strength increase in m. rectus abdominis muscle and corresponding to this, it caused an increase in crunch values by transferring the strength to upper extremities with the help of its own connective tissue (Akuthota and Nadler, 2004). We can state that the reason of that our study showed significant difference is that core training specifically strengthens the abdominal muscles and increase their stability.

A significant difference was observed in agility values after the core trainings performed by the tennis players. Tennis is a branch of sport that has sudden and quick direction changes and requires being active during the game. Core training can especially contribute to strengthening lower extremities and increasing explosive strength. The reason of the significant difference in the agility values of both experimental and control groups might be that both groups actively participated in tennis and other sports branches alongside it. In their study on core training, Shaikh et al. stated a significant difference in the agility figures of individuals participating in the study (Shaikh et al., 2019). In a study performed on basketball players, core training was revealed to increase muscular endurance and thus, improve the agility performance (Aksen et al., 2019). Similarly, in another study, a 6 week core training performed by adolescent basketball players resulted in a positive contribution

 doi:10.20944/preprints202502.0734.v1

to the agility values of the athletes and decreased agility time (Kafa et al., 2020). Our study is observed to be similar to the studies conducted in this field.

No significant difference was found in the standing long jump values of the tennis players as a result of the 6 week core training in our study. Standing long jump is one of the measuring methods used to determine the explosive strength of lower extremities, which is necessary for many sports branches (Castro et al., 2010). It can be observed in many studies that core training strengthens especially the lower area muscles and contributes to increasing explosive strength. The reason of that no significant difference was revealed in our study was that similar increases were observed in the standing long jump average values of both groups. The reason of that no significant difference was observed might be that the 6 week core training program we conducted was insufficient or the control group performed multiple other sports branches alongside tennis. Unlike our study, significant difference can be observed in many other studies. In the study Baş conducted on football players, he stated that 10 weeks of core training contributed in the standing long jump performance of the athletes (Baş, 2018). Results of a similar study performed on female football players also revealed positive contribution in the athletes' standing long jump performance (Taskin, 2016). It was also stated that 12 weeks of core training performed by football players between the ages of 12-14 who train actively resulted in an increase of the standing long jump values of the athletes (Boyacı and Afyon, 2017).

Consequently, it is observed that the core training we applied in our study have contributed the balance, crunch, vertical jump and agility values of the tennis players. Especially applying core exercises within the determined program ensures the strengthening of lower and upper extremities. Core training not only helps strengthening but also enables athletes to exercise for longer periods of time by preventing injuries. The fact that trainers and athletes include core training for sport branches requiring strong lower and upper extremities in their annual plans will increase athletes' performance and contribute the maintenance of the existing performance. We believe that increasing the weekly training time and number of repetitions of core exercises will contribute to the increase in performance values.

Limitations of the Study

Male students between the ages of 18-23 were included in the study.
Regularly participating in tennis training
Students studying at Sivas Cumhuriyet University Sports Sciences
The students participating in the study did not have any health problems
Exercises are limited to 6 weeks and 3 days a week

The subjects that make up the research group are limited to tennis specialization and students who have been playing tennis for at least one year.

Author Contributions: The introduction part of the research was carried out by the first author, the method part by the second author, the findings part by the third author, table 1 by the fourth author, table 2 by the fifth author, table 3 by the sixth author, Table 4 by the seventh author, the discussion part by the eighth author, the conclusion part by the ninth author.

Funding: Author statement no financial support.

Conflict of Interest: There is no conflict in the this study.

Ethich: The necessary permissions for this research were obtained in accordance with the Declaration of Helsinki from the Sivas Cumhuriyet University Scientific Research and Publication Ethics Committee with the decision numbered 20.07.2023-07/30

 doi:10.20944/preprints202502.0734.v1

References

Aksen, P, Cobanoglu, G, Gokdogan, CM, Zorlular, A, Akaras, E, Erikoglu, G. (2019). Therelationshipbetweenposturalstability, coremuscleenduranceandagility in professionalbasketballplayers. AnnMedRes. 26(10):2181-6

Akuthota, V, Ferreiro, A, Moore, T, Fredericson, M. (2008). Corestabilityexerciseprinciples. Current Sports MedicineReports, 7(1)

Akuthota, V, Nadler, SF. (2004). Corestrengthening. Archives of physicalmedicineandrehabilitation, 85, 86-92

Arı, Y. Çolakoğlu, FF. (2021). Tenis Oyuncularında Core Egzersizleri Tenis Performansını Etkiler Mi? Gaziantep Üniversitesi Spor Bilimleri Dergisi, 6(1), 40-54

Ateş, B, Çetin, E, Yarım, İ. (2017). Kadın sporcularda denge yeteneği ve denge antrenmanları. Gaziantep Üniversitesi Spor Bilimleri Dergisi, 2(2): 66-79

Bashir, SF, Nuhmani, S, Dhall, R, Muaidi, QI. (2019). Effect of coretraining on dynamicbalanceandagilityamongIndianjunior tenis players. Journal of BackandMusculoskeletalRehabilitation, 32(2), 245–252

Baş, M. (2018). 11-13 yaş grubu futbolculara uygulanan 10 haftalık core antrenmanın seçili motor parametrelere etkisinin değerlendirilmesi. İstanbul Gelişim Üniversitesi Sağlık Bilimleri Enstitüsü

Bayraktar, I. (2013). Elit boksörlerin çeviklik, sürat, reaksiyon ve dikey sıçrama yetileri arasındaki ilişkiler. Akademik Bakış Dergisi, 35:1-8

Bompa, TO, Pasqual, M, Cornacchia, L. (2014). Nitelikli kuvvet antrenmanı. Bağırgan, T Çev.), Spor Yayınevi ve Kitabevi, Ankara, 69-70

Bostancı, Ö, Mayda, MH, Tosun, Mİ, Kabadayı, M. (2019). Yüksek şiddetli interval antrenman programının fizyolojik parametreler ve solunum kas kuvveti üzerine etkisi. SPORMETRE Beden Eğitimi ve Spor Bilimleri Dergisi, 17(4), 211-219. https://doi.org/10.33689/spormetre.605119

Boyacı, A, Bıyıklı, T. (2013). Core antrenmanın fiziksel performansına etkisi: erkek futbolcular örneği. Kilis 7 Aralık Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi. 2(2): 18-27

Boyacı, A. Afyon, YA. (2017). TheEffecttheCoretrainingtoPhysical Performans in Children. Journal of EducationandPractice. 8(33), 81-88

Bozlak, S. Sporcularına uygulanan kalistenik egzersizlerin esneklik, kuvvet ve denge yetileri üzerine etkisinin incelenmesi. kırıkkale üniversitesi sağlık bilimleri enstitüsü, yüksek lisans tezi, kırıkkale, 2019

Castro, J, Ortega, FB, Artero, EG, Girela, MJ, Mora, J, Sjöström, M, Ruiz, JR. (2010). Assessingmuscularstrength in youth: usefulness of standinglongjump as a general index of muscularfitness. TheJournal of Strength&ConditioningResearch, 24(7), 1810-7

Cosio-Lima LM, Reynolds, KL, Winter, C, Paolone, V, Jones, MT. (2003). Effects of physioballandconventionalfloorexercises on earlyphaseadaptations in backandabdominalcorestabilityandbalance in women. TheJournal of Strength&ConditioningResearch, 17(4), 721-5

Doğan, G, Mendeş, B, Akcan, F, Tepe, A. (2016). Futbolculara uygulanan sekiz haftalık core antrenmanın bazı fiziksel ve fizyolojik parametreler üzerine etkisi. Niğde Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi, 10(1); 1-12

Eriş, F. Kadın Badminton sporcularında 12 haftalık core kuvveti egzersizlerinin bazı antropometrik değerler statik denge ve core kuvveti üzerine etkisinin araştırılması. Van Yüzüncü Yıl Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, Van, 2018

Escamilla, RF, Lewis, C, Bell, D, Bramblet, G, Daffron, J, Lambert, S, Pecson, A, Imamura, R, Paulos, L, Andrews, JR. (2010). CoremuscleactivationduringSwissballandtraditionalabdominalexercises. J Orthop Sports PhysTher, 40(5), 265-276

Fernandez, J, Ellenbecker, T, Sanz-Rivas, D, Ulbricht, A, Ferrauti, A. (2013). Effects of a 6-week juniortennisconditioning program on service velocity. Journal of Sports ScienceandMedicine, 12(2), 232-239

Göktepe, M, Göktepe, MM, Güder, F, Günay, M. (2019). Kadın futbolculara uygulanan kor kuvvet antrenmanlarının farklı dikey sıçrama yöntemlerine etkisi. Journal of Human Sciences, 16(3): 791-798

 doi:10.20944/preprints202502.0734.v1

Gür, F, Ersöz, G. (2017). Kor antrenmanın 8-14 yaş grubu tenis sporcularının kor kuvveti, statik ve dinamik denge özellikleri üzerindeki etkisinin değerlendirilmesi. Spormetre, 15(3): 129-138

He, Y, Sun, W, Zhao, X, Ma, M, Zheng, Z, Xu, L. (2019). Effects of corestabilityexerciseforpatientswithneckpain: A protocolforsystematicreviewand meta-analysis. Medicine, 98(46), e17240. https://doi.org/10.1097/MD.0000000000017240

Hsu, SL, Oda, H, Shirahata, S, Watanabe, M, Sasaki, M. (2018). Effects of corestrengthtraining on corestability. TheJournal of PhsicalTherapyScience, 30: 1014-1018

Jakobsen, MD, Sundstrup, E, Krustrup, P, Aagaard, P. (2011). Theeffect of recreationalsoccertrainingandrunning on posturalbalance in untrained men. EuropeanJournal of AppliedPhysiology, 111(3), 521-530. https://doi.org/10.1007/s00421-010-1669-2

Kafa, N, Cengizhan, PA, Örer, G, Çobanoglu, G, Gökdagan, ÇM, Zorlular, A, Akaras E, Güzel, NA. (2020). Adölesan Basketbolcularda "Core" Antrenman Programının "Core" Kas Enduransı, Denge, Çeviklik ve Anaerobik Güç Üzerine Etkisi. Turkiye Klinikleri J Sports Sci;12(3):274-82

Kermen, O. (2002). Tenis: teknik ve taktikleri: Nobel akademik yayıncılık

Kilit, B, Arslan, E. (2017). Tenis müsabakalarında fizyolojik gereksinimler. Spormetre beden eğitimi ve spor bilimleri dergisi, 15(3), 157-164

Lengkana, AS, Tangkudung, SA. (2019). Theeffect of corestabilityexercise (CSE) on balance in primaryschoolstudents. Journal of Education, HealthandSport, 9(4): 160-167

Mackenzie, B. (2005). 101 Performanceevaluationtests. Electric Word plc, London

Okudur, A, Sanioğlu, A. (2012). 12 yaş tenisçilerde denge ile çeviklik ilişkisinin incelenmesi. Selçuk Üniversitesi Beden Eğitimi ve Spor Bilim Dergisi, 14(2): 165-170

Pluim, BM, Miller, S, Dines, D, Renstrom, PA, Windler, G, Norris, B, Stroia, K, Donaldson, A, Martin, K. (2007). Sportscienceandmedicine in tennis. British Journal of Sports Medicine, 41(11), 703-704

Rajendran, V, Roy, FG, Jeevanantham, D. (2013). Effect of exerciseintervention on vestibularrelatedimpairments in hearing-impairedchildren. AlexandriaJournal of Medicine, 49(1), 7-12

Sandrey, MA, Mitzel, JG. (2013). Improvement in dynamicbalanceandcoreenduranceafter a 6-week core-stability-training program in highschooltrackandfieldathletes. Journal of SportRehabilitation, 22(4), 264-271

Sato, K, Mokha, M. (2009). Doescorestrengthtraininginfluencerunningkinetics, lower-extremitystability, and 5000-M performance in runners? TheJournal of Strength&ConditioningResearch, 23(1), 133-140

Savaş, S, Uğraş, A. (2004). Sekiz haftalık sezon öncesi antrenman programının üniversiteli erkek boks, taekwondo ve karate sporcularının fiziksel ve fizyolojik özellikleri üzerine olan etkileri. Gazi Eğitim Fakültesi Dergisi, 24(3):257-274

Sever, O, Kır, R, Yaman, M. (2017). Theimpact of periodizedcoretraining program on accurate service velocity of male tenis playersaged 11-13. Journal of Human Sciences, 14(3), 3022-3030. doi:10.14687/jhs.v14i3.4760

Shaikh, AI, Nuhmani, S, Kachanathu, SJ, Muaidi, QI.(2019). Relationship of corepowerandendurancewithperformance in randomintermittentdynamictypesports. Asian J Sports Med. 10(1):e62843

Shinkle, J, Nesser, TW, Demchak, TJ, McMannus, DM. (2012). Effect of corestrength on themeasure of power in theextremities. TheJournal of Strength&ConditioningResearch, 26(2), 373-380

Sun, X, Gao, Q, Dou, H, Tang, S. (2016). Which is better in therehabilitation of strokepatients, corestabilityexercisesorconventionalexercises? Journal of PhysicalTherapyScience, 28(4), 1131-1133

Taskin, C. (2016). Effect of coretraining program on physicalfunctionalperformance in femalesoccerplayers. International EducationStudies, 9(5), 115-123

Türksoylu, A, İşlegen, Ç. (2013). Kuvvet ve sportif yaralanmaların önlenmesindeki önemi. Spor Hekimliği Dergisi, 2013; 48: 9-16

Urhausen, A, Kindermann, W. (2002). Diagnosis of overtraining. Sports Medicine, 32(2), 95-102

Wehbe, G, Gabbett, T, Dwyer, D, McLellan, C, Coad, S. (2015). Monitoringneuromuscularfatigue in team-sportathletesusing a cycle-ergometer test. International Journal of Sports PhysiologyandPerformance, 10(3), 292-297. https://doi.org/10.1123/ijspp.2014-0217

 doi:10.20944/preprints202502.0734.v1

Weston, M, Hibbs, AE, Thompson, KG, Spears, IR. (2015). Isolatedcoretrainingimprovessprintperformance in national-leveljuniorswimmers. International Journal of Sports PhysiologyandPerformance, 10, 204-210. http://dx.doi.org/10.1123/ijspp.2013-0488

Willardson, JM. (2014). Developingthecore/nationalstrengthandconditioningassociation. Human Kinetics: NationalStrengthandConditioningAssociation, 41-115

Willardson, JM. (2018). Core gelişimi. (Ç. Bulgan ve M. A. Başar, Çev.) 1st ed. İstanbul: İstanbul Tıp Kitabevleri

World Medical Association. (2013). World Medical Association Declaration of Helsinki: ethicalprinciplesformedicalresearchinvolvinghumansubjects. Jama, 310(20), 2191-2194. https://doi.org/10.1001/jama.2013.281053

Yüksel, O, Akkoyunlu, Y, Karavelioğlu, MB, Harmancı, H, Kayhan, M, Koç, H. (2016). Basketbolcularda core alt ekstremite kuvveti antrenmanlarının dinamik denge ve şut isabeti üzerine etkisi. Marmara Üniversitesi Spor Bilimleri Dergisi, 1(1): 51-61

Zurar, BA. Erkek haltercilerde 10 haftalık core egzersizlerinin core kuvveti ve maksimal kuvvet üzerine etkisi. Van Yüzüncü Yıl Üniversitesi Eğitim Bilimleri Enstitüsü, Yüksek Lisans Tezi, Van, 2019